

2020-2021 ANNUAL REPORT



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MESSAGE FROM THE EXECUTIVE DIRECTOR

The 2020-2021 season proved to be another successful year for the California apple industry despite several challenges. In 2020, the outbreak and spread of the COVID-19 virus drastically changed our daily lives and forced our members to adapt to the numerous pandemic-related obstacles that arose. Additionally, increased production costs, lack of labor, water shortages, and Mother Nature continue to create new problems for growers and handlers to overcome.

Nevertheless, it is challenging times like these that spark innovation and generate new solutions. This has not been an easy year for our members, but the California apple industry continues to persevere. As we reflect on this past year, it is important to acknowledge the hardships we faced, but we should also take pride in the multiple ways our industry came together to feed the world. Although we are not completely through this pandemic, there is a light at the end of the tunnel. I am confident that the agriculture industry will prevail, as it has always done.



Todd W. Sanders Executive Director

At the Commission, we will continue to be an advocate for the California apple growers and handlers through our research, education, export, and government relations programs. More details on the Commission's programs can be found in the following pages within this report. Additionally, the Commission will continue to manage and oversee the California Blueberry Association, the California Blueberry Commission, the California Olive Committee, the Olive Growers Council of California, the California Wild Rice Advisory Board, and the newly acquired California Olive Oil Council (2021). This complements the Commission's philosophy of managing other commodities to share resources and capabilities while also driving costs down.

On behalf of the California Apple Commission, I am pleased to present to you the 2020-2021 annual report. As always, thank you for your continued support of the California Apple Commission, and we look forward to serving you in the next year.

Sincerely,

Todd W. Sanders
Executive Director

CHAIRMAN'S CORNER



The past year has been unlike any other. In the face of some difficulties and setbacks in the 2020-2021 season, the California apple industry continued to make strides and had a successful year. The main goal of the California Apple Commission is to provide significant assistance to the growers and handlers of the industry, perhaps now more than ever.

The 2020-2021 annual report highlights the various work that the Commission has completed throughout the year. Despite the obvious challenges that have been brought on by the COVID-19 pandemic, the Commission has been working diligently to properly assist the California apple industry. For example, in conjunction with the U.S. Apple Association and other state apple organizations, the California Apple Commission successfully encouraged the USDA to include apples in the critical second round of funding administered through the Coronavirus Food Assistance Program (CFAP).

Additionally, apple research and education continue to be priorities of the Commission. With that, the Commission was successful in receiving funding for a California Department of Food and Agriculture Specialty Crop Block Grant to assist with the funding of ongoing rootstock trial research in various apple growing regions of the state.

As we begin the 2021-2022 season, please do not hesitate to utilize the Commission and the resources they provide. Once again, I want to close by thanking the California apple growers, handlers, and board members for their hard work and continued support of the California Apple Commission. It continues to be a pleasure to serve as Chairman, and I wish you a safe and successful upcoming season!

Sincerely,

Jeff Colombini Chairman

Jeff of Colombini

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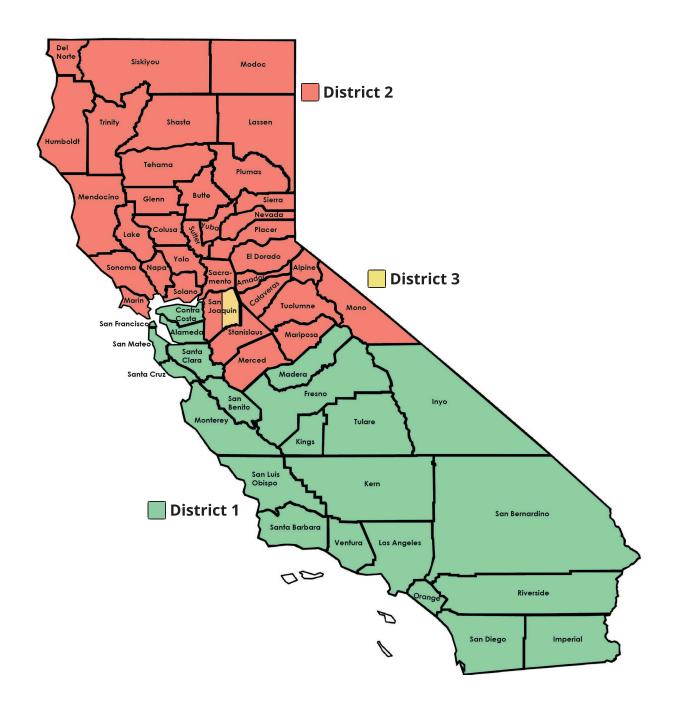
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BOARD OF DIRECTORS

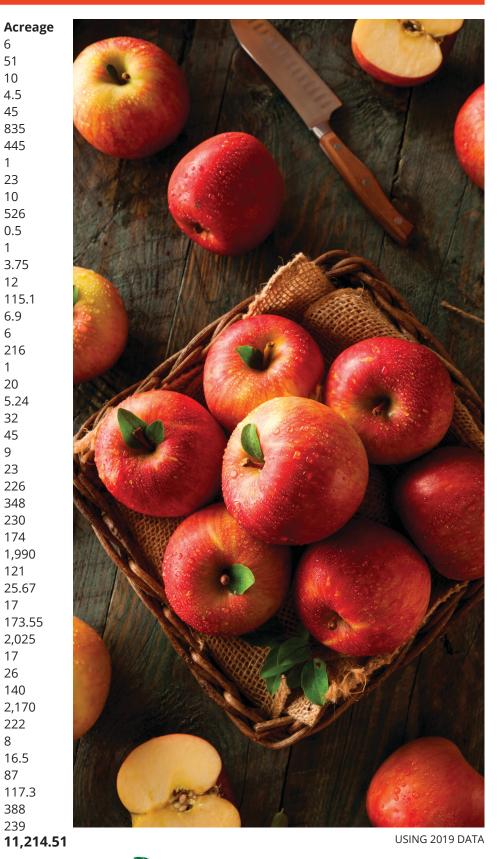
District 1	District 2	District 3
Producer Member	Producer Member	Producer Member
Kelley Hansen	Chris Britton	Jeff Colombini
Mt. Dennison Orchards	BK Partners	Lodi Farming
Term: 7/2020-6/2024	Term: 7/2018-6/2022	Term: 7/201-6/2021
Producer Member	Producer Member	Producer Member
Zea Sonnabend	Virginia Hemly Chhabra	Steve Chinchiolo
Fruitilicious Farm	Greene and Hemly	Riverbend Orchards
Term: 7/2020-6/2024	Term: 7/2018-6/2022	Term: 7/2018-6/2021
Handler Member	Handler Member	Handler Member
Bill Denevan	Doug Hemly	Tim Sambado
Viva Tierra	Greene and Hemly	Prima Frutta
Term: 7/2017-6/2021	Term: 7/2020-6/2021	Term:7/2017-6/2021
Alternate Member	Alternate Member	Alternate Member
VACANT	VACANT	VACANT
Term: 7/2020-6/2021	Term: 7/2020-6/2021	Term: 7/2020-6/2021
	Public Member	
	Dr. Steve Blizzard	
	Term: 7/2017-6/2021	
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DISTRICT MAP



CALIFORNIA APPLE ACREAGE TOTALS

_	
County	Acreage
Amador	6
Butte	51
Calaveras	10
Colusa	4.5
Contra Costa	45
El Dorado/Alpine	835
Fresno	445
Glenn	1
Humboldt	23
Inyo/Mono	10
Kern	526
Kings	0.5
Lake	1
Lassen	3.75
Los Angeles	12
Madera	115.1
Marin	6.9
Mariposa	6
Mendocino	216
Merced	1
	20
Monterey	5.24
Napa	
Nevada	32
Placer	45
Plumas and Sierra	9
Riverside	23
Sacramento	226
San Benito	348
San Bernadino	230
San Diego	174
San Joaquin	1,990
San Luis Obispo	121
San Mateo	25.67
Santa Barbara	17
Santa Clara	173.55
Santa Cruz	2,025
Shasta	17
Siskiyou	26
Solano	140
Sonoma	2,170
Stanislaus	222
Sutter	8
Tehama	16.5
Tulare	87
Tuolomne	117.3
Ventura	388
Yolo	239
TOTAL	11,214.5



STATEMENT FOR ACTIVITIES

FISCAL YEAR ENDED JUNE 30, 2020

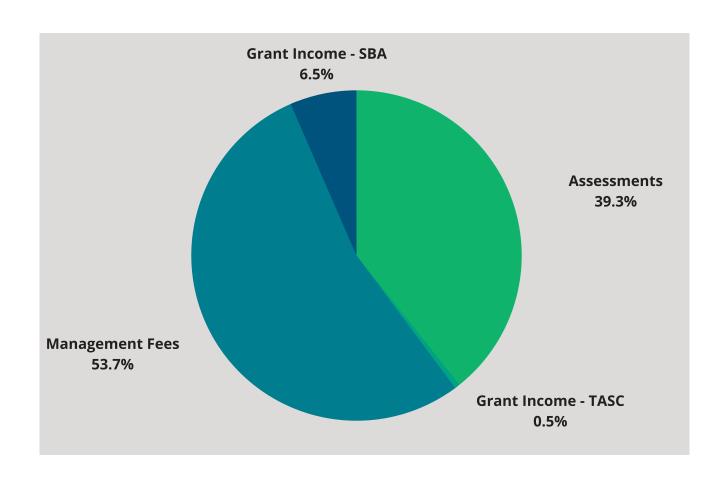
<u>ASSETS</u>	
• CASH	\$473,137
CERTIFICATES OF DEPOSIT	\$1,216,361
ACCOUNTS RECEIVABLE	\$11,497
INTEREST RECEIVABLE	\$14,345
PREPAID EXPENSES	\$4,080
RESTRICTED CASH - SBA GRANT	\$18,141
PROPERTY AND EQUIPMENT NET OF ACCUMULATED	
DEPRECIATION OF \$9,344 IN 2020 AND \$16,525 IN 2019	\$5,754
TOTAL ASSETS	\$1,743,315
LIABILITIES	
ACCOUNTS PAYABLE	\$27,823
ACCRUED COMPENSATED ABSENCES	\$6,101
UNEARNED REVENUE	\$27,307
TOTAL CURRENT LIABILITIES	\$61,231
NET POSITION	
UNRESTRICTED	\$1,682,084
NET POSITION	\$1,682,084
TOTAL LIABILITIES AND NET POSITION	\$1,743,315

STATEMENT OF REVENUES

REVENUES

 ASSESSMENTS 	\$284,759
GRANT INCOME - TASC	\$3,685
MANAGEMENT FEES	\$388,917
GRANT INCOME - SBA	\$47,234
• OTHER	\$0

TOTAL REVENUES \$724,595

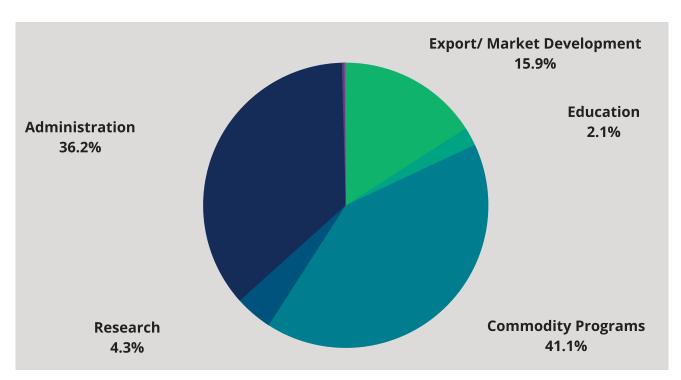


STATEMENT OF EXPENSES

EXPENSES

EXPORT/MARKET DEVELOPMENT	\$115,142
• EDUCATION	\$15,122
COMMODITY PROGRAMS	\$296,760
• RESEARCH	\$30,825
• ADMINISTRATION	\$261,931
 PEST DISEASE AND STANDARDIZATION COMMITTEE 	\$1,000
• DEPRECIATION	\$2,216

TOTAL EXPENSES \$722,996



CHANGES IN NET POSITION	\$23,622
NET POSITION, BEGINNING OF YEAR,	\$1,658,462
NET POSITION, END OF YEAR	\$1,682,084

CALIFORNIA APPLE RESEARCH PROJECTS



2020-2021 FINAL REPORTS

In 2020-2021, the California Apple Commission focused on four areas of research that were all continuations of prior research. Each of these research topics will continue to be areas of focus for the future as well.

In summary, our current projects are as follows:

- 1) Evaluation of new bactericides for controls of fire blight of apples caused by Erwinia amylovora and evaluation of new postharvest fungicides for pome fruits **Dr. Jim Adaskaveg**
- 2) Observing the phytotoxic effects on organic apples from various fungicide applications containing sulfur. A demonstration trial. **Devencenzi Agricultural Pest Management & Research**
- 3) Study on Mechanically Mass Harvesting of Cling Peaches (apples are included) **Dr. Stavros Vougioukas**
- 4) Apple Rootstock Breeding Program Field Trials Dr. Gennaro Fazio
- 5) Postharvest Quality and Physiology of 'Gala', 'Granny Smith', and 'Fuji' Apples Subjected to Phytosanitary Irradiation **Dr. Anu Prakash**

<u>2020/2021</u>	<u>Amount</u>
1) Evaluation of Bactericide	\$23,000 ¹
2) Observing the phytotoxic effects	\$12,000
3) Mechanically Mass Harvesting	\$2,500 ²
4) Apple Rootstock Breeding Program	\$0 ³
5) Postharvest Quality	\$1,500 ⁴
FISCAL IMPACT FOR 2020/2021:	\$39,000

¹Research done by Dr. Adaskaveg will be done on both organic and conventional apples.

²The CAC has partnered with the California Pear Advisory Board for this research project. The research includes applies and is applicable to our industry as well.

³The CAC received a 2020 Specialty Crop Block Grant to conduct this project in conjunction with USDA-ARS

⁴This amount was donated by the California Apple Commission for apples that will be used in the study.

Annual Report – 2020-21

Prepared for the California Apple commission

Project Title: Evaluation of new biological controls for management of fire blight of apples caused by

Erwinia amylovora and evaluation of new natural products as organic postharvest

fungicides for pome fruits

Project Leader: Dr. J. E. Adaskaveg, Department of Plant Pathology and Microbiology, University of

California, Riverside CA 92521.

Cooperators: D. Thompson, D. Cary, and H. Förster

SUMMARY

Fire blight management

- 1. Antibiotic and copper resistance surveys for populations of *Erwinia amylovora* in California pear growing areas were continued in 2020-21.
 - a. Kasugamycin: 17 strains from 15 orchards were all sensitive.
 - b. Streptomycin: 10 strains obtained from 8 locations were sensitive; moderate resistance (MIC <25 ppm) was found at 4 locations in Lake and Sacramento Co.; and high resistance (MIC>100 ppm) at 3 locations in Mendocino and Sacramento Co. Resistance to streptomycin was found previously in Lake Co. in our surveys in 2006 and 2019. Streptomycin should be used strategically, and our findings stress the importance of resistance management with mixtures or rotations, limiting the number of applications per season (ideally one), and the development of new alternatives.
 - c. Oxytetracycline: Strains with high resistance levels (>100 ppm) were detected for the first time in Sacramento Co. in 2018 and 2019. Two highly resistant strains were again detected in this county in 2020, and these were also highly resistant to streptomycin. Oxytetracycline resistance at this level in E. amylovora has never been reported from other locations, and this finding stresses the stability of the resistance and the seriousness of the problem. In pear flower inoculation studies, these resistant strains were virulent, and they were competitive in the presence of sensitive strains in co-inoculations. We initiated studies to characterize the molecular mechanism of resistance.
 - d. In in vitro spiral gradient endpoint assays, the new antibiotic ningnanmycin and the natural product Dart (capric and caprylic acids) were toxic to *E. amylovora* with MIC values of 24.8 ppm and 1200 ppm, respectively. The natural product QAM did not show toxicity. After 1-h exposures to 500 ppm TDA-NC-1, growth of *E. amylovora* was completely inhibited. Additional evaluations are in progress.
- 2. Six field trials on the management of fire blight were conducted on cv. Granny Smith, and on Bartlett, Comice, and apple pears.
 - a. The conventional antibiotics streptomycin, oxytetracycline, and kasugamycin continued to perform well and were the most effective treatments. A new formulation of Mycoshield was slightly more effective than the previous one.
 - b. Essential oil products such as BacStop, EF400, ET91, Guarda, and Thymox were among the most promising alternatives and resulted in intermediate to good fire blight control, similar to copper or Blossom Protect. They could become alternatives in organic apple production but should be continued to be evaluated for best treatment strategies. Alum (potassium aluminum sulfate) reduced the incidence of blight to low or very low levels, and this confirmed our previous studies.
 - c. Additional new bactericides such as ningnanmycin and QAM were evaluated for the first time by us. They showed moderate efficacy and should be evaluated at higher rates.

d. Kasumin is currently considered a conventional treatment, however, efforts are underway to obtain an organic registration. The compound is a natural substance that is commercially produced by fermentation. In contrast to streptomycin and oxytetracycline, it has very minimal or no usage in human medicine.

Postharvest decay control

- 1. In laboratory studies, BioSpectra was very effective in reducing blue mold on Granny Smith apple, but Scholar, Academy, and Penbotec completely prevented decay development. Mixture treatments of BioSpectra with either of the other fungicides at half rates of each component were also highly effective.
- 2. For the management of blue mold, we compared the performance of BioSpectra with Scholar on three additional apple cultivars, Fuji, Gala, and Honey Crisp. BioSpectra significantly reduced decay incidence on all three cultivars by up 75% but was outperformed by Scholar.
- 3. In experimental packingline studies with T-jet applications, Cerafruta (another natamycin product) showed poor or no efficacy against blue mold, gray mold, and Alternaria rot. Academy and a mixture of Cerafruta with a low rate of Scholar (i.e., 8 fl oz), however, was highly effective against the three decays. Oso was highly effective against gray mold, showed good efficacy against Alternaria rot but performed poorly against blue mold. New formulations of Cerafruta will be evaluated in the coming season.
- 4. The efficacy of natamycin needs to be improved for apples and other pome fruits. Although efficacy of Scholar or Academy is not enhanced when BioSpectra is added in mixture treatments, natamycin represents a resistance management strategy. Resistance to natamycin has not been reported previously to any *Penicillium* species, although the compound has been registered for food uses for over 20 years.

INTRODUCTION

Epidemiology and management of fire blight. Fire blight, caused by the bacterium *Erwinia amylovora*, is one of the most destructive diseases of pome fruit trees including apples. The disease is indigenous to North America but has spread worldwide. In the spring, flowers are infected through natural openings in nectaries of flowers, leaves, and stems. From the flower the bacteria spread into the peduncle, spur, and twig where it causes a canker. Infections of petioles and young shoots can also lead to cankers. During warm, humid environments, infected tissue can ooze or exude droplets consisting of bacterial cells that function as new inoculum that can infect healthy plant tissues. Inoculum is spread by wind, rain, insects, birds, or by contaminated pruning tools. Secondary infections may occur throughout the growing season. The pathogen overwinters in cankers, dead flower buds, and diseased fruit.

Current chemical control programs for fire blight are based on frequent bactericide applications that are best used as contact or protective treatments to prevent infections. Conventional copper compounds as pre-bloom or early-bloom applications are only effective when disease severity is low to moderate. They may cause fruit russeting and therefore, labeled rates are at low amounts of metallic copper equivalent (MCE) that are at the limit of effectiveness. New re-formulated copper products that can be used at reduced MCE rates and that cause less phytotoxicity are available. Badge X2, CS-2005, Cueva, and MasterCop are OMRI-approved, and the latter two are often more effective. Contributing to the low efficacy of copper is the low to moderate level of copper insensitivity in pathogen populations that we detected in our surveys. Moreover, copper resistance is an adaptive response by the pathogen in the presence of copper. Because only few treatments are permitted for organic apple production, research on OMRI-approved copper and other products needs to be continued.

The antibiotics streptomycin, oxytetracycline and kasugamycin can only be used in conventional pome fruit production. The incidence of resistance to streptomycin in California orchards has been fluctuating from very high to low in our surveys between 2006 and 2020. Reduced sensitivity to oxytetracycline has only been found sporadically, and these isolates did not persist. However, in 2018 to 2020, we detected highly resistant strains at several locations. In preliminary studies, we characterized these strains genetically and determined that the oxytetracycline resistance genes are like those that were previously described from non-plant pathogenic epiphytic bacteria such as *Pantoea agglomerans*. Apparently, these genes have jumped between bacterial species. It will also be interesting to determine if there is a molecular association between high-streptomycin and high-oxytetracycline resistance. Kasugamycin (Kasumin) is the most recent registration, and it is organically produced by fermentation. It differs from other antibiotics that are also naturally

produced by bacteria in that it is not used in human and animal medicine. It is being submitted to the NOSB for approval as an organic treatment. Resistance in *E. amylovora* to kasugamycin has not been found to date among hundreds of strains evaluated from different pome fruit growing areas in California.

The biocontrol treatments Blight Ban A506 (*Pseudomonas fluorescens* strain A506) and Bloomtime Biological (*Pantoea agglomerans* strain E325), as well as the fermentation product of *Bacillus subtilis* Serenade (strain QST 713) and Double Nickel (strain D747) have been inconsistent over the years in their performance in our trials and were most effective under low inoculum levels and less favorable microenvironments. Serenade, using the liquid ASO formulation, showed higher efficacy in mixtures with copper such as Cueva or MasterCop. Research needs to be continued to evaluate mixtures of biocontrols with new copper products or other additives. The biocontrol Blossom Protect (*Aureobasidium pullulans*) has been very effective under less to moderately favorable disease conditions, and it is one of the most consistent biologicals that we have evaluated, however the buffer component may cause russetting. Biocontrols are most effective when they are actively growing on the plant. Several mechanisms have been described for biocontrol agents that lead to the control of the pathogenic agent including: (1) Competition; (2) Antibiosis or biochemical inhibition; (3) Site exclusion; (4) Parasitism; and (5) Systemic-acquired resistance.

In previous research on apple, use of the OMRI-approved LifeGard (Certis) to complement copper and other control materials as a systemic acquired resistance (SAR) treatment was unsuccessful. The non-organic compound acibenzolar-S-methyl (Actigard) was also shown to be inconsistent in previous trials on pear. Therefore, we are evaluating other bactericide alternatives such as the natural fermentation compounds lactic acid, ε-poly-L-lysine (EPL), and nisin that have known anti-bacterial activity and are used as US-FDA-approved food preservatives, as well as ningnanmycin and capric/caprylic acids. They potentially could qualify as biopesticides with the EPA and ultimately as organic compounds with the NOSB and OMRI. Our initial evaluations of these compounds showed high in vitro toxicity, but only moderate activity in fruit assays. Therefore, we continue to try to improve their efficacy by using selected additives. We are currently consulting with a formulation chemist of a major registrant on ways to formulate ε-poly-L-lysine and nisin. Plant extracts evaluated containing clove, garlic, and cinnamon oils are EF-400, BacStop, ET-91, and Gargoil. Other natural products that we continued to evaluate are Alum (KAl(SO₄)₂·12H₂O), chlorine dioxide (ClO₂), RejuAgro, and TD-NC-1 (riboflavin). Compounds that we evaluated for the first time are the natural antibiotic ningnanmycin and the plant extract QAM. These products can be registered, and some are in the IR-4 program to test novel potential solutions for diseases that are difficult to manage such as fire blight.

In a recent international fire blight meeting, information was discussed concerning the pending registration of several mixtures of bacterial phages for reducing *E. amylovora* population levels. Our previous evaluations were unsuccessful. Other researchers have also shown that new composite phage products do not meet expectations, however, mixtures of the phages with biological controls such as *Aureobasidium pullulans* (e.g., Blossom Protect) gave a higher level of control than using either product alone (i.e., phages or *A. pullulans*). Our goal is to develop effective rotational programs for organic farming with the use of copper, biopesticides, food preservatives, and OMRI approved natural products. We also work on conventional programs with the use of antibiotics alone or in mixtures with copper, biologicals, or natural products during bloom or as cover sprays during early fruit development.

Management of postharvest decays. Apples like other pome fruits can be stored for some period of time using the correct storage environments. Still, postharvest decays caused by fungal organisms can cause losses that are economically detrimental to storing and marketing of fruit. The major postharvest pathogens of apples include *Penicillium expansum*, *Botrytis cinerea*, *Alternaria alternata*, *Mucor piriformis*, and *Neofabraea* spp. causing blue mold, gray mold, black mold, Mucor decay, and bull's eye rot, respectively. In California, the former three are most common. There is a deficiency of available postharvest biocontrols and natural products to prevent decays in storage. BioSave 100 is one of the only materials currently available in the United States, but it is not very effective. Others like Aspire have been discontinued. Still, new biological products have been registered in other countries.

In our studies we demonstrated that the food preservative natamycin is effective against a spectrum of postharvest pathogens including those causing gray mold, Rhizopus rot, Mucor rot, and Alternaria decays, but it was not highly effective against blue mold. Natamycin (produced by DSM) was registered as the

biopesticide BioSpectra 100SC on stone and citrus fruits and as CeraFruta (produced by Ceradis) also on pome fruit and pomegranates. This compound was federally approved by the US-Food and Drug Administration (FDA) as a food additive to prevent mold growth, including *Penicillium* species, on dairy (e.g., cheese and yogurt) and meat products for many years. Over all the years in use, resistance in *Penicillium* species against natamycin has not occurred. Working with producers and registrants, we submitted a letter of support to the NOSB for approval of natamycin as an organic postharvest treatment of pome fruits. Unfortunately, the first submission request was rejected by the NOSB in 2019. Natamycin is 'exempt from tolerance' by the US-Environmental Protection Agency (EPA). Codex is currently developing a similar category for these types of biopesticides. Therefore, our goal is to continue to evaluate natamycin and other new postharvest fungicides such as an organic formulation of polyoxin-D for the management of postharvest decays of apples.

OBJECTIVES FOR 2020-2021

Fire blight research - Evaluate the efficacy of treatments for managing fire blight.

- A. Laboratory in vitro tests with copper and zinc products in combination with antibacterial food additives (lactic acid, ε-poly-L-lysine, and nisin), natural organic acids (capric/caprylic acids), new and biologicals.
- B. Field trials with protective air-blast spray treatments:
 - i. Kasugamycin in combination with organic treatments to support organic petition to NOSB.
 - ii. New formulations of copper (e.g., Badge X2, CS-2005, Cueva, MasterCop) zinc, and chlorine dioxide in combination with food additives (lactic acid, poly-L-lysine, nisin), and biocontrols (e.g., Serenade ASO) or natural products (Alum, EF-400, BacStop, TDA-NC-1,) as new antibacterial strategies.
 - iii. Bacterial phage-mixture products in combination with other biological control treatments (i.e., Blossom Protect) to provide an integrated strategy.

Postharvest research - Comparative evaluation of new postharvest fungicides

- A. Evaluate natamycin (BioSpectra), other new postharvest fungicides such as organic formulations of polyoxin-D, and Academy at selected rates against gray mold, blue mold, Alternaria decay, and bull's eye rot and compare to fludioxonil.
- B. Evaluate mixtures of these compounds and new formulations of natamycin to improve performance of the fungicide.

PLANS AND PROCEDURES

Isolation of *E. amylovora* **and bacterial culturing.** Samples with fire blight symptoms were obtained in the spring of 2020 from 15 pear orchards in Lake, Mendocino, and Sacramento Co. Infected plant material (fruit, stems, pedicels, twigs) was cut into small sections and incubated in 1 ml of sterile water for 15 to 30 min to allow bacteria to diffuse out of the tissue. Suspensions were streaked onto yeast extract-dextrose-CaCO₃ agar (YDC) and single colonies of *E. amylovora* were transferred. A total of 17 strains were obtained and evaluated for their sensitivity to antibiotics.

Laboratory studies on the toxicity of bactericides against *E. amylovora*. Streptomycin (STR), oxytetracycline (OXY), and kasugamycin were evaluated for their in vitro toxicity using the spiral gradient endpoint method. For this, a radial bactericidal concentration gradient was established in nutrient agar in Petri dishes by spirally plating a stock concentration of each antimicrobial using a spiral plater. After radially streaking out suspensions of the test bacteria ($10 \mu l$ of 10^8 cfu/ml as determined by measurement of optical density at 600 nm) along the concentration gradient, plates were incubated for 2 days at 25°C. Measurements were taken visually for the minimal concentration that inhibited growth by >95% (MIC). The actual antibiotic concentrations were obtained by entering the radial distances of inhibition (measured from the center of the plate) into the Spiral Gradient Endpoint computer program. Selected resistant strains were also tested in an agar dilution test using nutrient agar amended with 100 ppm STR or OXY.

The toxicity of selected other bactericides (see Table 3) against *E. amylovora* was evaluated in spiral gradient endpoint and direct contact assays. For the latter assays, suspensions of a reference strain of *E. amylovora* were

incubated in solutions or suspensions of the antimicrobials, and water was used in control treatments. Mixtures were incubated for selected times, diluted 1:1000 with sterile water, and aliquots were then plated onto nutrient agar. After 2 days, bacterial colonies were enumerated, and percent inhibition in colony formation as compared to the control was calculated.

Virulence and competitiveness of STR-OXY double-resistant strains of *E. amylovora.* Ornamental pear flowers on the UCR campus were inoculated with single strains or with 1:1 mixtures of sensitive and highly STR-OXY-resistant strains. The incidence of infected flowers was determined after 7 days. *E. amylovora* was re-isolated from 15 flowers of each of three replications. Three isolates per flower were then tested for their sensitivity to OXY, and the percentage of recovery of resistant isolates was calculated.

Molecular characterization of STR-OXY double-resistant strains of *E. amylovora*. The presence of *strA-StrB* genes was evaluated in PCR amplifications using published primers (Appl. Environ. Microbiol. 63:4604,1997) at an annealing temperature of 58C. Primers for tetracycline resistance genes Tet1-F and Tet1-R (Schnabel and Jones, Appl. Environ. Microbiol. 65:4898, 1999) were used at an annealing temperature of 55°C. Amplification products were separated by agarose gel electrophoresis.

Field studies on the management of fire blight using protective treatments. Air-blast field studies on the relative efficacy of protective treatments were conducted in experimental cv. Granny Smith and Fuji apple orchards at the Kearney Agricultural Research and Extension Center (KARE). Three applications were done starting at 5-10% bloom and followed by phenology-based treatments until petal fall. Treatments included single compounds, mixtures, and a rotation. Incidence of blight was assessed in mid-June based on the number of infected flower clusters of approximately 100-200 clusters evaluated for each of the four two-tree replications. Additionally, potential phytotoxic effects of the treatments (e.g., fruit russeting and leaf burn) were evaluated. For comparison, field studies were also conducted on Bartlett, Comice and cv. Shinko apple pears with some overlapping treatments to the apple studies. Three to five applications were done, and disease was evaluated in late April. Data were analyzed using analysis of variance and LSD mean separation procedures of SAS 9.4.

Efficacy of new postharvest fungicides for managing apple decays in storage. In laboratory studies, the efficacy of Scholar, Academy, and Penbotec against blue mold was compared to mixtures of these fungicides with BioSpectra and to BioSpectra by itself. The efficacy of BioSpectra in comparison with Scholar was evaluated on Fuji, Gala, and Honey Crisp apples. In these studies, fruit were inoculated with a TBZ-resistant isolate of *P. expansum* 12 h before air-nozzle application with the fungicides. Fruit were then incubated at 20C for 7 days. In an experimental packingline study with Granny Smith apples, another formulation of natamycin, Cerafruta, was evaluated by itself and in mixtures with Scholar, Inspire (difenoconazole), and Oso (polyoxin-D). Fruit were wound-inoculated with *P. expansum* (TBZ-resistant; 500,000 spores/ml), *B. cinerea* (100,000 spores/ml), or *Alternaria alternata* (100,000 spores/ml) 15-17 h before treatment. Treatments were done by high-volume aqueous T-jet applications that were followed by a CDA application with carnauba wax. Fruit were then incubated at 20C for 7 days.

RESULTS AND DISCUSSION

Survey of antibiotic and copper sensitivity in E. amylovora strains from California in 2020. Samples for our annual resistance monitoring in *E. amylovora* were made available from Lake, Mendocino, and Sacramento Co. in 2020, and most of them consisted of a single infected twig. Thus, only 17 strains were obtained, however, our results are still very important.

For STR, 10 strains obtained from 8 orchards were sensitive (Table 1). Moderate resistance (MIC <25 ppm) was found at 2 locations each in Lake and Sacramento Co., and high resistance (MIC>100 ppm) at 3 locations (2 in Sacramento and 1 in Mendocino Co.). Resistance to STR was found previously in Lake Co. in our surveys in 2006 and 2019. Generally, less favorable environmental conditions for blight and the common practice of using STR-OXY in mixtures, may have delayed the development of resistance in Lake Co. In future surveys in this county, a larger number of samples should be collected (more than one sample per orchard) to determine the extent of resistance more accurately. Our findings indicate that STR should be used strategically in management programs. The importance of resistance management cannot be overstressed. Antibiotics should only be used in mixtures or rotations, the number of applications of each per season should be limited to two, and new alternatives (e.g., early season copper, biologicals) should be used and developed.

Strains with OXY resistance levels of >100 ppm were detected for the first time in Sacramento Co. in 2018 and 2019. Two highly resistant strains were again detected in this county in 2020, and these were also highly resistant to STR, similar to the OXY-resistant strains we described previously. Spray programs in these orchards consisted of STR, OXY, and kasugamycin. OXY resistance at this level in *E. amylovora* has never been reported from other locations worldwide, and this finding is a serious concern and demonstrates the stability of the resistance with three years of detection. Resistance development to oxytetracycline in pathogen populations was considered a low risk due to the ephemeral residues of the antibiotic. Over-reliance on OXY combined with frequent, alternate row applications in short intervals may have contributed to high resistance.

In pear flower inoculation studies, two strains highly resistant to STR and OXY were statistically similarly virulent as a sensitive strain and resulted in 62.1% or 47.1% infected flowers as compared to 56.1% for the sensitive strain (Table 2A). These resistant strains also competed well in the presence of a sensitive strain. Thus, in mixed inoculations, 61.5% or 63.8% of strains recovered from diseased flowers had the high STR-OXY resistance phenotype (Table 2B). Still, it is currently not known if these new resistant strains will persist in the absence of selection pressures (i.e., applications with oxytetracycline and streptomycin).

We started to characterize the molecular mechanism of high STR-OXY resistance. PCR amplifications using primers specific for the previously described StrA and StrB genes expectedly amplified a fragment from strains moderately resistant to STR (Fig. 1). For these strains, we previously were able to locate these genes on a new plasmid. These primers also amplified a fragment for strains with high STR-OXY resistance, but not for strains that were only highly resistant to STR. High resistance to STR in California is based on a chromosomal mutation in the ribosomal rpsL gene. Thus, a different mechanism of STR resistance appears to be present in the high STR-OXY resistant strains that may be linked to OXY resistance.

Using published primers for tetracycline resistance genes tetA, tetB and tetC, a DNA fragment with the expected length of 293 bp was amplified using primers Tet1-F/Tet1-R in highly STR-OXY-resistant strains of E. amylovora (Fig. 2). Sequencing of this fragment resulted in 98% homology with a tetA or tetB gene from *Pantoea agglomerans* and other members of the family Enterobacteriacae that was also described from phylloplane bacteria in Michigan apple orchards (Schnabel and Jones1999). Thus, OXY resistance in *E. amylovora* is based on the presence of a previously described 'tet' resistance gene. Our next steps will be to localize this gene, as well as StrA-StrB in our highly STR-OXY-resistant strains. Additional molecular characterization of resistant strains from different areas may provide information if this new resistance evolved several times or if resistant strains were spread among growing areas.

In vitro toxicity of new bactericides against E. amylovora. The in vitro activity of the test compounds varied with the type of assay conducted, i.e., direct exposure and spiral gradient endpoint assays. None of the compounds was found to be highly toxic (Table 3). In 30-min direct exposures of *E. amylovora* suspensions to 500 ppm nisin or ε-poly-L-lysine, colony formation by was reduced by 40 or 50%, respectively, and the toxicity of both food additives was significantly increased with the addition of 100 or 500 ppm EDTA. Using our assay conditions, no inhibition of growth of *E. amylovora* was observed using BacStop, ET91, or QAM. Higher concentrations need to be tested for these compounds. For ningnanmycin, a MIC value of 24.8 ppm was determined, and for Dart it was 1,200 ppm. This compares to MIC values of <0.5 ppm for STR, <1 ppm for OXY, and <20 ppm for kasugamycin. Thus, effective concentrations of the new bactericides are rather high. It needs to be considered, however, that some of the new compounds are thought to affect the host by increasing its natural resistance against diseases, and this is supported by some limited efficacy that we observed in our field management studies (see below).

Field studies on fire blight using protective treatments. A total of six field studies on fire blight management were conducted on Granny Smith and Fuji apple, and on Bartlett, Comice, and Shinko apple pears. In all studies, the conventional antibiotics STR, OXY, or kasugamycin were numerically the most effective treatments, but in some trials, alternative treatments showed promising results with efficacy statistically similar to the three conventional antibiotics.

The new Mycoshield formulation (NUP-17010) by itself was slightly more effective (Fig. 3) and in combination with LI-700 was significantly more effective (Fig. 6) than the older formulation. The addition of LI-700 slightly improved the efficacy of NUP-17010 in one study (Fig. 3), but not in another one (Fig. 6). The FireLine

formulation of oxytetracycline was similarly effective as NUP-17010 (Fig. 4), and the new FireLine formulation was slightly more effective than NUP-17010 (Fig. 5). The efficacy of Kasumin (2L or 4L formulations) was slightly improved when mixed with either Syllit or FireWall (Fig. 6) and was similar in a mixture with FireWall as compared to with LI-700 (Fig. 3).

Copper treatments provided moderate (Figs. 3, 4, 5) or low (Fig. 6) fire blight control. MasterCop mixed with Syllit was slightly more effective than when mixed with Serenade. Cueva mixed with the biocontrol Double Nickel was similarly effective as the MasterCop treatments (Fig. 3). The food preservatives nisin and \varepsilon-poly-L-lysine (EPL) were tested in mixtures with Dart or Manniplex Zn. The addition of Manniplex Zn slightly increased efficacy (Figs. 3,6). Still these food preservatives only provided moderate disease control in comparison to the antibiotics. In a study on Fuji apple, they were not effective. Commercial formulations are needed, and a potential registrant is willing to provide these for the next season.

Treatments with essential oil products (BacStop, EF-400, ET-91, Guarda, Thymox) or plant extracts (QAM) resulted in intermediate to good fire blight control, similar to copper or Blossom Protect treatments (Figs. 3-5,7), and they could become alternatives in organic apple production. They should be continued to be evaluated for best treatment strategies. The new antibiotic ningnanmycin (Ninja, SP2700) was used at a very low rate (16 oz/A of a 2% active ingredient formulation) and showed moderate (Fig. 6) or low efficacy (Figs. 7,8). With an MIC value for *E. amylovora* of 24.8 ppm, it will need to be evaluated at a higher rate (i.e., 250 ppm) in field studies. In studies on Shinko apple pear and Comice pear, Alum (potassium aluminum sulfate) reduced the incidence of blight to low or very low levels (Fig. 7). We and others evaluated this product previously with good results.

RejuAgro, TDA NC-1, and Aqua-Clear were evaluated following protocols for an IR-4 efficacy trial. Inoculation of trees treated with these compounds demonstrated that Aqua-Clear did not have residual activity because it is an oxidizer like peroxyacetic acid products (i.e., Oxidate, Perasan) (Fig. 8). RejuAgro and TDA NC-1 were inconsistent in performance (Figs. 6,7,8).

In conclusion, among organic treatments, Blossom Protect and essential oils showed acceptable commercial efficacy in the management of fire blight, and the latter are the most promising of the new alternative products evaluated. Conventional treatments containing the antibiotics STR, OXY, or kasugamycin were always very effective. Still, other biological treatments to be considered are liquid copper formulations such as Cueva and MasterCop and the food preservatives nisin and ϵ -poly-L-lysine. Formulating these antimicrobial food preservatives to improve their efficacy needs to be done in cooperation with a potential registrant. Nisin and ϵ -poly-L-lysine are eligible for biopesticide registration with the US-EPA. Alum showed good efficacy. It does not cause any known OSHA hazards and is not considered a dangerous substance. Until a supporting agrochemical company is identified as the registrant, it may be difficult to register and label the product on a fruit crop as a pesticide or biopesticide.

Kasumin is currently considered a conventional treatment, however, efforts are underway to obtain an organic registration. The compound is a natural substance that is commercially produced by fermentation of *Streptomyces* species. In contrast to streptomycin and oxytetracycline, it has very minimal or no usage in human and veterinary medicine. Thus, an organic registration seems plausible.

Evaluation of postharvest treatments using single-fungicides, mixtures, and pre-mixtures. Postharvest studies focused on the efficacy of the natural compound natamycin that is currently registered as a biopesticide with tolerance exemption status by the US-EPA. It is registered as BioSpectra on citrus and stone fruits and as Cerafruta on pome, stone, citrus fruits and other crops. In laboratory studies, we compared BioSpectra by itself and in combination with other postharvest fungicides at half rates. In two studies, BioSpectra was very effective in reducing blue mold on Granny Smith apple, but Scholar, Academy, and Penbotec completely prevented decay development (Fig. 9). Mixture treatments of BioSpectra with either of the other fungicides at half rates of each component were also highly effective. For the management of blue mold, we compared the performance of BioSpectra in comparison to Scholar on three additional apple cultivars, Fuji, Gala, and Honey Crisp. BioSpectra significantly reduced decay incidence on all three cultivars by up 75% but was outperformed by Scholar (Table 3). Previously, we found natamycin not to be effective against blue mold on apple-pear (i.e., Asian pear) and four other pear cultivars (e.g., Bartlett, Bosc, Comice, and D'anjou). This is the first time that we observed differential activity of a fungicide on different fruit crops against the same pathogen despite demonstrated in vitro toxicity. This has been a challenge for several years because the fungicide is highly

effective on other decays of pears such as gray mold, Alternaria, and Rhizopus rot even when inoculated on the same fruit as *P. expansum*. We are currently conducting studies to find out the reason for this differential activity.

The efficacy of another natamycin product, Cerafruta, was evaluated for the control of blue mold, gray mold, and Alternaria rot in experimental packingline studies with T-jet applications. Cerafruta showed poor or no efficacy against the three decays (Fig. 10). Academy or a mixture of Cerafruta with a low rate of Scholar (i.e., 8 fl oz), however, was highly effective against the three decays. Oso was highly effective against gray mold and showed good efficacy against Alternaria rot, but performed poorly against blue mold, and a mixture with Cerafruta did not significantly improve performance. New formulations of Cerafruta will be evaluated in the coming season.

Based on the moderate efficacy of natamycin, it should not be used by itself for managing decays of pome fruits, but it may be developed in a premixture with other fungicides. Although efficacy is not improved as compared to using Scholar, Academy, or Penbotec by themselves, adding natamycin represents an excellent resistance management strategy. Resistance to natamycin has not been reported previously to any *Penicillium* species, although the compound has been registered for food uses for over 20 years. We will continue to try to improve its efficacy. Moreover, natamycin still has a chance to receive an OMRI listing with our NOSB petition.

Table 1. Sensitivity of *E. amylovora* strains from pear orchards in California to streptomycin, oxytetracycline, and kasugamycin in 2020

Orchard No.	County	Streptomycin	Oxytetracycline	Kasugamycin
1	Lake	S	S	S
2	Lake	MR	S	S
3	Lake	S	S	S
4	Lake	S	S	S
5	Lake	MR	S	S
6	Lake	S	S	S
7	Lake	S	S	S
8	Lake	S	S	S
9	Lake	S	S	S
10	Mendocino	HR	S	S
11	Sac	MR	S	S
12	Sac	HR	HR	S
13	Sac	S	S	S
14	Sac	MR	S	S
15	Sac	HR	HR	S

Sensitivity to streptomycin, oxytetracycline, and kasugamycin was determined using the spiral gradient endpoint method. S = sensitive, MR = moderately resistant (MIC = <20 ppm), HR = highly resistant (MIC = >100 ppm).

Table 2. Virulence and competitiveness of oxytetracycline-resistant strains of *E. amylovora*

A. Virulence

	Incidence of
Inoculation	flower infections
with	(%)
STR ^s /OXY ^s	56.1 a
STRR/OXYR -1	62.1 a
STRR/OXYR -2	47.1 a

B. Competitiveness

		Recovery of resistant
	Inoculation with	phenotype (%)
Single	STR ^s /OXY ^s	0
strains	STR ^R /OXY ^R -1	94.5
	STR ^R /OXY ^R -2	100
Mixtures	STR ^s /OXY ^s + STR ^R /OXY ^R -1	61.5
	STR ^s /OXY ^s + STR ^R /OXY ^R -2	63.8

Ornamental pear flowers were inoculated with single strains or with 1:1 mixtures of sensitive and resistant strains. The incidence of infected flowers was determined after 7 days. *E. amylovora* was re-isolated from flowers, and sensitivity to oxytetracycline was determined.

Table 3. Summary of in vitro toxicity studies with E. amylovora

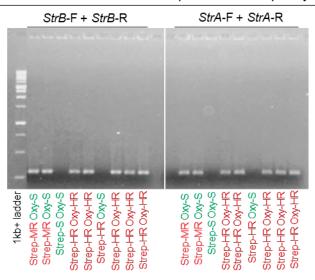
Compound	Type of compound	Spiral gradient endpoint assays	Direct exposure studies		
BacStop	Essential oils	No inhibition at >80 ppm	No inhibition at 1000 ppm		
Capric/caprylic acids (Dart)	Natural acids	MIC = aproximately 1200 ppm	Not done		
ET91	Essential oils	No inhibition at >80 ppm	No inhibition at 1000 ppm		
Ningnanmycin (Ninja)	Natural antibiotic of Streptomyces noursei var. xichangensis	MIC = 24.8 ppm	Not done		
Nisin	Food additive	No inhibition at >80 ppm	50% inhibition at 500 ppm after 30 min		
Nisin + 100 ppm EDTA	Food additive	not done	Completely inhibitory at 500 ppm after 30 min		
QAM	Agave extract	No inhibition at >80 ppm	Not done		
TDA-NC-1	Riboflavin	not done	Completely inhibitory at 500 ppm after 1 h		
ε-poly-L-lysine	Food additive	No inhibition at >80 ppm	40% inhibition at 500 ppm after 30 min		
ε-poly-L-lysine + 500 ppm EDTA	Food additive	not done	Completely inhibitory at 500 ppm after 30 min		

Table 4. Evaluation of postharvest treatments for managing blue mold of Fuji, Gala, and Honey Crisp apples

	Fuj	i	Gal	a	Honey Crisp			
Treatment	Incid. (%) LSD		Incid. (%) LSD		ncid. (%) LSD Incid. (%) LSD		Incid. (%)	LSD
Water control	100	а	100	а	100	а		
BioSpectra 1000 ppm	20.9	b	25	b	25	b		
Scholar 300 ppm	0	С	2.1	С	0	С		

Fruit were wound-inoculated with *P. expansum* 12 h before spray treatments with an air-nozzle sprayer. Treatments were done Fruit were then incubated at 20C for 7 days. Data are the average of 2 experiments.

Fig. 1. PCR amplification of *StrA-StrB* genes in *E. amylovora* strains with different resistance profiles to streptomycin and oxytetracycline



PCR amplifications were performed using published primers for the two streptomycin resistance genes with a 58C annealing temperature. Isolates used were either streptomycinsensitive (Strep-S), moderately resistant (Strep-MR), or highly resistant (Strep-HR), and oxytetracycline-sensitive (Oxy-S) or highly resistant (Oxy-HR).

Fig. 2. PCR amplification of a tetracycline resistance gene in *E. amylovora* strains sensitive or highly resistant to oxytetracycline

Amplification using degenerate primers Tet1-F and Tet1-R with a 55°C annealing temperature (Schnabel and Jones1999)

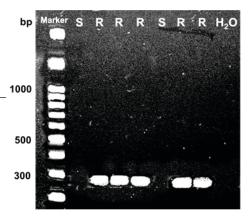


Fig. 3. Efficacy of bactericides for management of fire blight of Granny Smith apples,
Fresno Co. 2021

Treatment	Rate	2 10	3-29	4-11	Blight incidence (%)
Control		<u> </u>	<u> </u>		а
Nisin + Dart	13.5 oz + 24 fl oz	@	@	@	b
ε Poly-L-Lysine + Dart	13.5 oz + 24 fl oz	@	@	@	b
Nisin + Manniplex Zn	13.5 oz + 32 fl oz	@	@	@	bc
MasterCop + Serenade	64 fl oz + 96 fl oz	@	@	@	bcd
MasterCop + Syllit	64 fl oz + 48 fl oz	@	@	@	bcd
Cueva + Double Nickel	96 fl oz + 96 fl oz	@	@	@	bcd
Blossom Protect + Buffer Protect	20 oz + 5 lbs	@	@	@	bcd
BacStop + EF400	38 fl oz + 38 fl oz	@	@	@	bcd
Mycoshield (NUP 17010)	8 oz	@	@	@	bcd
ε Poly-L-Lysine + Manniplex Zn	13.5 oz + 32 fl oz	@	@	@	bcd
Mycoshield + LI-700	16 oz + 32 fl oz	@	@	@	bcd
Kasumin 2L + LI-700	64 fl oz + 32 fl oz	@	@	@	cd
Kasumin 2L + FireWall	64 fl oz + 8 oz	@	@	@	cd
Mycoshield (NUP 17010) + LI-700	8 oz + 32 fl oz	@	@	@	d
					0 10 20 30 40

Treatments were applied on 3-19 (king bloom), 3-29 (full bloom), and 4-11-21 (petal fall) using an air-blast sprayer. There were four replications of two trees each per treatment. Disease was evaluated in late May on 100 flower clusters per tree.

Fig. 4. Efficacy of bactericides for management of fire blight of Granny Smith apples, Orchard 2, Fresno Co. 2021

Grenard 2, 1 resino 60. 2021											
Treatment	Rate	3/24	4/6	4/14	Blight incidence (%)						
Control					a						
Thymox	64 fl oz	@	@	@	b						
Guarda	1%	@	@	@	b						
BacStop + EF400	38 fl oz + 38 fl oz	@	@	@	b						
Cueva + Double Nickel	96 fl oz + 64 fl oz	@	@	@	b						
NUP-17010	8 oz	@	@	@	b						
FireLine	16 oz	@	@	@	b						
Kasumin 2L	64 fl oz	@	@	@	b						
					0 5 10 15						

Treatments were applied on 3-24 (5% bloom), 4-6 (full bloom), and 4-14-21 (petal fall) using an airblast sprayer. There were 5 replications per treatment. Disease was evaluated in mid-June on 100-200 flower clusters per tree.

3/30 4/7 4/15 Blight incidence (%) Treatment Rate Control EPL + ManniPlex 6.75 oz + 32 fl oz @ @ @ Nisin + ManniPlex 6.75 oz + 32 fl oz ab @ @ @ BacStop + EF400 38 fl oz + 38 fl oz @ @ @ bc cd Cueva + Double Nickel 96 fl oz + 64 fl oz @ @ @ de NUP-17010 8 oz @ @ @ ef New FireLine 5.33 oz @ @ @ Kasumin 4L 32 fl oz @ @ @ 10 20 30

Fig. 5. Efficacy of bactericides for management of fire blight of Fuji apples, Fresno Co. 2021

Treatments were applied on 3-30 (5% bloom), 4-7 (full bloom), and 4-15-21 (petal fall) using an air-blast sprayer. There were 5 replications per treatment. Disease was evaluated in mid-June on 100-200 flower clusters per tree.

Fig. 6. Efficacy of bactericides for management of fire blight of Bartlett pears, Live Oak, 2021

	Treatment	Rate (oz, fl oz)	3-23 WT	3-31 FB (80%)	4-7 PF	4-15 PF	Natural disease (strikes/tree)
	Control						a
	Nisin + Dart	13 + 24	@	@	@	@	ab
	Cueva + Double Nickel	64 + 128	@	@	@	@	ab
	TDA -NC-1 + NuFilm 17	20+8	@	@	@	@	abc
	Nisin + ManniPlex	13 + 32	@	@	@	@	abc
	EPL + Dart	13 + 24	@	@	@	@	abc
	EPL + ManniPlex	13 + 32	@	@	@	@	abc
	Mycoshield + LI-700	16 + 32	@	@	@	@	bc
	Ninja (SP2700) + Dart	16 + 24	@	@	@	@	bcd
, 0,	Blossom Protect + Buffer	20 + 80	@	@			bcd
Rotation	Serenade Opti	96 oz			@	@	
4	QAM + Dart	38 + 24		@	@	@	cde
	Kasumin 2L	64	@	@	@	@	de
	NUP-17010 + LI-700	8+32	@	@	@	@	de
	Kasumin 2L + Syllit	64 + 48	@	@	@	@	cd
	Kasumin 2L + FireWall	64 + 16	@	@	@	@	e
	NUP-17010	8	@	@	@	@	e
	New FireLine + Dart	8 + 24	@	@	@	@	e
							0 10 20 30 40 50

Treatments were applied on 3-23, 3-31, 4-17 and 4-15-21 using an air-blast sprayer. Natural disease was determined on 4-21-21.

WT FB FB Early Late Blight incidence (%) 80% FB PF PF Treatment 5% 50% Rate (/A) a Control --------ab SP2700 + LI700 16 oz + 16 fl oz @ @ @ @ --b Blossom Protect + Buffer 20 oz + 80 oz@ @ ---Serenade ASO 96 fl oz @ Alum + Regulaid 128 oz + 16 fl oz 12 h BI 12 h AI @ bc TDA-NC-1 + NuFilm 17 20 oz + 8 fl oz@ @ @ @ bc 0.6 gal/3 gal RejuAgro A* 12 h BI | 12 h AI bc ET-91 + LI700 320 + 8 fl oz 12 h BI | 12 h AI @ Firewall 17 200 ppm - 16 oz @ @ @ 0 2 4 6 8 10

Fig. 7. Efficacy of new bactericides for management of fire blight of Shinko Asian pear at UC Davis 2021

Treatments were done on 3-17 (WT = white tip), 3-23 (50% bloom), 3-24 (80% bloom), 3-31 (petal fall), and 4-6-21 (late petal fall) using an air-blast sprayer. SP2700 = ningnanmycin, Ninja. Trees were inoculated with E. amylovora (1 x 10^6 cfu/ml) on 3-24-21 before the 80% bloom application. BI = before inoculation, AI = after inoculation. Disease was evaluated on 4-29-21.

Fig. 8. Efficacy of new bactericides for management of fire blight of Comice pear in a field study at UC Davis 2021

			Timing		
Treatment	Rate (/A/100 gal)	4/1	4/6	4/14	Blight incidence (%
Control					ab
RejuAgro A* + Regulaid	0.6 gal/3 gal + 16 fl oz	@	@		a
Aqua-Clear 7.5	40 ppm	@	@	@	ab
SP2700 + LI700	16 oz + 8 fl oz	@	@	@	ab
SP2700 + LI700 Blossom Protect + Buffer Serenade ASO	20 oz + 80 oz	@	@		bc
Serenade ASO	96 fl oz			@	
Alum + Regulaid	128 oz + 16 fl oz	@	@	@	cd
Firewall 17 + LI700	200 ppm - 16 oz + 8 fl oz	@	@	@	d

 $^{^{\}star}$ No more material was available for the third application of RejuAgro. Treatments were applied using an air-blast sprayer. SP2700 = ningnanmycin, Ninja. Flowers were inoculated with *E. amylovora* (5 x 10⁶ cfu/ml) after the first application. Disease was evaluated on 4-20-21.

^{*} RejuAgro A was mixed as per instructions with PEG and Regulaid

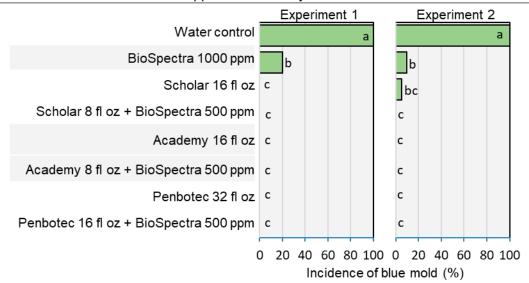


Fig. 9. Evaluation of postharvest treatments for managing blue mold of Granny Smith apple in laboratory studies

Fruit were wound-inoculated with *P. expansum* 12 h before spray treatments with an air-nozzle sprayer. Treatments were done Fruit were then incubated at 20C for 7 days.

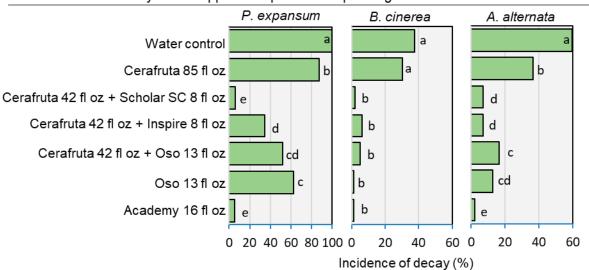


Fig. 10. Evaluation of postharvest treatments for managing postharvest decays of Granny Smith apple in experimental packingline studies

Fruit were wound-inoculated with *P. expansum* (TBZ-resistant; 500,000 spores/ml), *B. cinerea* (100,000 spores/ml), *or A. alternata* (100,000 spores/ml) 15-17 h before treatment. Treatments were done by high-volume aqueous T-jet applications that were followed by a CDA application with carnauba wax. Fruit were then incubated at 20C for 7 days.



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California Apple Commission 2020 effects of Sulfur / Lime Sulfur on Apple Demo Trial



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Email: Devencenziag@gmail.com Phone: 209-329-2165 2020 Observing the phytotoxic effects on Organic Apple from various fungicide applications containing sulfur. A Demonstration Tria

Preformed for the California Apple Commission

Introduction

the bloom, the foliage, the fruit size at harvest, and the fruit finish is among the concerns that applications was determined to be the best way to address these questions. The CAC realizes some insight for further testing, possibly in a replicated trial to better pinpoint concerns that depending on the manufacturer, are allowed to be applied at these stages or later, example Organic growers are limited on the fungicides that they can use for various diseases. limited to what we observe at the time we are surveying the treatments. They may provide Although Lime Sulfur labels may avoid the bloom stage applications, it does not prohibit it. bloom stages is a common practice and could have an effect on the crop set, russeting, etc. being subjected to the Lime Sulfur Application. Wettable Sulfur being applied during these formulations of sulfur on organic apples. The phytotoxic effects of applications of sulfur on Observation purposes. The results could vary from year to year or field to field and will be everything from pre bloom to petal fall on the same tree. Thus, the varying stage of crop have been expressed. An observation trial evaluating the different grower practices and that this trial is not replicated, has no statistical validity, is solely for Demonstration and Wettable suifur and Lime Sulfur are both used in the pre bloom and petal fall period for diseases such as Scab and Powdery Mildew. Both formulations of these sulfur products, inquiring how much of a phytotoxic effect do these have on the tree and the crop itself. With the prolonged bloom period that occurs in California, due to lack of chill, we have The CAC has decided to fund a study on the effects of the various labeled rates of both Wettable sulfur can be used into the season for mildew or scab. The apple industry is may appear to occur.

California, but it is in other states. This trial is using product rates that are legal as fungicides, because of the prolonged bloom period in California apples, we may see some reduction in crop yield or crop quality due to the variable presence of the different an effect or if the grower co-operator deviated from the original protocol. Lime Sulfur is not registered for thinning in a look at the effects of Wettable Sulfur and/or Lime Sulfur Solution applications on apple during the bloom period. some deviation from the original design, usually due to a change that may have given us a better chance to observe We followed the trial design that was given to CAC when possible. The following report will show that there was The above was the introduction and pre-trial statement that was given to the California Apple Commission to summarize the wishes of the commission. Based on this we proceeded with a Demo Trial designed to give us bloom and fruit stages present when these products may be applied.

Devencenzi Agricultural Pest Management & Research

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Email: Devencenzia<u>g@gmail.com</u> Phone: 209-329-2165 2020 Observing the phytotoxic effects on Organic Apple from various fungicide applications containing sulfur.

A Demonstration Trial Preformed for the California Apple Commission

Design, Location, Methods

Grower 2 Location - North San Joaquin County Grower 1 Location - South San Joaquin County Variety - Buckeye

Variety - Buckeye

Rootstock - M7

Row spacing - 9X16, north-south planting

Rootstock - M111

Mature bearing orchard Farming System - Organic

Row Spacing - 14X8, north - south planting

Mature Bearing orchard

Farming System - Conventional

Design 10 like trees per treatment were selected to obtain data from in the trial

The 10 trees per treatment that were selected were used for the leaf phyto, crop load counts, and harvest sampling data each treatment was 3-4 rows wide

The 10 trees were selected from the inside rows as to eliminate drift issues to be used for observations

We avoided trees near pollinator trees to eliminate the crop set effect

We avoided trees on borders to eliminate drift issues

We made an effort to select trees and areas the had trees of similar size when selecting the 10 trees

Treatment areas were near each other to insure that orchard conditions, tree age, size, health was similar

Orchards used for trial were all healthy and vigorous

Applications applications were made with Spectrum Speed Sprayers, volume - 100 - 150 gpa

all products allowed to dry prior to rain occurrence, applications were made between 3/24/20-3/30/20

Lime Sulfur Solution was TKI Brand

Cosavet Edge was the Wettable Sulfur Brand

evaluations, we did go back to the trial area for the evaluation which was made each time an application was Bloom Stage The bloom evaluations were objective, randomly evaluating 50 spurs each time we made the evaluation Evaluations to trees with in the treatment arca. We may not have gone back to the same tree for the bloom stage made when possible.

effects present in a designated area in each tree to compare to a UTC when possible, in an effort to observe a reduction Foliage & Fruit Each of the 10 trees that we selected to evaluate any phytotoxicity to foliage, as the number of fruit that was in crop load. This was preformed prior to a hand thinning

sample was then rated for fruit russeting and weighed to better understand effects on fruit size if there were any. Harvest Evaluations 10 apples were taken from each of the ten trees in the treatment to be used for further evaluation. This 100 fruit The ten apples were selected from a 6 ft high X 6 ft wide area that was evalusted earlier for crop load

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California Apple Commission 2020 effects of Sulfur / Lime Sulfur on Apple Demo Trial

Application Data & Bloom Evaluation Grower 1

*Rate - Volume - applications were not supposed to exceed 2 gals of Lime Sulfur Sol./100 gals staying with in label fungicide rates

Petal Fall - PF

			000000 00000	ages, source	% NDFF/FF/F			Ses	es Sees	tages on 3/27/20		3	
	Comments		Variations of bloom stages	coeffede not once 100 Property	stations not open, to	3rd Sc3	43 07 TODDE/DE/E	30 0/ 1/DBE/PF/F Stages	Zw 30 % NBFF/FF/F stages	Evaluation of bloom stages on 3/27/20	24% C79% K DDE/DE/E ctones	Se /u INDI E/I E/F SIZE	
		14.	L	L			790	20%	87		24%	5	
		äd	300				2000	1 40/	2		700		
		18	30%				1,040	2000	802		30%	2	
		KBPF	8.80				14%	1.40%	2		14%		- 3:
		KB	20%				1884	10%			14%		
		dd	20%				24%	30%			4%		
		d	20%				9.9	10%					
	Bloom Stages	od .											1
		*Rate	3 gals	7.5 lbs.	3 gals		2 gals	2 gals	2 gals		1 gai	1 gal	
4-1011		product	Lime/Suffur Sol.	Wett, Sulfur	Lime/Sulfur Sol		Hme/Suffur Sol	=	Lime/Sulfur Sol			Lime/Sulfur Sol	
Full Bloom - FB		Application Date	3/24/2020	3/24/2020	3/24/2020		3/28/2020	3/28/2020	3/28/2020		3/30/2020	3/30/2020	
Full Pink - FP	į	Grower 1 Treatment	1-1 Orange	1-2 Pmk	1-3 Red Dot	1-4 Blue-UTC	1-1 Orange	1-5 Red/White	1-3 Red Dot	1-4 Blue UTC	1-5 Red/White	1-3 Red Dot	1-4 Blue-UTC

70% KB open with some PF Grower Observations -FYI 95% - KB open 95%- KB dry 30% KB Pink 3/24/2020 5% - KB pink 60% - KB PF 3/27/2020 25% - SB PF

we did go to the area where the demo trial was being conducted, thus the variance of different stages. This would be indicative of the uneven bud breaking in the orchard due to lack of chill. One could expect fruit in the petal fall stage When making the bloom stage evaluations we may not have gone back to the same tree for every evaluation, or later would be more subject to russet or phytotoxicity

The bloom evaluations were objective, randomly evaluating 50 spurs each time we made the evaluation

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Application Data & Bloom Evaluation Grower 2

*Rate - Volume - applications were not supposed to exceed 2 gals of Lime Sulfur Sol./100 gals staying with in label fungicide rates

	Commont	Silent	150/ Free Looked After a section of	on 2/25 20% VBDE/DE/F	1/1/1/1 A NB 1/1/1/1	90% VBBF/BF/F		26% G2% KBPF/PF/F	
		30	700	80		7696	2	16%	
		FR	33%	25/70		24%	2	28%	
		KRPF	%9	S		14%	2	20%	
		KB	12%			%		2%	
		d:d	20%			10%		%	
		a	%9			10%			
	Bloom Stages	dd							
		*Rate	20 Ubs	20 lbs	3 gals	3 gals	3 gals	3 gais	
Fruit - F		product	Wett Sulfur	Wett sulfur	Lime/Sulfur Sol	Lime/Suffur Sol	=	=	
King Bloom Petal Fall-KRPF Full Bloom - FB		Application Date	3/24/2020	3/24/2020	3/24/2020	3/27/2020	3/27/2020	3/30/2020	
	1	Treatment	Orange	Blue	2-3 Red/White	Orange	2-3 Red/White	2-3 Red/White	
Pink - P Full Pink - FP		Grower 2 Treatment	2-1	2-2	2-3	2-1	2-3	2-3	

we did go to the area where the demo trial was being conducted, thus the variance of different stages. This would be indicitive of the uneven bud breaking in the orchard due to lack of chill. One could expect fruit in the petal fall stage When making the bloom stage evaluations we may not have gone back to the same tree for every evaluation, or later would be more subject to russet or phytotoxicity

The bloom evaluations were objective, randomly evaluating 50 spurs each time we made the evaluation

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Applications effect on bloom / foliage Grower 1

and the alternate side of the other 5 trees. This allowed us to look at both sides of the trees, 1/2 trees one side, 1/2 trees the other. See Example below; 6 ft wide and 6 feet up into the tree. We still evaluated 10 trees in a row with in the treatment, alternating back and forth evaluating one side of 5 trees per tree, we took an area aprox 2 meters wide and 2 meters high from the ground and counted the fruit in that area. This would be aprox. and to obtain a better trend if possible on the treatments effect on the bloom or the foliage. Instead of counting a limited amout of spurs We adjusted the effects on bloom and foliage evaluation from the original protocol to better compare treatments

xample	East		West
		Tree	Evaluate
	Evaluate	Tree	
		Tree	Evaluate
	Evaluate	Tree	
		Tree	Evaluate

Fruit counted with in the 6 ft. X 6 ft. area of Tree	he 6 ft. X 6 ft. a	rea of Tree								
Grower 1	Treatment									
	Blue	1-4	Orange	1-1	Red/White	1-5	Red Dot	1-3	Pink	1-2
	East Side	West Side	East Side	West Side	East Side	West Side	East Side	West Side	4.5	Work Ci
Fruit / 1 side of tree	37	44	47	88	45	125	30	4	0	90
Ξ	69	106	40	89	38	06	24	. 60	888	90
=	43	38	28	36	64	62	6	48	115	90
Ξ	15	35	6	43	61	73	28	33	113	90
=	29	50	15	19	54	33	26	2 2	ď	450
Side Total	193	273	1.39	225	262	383	117	195	474	E.53
Total fruit		46.6		36.4		64.5		31.2		00 7
avg. / tree										-
Foliage Phyto	0	0	0	П	0	0	1	H	1	-
Rating									l	1

Phytotoxicity Table	0 - No obvious leaf damage
	1 - some leaf distortion of deformity compared to UTC
	2 - some distortion along with tip and marginal burn
	3 - same as 2 rating but with more leaf puckering and burn
	4 - heavy burn and leaf /tip distortion

Evaluation made prior to handthinning on 4/16/20

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California Apple Commission 2020 effects of Sulfur / Lime Sulfur on Apple Demo Trial

Applications effect on bloom / foliage Grower 2

and the alternate side of the other 5 trees. This allowed us to look at both sides of the trees, 1/2 trees one side, 1/2 trees the other. See Example below; 6 ft wide and 6 feet up into the tree. We still evaluated 10 trees in a row with in the treatment, alternating back and forth evaluating one side of 5 trees per tree, we took an area aprox 2 meters wide and 2 meters high from the ground and counted the fruit in that area. This would be aprox. and to obtain a better trend if possible on the treatments effect on the bloom or the foliage. Instead of counting a limited amout of spurs We adjusted the effects on bloom and foliage evaluation from the original protocol to better compare treatments

Example	East		West
		Tree	Evaluate
	Evaluate	Tree	
		Tree	Evaluate
	Evaluate	Tree	
		Tree	Evaluate

20		Evaluate					
or to handthinning on 4/16/20 Treatment East Side Corange 2-1 Red/White 42 68 20 23 20 42 68 20 23 21 42 68 20 23 21 42 68 20 23 21 38 53 41 27 3 57 54 23 41 33 247 272 137 152 88 247 272 137 152 88 51.9 26.9 26.9 26.9 26.9			Tree	Evaluate			
corto handthinning on 4/16/20 The 6ft X 6ft. area in tree Treatment Blue 2-2 Orange 2-1 Red/White A5 61 28 39 20 42 68 20 23 21 42 68 20 23 21 42 68 20 23 41 27 57 54 25 41 27 3 57 54 23 41 27 3 57 54 25 41 27 3 51.9 26 25 41 27 88 51.9 21.9 22.5 22.5 22.5							
Treatment Search Search	Evaluation made prior	to handthinnir	ng on 4/16/2	0.			
Treatment Sign Si	Fruit counted with in th	ne 6 ft X 6 ft. a	rea in tree				
Blue 2-2 Orange 2-1 Red/White Fast Side West Side	Grower 2	Treatment					
East Side West Side East Side Weet Side <t< td=""><td></td><td>Blue</td><td>2-2</td><td>Orange</td><td>2-1</td><td>Red/White</td><td>2-</td></t<>		Blue	2-2	Orange	2-1	Red/White	2-
46 61 28 39 20 42 68 20 23 21 38 53 41 22 11 64 36 25 27 3 57 54 23 41 33 247 272 137 88 51,9 25 28 88 0 0 2.5 2.5 2.5		East Side	West Side			East Side	West
42 68 20 23 21 38 53 41 27 11 64 36 25 27 3 57 54 23 41 33 247 272 137 152 88 247 51.9 28.9 1 0 0 2.5 2.5 2.5	Fruit / 1 side of tree	46	6.1	28	38	20	31
38 53 41 27 11 64 36 25 27 3 27 54 23 41 33 247 272 137 152 88 51.9 28.9 28.9 1 0 0 2.5 2.5 2.5	=	42	89	20	23	21	7
64 36 25 27 3 57 54 23 41 33 247 272 137 152 88 51.9 28.9 28.9 1 0 0 2.5 2.5 2.5	=	38	23	41	12	11	17
57 54 23 41 33 247 272 137 152 88 51,9 28,9 28,9 0 0 2.5 2.5 25 2.5 2.5	=	64	36	225	2.7	က	26
247 272 187 152 88 51,9 28.9 1 1 0 0 2.5 2.5 2.5	44	57	54		41	33	17
0 0 2.5 2.5 2.5	Side Total	247	272	137	152	88	86
0 0 2.5 2.5 2.5	Total fruit		51.9		28.9		18.
0 0 2.5 2.5	avg. / tree						
Rating	Foliage Phyto	0	0	2.5	2.5	2.5	m
	Rating						1

Phytotoxicity Table	O No obsidence land demonstrate
יין	o - No obvious lear damage
	1 - some leaf distortion of deformity compared to UTC
	2 - some distortion along with tip and marginal burn
	3 - same as 2 rating but with more leaf puckering and burn
	4 - heavy burn and leaf /tip distortion

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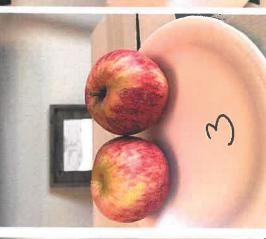
209-329-2165

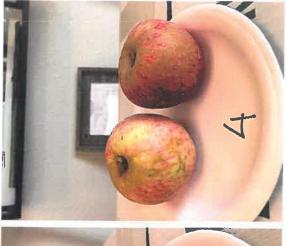
California Apple Commission 2020 effects of Sulfur / Lime Sulfur on Apple Demo Trial Harvest Data - 7/24/20

Russet evaluation

- 0 no obvious russeting in stem well or on fruit
- 1 obvious russeting in stem well, not on shoulder or exceeding the horizon of the shoulder of the fruit
 - 2 obvious russeting in stem well, continuing over the shoulder showing on upper part of fruit
- 3 obvious russeting as on rating 2 but continuing down to the side of the fruit in some areas of the fruit
- 4 obvious russeting on a large part of the fruit, usually present in stem well, calγx, and/or the sides of the fruit









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Grower 1					
Total Weight	30.2 lb	26.4 lb	28.2 lb	30.8 lb	29.8 lb
100 fruit					
Russet Rating	1.43	1,73	1.39	1.64	1.64
Average	Blue	Orange	Pink	Red/White	Red Dot
percent 0	0=7%	%9=0	%8=0	0=4%	0=5%
percent 1	1=44%	1=32%	1=46%	1=37%	1=33%
percent 2	2=48%	2=48%	2=45%	2=50%	2=55%
percent 3	3=1%	3=11%	3=1%	3=9%	3=7%
percent 4	4=0%	4=3%	4=6%	4=0%	4=0%
Treatment	Treatment	Application Date	product	* Rate	
1-1	Orange	3/24/2020	Lime/Sulfur Sol.	3 gais	
1-2	pink	3/24/2020	Wett. Suffur	7.5 lbs	
1-3	Red Dot	3/24/2020	Lime/Sulfur Sol	3 gals	
1-4	Blue-UTC				
1-1	Orange	3/28/2020	Lime/Suffur Sol	2 oale	
1-5	Red/White	3/28/2020		2 gais	
1-3	Red Dot	3/28/2020	Lime/Sulfur Sol	2 gals	
1-4	Blue - UTC				
1-5	Red/White	3/30/2020	=	100	
	Red Dot	3/30/2020	Character Continue cont	000	

	Ground's			
	2 Iawai 2			
	Total Weight	29.8 (b)	28.8 lb	32 lb
	100 fruit			
	Russet Rating	1.09	1.32	1.67
	Average	Blue	Orange	Red/White
	percent 0	0=19%	0=21%	0=3%
	percent 1	1=53%	1=32%	1=34%
	percent 2	2=28%	2=43%	2=58%
	percent 3	3=0%	3=2%	3=3%
	percent 4	4=0%	4=2%	4=2%
Treatment	Treatment	Application Date	product	*Rate
2-1	Orange	3/24/2020	Wett Sulfur	20 Lbs
2-2	Blue	3/24/2020	Wett suffur	20 (02
2-3	Red/White	3/24/2020	Lime/Sulfur Sol	3 gals
2-1	Orange	3/27/2020	Lime/Sulfur Sol	1 Anile
2-3	Red/White	3/27/2020	-	3 gals
2-3	Red/White	3/30/2020	=	3 28

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2020 Observing the phytotoxic effects on Organic Apple from various fungicide applications containing sulfur.

A Demonstration Trial

Preformed for the California Apple Commission

Observations & Trends

Grower 1

Grower 2 Location - North San Joaquin County	Variety - Buckeye	Rootstock - M7	Row Spacing - 14X8, north - south planting	Mature Bearing orchard	Farming System - Conventional
Grower 2					
Location - South San Joaquin County	Variety - Buckeye	Rootstock - M111	Row spacing - 9X16, north-south planting	mature bearing orchard	Farming System - Organic

Bloom Stage Evaluations

They were different although they were in the same vicinity of each other. There were some spurs with fruit present on the tree that was If you add up the stages of the spurs with fruit that could be present and susceptible to russeting due to the application (KBPF/PF/F) used for the 3/24/20 evaluation in the Grower 2 trial. A different tree had less fruit on it 3 days later when evaluated on 3/27/20. followed is a huge factor in the effects of the applications that were made and followed in this trial. The observations showed the stages at the timing of each of the treatment. We made 2 observations on 3/27/20 at the Grower 1 trial. to trees with in the treatment area. The variation of bud break and it's relation to the bloom and fruit stages that The bloom evaluations were objective, randomly evaluating 50 spurs each time we made the evaluation These observation examples illustrate that there were some variation of crop stage from tree to tree.

You would have the following -Grower 1 Grower 2

Foliage & Fruit

Foliage Phytotoxicity - Using the 10 observation trees, Grower 1 showed very little if any effects on foliage. Grower 2 had more foliage symptoms the leaf phyto increased. With grower 2 the more Lime Sulfur that was applied the more the leaf phyto., Wettable Sulfur alone was a 0 rating, than 1, the Wett Sulfur in the Grower 2 trial was undamaged, when we added the single or multiple applications of Lime sulfur when we added the Lime Sulfur Solution applications it jumped to a 2.5 - 3 rating.

Fruit Counts - made prior to hand thinning in these treatments showed some trends. Both grower trials showed the

more applications that were made of either Wett. Sulfur followed by Lime Sulfur Sol., or multiple Lime Sulfur Sol. applications, the less fruit that was present on the 10 observation trees.

Harvest Evaluations

Weights for both growers ranged from a low of 28.2 lbs. to 32 lbs. with the exception of the 26.4 lb. in treatment mentioned. The effects on the fruit weight did not really show any large differences that stood out, most of the 100 fruit sample weight 10 apples were taken from each of the ten trees in the treatment to be used for further evaluation. This fruit was then were very similar. The Orange treatment for grower 1 was a little lower than most of the other treatments, 26.4 lbs. rated for fruit finish russeting and were boxed and weighed to better understand effects on fruit size.

Grower 2 - the Wettable Sulfur alone treatment (2-2) resulted in a 72% of none to very little russeting out of the 100 sampled fruit. When you add a Lime Sulfur Sol. application (2-1) to it we counted a 53% of the sample in the zero to very little russeting score. Grower 1 - the UTC,(1-4) had 51% of the sample 100 fruit in the none to very little russeting grades. They had very similar Russet ratings showed a definite trend towards the fact that the more applications of Lime Sulfur Sol. that were applied the more of an increase in russeting. The wettable sulfur alone and the UTC treatments were similar in russeting effect. effects on the Wettable Sulfur treatment alone (1-2) at 54% in the same none or very little russet rating.

NOTE - Both Growers:

On the other hand when there were multiple applications of Lime Sulfur solution the range of none to very little russeting score drops to 37 - 41 % of the fruit in the sample.

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Conclusions and Summary

taking crop load data, and fruit for evaluation again not only from the same trees, but from a similar area with in each tree. Regardless of this effort we still ran into a variable bloom and crop presence that will show in our crop load counts. From the data collected the following bullet points Because of this issue the demo trial was adjusted accordingly. Example being similar trees to be evaluated from treatment to treatment, It is not uncommon for Gala apple in California to bloom for 3 weeks or more due to the lack of proper winter chill. should help explain any trends, and findings along with a few opinions; * The more applications of Lime Sulfur Treatment the more the crop load was effected, example Grower 2 comparisons, treatment 2-3 compared to other Grower 2 treatments and Grower 1, treatment 1-3 compared to the other treatments

* Grower 1 treatments showed little difference in russet ratings in regards of timing, whether it be early or late in the bloom stages, Grower 1 showed the biggest difference between the UTC or Wettable Sulfur alone when compared to when Lime Sulfur Sol. was added

* Grower 2 showed a decrease in crop load, a increase in russeting and foliage damage as Lime Sulfur was added to the treatments compared to the Wettable Sulfur alone * The more Lime Sulfur that was applied during the application period the overall increase in russeting, foliage phytotoxicity, and decrease in crop load. Both growers showed this with the Grower 2 site demonstrating it the best.

*Effect on fruit size was variable and similar, only Grower 1, treatment 1-1 was a standout, a replicated treatment comparison may show better effects

temperatures warm to approaching 80F or more that the crop load may also drop. 80F can also effect apple pollen, but it is felt that the sulfur also * Temperatures may have been to low for the Wettable Sulfur to have an effect on the bloom as it has been noticed by many growers that as the contributes to this. *if future trials are to be made they should be replicated. Consider counting all apples in each treatment when evaluating crop load effect. At least a couple trees per treatment. This would help adjust the data to better reflect what we missed due to lack of chill/uneven bloom

*Any products that would tighten the bloom and overcome the lack of chill effect should help considerably

Please contact me with any follow up questions now or in the future.

Thank you

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California Apple Commission 2020 effects of Sulfur / Lime Sulfur on Apple Demo Trial

Temperature Data at Bloom Stages

				- Treatment neriod																
	Precip.	0.04	0.07			0.05								0.01	0.92	0.07			0.08	0.01
South SJC	Max lemp	63	9	61	65	59	89	70	74		89	7.1	70	62	59	59	29	70	62	69
Constitution of the second	Precip.	0.2				0.05								0.12	1.35	0.19			0.04	0.03
North SJC	ivida i emp	62	29	09	63	28	29	69	73		99	69	89	59	57	57	99	89	64	70
March	INIGICII	24	25	56	27	28	29	30	31	April	П	2	m	4	5	9	7	00	o	10

Temperature Data from U.C. Ext. Pest Cast Stations

Cling Peach Review Article, February 2021, Draft

The problem of finding skilled labor to manually harvest tree fruits is growing more acute every year. The supply of workers from rural Mexico, the primary source of farm workers in the past, is dwindling due to restrictive immigration policies, an aging workforce, and greater opportunities for workers to find good paying jobs in Mexico. In addition, new minimum wage laws, transient worker housing requirements, and other regulations are significantly driving up the cost of this very labor-intensive operation. The need for mechanical harvesting of tree fruits is the number one issue cited by growers if the industry is to survive.

Collaborating with the California Cling Peach Board, Pear Advisory Board, and Apple Commission, the University of California-Davis Bio-Automation Lab has been working to solve the problems associated with the mechanical harvesting of tree fruits. Under the direction of Dr. Stavros Vougioukas, UC Davis has meticulously mapped the precise geometry and fruit locations for scores of actual fruit trees. These tree maps have enabled us to create virtual orchards in which computer simulations are used to test mechanical harvesting concepts.

There are two main approaches to the mechanical harvesting of fruit trees. One method uses computer vision and robotic arms to individually locate and pick each piece of fruit. This most closely emulates what a human does, but for reasons given below is extremely difficult for a machine to replicate. The second method is to shake the tree and catch the fruit on some type of soft catching surface. This has its own unique challenges, but could prove to be a faster and more efficient way to harvest.

Consider the "locate and pick" method for a moment. Despite advances in both hardware and software, it is still difficult for a computer to "see" fruits on a tree. Leaves and branches partially or completely occluding the fruit is the main factor hindering computer vision. In addition, variations in lighting, colors, shapes, and shadows make it more difficult for a computer to determine what is or isn't a piece of fruit to be picked. This technique may work on a "fruit wall" in which the trees have been meticulously trained, trimmed, and pruned such that the vast majority of fruit is readily visible. However, trees in more conventional orchards tend to have large, complex, 3-dimensional structures which severely limit fruit visibility. The mapping studies by UC Davis and others found that a significant percent of fruits could not be seen by looking directly at the tree. Also, robotic arms are complicated mechanisms, generally slow to move into position to pick a fruit, and very expensive. It is for these reasons that the UC Davis team has been exploring the shake and catch approach, in parallel to robotic harvesting.

Tree shaking is a commonly used technique to harvest nuts or hard fruits that are not likely to be damaged as they fall from the tree. However, softer fruits, like peaches, can suffer significant damage such as punctures and bruises if left to fall through the canopy onto a catching surface beneath the tree. Simulations using our virtual orchard showed that fruit to limb collisions are very common unless the fruit is caught after falling only a short distance. By using a Multi-Layer Fruit Catching and Retrieval system (MFCR) the drop height for a piece of fruit before it is caught can be reduced such that its chances of colliding with a branch are

almost zero. Controlled laboratory experiments using an array of inflated polyethylene tubes as a catching surface showed that fresh fruits could be repeatedly dropped from a height of 12 inches onto the catching surface without sustaining any visible damage. We have built a single layer of an MFCR and took it to orchards to "catch" falling peaches and pears. This layer consisted of aluminum square tubing booms which could be inserted into the tree canopy. After insertion, air pressure inflated a row of polyethylene tubes from opposite sides of the boom to form a catching surface which could bend around branches in necessary. The free ends of the tubes were supported by a dummy boom, and all the booms were padded. Figure 1A shows the MFCR layer inserted in a pear tree and Figure 1B in a peach tree.





Figure 1A: MFCR in a pear tree.

Figure 1B: MFCR in a peach tree.

Since we had only one layer, and did not have a trunk shaker available, we used the following procedure to get fruit to drop onto the catching surface. The MFCR was mounted on a hoist and inserted near the top of the canopy about one foot below the highest fruits. After inflating the tubes, researchers on ladders reached into the canopy and clipped the stems of all the fruits in the region from a foot above the surface to the surface, allowing them to free fall onto the catching surface. The fruits were removed by hand from the surface and placed into collection boxes. Then the tubes were deflated and the booms withdrawn from the canopy. Next the MFCR was lowered by a foot and reinserted into the canopy. Again stems were clipped and allowed to drop onto the catching surface. This procedure was repeated until the catching surface was below the lowest fruit-bearing branches. This was done for multiple trees resulting in the collection of several hundred pieces of fruit. To get an equal number of control samples, an experienced picker was carefully manually harvesting fruit from the same tree and adjacent trees.

After harvesting, the fruits were immediately taken to the UC Davis Post Harvest Center for sorting to remove diseased fruit, cold storage, and subsequent evaluation. To prevent additional ripening all fruit was stored in a temperature controlled room at 0°C. The peaches were kept at 0°C for 5 days. After the 5 day period we sought to compare our two harvest treatments by performing three evaluations a pre-peel, post-peel, and canning on 180

mechanically harvested peaches and 180 control samples. Figure 2 shows the results of the pre-peel and post-peel examinations.

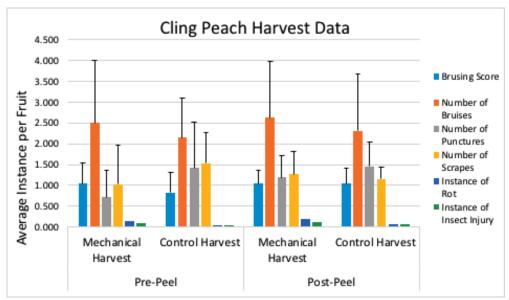


Figure 2: Pre-Peel and Post-Peel Examination Results

It should be noted that the peaches were about one week past peak ripeness when harvested, so damage may be a little higher than if these trials had been conducted a week earlier. The data shows that there is not a significant difference in the rate of injury between the two harvest methods.

These early simulations, experiments, and prototypes show that the shake and catch method using an MFCR system has great potential to rapidly harvest fruit trees. Of course an actual MFCR would have many layers, perhaps 10 or more, spanning the entire height and width of the canopy. This means a great many booms and inflatable tubes would be needed. For the past two years the UC Davis team has focused on the development of booms that are relatively simple to fabricate, lightweight, inexpensive, and extremely reliable. This is very challenging for a number of reasons. First, the spacing between trees of quite limited, so there may be insufficient room to deploy long, one-piece booms. During our trials we could access trees at the edge of the orchard, so there was adequate room for our 9 foot long booms. In the center of the rows the canopies nearly touch, so shorter booms which can telescope into the tree are needed. Second, inflatable tubes that are perpendicular to the booms extend nicely upon inflation, but it is difficult to retrieve the fruit from the catching surface. Also, the tubes do not retract back into the boom upon deflation, even if suction is applied. Instead they tend to droop down the side of the boom and can get tangled in branches and torn as the boom is withdrawn from the canopy. We have been looking at various approaches to overcome these challenges.

One technique is to have a large number of rigid, adjacent telescoping booms each supporting a long inflatable tube. The booms can vary slightly in height from one to the next to create a series of ridges and valleys. Fruits falling on the booms would settle into the valleys and could

be pulled to the base of the boom when the telescoping boom is retracted. Figure 3 is a photo of three such booms retracted. The two red inflatable tubes form the ridges and the gray center tube is the valley or collection boom.



Figure 3: Booms retracted

Figure 4 shows the booms after they have been extended, inflated, and have "caught" some peaches. When extended, a red retrieval strap covers the center collection boom. The black object at the end of the strap is a foam block which pushes the fruit towards the base of the boom when it is retracted.

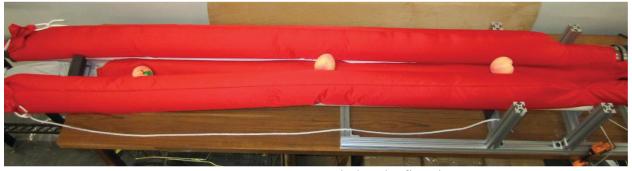


Figure 4: Booms extended and inflated

The telescoping support booms in Figures 3 and 4 are made from nested PVC pipes. They are relatively lightweight and inexpensive, but difficult to fabricate, requiring internal pulleys and cables. The inflatable red and gray tubes are sewn from rip-stop nylon. After trying various thicknesses of polyethylene tubing and heat sealed taffeta, we have found rip-stop nylon to be the most durable material. Keeping the inflatable tube centered over the round support boom is a challenge. We have made booms using half-pipes so the tube can rest within the concave surface, but these are far more difficult to fabricate and they leave the cables and pulleys exposed to where they could get tangled in branches. We've also tried nesting U-channels made of plastic, but they tended to flex too much and get off track.

Another obstacle to overcome is the fact that when pushing an array of closely spaced booms into the canopy, some of them will collide with a large branch and refuse to go any further. The system must be flexible enough to accommodate this. To solve this we are looking into what we call the "pin art" or contour gauge concept as illustrated in Figure 5.



Figure 5: A contour gauge

In this approach booms stop when they encounter an obstacle, but adjacent booms continue past the obstacle. Of course our booms would be much wider than the pins of a contour gauge, so perhaps only one or two booms would need to stop.

With the support of the peach and pear commodity boards, industry and university partners, and the National Institute of Food and Agriculture, UC Davis will continue to work towards the development of a feasible shake and catch system for tree fruits.

Project Summary

The U.S. apple industry features 244,000 acres of orchards which produce 240M bushels each year with a farm gate worth of almost 4 billion dollars. Apple rootstocks are the foundation of a healthy and productive apple orchard. They are the interface between the scion and the soil, providing anchorage, water, nutrients, and disease protection that ultimately affect the productivity and sustainability of the orchard. Dwarfing and early bearing apple rootstocks provide unique advantages in fruit growing as they increase the efficiency of fruit production by making the orchard amenable to high density and automated or mechanically assisted operations. Most commercial dwarfing apple rootstocks being used by the U.S. industry are susceptible to devastating diseases (fire blight, apple replant disease, viruses), can be intolerant to other abiotic stresses (cold, drought, nutrient deficiencies, poor water quality) and may not be physiologically compatible with existing grafted scion varieties. This research project concerns breeding and evaluation of improved apple rootstocks and developing an understanding of the genetic and physiological components of apple rootstock traits. In cooperation with other USDA units, universities, and private concerns, the project aims to develop and release improved apple rootstocks and apply genomic, phenomic and bio-informatic tools for marker assisted breeding of apple rootstocks while leveraging discoveries in plant nutrition and root morphology. Research work in greenhouse, laboratory, nursery, and field plots, whether located at the PGRU or at cooperators' facilities, will be used to evaluate the characteristics of interest and examine new rootstock selections for commercial adaptation. The project utilizes cost efficient state of the art technologies to understand how rootstocks can make the orchard more productive and apply such knowledge to develop improved rootstocks. This research impacts all U.S. apple producing regions, with the potential to improve productivity, safety and survivability of apple orchards by 10% to 20% when new rootstock technologies are implemented, and increasing labor efficiency by enabling mechanization of cultural practices.

Currently, in California, as part of the ongoing rootstock trials, Dr. Fazio has been successful in developing virus free plant material for several rootstocks targeted for testing in California. These materials have been transferred to Sierra Gold Nursery and the National Clean Plant Network Center located at U.C. Davis. Additionally, the next set of trials are being propagated at Sierra Gold Nursery. The first batch is expected to be ready in 2022 and the next in 2023. At this point, current field trial locations are monitored by California growers and Dr. Fazio. Future field trial locations will be identified in 2021. California Department of Food and Agriculture Specialty Crop Block Grant and CDFA Nursery Program Grant funds are now being utilized to fund these trials in California. For more information on the trials, please do not hesitate to contact the Commission office.

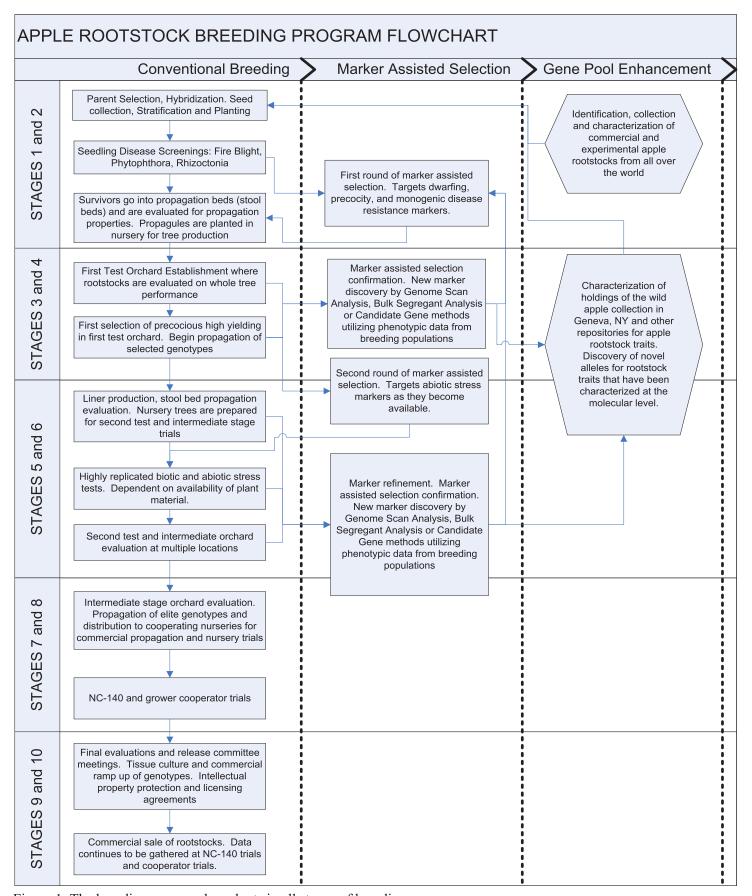


Figure 1. The breeding program has plants in all stages of breeding

Objectives

The Geneva® Apple Rootstock Breeding Program has a good track record of providing superior apple rootstock genotypes that are more productive and disease resistant than currently available rootstocks for the U.S. and world apple industry. The program will pursue this by means of best affordable technology available, including novel methods of high throughput phenotyping, genomic and bioinformatic tools.

- Objective 1: Develop and release improved apple rootstocks by leveraging advances in marker assisted breeding, including construction of genetic maps, establishing trait associations, gene discovery for important rootstock traits (dwarfing, early bearing, yield efficient, fire blight resistant), and screening for novel alleles for important rootstock traits. [NP301, C1, PS1A, PS1B]
 - Sub-objective 1A Perform all breeding and evaluation stages involved in the 15-30 year process (timeline depending on intensity of phenotyping and need to fast-track) of developing new rootstocks with the assistance of recently developed breeding tools, such as high throughput phenotyping and marker-assisted breeding.
 - Sub-objective 1B Identify and characterize novel germplasm, genes, alleles and trait loci through quantitative trait analyses leveraging new genetic-physical maps.
- Objective 2: Identify and dissect important rootstock traits that modify gene activity in the scion, toward enhancing drought tolerance, tree architecture, propagation by nurseries, root growth and physiology, nutrient use efficiency, and disease resistance; incorporate this knowledge into breeding and selection protocols. [NP301, C3, PS3A; C1, PS1A]
 - Sub-objective 2A Identify components of rootstock induced traits that modify gene expression and metabolic/physiological profiles of grafted scions to increase tolerance to abiotic stresses, improve fruit quality and storability, increase tree productivity, disease resistance and nutrient use efficiency.
 - Sub-objective 2B Validate relationships between trait components and overall apple tree
 performance in different rootstock-scion combinations and incorporate new knowledge
 into breeding and selection protocols.

Need for Research

Description of problem to be solved:

The United States has 7,500 apple producers who, collectively, grow 240 million bushels of apples on average each year on 322 thousand total acres of land. The farm-gate revenue, or wholesale value, of the U.S. apple crop annually is close to \$4 billion, with a predicted additional \$14 billion related downstream economic activity each year (U.S. Apple Statistics). Members of the U.S. apple industry and industry groups (Washington Tree Fruit Research Commission – WTFRC, New York Apple Research and Development Board - NYARDP, U.S. Apple, etc.) have prioritized national and localized research needs that address problem areas identified by stakeholders. For example research needs in the "critical" and "high priority" for 2017 by the WTFRC included "soil health" and "improved rootstock and scion genetics", highlighting the importance of new rootstock technologies to promote sustainability, efficiency and increased productivity for their industry

(http://www.treefruitresearch.com/images/2017_apple_hort_postharvest_priority_list.pdf). Secondary to the choice of a scion variety, the choice of rootstock is perhaps the most important orchard establishment decision growers make because rootstocks affect productivity, fruit quality, orchard longevity, mechanization and many other aspects of apple production. Another aspect that was not evident until recent experiments is that there is a scion by rootstock interaction that can be leveraged to make the system more (or less) efficient i.e. the scion variety Honeycrisp produces more good quality apples with G.890 as a rootstock than G.210. Understanding the underpinnings of that interaction and designing new rootstocks that can be classified or localized to a specific environment and scion variety is very important to apple growers. The scion-rootstock-environment interaction begins at the soil-root interface where water, soil properties, nutrients and rhizospheric biota mingle with rootstock genetics to affect whole tree traits like drought tolerance, nutrient uptake efficiency, anchorage, and replant disease disorder etc. The

interaction continues as the rootstock transcriptome, metabolome, phytohormone apparatus sends and receive signals from the scion – with the graft union as the interface between the two genotypes. More research is needed to understand those interactions and produce improved rootstocks that increase the profitability of the apple industry.

Relevance to ARS National Program Action Plan:

Apple growers require improved, economically and environmentally sustainable production systems to compete in the international fruit market. They are doing this by establishing high-density orchards of high-value cultivars. The apple rootstock determines many key aspects of tree performance, including tree size, productivity, fruit quality, nutrient uptake efficiency, pest resistance, stress tolerance, and ultimately profitability. New, improved rootstocks that incorporate improvements in biotic and abiotic stress tolerance/resistance traits are essential to grower profitability because in modern orchards, rootstocks are subjected to numerous biotic and abiotic stresses – rhizospheric pathogens, temperature, water availability, soil pH, and fertility. These stresses end up affecting not only tree productivity, but also the quality of fruit being harvested. The returns from high-density plantings far exceed those of low-density plantings. However, the initial investment may cost 10 times more for high-density plantings than low-density plantings, thus greatly enhancing economic risk. A key component of high-density apple production is the rootstock. The rootstock can induce early cropping, thus allowing close plant spacings. It is critical to develop more rapid means of screening potential rootstock candidates for susceptibility to stresses, to understand how different rootstocks respond to biotic and abiotic stresses, and to develop recommendations for the use of particular rootstocks under changing orchard conditions and production practices. Understanding factors contributing to apple root physiology – stress tolerance, nutrition, and growth related gene networks is vital. Knowledge of the physiological mechanisms that underlie these responses will allow for the development of genetic maps, molecular markers for target traits, new marker assisted breeding strategies, cultural practices, and ultimately practical means for mitigating various stresses for industry.

The proposed research is relevant to the NP 301 Action Plan, Component 1 – Crop Genetic Improvement; Problem Statement 1A: Trait discovery, analysis, and superior breeding methods; Problem Statement 1B: New crops, new varieties, and enhanced germplasm with superior traits; and to Component 3 – Crop Biological and Molecular Processes; Problem Statement 3A: Fundamental knowledge of plant biological and molecular processes.

Potential benefits expected from attaining objectives – NP 301 Action Plan Anticipated Products to which the project will contribute -

- 1. Higher yielding plants.
- 2. Plants with resistance or tolerance to diseases and pests.
- 3. Plants tolerant to environmental changes or extremes.
- 4. Plants optimized for production efficiency.

Specific project products and/or outcomes:

- New apple rootstock varieties with superior performance with regards to dwarfing, productivity and disease resistance.
- New understanding about genetic effects of apple rootstock on several whole tree health traits including tolerance to replant disease, nutrient absorption and translocation.
- New understanding about the application of tree architecture modifying rootstocks to make the orchard/nursery more amenable to mechanized operations.
- Incorporation of new alleles/traits in the apple rootstock breeding pool. Identification and characterization of new gene pools for apple rootstock traits.



• Genetic maps, robust, haplotype-specific molecular markers linked to important traits, and new marker assisted breeding protocols.

• Generation of mass-gene expression profiles of rootstocks in breeding populations and integration of expression profiles with marker assisted breeding.

Customers of the research and their involvement

Our customers are all apple growers, especially those in the regions affected by fire blight (Northeast, Midwest, Northwest U.S.) and growers who plant in soil that is symptomatic for Apple Replant Disease. These customers include small, medium and large conventional and organic fruit growing companies – growers like Jennifer Crist and Jim Bittner in New York and Mike Wittenbach in Michigan who have planted field trials of Geneva® rootstocks because of their need to find better stocks that are resistant to fire blight and that will perform well under organic management (Singer Farms -Bittner); growers near the tri-city area in Washington where they witnessed increased incidence of fire blight in the last five years; and growers in the Yakima (WA) who will need to replant a quarter of older orchards in the next 10 years while virgin land, optimal for apple orchards, is becoming rare in the same area, leaving no alternative to replanting on previous orchard sites needing fumigation with harmful chemicals. Another customer group is made up of organic apple growers and growers participating in integrated pest management like Stemilt Growers Inc., the largest multiple apple variety shipper in the US and the largest organic apple grower in the state of Washington. Two other important customer groups are apple growers planting high density orchard systems and nurseries supplying North America that specialize in the production of apple rootstock liners and finished apple trees, like Richard and Brett Adams of Willow Drive Nurseries (Ephrata, WA), who are propagating test rootstocks for research trials in the US, Devin Cooper, owner of Willamette Nurseries (Canby, OR), Brett Smith of Treco Nursery (Woodburn, OR), Cliff Beumel of Sierra Gold Nurseries (Yuba City, CA), and Todd Cameron of Cameron Nurseries (Quincy, WA) who are among the several nursery operators that are propagating Geneva® rootstocks and selling liners or finished trees to growers everywhere in the US. Additional customers include international apple nurseries and growers that have found value in adopting superior apple rootstock varieties produced by this program.

Commercial apple trees are a combination of two different genetic types: the rootstock (root system) and the scion (aerial system) which bears fruit.



 The rootstock mother plants are layered with saw-dust in a stoolbed to generate rooted rootstock shoots



A bud from a scion variety like Gala or and precocity of the Granny Smith is grafted on the rootstock apple tree.



The rooted rootstock shoots are harvested from the mother plant and planted in a nursery

4. The scion bud grows into a shoot and then into a mature apple tree. The rootstock will influence the productivity, size and precocity of the apple tree.







Figure 3. Comparison of nursery tree architecture featuring a flat branching rootstock, G.935 (right), versus an upright branching rootstock (JTE-B).

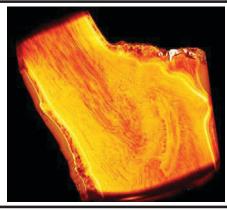
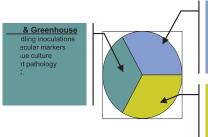


Figure 4. Micro CT scan of a graft union of Honeycrisp on G.41 showing the region where the bud was placed and the unorganized formation of some vessels that may contribute to graft weakness.



Orchard Production
-Individual yield and
growth
-Disease incidence
-Scion compatibility
-Suckering
-ETC.

Nursery
-Liner production
-Tree Production
-Stoolbed evaluation
-Transplant Evaluation
-ETC.

Figure 5. Activities of the apple rootstock breeding program. Laboratory, orchard and nursery components are essential for he success of the program.

 Fable 1. Selection traits for breeding apple rootstocks. These raits are sometimes evaluated at different locations by the nany collaborators of the apple rootstock program.

	TEMNO	
Fire Blight resistance	1 or 7	Greenhouse/Field
Phytopthora resistance	1	Greenhouse
Replant Disease Complex	1 or 7	Greenhouse/field
Wholly apple aphid res.	1-5	Greenhouse/field
Juvenility nursery - Spines	3-4	Field/Stoolbed
Stoolbed rooting	3-4	Field/Stoolbed
Growth habit - Brittleness	3-4	Field/Stoolbed
Dwarfing	8-12	Orchard
Precocity	8	Orchard
Suckering	8	Orchard
Yield – Biennial bearing	12	Orchard
Cold hardiness	15	Orchard
Drought tolerance	4	Orchard
Graft union compatibility	5	Orchard

Scientific Background

History and foundation germplasm - The foundations of a productive and healthy orchard are the rootstocks that provide anchorage, water and nutrients essential to the above- ground portions of the trees. The utilization of composite trees has increased the efficiency of breeding productive apple trees by dividing the selection of scion traits and rootstock traits into two genetically (and functionally) different specimens, which are then brought together through grafting. The art and science of grafting scions onto rootstocks spans several millennia; it is thought that it was used initially to aid in the clonal propagation of desirable scion varieties for fruit and nut production (Janick, 2005). In these millennia, it is likely that very little attention was dedicated to the selection of a particular rootstock chosen for its properties (ease of propagation) and the properties it imparted to the scion (Tukey, 1964; Rom and Carlson, 1987; Webster, 2003; Webster and Wertheim, 2003). Clonal selection and the beginning of the science of rootstocks seems to have originated in the latter half of the last millennia, where at least for apple, certain rootstock clonal selections were identified to impart unique productivity and architectural properties (early bearing and dwarfing) onto the grafted scion variety (Monceau, 1768). It is very likely that these properties existed or were selected directly on own-rooted trees first as these trees were early bearing, inherently dwarfed and production of fruit from these curious apple plants was early and abundant compared to seedling trees (Loudon, 1822). The combination of small architecture and productivity is optimal for cultivation in fruiting gardens typical of monasteries, aristocratic and wealthy middle-class dwellings (Rivers, 1866), where the 'Paradise' apple, 'Jaune de Metz' (Lindley, 1828) otherwise known as Malling 9 (and relatives) could make grafted scions dwarfed, becoming popular in central Europe for making composite dwarfed trees (Hatton, 1917). Scientists at the East Malling Research Station in the United Kingdom, collected many clonal rootstocks from around Europe and painstakingly characterized each of them eliminated duplicates and established foundation material of rootstocks named 'Malling 1-16' (Hatton, 1919; 1920). Rootstock "Malling 9' (M.9) and its sport mutations became the primary rootstock that fueled the green revolution of dwarfed apple orchards that occurred in the twentieth century in many apple production regions of the world. Narrow crosses among the Malling rootstocks resulted in two widely used rootstocks: Malling 26 (M.26) and Malling 27 (M.27) that have improved propagability, and different forms of the early bearing and dwarfing effects. Most of the dwarfing founding germplasm was interrelated and had a narrow genetic base (Oraguzie et al., 2005; Gharghani et al., 2009), suggesting the need to introduce new forms of disease resistance and improvement on other horticultural characteristics through wide crosses with germplasm that exhibited the desired phenotypes (Aldwinckle et al., 1999; Momol et al., 1999; Forsline et al., 2002). The results of these wide crosses have produced a series of rootstocks that combine disease and insect resistance with productivity, and represent the second generation of rootstock technologies applied worldwide (Fischer, 1991; Wertheim, 1998; Fischer et al., 2000). The apple rootstock breeding program operated in Geneva, NY is the only one that has commercial deployment of results from these wide crosses. This breeding program has operated in Geneva, NY since 1968 by Cornell University Geneva Campus and joint with the U.S. Department of Agriculture Agricultural Research Service since 1998 (Johnson et al. 2001; Fazio et al. 2015b). This program produced the Geneva® series of apple rootstocks by crossing germplasm that complemented the weaknesses of the Malling germplasm (susceptibility to fire blight, woolly apple aphids, crown rots) and systematically crossed such germplasm with all available dwarfing, precocious rootstock germplasm available to the program (Gardner et al. 1980a, b). The parent Robusta 5 became the source of resistance to fire blight and woolly apple aphids (Aldwinckle et al. 1976; Aldwinckle and Lamb 1978; Cummins et al. 1983). Several novel traits have been identified in the Geneva® germplasm including induction of flat branching (or open tree architecture), increased nutrient concentration, and induction of bud-break in low chilling environments (Fazio and Robinson 2008; Fazio et al. 2012, 2013; Jensen et al. 2012). The Geneva® breeding program continues to make new crosses to improve tolerance to drought and other biotic and abiotic stresses that can be ameliorated in apple rootstocks. (Fazio et al. 2015b; Shin et al. 2016; Tworkoski and Fazio 2016; Tworkoski et al. 2016). As our understanding of physiology of apple trees, both at the whole tree level and at the cellular level, has increased, so has the understanding of how and what scion properties are modulated by rootstocks, thus increasing the target traits that may be



selected to improve whole tree performance by improving rootstock performance (Fazio and Mazzola, 2004). Improving rootstock performance involves two sets of very different types of traits: the inherent apple rootstock traits (rooting for propagation, lack of spines and burr knots, resistance to root pathogens, cold hardiness, etc.) which deal with the interaction between rootstocks and the environment, and scion traits that are modulated by rootstocks (tree architecture, productivity, etc.) that represent the interaction between rootstocks and scions.

Breeding methods -Breeding apple rootstocks can be a very lengthy process (Johnson et al., 2001a); there are two ways to accelerate the process: the application of marker- assisted breeding (MAB) in the pipeline and/or the intensification of later stages of field testing (Fazio et al., 2015b). The first aims to eliminate substandard germplasm (non-precocious, non-dwarfing, susceptible to diseases, etc.) from the parental and progeny pools via the development and application of robust diagnostic markers. The second is to increase the number of clonal plants tested for each elite genotype and subject them to multiple phenotyping tests and environments that represent production regions. The theoretical benefits from the application of marker technologies to breeding have been reported in publications (Bus et al., 2000; Fazio et al., 2003; Antanaviciute et al., 2012; Bassett et al., 2015). In 2011 the USDA- ARS apple rootstock breeding program located conducted an internal analysis of the economic impact of applying molecular markers in the breeding program by itemizing the cost per genotype for each stage of selection. A detailed description of the rootstock breeding program stages can be found in Fazio et al. (2015b). Briefly: stages 1 and 2 deal with parent selection, crossing, culling seedlings with disease inoculations and propagation of survivors; stages 3 and 4 deal with the establishment of plants as rootstocks in field orchards and propagation beds (see figure Fig. 1); stage 5 includes the evaluation of propagation beds and replicated tests on biotic and abiotic resistance. Stages 6-7 are secondary highly replicated tests and stages 8-10 deal with pre-commercial testing with multiple varieties and multiple locations. The Geneva breeding program elected to conduct the first round of MAB before stage 3, which involves the initial propagation of plants surviving Phytophthora root rot and fire blight screens. The cost of genotyping with two markers including DNA extraction and labor was about \$10 per seedling. The cost to phenotype each seedling for dwarfing and precocity during stage 3 (9 years of evaluation) in 2010 dollars was \$15.40/year for 9 years = \$138. The cost savings by culling non-dwarfing individuals was significant, and in 2012 we were able to plant 2 orchard rows of well-replicated, high-density first-test orchard instead of the 12 previously planted.

Scion traits affected by rootstocks - Until recently, the number of traits that were recognized to be modulated by apple rootstocks was pretty small: tree vigor, early bearing, and water use. This list has been expanded to new architecture components such as canopy shape and bud break (sylleptic branching), and effects on fruit size and quality, on disease resistance and on nutrient availability in the scion. Perhaps the biggest breakthrough in our understanding of rootstock effects on scions is the study that monitored gene expression changes in scion tissue by different apple rootstocks (Jensen et al., 2003; Jensen et al., 2010; Jensen et al., 2011; Jensen et al., 2012). At the cellular level, signals sent from the root system of different genotypes to the scion can change the expression levels of genes, which in turn change the composition of proteins and related metabolic processes and compounds in the scion. While there are no experiments in apple that have described the opposite interaction, it is safe to assume that this dramatic change likely occurs as signaling from the scion affects the way roots behave and grow. The science behind understanding the issue of communication and affinity between scion and rootstock seems to be in its infancy and has a lot of potential as the concept of "designer rootstocks" gets more traction in the industry.

Tree vigor -The reduction in tree vigor (Figure 2) is perhaps the most important trait imparted by apple rootstocks to the grafted scion (Tukey, 1964). It is imparted to the scion as an early termination of overall season growth (Seleznyova et al., 2008). The benefits due to this trait in modern orchards are enormous and range from increased efficiency in picking and tree management operations, including mechanization, to the decrease of pesticide inputs, ladder accidents, and other ergonomic issues (Groot, 1997a; Groot, 1997,b; Masseron and Roche, 1999; Robinson et al., 2007; James and Middleton, 2011). At the physiological level, the dwarfing trait has increased the effective light interception and partition to fruit

production in the orchard and increased the production per unit area by at least 30% when compared to non-dwarfing rootstocks (Brown et al., 1985; Strong and Miller Azarenko, 1991; Atkinson et al., 1998). This means that for an industry worth \$4 billion like the U.S. industry at least \$ 900 million are a result of the efficiency gained through dwarfing rootstocks. While the genetic components to this trait have been described to be the interaction of two main loci (Fazio et al., 2014b) and perhaps additional modifying loci (Harrison et al., 2016, Foster et al. 2015) it is important to mention that this is a complex trait that has fairly big interaction components and that the total effect of these components results in the overall vigor of the tree. Therefore for any scion 'S', the vigor 'V' is equal to the inherent growth dynamic genetics of the scion 'Sg', plus the dwarfing genetic components of the rootstock 'Rg', plus their interaction, plus the interaction of the whole composite tree with environmental effects 'E' such as fertility, water availability, diseases, soil type, soil pH, and soil type, or orchard management, weed competition, and the like, so that when scion vigor is measured, the genetic components of dwarfing rootstocks are only a part of the equation. This is exemplified by observing the effect of stunting caused by soil-borne replant disease, which has a similar effect to the dwarfing loci in apple and sometimes confuses the estimation of vigor potential of a rootstock (Auvil et al. 2011). While several architectural dwarfs have been identified in domesticated and wild apple populations (Fazio et al., 2009a; Fazio et al., 2014a), this material has not produced commercially viable rootstocks or has not been tested for similarity to the dwarfing characters offered by the alleles contained in M.9, M.8, M.13 and other Malling rootstocks belonging to the initial set selected in East Malling. The dwarfing trait has been shown to be highly heritable, modulated mainly by the combination of alleles of locus Dw1 found on chromosome 5 (Rusholme et al., 2004; Pilcher et al., 2008) and locus Dw2 found on chromosome 11 (Fazio et al., 2014b). Models that take into account some or all combinatorial allelic effects of these two loci have been able to explain upwards of 80% of the genotypic variation for dwarfing (Foster et al., 2015). The two loci interact with each other and do not necessarily seem to be additive, meaning that the lack of one dwarfing locus effect in the model negates the effect of the other. Several physiological models based on phenotypic observation have hypothesized the involvement of hormone signaling (Zhang et al., 2015; Tworkoski and Fazio, 2016), graft union anatomy (Tworkoski and Miller, 2007; Tworkoski and Fazio, 2011), hydraulic conductivity (Atkinson et al., 2003; Cohen et al., 2007), dry matter partitioning to fruit production, or a combination of these (van Hooijdonk et al., 2011), while the underlying causative genes are still largely unknown. Evaluation of this trait for breeding still requires a lengthy period of 7—10 years for the first observation and perhaps another 10—12 years for multi-location trials with multiple scions. As mentioned in the beginning of this section, multiple field trials are needed to evaluate rootstock interactions with different scions and environmental factors. Induction of early bearing in scions - Apple seedlings planted on their own roots experience a juvenile period anywhere from 4—7 years before they reach sexual maturity and bloom and fruit (Visser, 1967). Some dwarfing rootstocks have the ability to induce early bearing or reduce the juvenile period to 2 years in extreme cases (Visser and Schaap, 1967; Visser, 1973). Early bearing is a major selection criterion for improved apple rootstocks because the intensive types of cultivation of apple require a quick return on investment (early production of apples) to offset the installation and infrastructure costs to build the orchard (Cummins et al., 1995; Robinson et al., 2007; Robinson et al., 2011). The genetic loci underlying the rootstock- induced trait 'early bearing' were first described by Fazio et al. (2014), who identified two loci, Eb1 and Eb2, that roughly co-located with Dw1 and Dw2, perhaps indicating that the two traits may be physiologically and genetically interconnected. Several studies have described the rootstock-induced partitioning effect of photosynthate into sexual (fruit) and vegetative portions of the tree (Seleznyova et al., 2008), comparing the effects of different rootstocks (Marini et al., 2006a; Autio et al., 2011b; Autio et al., 2011c), crop loads on tree growth (Marini et al., 2012), productivity, and bienniality (Marini et al., 2013). However, there is paucity in the literature about the causative elements for these rootstock effects. Breeding for this trait requires field evaluation for four years for the first observation in a replicated experimental orchard and then an additional 5 years in multi-location, multi-scion trials. Visser (1967)

showed that scions with reduced juvenility also seemed to be more productive when grafted on M.9

dwarfing rootstocks, indicating the possibility of an inherent scion effect on early bearing and the need to test this scion—rootstock interaction in replicated trials.

Induction of sylleptic branching in the nursery and other architectural changes - Early and abundant fruit production is related to the number of flowering buds produced in the nursery phase and early establishment of the tree in the orchard (Ferree and Rhodus, 1987; Robinson et al., 1991a; Robinson et al., 1991,b; Theron et al., 2000). This number can be influenced not only by the early bearing effects of the rootstocks discussed previously, but also by the ability of the rootstocks to produce prolific sylleptic branching (feathers on a nursery tree) in the nursery and later in the orchard. Early yield has been associated with nursery tree caliper, tree height, and number of feathers. Rootstocks with wider genetic diversity than M.9 and Budagovsky 9 (B.9) have been shown to influence the production of sylleptic branches and the formation of crotch angles, that produce trees with a more open (flatter branches) structure (Fazio and Robinson, 2008a; Fazio and Robinson, 2008,b). This characteristic is mostly observed in rootstocks developed by the Geneva, New York, breeding program, especially with rootstocks G.935, G.213 G.41 and G.214 (Figure 3). The strength of these effects vary with different scions and continue through the life of the tree in the orchard, as observed in the millions of trees planted on G.935 rootstock throughout the world. One additional characteristic that may be related to sylleptic branching is the ability of some rootstocks in the Geneva breeding program to induce bud break and flowering in low chill environments. This effect was observed in a highly replicated trial in Southern Brazil with 'Gala' grafted on three rootstocks (G.213, M.9 and, Marubakaido with M.9 interstem (an interstem is a section of the trunk grafted in between the rootstock and the scion usually made from a third rootstock variety to bridge incompatibility or leverage the qualities of the interstem to increase precocity of the whole tree) where it was observed that in Spring time flowering and bud break were 35% higher in trees with G.213 rootstocks, resulting in higher productivity of the trees (Francescatto, pers. comm.). Breeding for these characteristics requires a lot of time and effort as the effects are confounded by the interaction with the dwarfing potential of the rootstocks and the difficulty of measuring crotch angle and branch length of thousands of replicated nursery trees. Our understanding of the genetic effects underlying these traits is in its infancy as the trait was first described in 2007. It is likely that research and breeding efforts aimed at uncovering the genetic factors for these traits will lead to more productive apple

Propagation traits - Apple rootstocks can be clonally propagated by sterile in vitro methods, soft and hard wood cuttings (Bassuk and Howard, 1980), and by layer or stool cuttings (Adams, 2010). While efforts to breed rootstocks amenable to in vitro culture are virtually impossible due to the complexity of media and growing conditions, efforts to improve rooting ability in layering beds and cuttings although difficult may result in superior rooting genotypes. Breeding for nursery performance can be quite complicated as many factors influence apple rootstock performance in the different nursery phases and at times may conflict with field performance. A prime example of this is the fast and easy adventitious rooting trait, highly desired in the propagation phase but correlated with the development of burr knots in the orchard – a harmful trait in certain orchard environments especially where dogwood borers and other insect borers may be present (Bergh and Leskey, 2003). These difficulties can be overcome with improved nursery management practices developed for the establishment of new layer beds, that which include utilization of different propagation techniques like cuttings (Hansen, 1989; Deering, 1991) or micropropagation (Castillo et al., 2015; Geng et al., 2015), and the treatment with plant growth regulators such as prohexadione calcium in the nursery (Adams, 2010) to increase production of primary adventitious roots. The genetics of adventitious root formation have been investigated in the Geneva breeding program revealing a complex trait with low heritability. Therefore, while it may be possible to breed for rooting traits, the importance of these traits is dwarfed by the importance of low suckering and lack of burr knots in the orchard.

Another characteristic affected by the rootstock is graft compatibility. Historically, most problems that were blamed on compatibility turned out to be virus related (Cummins and Aldwinckle, 1983; Lana et al., 1983), however, certain rootstock/scion combinations under unspecified grafting and nursery management conditions have shown a tendency for weak graft unions in very young trees (Robinson et

al., 2003). Graft incompatibility can arise because of the disruption of normal healing between grafted tissues and can result in anatomical and physiological symptoms, biochemical and mechanical issues that lead to graft failure or tree death (Simons and Chu, 1983, 1985; Skene et al., 1983; Simons, 1985; Simons and Chu, 1985). While it is likely that the method of grafting (chip budding, whip -and- tongue grafting, and machine V grafting) (Hartmann et al., 1997) has an effect on healing and union strength at various stages in the nursery cycle, there may be plant- growth- regulator-related and metabolic- compound - related signals that prevent the formation of a strong graft union. Efforts to understand the ability of the rootstock/scion combination to generate enough connective tissue where they meet is underway in the Geneva breeding program through the use of X-Ray tomography (CAT Scans) shown in figure Fig. 4. Some nurseries report that large caliper stocks may not form as strong a graft union as small caliper stocks; therefore, a rootstock genotype that produces smaller caliper liners from the stool bed may be more suitable for nursery tree production.

Drought tolerance - It is difficult to define drought tolerance without an objective reference or phenotype to measure and it is even more difficult to define in a rootstock independent of the scion-specific tolerance (Higgs and Jones, 1991; Virlet et al., 2015). The economic definition of drought tolerance (little or no loss of marketable fruit production) is different from some of the physiological definitions, which range from loss of photosynthetic activity (Massacci and Jones, 1990), to shoot and root growth under stress (Atkinson et al., 2000), to water use efficiency. Perhaps drought-tolerant rootstocks are of little value where irrigation water is available and relevant only in regions that utilize rainwater and may experience long stretches of drought. However, as climate changes and fresh water availability is threatened in traditional apple growing regions, the search for rootstocks that can thrive with less water is becoming more and more important (Ebel et al., 2001). It has long been recognized that there are differences in apple rootstock reaction to drought (Preston et al., 1972; Cummins and Aldwinckle, 1974; Ferree and Schmid, 1990), but those observations mostly dealt with spurious drought events and compared vigorous and non-vigorous types (Chandel and Chauhan, 1993; Fernandez et al., 1994). Decreased sensitivity to drought was attributed to 'Malling 9' rootstock when compared to 'Mark' (Fernandez et al., 1997) in a potted tree study. A comparison of hormonal drought response between M.9 and MM.111 rootstocks indicated that both rootstocks provided drought resistance but by mechanisms which appear to differ — M.9 produces higher levels of abscisic acid (ABA) that may regulate stomatal opening while MM.111 possesses a more extensive root system (increased soil exploration index) (Tworkoski et al., 2016). Water use efficiency, defined as the ratio of biomass produced to the rate of transpiration, and decreased sensitivity to drought (Xiang et al., 1995; Bassett et al., 2011) has been described in wild apple populations indicating the possibility of using this descriptor as a selection method. Breeding for such a complex trait may be possible only at latter stages of selection as discernment of field-meaningful data requires experiments with high replication, special equipment to control water delivery and use, and very- high- density morphological and physiological measurements. Perhaps gain can be made by selection of components of the trait such as improved root morphology, plant growth regulator signals, and nutrient uptake once their effect is identified in breeding populations possessing all the other 'important' traits.

Cold tolerance - Several rootstocks seem to be tolerant to the different types of cold events that can cause injury of cambial and root tissues (Embree, 1988). Damaging cold events can be quite different in their mode of action as mid-winter, events can have very different modes of action than late fall or spring cold events (Cline et al., 2012). Therefore, the methods used to evaluate sensitivity to differing cold injuring events need to address the physiological conditions specific to each event (Quamme et al., 1997; Moran et al., 2011a; Moran et al., 2011,b). Fluctuating temperatures in late fall, early winter and early spring are associated with hardening and de-hardening of tissues. This hardening and de-hardening process may have a strong genetic component (Forsline and Cummins, 1978), where a group of Malus rootstocks seem to have improved ability to be insensitive to such temperature fluctuations and remain dormant and cold-acclimated. Harvesting rootstock liners during these periods and subjecting them to increasingly low temperatures to show cambial damage is perhaps the most meaningful way to select cold hardy apple rootstocks. Observation of black-heart damage can also aid in the discernment of rootstock/scion

combinations that are susceptible to mid-winter injury (Warmund and Slater, 1988; Warmund et al., 1996). Genes associated with cold response have been described for 'Gala' scions (Wisniewski et al., 2008), and similar genes may be found in apple rootstocks. However, the understanding of segregating factors that influence the different types of cold stress adaptation is virtually non-existent, making genetic or genomic-informed breeding impossible, and therefore selection relies entirely on highly replicated phenotyping.

Root morphology and architecture - Phenotypic variation in the morphology of roots has been associated with increases in yield and tolerance to abiotic stresses in several crops (Sousa et al., 2012; Chimungu et al., 2014; Lynch et al., 2014; Burton et al., 2015; Zhan et al., 2015). Harnessing genetic and phenotypic variation in root morphology traits in apple rootstocks may improve productivity, tree size, drought tolerance, nutrient uptake, anchorage and other related whole tree functions (Eissenstat et al., 2001). Ample phenotypic variation has been characterized in wild Malus sieversii populations and within the Geneva apple rootstock breeding program where genetic factors for fine root formation (highly branched fine roots) have been mapped to chromosome 4 and 11 of the apple genome (Fazio et al., 2009b). Other traits that may be important to characterize may be the volume explored by the roots, the angle of the roots, the longevity of the roots and so on, etc., which are all traits that are difficult to phenotype and for which robust genetic markers may be extremely useful. In Geneva, New York, the apple rootstock breeding program measured several scion and root morphology characteristics of nursery trees of related (half- sibs) Malus sieversii seedlings which showed correlation between canopy volume/tree size and number of thick roots (0.38, P < 0.001), and a less pronounced correlation between tree size and root mass (0.25, P < 0.001), indicating a feedback loop between scion and root growth: the ability of the canopy to support the growth and expansion of a larger primary root system increased the vigor of young trees by their ability to produce root systems with strong primary hierarchy (Fazio et al., 2014a). Apple root systems vary in seasonal growth patterns (Eissenstat et al., 2006), which may affect their ability to forage for nutrients and water, and even colonization with beneficial mycorrhizae (Resendes et al., 2008). Root turnover rates may also play a significant role in tree nutrition and productivity as well as disease resistance or evasion as demonstrated by experiments that utilized replant -tolerant rootstocks from the Geneva breeding program (Atucha et al., 2013; Emmett et al., 2014). While these root traits can be targeted for marker assisted breeding (MAB), the understanding of genes, gene expression patterns and physiological attributes associated with these traits in rootstocks is limited compared to our understating of scion traits; therefore, more research is needed to understand these traits before they become the subject of selection based on genetic markers. The program is currently leveraging aeroponic systems (Appendix B figures 1-3) and mini-rhizotrons to phenotype apple root systems.

Nutrient uptake - Another set of root -related traits deals with the genetic variation and inheritance of absorption and translocation of macro- and micronutrients by the rootstock to the scion (Tukey et al., 1962). Rootstocks have been shown to vary significantly with regards to their intrinsic ability to forage for nutrients as well as transfer them up to various sinks in the scion, including fruit, perhaps affecting organoleptic, post-harvest qualities of the fruit and disease resistance (Lockard, 1976; Westwood and Bjornstad, 1980; Om and Pathak, 1983; West and Young, 1988; Chandel and Chauhan, 1990; Rom et al., 1991; Sloan et al., 1996; Chun and Chun, 2004; Kim et al., 2004). Transgenic, cisgenic, or conventional breeding approaches have been suggested to increase nutrient uptake of minerals such as zinc to improve productivity of the orchard (Swietlik et al., 2007). Most research on nutrient uptake by apple rootstocks has focused on developing the best management practices for nutrient application on a genetically restricted set of rootstocks, and it was not until a large set of genetically diverse rootstocks were observed in different soils and pH treatments that the physiological diversity of apple roots was revealed (Fazio et al., 2012). The analysis of scion nutrient concentration in leaves and fruit in several rootstock field trials in New York State have indicated the possibility that specific rootstocks may affect fruit quality of Honeverisp apples showing that certain rootstocks are able to transfer higher calcium levels to the fruit and that the calcium-linked disorders typical of Honeycrisp are a result of scion-specific intrinsic challenges in the movement of calcium into the fruit (Fazio et al., 2015a). Investigation of the inheritance of nutrient uptake and translocation in a full- sib population of apple rootstocks revealed

quantitative trait loci (QTL) influencing scion leaf mineral concentrations of potassium (K), sodium (Na), phosphorus (P), calcium (Ca), zinc (Zn), magnesium (Mg) and molybdenum (Mo), with the most significant ones on chromosome 5 for potassium, chromosome 17 for sodium and lower significance QTLs for calcium, copper, zinc, and phosphorous (Fazio et al., 2013). Concentrations of some nutrients were highly correlated (K and P, S and P), indicating common nodes in the networked pathway that takes nutrients from the soil through the rootstocks to diverse sinks in the scion (Neilsen and Havipson, 2014). The very different mechanisms (interaction with soil biota, active and passive transport, vessel composition and size, etc.) that impact absorption and transport and the fact that crop load and irrigation can also influence mineral concentrations (Neilsen et al., 2015) makes these traits difficult to improve without the aid of a robust understanding of molecular genetic factors involved. Modeling those factors to achieve a particular balance of nutrients in selected scions is therefore very complicated.

<u>Disease and pest resistance</u> - Commercial application of improved disease and insect resistance can be observed in the Geneva, New York, breeding program. Since its inception, the program focused on developing apple rootstocks resistant to fire blight, a North American disease caused by Erwinia amylovora while maintaining the resistance to crown and root rot caused by Phytophthora cactorum (Aldwinckle et al., 1972; Gardner, 1977; Gardner et al., 1980). This effort over three decades produced rootstocks that are not only resistant to fire blight and crown rot, but that are tolerant to the replant disease complex, and are also resistant to wooly apple aphids WAA (*Eriosoma lanigerum*).

Resistance to fire blight- Fire blight is a devastating disease caused by the anaerobic, gram-negative bacterium Erwinia amylovora, which causes visible symptoms in blossoms, green tissues, fruit and some woody tissues of apple scions and rootstocks. While this disease seems to have originated in the Eastern part of North America, it has now spread to most of the apple growing regions of the world. Rootstock blight on susceptible rootstocks (M.9, M.27 and M.26) can be devastating as the infection results in girdling and death of the rootstock shank eventually killing the whole tree – entire orchards and millions of trees have been destroyed because of rootstock blight. While spraying antibiotics like Streptomycin can alleviate the onset of rootstock blight, genetic resistance of the rootstock is the best preventive treatment. Rootstock resistance to E. amylovora is found in several wild apple species and these have been utilized to breed a new series of fire blight -resistant rootstocks. There seem to be two main types of resistance in apple rootstock: a multi-genic type similar to that is found in Malus robusta 'Robusta 5' where green tissues and flowers are not affected by the bacterium (Aldwinckle et al., 1974b; Cummins and Aldwinckle, 1974) and an ontogenic type of resistance found in Budagovsky 9 (B.9) rootstock where the green tissues are severely affected, but two-year- old and older wood seems not to react to the bacteria (Russo et al., 2008). Genetic inheritance of the 'Robusta 5' type of resistance has been described as having a strain-specific component on chromosome 3 identified as a gene belonging to the NBS-LRR class of resistance genes (Fahrentrapp et al., 2013; Broggini et al., 2014; Kost et al., 2015) and other minor QTLs on linkage groups 5, 7, 11, and 14, which do not seem to be strain-specific detected in a non-rootstock population ('Idared' x 'Robusta 5') (Wohner et al., 2014). Another locus that is non -strain specific was discovered on linkage group 7 in a rootstock population derived from a cross between 'Ottawa 3' and 'Robusta 5' (Gardiner et al., 2012). Cis-genic approaches with the LG03 gene proved only partially successful, suggesting a more complex pathway of resistance than just one gene recognition of the pathogen (Kost et al., 2015).

Replant disease complex - The specific apple replant disease complex is a syndrome observed as stunting and poor growth of young apple trees planted in soil that was previously planted with an apple or pear orchard. This complex disease causes major production losses throughout the life of the orchard. The main causative agents implicated in this syndrome are Cylindrocarpon destructans, Phytophthora cactorum, Pythium spp., Rhizoctonia solani and various pathogenic nematodes (Mazzola, 1998). The occurrence of one or more of these agents will affect the severity of the syndrome and may explain some of the site -to- site variation observed in replant land. This is one of the major problems faced by orchardists as virgin land becomes more rare, major infrastructure investments (hail nets, irrigation, etc.) become more prevalent and require a 'replant -in- place' type of renewal of the orchard and as fumigation

chemistries are restricted by environmental laws (Auvil et al., 2011). The removal of the old orchard leaves a major pathogen load in the soil, which overwhelms the young root system of nursery trees. Fumigation treatments (Methyl Bromide, Chloropicrin, and Nematicides) seem to be effective for less than a year as the pathogens implicated in this disease quickly recolonize the sterile soil, and fallow treatments (undesirable because they leave the land in an unproductive state) have shown mixed results, with replant symptoms sometimes appearing even after 4 years of fallow (Leinfelder and Merwin, 2006). Alternative treatments like seed meal amendments, fertilizers, compost teas, and solarization have been proposed and are in various phases of research and development (Utkhede, 1999; Utkhede and Smith, 2000; Mazzola and Mullinix, 2005; Mazzola and Manici, 2012). In addition to the combination of pathogens involved in each orchard, factors like soil type, climate and other edaphic conditions seem to affect the severity of the complex, making it difficult to diagnose (Fazio et al., 2012). The effects of the disease complex are usually measured by comparing the growth of the same rootstock in sterile soil (pasteurization or chemical treatment) to a biologically active soil collected from the rhizosphere of the old orchard (Leinfelder et al., 2004; Rumberger et al., 2004; Yao et al., 2006a). A comprehensive study of multiple rootstock accessions and Malus species indicated that there was sufficient phenotypic diversity to enable growth in non-pasteurized soil (Isutsa and Merwin, 2000); however, the only reported commercially applicable genetic tolerance to the replant disease complex seems to be derived from progeny of 'Robusta 5' and other wild apple species. Certain root genotypes have been reported to promote unique types of microbial communities, indicating a specificity or perhaps a pseudo- symbiotic effect of specific root systems that defeat the presence of pathogenic microbes (Yao et al., 2006b; Rumberger et al., 2007; St. Laurent et al., 2010). Breeding and selection for Phytophthora resistance is performed by inoculating young seedlings (Aldwinckle et al., 1974a). New studies leveraging Next-Generation sequencing of Pythium challenged rootstock seedlings show upregulation of disease resistance- related pathways in resistant plant material indicating the possibility to select for specific resistance to Pythium components of replant disease (Shin et al., 2016). The placement of several apple rootstocks and breeding populations in sterile culture (micropropagation) has enabled identification of separate genetic effects of resistance to the individual replant components, as these rootstocks were inoculated with cultures of Rhizoctonia species and Pythium species independently. While this set of experiments is still ongoing (Zhu, personal communication), preliminary reports indicate segregation of QTLs affecting this trait and the possibility of developing molecular markers to select superior genotypes.

Resistance to wooly apple aphids - Woolly apple aphid, Eriosoma lanigerum (Hausmann) (Homoptera: Aphididae) has become a more severe pest in apple production areas in the past few years. The retirement of powerful organophosphate pesticides has also increased pressure on orchards. Orchards with resistant rootstocks have been shown to eliminate need for spraying for this pest because the insects cannot overwinter in the rhizosphere. Monogenic resistance to WAA derived from 'Robusta 5' has been mapped to chromosome 17 (Er2 locus) and has been utilized extensively in the Geneva, New York, and New Zealand breeding programs (Bus et al., 2008). Another resistance locus (Er3) from Aotea rootstock has also been mapped on chromosome 8, although it is not as effective as Er1 and Er2 (Sandanayaka et al., 2003; Sandanayaka et al., 2005; Sandanayaka and Backus, 2008). Phenotypic evaluation of this trait consists of rearing insects on susceptible germplasm and then transferring a specific number of insects on actively growing shoots of seedlings or replicated clones in a confined space (usually a netted greenhouse), then observing feeding and proliferation of WAA during a 2 month period after transfer (Beers et al., 2006). The monogenic nature of this type of resistance makes it amenable to utilization of cis-haplotype- specific markers to select parents and cull progeny that do not possess the resistance locus (Bassett et al., 2015). Other sources of WAA resistance are known in the Malus germplasm but very little is known about the genetic inheritance of these sources.

Rootstock tolerance to phytoplasma and viruses - Apple viruses and phytoplasmas can cause losses in productivity by interdicting basic plant functions, deforming branches and roots, and by making fruit unmarketable. To date, these pathogens are known to be spread by grafting, where infected clonal rootstocks or scions are the media for transmission (Wood, 1996; James et al., 1997; Silva et al., 2008).



While the goal of apple industries throughout the world should be to work only with material that has been certified tested for viruses, phytoplasmas and other graft-transmissible agents, the eradication of these agents has been elusive due to propagation practices of some growers and homeowners that use infected sources of budwood. It is recommended that apple rootstock improvement programs pay some attention to phenotyping apple rootstocks for susceptibility to some or all of the possible grafttransmissible viruses or phytoplasmas (Lankes and Baab, 2011). Efforts have been made in Germany and Italy to produce rootstocks resistant to the proliferation phytoplasmas (Candidatus Phytoplasma mali) found in certain accessions of M. sieboldii (Seemuller et al., 2007; Seemuller et al., 2008) and M. sargentii (Bisognin et al., 2008, 2009; Jarausch et al., 2008; Bisognin et al., 2009). Susceptibility to Apple Stem Grooving Virus has been observed in 'Ottawa 3' rootstocks and some of its derivatives (G.16 and G.814) which exhibited stunting or death upon being grafted with an infected scion. The slow decline caused by graft union necrosis among certain rootstock/scion combinations in the presence of Tomato Ring Spot Virus (ToRSV) (Tuttle and Gotlieb, 1985a; Tuttle and Gotlieb, 1985,b) observed in MM.106 rootstock grafted with 'Delicious' scion is also of concern when breeding apple rootstocks. A large trial is underway in collaboration with Cornell University and Virginia Tech to evaluate 50 genotypes for this sensitivity (Robinson, personal communication). Furthermore, there is paucity of genetic studies that describe the inheritance of susceptibility of Malus germplasm to viruses and phytoplasmas, making genetically informed breeding impossible. In the Geneva breeding program, virus- sensitive parents like G.16 have been utilized for crosses, and efforts to map susceptibility loci are underway in collaboration with Cornell University virologists as a prerequisite to marker development to be utilized for culling susceptible seedlings before resources are wasted on growing them in larger field trials.

Coordinated testing and evaluation programs in the world

The varied environments where apples are grown suggest that no one rootstock will be well adapted to all environments and that coordinated, independent evaluation of new material from breeding program be performed by local pomologists. There are some organizations in certain apple growing regions in the world that aim to independently test rootstocks in a regimented way covering multiple environments and scions (Elfving and McKibbon, 1990; Schechter et al., 1991; Usa, 1991; Kviklys, 2011). A considerable program of tree fruit rootstock evaluation in the United States, Canada and Mexico is conducted by a group of 35+ researchers, extension specialists and industry collaborators within the CREES (cooperative research and extension services of the USDA) multi-regional project NC-140 (www.nc140.org) and in Europe through EUFRIN (www.eufrin.org). As a group the NC-140 researchers have made significant contributions to tree fruit rootstock research over the last 3 three decades and have conducted highly coordinated impactful research for the tree fruit industry (Rom and Rom, 1991; Fernandez et al., 1995; Perry, 1996; Autio et al., 1997, 2011a,b; Barritt et al., 1997; Marini et al., 2002; Marini et al., 2006b; Autio et al., 2011a; Autio et al., 2011b). Other organizations featuring coordinated international research on apple are RosBREED (www.rosbreed.org) (Iezzoni et al., 2010), FruitBreedomics (www.fruitbreedomics.com) and, the Genome Database for the Rosaceae (www.rosaceae.org) are advancing the development of new knowledge about physiology, phenomics, genetics, and genomics of Rosaceaous crops and providing useful infrastructure to the development and evaluation of new apple rootstocks(Evans et al., 2012; Evans, 2013a; Evans, 2013,b; Peace et al., 2014; Chagne et al., 2015; Guan et al., 2015; Liverani et al., 2015; Mauroux et al., 2015; Fresnedo-Ramirez et al., 2016). The ultimate goal for all these organizations is to make apple growing more efficient, more environmentally friendly, more profitable for those that grow apples and more nutritious for the customers that eat apples, and the development of new apple rootstocks is an important cog in this intricate effort.

Relationship to Other Projects Search -

This research is closely tied to the evaluation and utilization of the apple germplasm collection 8060-21000-025-00-D, "Management of Apple, Cold-Hardy Grape, and Tart Cherry Genetic Resources and Associated Information" in Geneva NY with G.Y. Zhong and C.T. Chao as principal investigators – this project is the main source of novel breeding material for our program. CRIS PROJ NO: NYC-625410 "Identification and validation of novel genetic loci linked to fire blight resistance in apples" managed by Dr. Khan at Cornell University is closely associated to our research program in the development of

resistance to fire blight in apple rootstocks. CRIS PROJ NO: CALW-2016-04616 "Characterizing genotype-specific apple root biochemistry and its implications for rhizosphere microbial ecology in apple replant disease (ARD)" is also closely associated with the program as we provide much of the germplasm and some of the root samples to investigate genotype specific associations with rhizhospheric biota. Dr. Fazio was one of the inceptors and Co-PI of NIFA SCRI CRIS PROJ NO: NYC-145543 "Accelerating the development, evaluation, and adoption of new apple rootstock technologies to improve apple growers' profitability and sustainability" led by Dr. Cheng at Cornell University which aims to study many aspects of apple rootstock influence on fruit production that are multidisciplinary and related to the breeding program. The program also works closely with Dr. Zhu of the USDA ARS Tree Fruit Research Laboratory in PROJ NO: 2094-21220-002-10T "Phenotyping resistance traits of apple rootstock germplasm to replant pathogens" where germplasm from the breeding program is being used to discover QTLs and genes related to apple replant disease resistance. We collaborate with Dr. Mazzola also in Wenatchee in PROJ NO: 2094-21220-002-08T "Managing rhizosphere/soil microbiology via apple rootstock chemistry" to study aspects of soil biology related to apple rootstocks. We also collaborate with several scientists at the USDA Appalachian Tree Fruit Research Station in Kearneysville, WV, with PROJ NO: 8080-21000-023-00D "Genetic improvement of fruit crops through functional genomics and breeding" where we are investigating the effect of specific genes on tree architecture and PROJ NO: 8080-21000-024-34S "Three-dimensional modeling system for fruit trees" to see how rootstocks influence the architecture of apple trees. PROJ NO: 8080-21000-024-00D "Integrated orchard management and automation for deciduous tree fruit crops" with Dr. Tabb to investigate how apple rootstocks can aid in developing optimal canopies for orchard automation. The program also collaborates closely with ~35 scientists from all apple growing regions in North-America participating in the NC-140 multi state project CRIS PROJ NO: MO-MSPS0006 "Improving economic and environmental sustainability in tree-fruit production through changes in rootstock use". PROJ NO: 8060-21000-026-02N "Development of apple rootstock technologies for U.S. and Brazilian apple growers" is one of the many international research projects aimed at studying apple rootstock performance. Our project is the result of a close collaboration between Cornell University and USDA ARS. This collaboration has been ratified with a Cooperative Research and Development Agreement (CRADA No. 58-3K95-4-1668-M)

APPROACH AND RESEARCH PROCEDURES

Objective 1: Develop and release improved apple rootstocks by leveraging advances in marker assisted breeding, including construction of genetic maps, establishing trait associations, gene discovery for important rootstock traits (dwarfing, early bearing, yield efficient, fire blight resistant), and screening for novel alleles for important rootstock traits.

Sub-objective 1A Perform all breeding and evaluation stages involved in the 15-30 year process of developing new rootstocks with the assistance of recently developed breeding tools, such as marker-assisted selection.

Non Hypothesis Goal Driven 1A Perform all breeding and evaluation stages involved in the 15-30 year process of developing new rootstocks with the assistance of recently developed breeding tools, such as high throughput phenotyping and marker-assisted breeding.

Experimental design 1A: We will select new parents based on their genetic potential and field performance. We will generate new genotypes by crossing these parents and we will continue data collection and subsequent selection on approximately 4,000 genotypes that are at different evaluation and selection stages of the breeding pipeline. This includes performing multi-state and international advanced orchard trials, advanced cooperator trials with commercial stool-bed nurseries and first test orchards on location.

A Crossing Block composed of elite germplasm and commercial varieties is in place in Geneva, NY and will be used to generate new populations segregating for rootstock quality traits (propagation, dwarfing,



and precocity) and disease resistance. We will follow the ten-stage selection and evaluation protocol outlined in Johnson (2001) with some modifications regarding the utilization of molecular markers to assist selection and the incorporation of newly identified traits. This process is also outlined in a flow chart diagram attached to this document describing the breeding program (Page 6). We currently have plants in all of these stages and expect to perform all operations within these stages during the next five year period. Due to space and resource constraints we begin a new breeding cycle (lasting 15-30 years) every three years. We expect to initiate two breeding cycles during the five year period of this project. Stage 1. Parental Selection, hybridization, disease screenings, stool plant establishment, Years 1-2/ **2,000-10,000 seedlings.** Parental combinations that have complementary characteristics are chosen for hybridization; for example, an easily propagated dwarfing parent might be crossed with a disease resistant parent. Seeds are collected from the fruit of these crosses, and the seed are stratified (cold treated to break dormancy) and germinated. We then inoculate the seedlings with fire blight bacteria (Erwinia amylovora) (Gardner et al. 1980) and crown rot fungus (Phythophthora spp.) (Cummins and Aldwinckle 1974). Based on the results of previous selection cycles we expect to eliminate 50-80% of the seedlings and establish the rest as single plant stool tree populations. DNA is extracted from all surviving seedlings and tested for dwarfing loci and other markers associated with important traits using high throughput PCR markers (SCARs) that have been developed in our laboratory (Appendix B Figure 4). Depending on the parents used, markers generally eliminate 75-95% of surviving seedlings. Contingency: If parents selected for breeding do not have the necessary horticultural and resistance traits then we will select from a pool of novel accessions. If a new virulent pathovar overcomes known resistance then we will search the accessions for resistance to the new pathovar. If PCR markers don't perform as expected for selection, then we will search for alternative methods of high throughput screening.

Stage 2. Stool plant selection, nursery liner establishment, nursery tree growth, Years 3-4 / 25-100 stool trees. Genotypes are propagated as single tree stool-bed plants which are then used to propagate rootstock liners harvested from genotypes that show adequate rooting (at least three adventitious roots per shank) and do not have brittle wood. Liners are moved to a nursery (McCarthy farm, Cornell University – Geneva, NY) for years 5 and 6, where finished trees are produced (it takes at least 2 years to make a finished tree: harvest rootstock liner from mother plant in Fall of year 1; plant in field nursery in Spring of year 2; graft scion bud in Summer of year 2; cut tops of rootstock liners in Spring of year 3 to allow grafted bud to push; allow grafted bud to grow a full finished tree in Summer of year 3; harvest finished tree in Fall of year 3; plant finished tree in the field experiment in Spring of year 4 – the procedure can be cut one year if bench-grafts are used instead of August budding). In years 5 and 6 stool trees are again evaluated for resistance to fire blight and for infestation levels with woolly apple aphids (Johnson 2000), and susceptible genotypes are discarded from the nursery and from the stool tree fields. *Contingency*: If stool bed tests for rooting don't work on a particular year then we will repeat them on a subsequent year. If field fire blight and wooly apple aphid tests are inconclusive we will repeat them in a more controlled environment (greenhouse) in successive years.

Stage 3. First test orchard establishment, precocity evaluation and selection, Years 5-6 / 25-50 rootstock genotypes. Because marker assisted selection for dwarfing has been implemented, we expect the vast majority of rootstocks to be dwarfing and we will plant four to six finished trees on each rootstock genotype in a medium density first test orchard in two locations in the U.S. In addition to the test genotypes, size standard varieties are included (M.27, M.9, M.26, MM.106). Trees are trained to develop an open branching pattern, but pruning is allowed to pattern a slender spindle system. Data is collected and analyzed annually for yield, yield efficiency, tree vigor, suckering, nutrient uptake efficiency and response to any unique stress events. *Contingency*: If dwarfing phenotype is not recovered efficiently by markers then we will cull larger trees in the orchard.

Stage 4. First test orchard evaluation and selection, elite stool bed establishment, Years 7-12 / 10-15 rootstock genotypes. Rootstock genotypes that exhibit precocity and adequate yield efficiency by the fourth leaf (year 10 of breeding cycle) are propagated to increase plant material for an elite stool bed in two locations (Geneva, NY and at cooperating nurseries in the North West). Stool beds are developed from liners retained from stage 2 or from root cuttings of older orchard trees. *Contingency*: If we are not

able to identify precocious genotypes in the test orchard then we will test individuals from different crosses and populations. If we are not able to propagate the selections using root cuttings we will consider the utilization of other methods to establish new elite stool beds.

Stage 5. Liner production, stool bed evaluation, nursery tree growth, Years 10-15 / 5-10 rootstock genotypes. The important characteristic of this stage is that by this time we have enough stool bed material (liners) to be able to run replicated tests and produce a reliable estimate of how resistant or tolerant a selection is to the different biotic and abiotic stresses that the genotypes will be faced within the life of an orchard. This critical number of plants per genotype is between 100-1000 and is very difficult to achieve with conventional propagation methods and may be best achieved through micropropagation (Fazio et al. 2015b). At this stage we produce trees with several scion/rootstock combinations to test graft union compatibility and strength. Liners in the nursery are budded with selected scions to produce 30 high quality finished trees. First test orchards are removed after harvest in year 15 (after 9th leaf). After 30 trees are produced in the nursery, liners are collected from elite stool beds and subjected to evaluations of disease resistance and stress tolerance, extreme temperature soil tests (trees are grown in heated pots), replant soil tests (Isutsa and Merwin 2000), fire blight tests, crown rot tests, virus resistance / hypersensitivity tests, graft union strength tests (3-4 year old finished trees with several scion/rootstock combinations are subjected to mechanical stress at the graft union) while in stages 5-7 (Fazio, 2015). Protocols and methods for these techniques are published (J. Cummins and H. Aldwinckle 1974). Contingency: In the event that the stress tolerance tests are not adequate then we will investigate novel ways to test for cold tolerance, soil heat tolerance, etc. If second battery of disease resistance screens reveals susceptible individuals then we will investigate to correct initial screens.

Stage 6. Intermediate stage orchard establishment and early evaluation, Years 16-18 / 10 rootstock genotypes. Intermediate stage orchards are planted beginning in year 16 at three sites representing a cross-section of domestic apple production environments. Each year's planting includes commercial standard dwarfing genotypes (M.9, B.9, M.26) and 5 to 10 elite rootstock genotypes that have shown promise in elite stool bed liner production, initial test orchard performance, and biotic and abiotic stress resistance screens. These orchard trees are evaluated for precocity in their early years.

Stage 7. Intermediate stage orchard evaluation, commercial stool bed trials, Years 19-21 / 5 rootstock genotypes. Intermediate stage orchard trial data collection continues (Russo et al., 2007). Biotic and abiotic stress screenings of rootstock liner trees is completed. The most promising rootstock genotypes (a maximum of 5 per year) from the Cornell/USDA program are distributed to cooperating nurseries for commercial stool bed trials (50 liners to each of 2 cooperating rootstock nurseries) beginning in year 19. The most promising Geneva rootstock genotypes are submitted for phytosanitary certification (NRSP5, Prosser WA) to enable international distribution. It is possible to start the technology transfer to cooperating nurseries at stage 5 or 6 because these nurseries may be the location where the finished trees for intermediate trials are prepared. In that contingency we will transfer plant material (rootstock liners) to cooperating nurseries under contract to generate finished trees. Data on nursery tree performance will be collected at this stage (Fazio et al., 2008a). This will also allow cooperating nurseries to take a first look at these selections and learn to the best cultural practices adapted to the new genotypes.

Stage 8. NC-140 and on-farm trials, distribution to all cooperators, Years 22-24 / 2 rootstock genotypes. Intermediate stage orchard trial data collection continues (Robinson et al., 2006). For outstanding rootstock genotypes from the intermediate stage orchard trials and commercial nursery stool bed trials, liner production from cooperating nurseries is used to propagate trees for NC-140 and/or on-farm trials. Each multi-state NC-140 trial and on-farm grower cooperator trial is unique and follows methods and protocols that are established by the cooperators participating in the trial. Generally, data on yield efficiency, productivity, precociousness, hardiness, incidence of disease, tree size is collected for each rootstock for a period of 8-12 years. Best rootstock genotypes, as determined by each unique individual trial's protocol, are distributed to domestic cooperating nurseries for propagation, and to international cooperating nurseries and institutions for propagation and local evaluation trials. Internationally commercially successful genotypes join the USDA/Cornell rootstock evaluation program

as stage 8 materials following evaluation in biotic and abiotic stress screenings – this is done to provide a benchmark for all commercial rootstocks.

Stage 9. Final evaluations and selections, commercial ramp-up, patent applications, Years 25-27 / <1 rootstock genotype. Plant material for rootstock genotypes demonstrating marked improvement over commercially available varieties based on results from cooperator and NC-140 trials is increased in commercial stool beds and micropropagation facilities. Intermediate stage evaluation orchards are removed after 11th leaf. Plant Patent and UPOV protection applications are filed on commercially viable rootstock genotypes given that the IP protection is necessary for successful deployment and implementation of the new genotypes.

Stage 10. First commercial sale of Geneva rootstocks, elimination of all unreleased genotypes from trials, Years 28-30. Data collection continues for NC-140 and on-farm grower cooperator trials. Unreleased genotypes that showed promise but were not demonstrably superior to commercially available rootstocks are eliminated from the program or selected for release in alternative markets (ornamental etc.).

Contingencies: There are several contingency points in this part of the project as there are many stages. Amendments to the breeding protocol will be made to include innovations in propagation, molecular markers.

Collaborations: Domestic collaborators: Awais Khan, Cornell University, collaborates on fire blight resistance characterization and inoculation, phytopthora root rot inoculations, tissue culture and genetic engineering. T. L. Robinson, Cornell University, provides second test and intermediate orchard evaluation, national and international evaluation of Geneva rootstocks, and commercialization. John Norelli (fire blight resistance), Chris Dardick (modification of plant architecture by rootstocks), all from ARS Kearneysville, West Virginia; C.T. Chao (novel gene pools for rootstock traits) ARS, Geneva, New York; Mark Mazzola and Yanmin Zhu (replant tolerant rootstock genotypes) ARS Wenatchee, Washington. Willow Drive Nursery provides advanced testing locations for stool bed evaluation, nursery tree development and is one of our stakeholders. Dr. Stefano Musacchi (Wenatchee, WA) is testing advanced selections in Washington State. The Washington Tree Fruit Research Commission performs advanced apple rootstock testing including intermediate and commercial trials in organic and replant situations. The NC-140 network of collaborators (list available at www.nc140.org) is essential for proper testing of local adaptations of these new genotypes.

International collaborators: A network of international test sites in which we are actively involved was established in the past 10 years. These test sites are in Germany, France, Italy, Poland, New Zealand, Australia, South Africa, South Korea, Brazil, Uruguay, and Chile and include representatives from major research institutions (University of Bologna, Italy, IRTA, INRA, EMBRAPA) and representatives from international nursery organizations.

Sub-objective 1B Identify and characterize novel germplasm, genes, alleles and trait loci through quantitative trait analyses leveraging new genetic-physical maps.

Hypothesis 1B Novel genotyping and phenotyping techniques will allow the discovery of novel sources of germplasm and alleles to be used as new parents in the breeding program.

Experimental Design 1B. The program has utilized Single Nucleotide Polymorphism (SNPs), Insertion-Deletion (InDel), microsatellite or simple sequence repeats (SSR) markers to generate DNA fingerprints of apple rootstock populations and potential parents. While these genotyping methods have positive aspects, they mostly lack information about functionality (direct connection to genes) and are not set up to generate haplotype data based on combinations of polymorphisms in longer stretches of DNA. Because of advances in sequencing technologies, in the next five years the program will transition to genotyping by AmpSeq (Yang et al., 2016) which allows the multiplexed (380 individuals x 300 amplicons – Cadle Davison pers. comm.) genotyping of stretches of DNA amplified by PCR. Amplicons are targeted to

genes or specific regions of the genome and the assembly of the sequences onto the apple genome (Velasco et al. 2010; Fazio et al., internal resource), differentiating and grouping sequences based on similarity and haplogroups. Segregation will allow the distinction between homologous and homeologous genes (Malus is an ancient tetraploid). We will target a set of genes whose expression is segregating in rootstock breeding populations that have been characterized by gene expression OTL (eQTLs) of published microarray experiments (Jensen et al., 2011; Jensen et al., 2012, Jensen et al., 2014) and eQTLs (internal data, unpublished) derived from RNAseq analyses of areal and root tissues of apple rootstock breeding populations. We will choose germplasm that possesses the best combinatorial arrangement of desirable loci from within the breeding program and novel germplasm from the Malus collection based on feedback from past and future phenotyping experiments (Fazio et al. 2014a; Bassett et al., 2011). As clonally propagated material becomes available, we will design a series of replicated pot experiments (based on statistical power analysis for key parameters) where we will treat rootstocks and finished trees with different water regimens and aeroponically delivered pH treatments. Means and effects will be calculated and relevant multivariate analyses will be conducted for measured parameters including tree growth, photosynthesis, nutrient concentration in the leaves or fruit, tree architecture parameters (bud break, rooting, root morphology, branching, growth, flower induction). We are currently running phenotyping experiments involving root growth imaging and sensing with CI-600 root imagers and root analysis software (CID Bio-Science, RootSnap, Giaroots, etc.) and pH-nutrient treatments in connected aeroponic systems (Appendix B Figures 1-3). We see potential for these measurements to help us and apple growers make more informed decisions regarding the type of rootstock that matches their pedoclimatic conditions. Once the methodology is standardized and the results are interpreted it will be incorporated into the breeding process, possibly at stage 5-8 where availability of enough clonal replicates (rootstock liners) is assured. We will seek collaborations with expert physiologists, plant pathologists, etc. to help in the design and interpretation of these experiments.

Contingencies If AmpSeq is difficult to implement, we will seek similar, high throughput genotyping systems as they become available or continue using Malus Consortium Illumina SNP Chips. Expert labor, cost, instrument, greenhouse, plant and land availability are all limiting factors to the success of these experiments. We will tailor each experiment based on resources available each year.

Collaborations Dr. Cadle-Davidson (USDA ARS, Geneva) on AmpSeq matters. Dr. Terence Robinson program (Cornell University) and other visiting scientists in his laboratory on evaluation of advanced breeding lines in different orchard systems. Drs. Dardick and Tabb (USDA ARS, Kearneysville, WV) in matters related to tree and root architecture and imaging. Dr. Michael Grusak (USDA ARS, Fargo, ND) in matters regarding nutrient content, impact on tree health and possibly human nutrition. Dr. Moran (University of Maine) to investigate low temperature stress on apple rootstocks. Plant pathologists at Cornell University and Dr. Mark Mazzola (USDA ARS, Wenatchee, WA) to devise and interpret experiments involving soil pathogens associated with replant disease, and Dr. Lee Kalcits (Plant Physiologist, Washington State) on matters of nutrient partitioning by apple rootstocks.

Objective 2: Identify and dissect important rootstock traits that modify gene activity in the scion, toward enhancing drought tolerance, tree architecture, propagation by nurseries, root growth and physiology, nutrient use efficiency, and disease resistance; incorporate this knowledge into breeding and selection protocols.

Sub-objective 2A Identify components of rootstock induced traits that modify gene expression and metabolic/physiological profiles of grafted scions to increase tolerance to abiotic stresses such as tolerance to drought, improve fruit quality and storability, increase tree productivity, disease resistance and nutrient use efficiency.

Hypothesis 2A Genetic maps, QTL analyses, RNAseq, gene expression QTLs, whole genome sequences can be used to deconstruct traits to their segregating components.

Experimental Design 2A The Geneva breeding program has successfully used genetic maps in combination with phenotypic data to identify Quantitative Trait Loci (QTLs) associated with several important traits in apple rootstocks leveraging very diverse interspecific crosses. We know from Jensen et al., 2011 and 2012, that gene expression in the scion is modified by apple rootstocks, what we do not know is how genetically complex these scion expression modulations are in segregating rootstocks. Similarly to what has been done within our program with eQTLs, we will plant 1-2 apple rootstock replicated segregating populations, graft them with the same scion (Honeycrisp for example) and measure gene expression by 3' RNAseq (www.lexogen.com), tree growth, photosynthesis, metabolites, nutrient concentration in the leaves or fruit, tree architecture parameters (bud break, branching, growth, flower induction) on the scion to detect rootstock induced gene expression QTLs and possibly associate them with physical traits measured on the same trees. For example, we have now very strong evidence of rootstock mediated nutrient absorption and translocation (our group was the first in the world to publish on the genetics of such traits) as demonstrated by this dual clustering diagram of boron concentration in grafted Honeycrisp scion from a field experiment with four years of data and multiple. We would take contrasting rootstocks and progeny to see what genetic elements are fostering such differences. In this case we have G.935 that consistently confers higher levels of boron and B.9 that has lower levels consistently. We also have a segregating population that is derived from the cross between G.935 and B.9. Depending on resources (funds and scientific effort) we plan to hold maximum of two experiments per year. The next iteration is to apply abiotic stresses on the same populations (drought, pH, lack of nutrients) and follow with performing similar measurements. The next phase is to connect known gene networks (based on functional annotations – MapMan and KEGG analysis software) segregating in the rootstocks with gene networks modulated in the scion by segregating rootstocks using multivariate analyses such as Ward's dual clustering analyses on correlation coefficients, principal component analyses and gene neural network analyses. The program has acquired next generation sequences (Illumina platform) of several founding parents of the apple rootstock breeding program (G.41, M.27, O.3, R.5, M.9, Dolgo), a complete genome assembly of R.5 (obtained by combination 100X Sequel – Pacific Biosciences, BioNano and Phase Genomics data) and has developed an internal database of aligned haplotypes for small genomic regions of interest such as genes with drastically changed expression (expressed or not expressed) identified in the eQTL discovery process. All of the above processes are very data intensive. To accomplish these tasks we will use a combination of off the shelf genomic analysis software, like SAS JMP Pro, Geneious (www.biomatters.com), JoinMap/MapQTL (www.kyazma.com), CLC Genomics Workbench (www.clcbio.com), we will also utilize genomic and breeder's tool box resources available through the Genome Database for Rosaceae (www.rosaceae.org), and other bioinformatic tools specifically designed by collaborators.

Contingencies If methodology described above is not cost effective or fails to produce high quality data, we will seek different methods to genotype and phenotype plants in the populations. We will also continue to explore and adopt the best available, cost effective methodology to harness DNA information for breeding improved apple rootstocks. Current bioinformatic and statistical tools may not be well suited for our dataset types — we will seek advice from the NEA Computational Biologist and/or Statisticians and, when necessary, devise new tools to enable the analysis and correct interpretation of the results. Collaborations We will collaborate with Dr. Udall and his team (Brigham Young University) with regards to the R.5 genome assembly to be used in this study. Dr. Dardick (USDA ARS, Kearneysville) will aid with mapping and statistical analyses.

Sub-objective 2B Validate relationships between trait components and overall apple tree performance in different rootstock-scion combinations and incorporate new knowledge into breeding and selection protocols.

Hypothesis 2B Scion gene expression and phenotype modulation by segregating rootstocks transfers to other apple scions.

Experimental Design 2B Based on the results of experiments in sub-objective 2A, we will validate the strongest rootstock induced scion trait associations on other apple scion varieties like Gala, Golden Delicious, SnapDragon, Autumn Crisp. As an example, if Gene A segregating in rootstock population R had an effect of increasing or decreasing phenotype Y (including gene expression) in Honeycrisp, does it have the same effect on SnapDragon scion? An experiment to validate such effect would only require a subset of rootstock germplasm segregating for such locus (15 with and 15 without) to test the mean separation between phenotypes of the groups (Jensen et al. 2015). We just started experiments in containers and in aeroponics deal with pH: three different levels (5.5, 7 and 8) to measure growth, nutrient uptake and root gene expression of grafted trees. Exploratory experiments with aeroponics: drought response where nutrient mist can be turned off for a number of hours (TBD) or drastically reduced. Items to be measured: physiological traits (photosynthesis, transpiration and hormonal activity), root and scion gene expression. Validated rootstock loci will be transitioned to working DNA markers and published.

Contingencies In the event that we are not able validate effects of selected rootstock loci on phenotypes (including gene expression) of other scion varieties, we will select a new set of loci to validate. **Collaborations** We can perform this type of analysis in house, but will seek expertise and collaborations as needed.

Physical and Human Resources

The program enjoys cooperation with Cornell University under a Cooperative Research and Development Agreement (CRADA) 58-3K95-4-1668-M specifically with the Cornell University New York State Agricultural Experiment Station in Geneva (NYSAES). Approximately 25 acres of land belonging to NYSAES are dedicated to the apple rootstock breeding program, including land set aside for stool beds, stool nursery, tree nursery, first test orchards, and replicated trials. NYSAES provides rented greenhouse space for controlled experiments (inoculation, propagation), an aeroponic system able to accommodate 350 plantlets and 2000 sq. ft. cold storage space for storage and processing of finished trees and liners during winter months. The Field Research Unit of NYSAES provides (at a subsidized cost to the USDA) equipment and personnel necessary to conduct large field operations such as pruning, pesticide and herbicide spraying of orchards, etc. A Kubota and a John Deere tractors owned by the program are used for small field operations. Our laboratory is located in the Horticulture Section of the Cornell University Campus of NYSAES. It possesses modern molecular genetic laboratory equipment (water baths, freezers, pipetters, centrifuges etc.). This lab is equipped with a sequencing apparatus ABI3130 genetic analyzer for determining SSR parental allele sizes and a capillary sequencer to perform genotyping and DNA fragment sequencing. Seven 96 well thermal cyclers with high throughput agarose gel apparatuses (96-192 samples) are available to genotype with markers having allele size polymorphisms greater than 10bp. A ROCHE real time PCR machine capable of High Resolution Melting is also available to the lab. The program also has access to the Cornell Institute of Biotechnology Resource Center for services like Next Generation Sequencing, Microarrays, etc. Computer resources include a dedicated Dell and HP computers that are able to work with bioinformatics software like CLC Genomics workbench (www.quiagen.com) and Geneious (www.biomatters.com). Stable human resources for this project are Lead Scientist Geneticist Gennaro Fazio, Research Leader and Geneticist Gan-Yuan Zhong (5%), Field/Lab technician Todd Holleran, Lab Technician Sarah Bauer, and temporary labor pool during the summer months.

Project Management and Evaluation

This project is the result of collaboration between USDA ARS and Cornell University that is ratified with a CRADA. While the USDA has a lead role in the project, project co-directors (Dr. Robinson or his staff and Dr. Khan or his staff) meet regularly to evaluate progress, make critical management decisions about testing and release of apple rootstocks. We hold annual meetings and semi-annual phone conferences with Nursery and Industry cooperators to evaluate the progress of the breeding program. We hold regular (bi-weekly) staff meetings to plan and discuss progress on the project's milestones and regular meetings with collaborators in PGRU to coordinate efforts on germplasm collection and evaluation. We utilize tools like AT&T Connect to routinely share data, presentations and interact with collaborative scientists worldwide. Our ARS Location (Geneva) holds regular monthly meetings that include the Research Leader and all location scientists to coordinate research projects and discuss advancements in research.

We also routinely communicate with Area Director and members of the Office of National Programs staff regarding general direction of project, interaction with industry and progress with milestones.

Data Management

This project produces several types of data assembled in different sizes from small to very large. The smaller sets are phenotypic evaluations of several traits collected during the process of evaluation of genotypes in the breeding program – these sets also include the statistical analyses associated with the traits. Larger data sets are generated as a result of next generation sequencing of samples in the breeding program. All data is backed up and stored on an ARS secure server. Because we work under a CRADA (Cooperative Research and

Development Agreement) with Cornell University, the datasets germane to breeding program genotypes can only be released to the public upon agreement of both parties. This release has been accomplished in many cases through consensual publication. Sequencing datasets are usually published and deposited in related databases like www.rosaceae.org or NCBI when they are processed for publication.

Milestones

St		ent of Biotic erance in A	Project No.	8060-2	1000-026-00D		
National Progran			Resources, Genom	ics and Genetic	and Genetic Improvement		
Objective	1. Deve marker associa yield eff	1. Develop and release improved apple rootstocks by leveraging advances in marker assisted breeding, including construction of genetic maps, establishing tr associations, gene discovery for important rootstock traits (dwarfing, early bearing yield efficient, fire blight resistant), and screening for novel alleles for important rootstock traits.				g advances in ps, establishing trait rfing, early bearing,	
Subobjective		1A. Perform all breeding and evaluation stages involved in the 15-30 year process of developing new rootstocks with the assistance of recently developed breeding tools, such as marker-assisted selection.					
NP Action Plan Component		1– Crop Ge	netic Improvement				
NP Action Plan P Statement	Problem		tement 1B: New c		ies, and	enhanced	
Hypothesis	SY Team	Months	Milestones	Progre Chang	es	Products	
Perform all breeding and evaluation stages involved in the 15-30 year process of developing new rootstocks with the assistance of recently developed breeding tools, such as high throughput phenotyping and marker-assisted breeding.	1	12	Nearly all the procedures in this objective are cycli in nature – almost every year we select parents, make crosses, select genotypes from first test orchards, inoculat seedlings, send to selections to cooperators, plant orchards, collect yield data, conduct Marker Assisted Breeding for dwarfing, WAA resistance, etc.	te est t		Seed from crosses, selections, trees for testing on cooperators farms. Selections distributed to nurseries for advanced testing. Selections distributed to cooperators for comparative testing in multiple U.S. environments prior to release.	
	Fazio Fazio	36	Select and establi 5 new female parent trees in crossing block Implement new selection protocol for nutrition and rearchitecture	s		Rootstock Release – this will be a rootstock that has probably been in the pipeline for 20 years.	
	Fazio	48	Select and establi 5 new female parent trees in crossing block	ish		20 ,001.0.	



	Fazio	60	Implement new protocols for replations disease selection.				Rootstock Release – this will be a rootstock that has probably been in the pipeline for 20 years.
	•	erance in A		Pro	ject No.	8060-2	1000-026-00D
National Progra	ı m 301, Pla	ant Genetic F	Resources, Genomi	ics a	and Genetic	Improve	ement
Objective	marker associa yield ef	assisted bree itions, gene of ficient, fire bli ck traits.	nstr tant scre	uction of ger rootstock tra eening for no	netic ma aits (dwa ovel alle	ng advances in ips, establishing trait arfing, early bearing, les for important	
Subobjective							, alleles and trait loci etic-physical maps.
NP Action Plan Component		1– Crop Gei	netic Improvement				
NP Action Plan Statement	Problem	Problem Sta methods	tement 1A: Trait di	isco	very, analys	is, and s	superior breeding
	SY				Progre	ss/	
Hypothesis	Team	Months	Milestones		Chang		Products
Novel genotyping and phenotyping techniques will allot the discovery nove sources of germplasm and alleles to be used new parents in the breeding program.	as	12	Identification of target genes (1500 and generation of PCR primers in preparation for AmpSeq. Amplico optimization and validation.				New set of apple primers for multiplexed AmpSeq – deposit to Rosaceae database.
	Fazio	36	parents and populations for screening with AmpSeq. Run AmpSeq on selected individual Design phenotypic experiments on selected individual (pH, water use efficiency, nutrient uptake, root morphology, etc.) Analysis of AmpSe	ls t			Candidate loci for
	i azio	30	data, identification of unique alleles and haplotypes. Connection to legacy genotypic and phenotypic datasets.				incorporation into breeding program. If needed, transition to gel based PCR marker types.

	Fazio Fazio	60	Selection and crossing of new individuals based on AmpSeq. Second set of phenotypic			Unique parents with desirable combinations of desired trait loci.
			experiments – to determined upon need.	be		
Str	•	erance in A		Project No.	8060-2	1000-026-00D
National Program	301, Pla	ant Genetic F	Resources, Genom	ics and Genetic	Improve	ement
Objective 2. Ident scion, t		ify and dissect important rootstock traits that modify gene activity in the oward enhancing drought tolerance, tree architecture, propagation by es, root growth and physiology, nutrient use efficiency, and disease ace; incorporate this knowledge into breeding and selection protocols.				
Subobjective		2A Identify of expression a increase tole quality and s	2A Identify components of rootstock induced traits that modify gene expression and metabolic/physiological profiles of grafted scions to increase tolerance to abiotic stresses such as tolerance, improve fruit quality and storability, increase tree productivity, disease resistance and nutrient use efficiency.			
NP Action Plan Component		Component	3 – Crop Biologica	al and Molecular	Process	ses
NP Action Plan Pr Statement	oblem	Problem Statement 3A: Fundamental knowledge of plant biological and molecular processes.				
Hypothesis	SY Team	Months	Milestones	Progre Chang		Products
Genetic maps, QTL analyses, RNAseq, gene expression QTLs, whole genome sequences can be used to deconstruct traits to	Fazio	12	Selection of segregating populations and generation of clonally replicated materials for experiments.	ı		
their segregating components.	Fazio	24	Grafting of same scion, planting in pots or aeroponic systems.			
	Fazio	36	Growth, phenotypmeasurements ar sampling of RNA 3'RNAseq. Subjection of experimental unit to mild drought stress.	nd for		Database of rootstock induced phenotype modulation (including gene expression) in nonstressed vs. stressed plants.
	Fazio	48	Analysis of first ye data, collection of second year data	:		First gene network analysis and first set of candidate loci to test in sub- objective 2B

	Fazio	60	Analysis of secon-	d			Publication of research findings
	-	ess Tolerance in Apple			Project No. 8060-21000-026-00D		
National Progra	am 301, Pla	ant Genetic F	Resources, Genom	ics	and Genetic	Improv	ement
Objective	2. Ident scion, t nurserie	ify and dissect important rootstock traits that modify gene activity in the oward enhancing drought tolerance, tree architecture, propagation by es, root growth and physiology, nutrient use efficiency, and disease ace; incorporate this knowledge into breeding and selection protocols.					ene activity in the propagation by and disease
Subobjective		2B Validate relationships between trait components and overall apple tree performance in different rootstock-scion combinations and incorporate new knowledge into breeding and selection protocols.					
NP Action Plan Component		1– Crop Ge	netic Improvement				
NP Action Plan Statement	Problem	Problem Sta methods	atement 1A: Trait d	isco	overy, analys	is, and	superior breeding
	SY				Progre		
Hypothesis	Team	Months	Milestones		Chang	es	Products
Scion gene	Fazio	12					
expression and phenotype	Fazio	24					
modulation by segregating rootstocks transfers to other apple scions.	Fazio	36	Preparation of comparative rootstock subsets (presence/absence of target locus) and grafting of different scions.	e id			
	Fazio	48	Growth and collection of first year data in stressed and non-stressed comparisons.	-			First validation of locus effects. Validation of gene networks associated with target loci. Identification of new genes associated with target pathways.
	Fazio	60	Measurement of second year of data. Transition of validated loci into haplotype specific markers to be use in breeding.	;			

Prior Research Accomplishments

Terminating Project Number: 8060-21000-026-00D

Title: Development of Pest, Disease Resistance, and Stress Tolerance in Apple Rootstocks

Project Period (beginning and ending dates- Month/Day/Year): March 28 2013-March 27 2018

SY Time – Investigators: Gennaro Fazio (100%) Gan-Yuan Zhong (5%)

FTE 1.85: Todd Holleran (100%) Sarah Bauer (85%)

Project Accomplishments and Impact:

Objective 1 Develop superior apple rootstocks, applying advances in marker-assisted breeding for important traits such as dwarfing, precocity, wooly apple aphid resistance, and tree architecture.

Technology Transfer - The major impact of the project relates to the adoption by the U.S. industry of new varieties released in the last cycle where, production of Geneva rootstocks increased from less than 1 million rootstocks/year in 2013 to roughly 10 million rootstocks/year in 2017. This was accomplished by numerous on farm field trials that proved the worth of these new disease resistant and productive rootstocks to the U.S. industry. These technology transfer efforts in the project earned the "Excellence in Technology Transfer" award from the Federal Labs Consortium (competed against NASA, DOE, NIH, and other federal agencies) in April, 2015 and discoveries on apple rootstock dwarfing loci published by the project earned the Outstanding Fruit Research Paper Award by the Journal of the American Society for Horticultural Science in August 2015.

Release of New Apple Rootstock G.814. The project provided new solutions and opportunities to the apple industry by releasing this rootstock that addressed issues like replant disease and fruit quality and size. This clonally propagated apple rootstock G.814 is a dwarfing, productive, early bearing, highly yield efficient, resistant to fire blight. Although it is susceptible to wooly apple aphids and to Apple Stem Grooving Virus (ASGV), G.814 has shown tolerance to the replant disease complex. G.814 produces scions that when fully developed are about 40% the size of a standard seedling apple tree. G.814 has the potential to increase productivity of larger, high quality fruit in marginal replanted orchard land.

Release of new apple rootstock G.213. Some apple scions like Gala have a tough time blooming in low winter chill subtropical regions. Apple growers needed yield efficient, disease resistant apple rootstocks when growing apples in low chill environments or when current environments are affected by climate change. The project is releasing a new productive, disease resistant apple rootstock which improves bud break and productivity in low chill environments such as Southern U.S., California and Brazil. This rootstock was developed over a 35 year process where it survived a series of inoculations with apple rootstock pests and pathogens (fire blight, crown rot and wooly apple aphid) and was tested over 25 years with multiple grafted scion varieties in multiple environments increasing productivity and producing scions that when fully developed are about 30-40% the size of a standard seedling apple tree. When clonally propagated in the stool bed the mother plants produce rootstock liners that are 30 to 50 cm tall with few spines. This new rootstock seems to be the first in the world that possesses the characteristic of increasing bud break in low chill environments of scion cultivars like Gala, therefore it will increase production of high quality fruit in apple growing regions in the U.S. and worldwide that are affected by low winter chilling hours.

Characterization of rootstock nutrient uptake. Apple rootstocks can affect the nutritional status of Honeycrisp and Fuji apples. Mineral nutrient status (calcium, potassium, nitrogen, magnesium and phosphorous) affects the eating quality, health, storability and appearance of apples like Honeycrisp causing many apples to be discarded or apple trees to produce poorly. Recently published in a grower oriented journal (New York Fruit Quarterly) is a first of its kind description of how apple rootstocks affect the mineral nutrient and nitrogen concentration of Honeycrisp and Fuji fruit grafted on more than 40 rootstocks in replicated field trials in New York apple growing regions. As the availability and knowledge of diverse rootstocks increases, it will increase the potential to impact fruit productivity, quality and ultimately profitability of our apple orchards. The choice of the best rootstock for the site, scion and orchard system is going to become more important than ever. The

ability to match the nutritional requirements of a scion cultivar to a specially tuned rootstock will enhance orchard management in the future by allowing healthier trees and more efficient use of fertilizers. This study, first of its kind, lays the foundation for this line of research and will provide better choices to our apple growers in terms of rootstock technologies.

The results of a decade long field trial of 48 apple rootstocks grafted with the apple variety Fuji were published. Rootstocks had significant influence on fruit yield and fruit nutrient concentration. Several Geneva® rootstocks evaluated showed considerable promise as alternatives to M.9. CG.6006, CG.8189, CG.4004, CG.5087, CG.4011, G.969, G.935, and G.890 had good performance on 'Fuji'. The rootstock induces changes in the concentrations of leaf and fruit nutrients. Cumulative yield efficiency had a moderate positive correlation with leaf Ca concentration. G.214, JM.10, CG.4003, M.9, G.935, CG.4088, CG.2406, G.969, and G.210 had low alternative bearing which means stable production of flowers and fruit year over year. All these data help apple growers determine the best rootstock for their local growing condition and variety and provide apple consumers with consistent high quality apples.

Graft Union Strength of Geneva Apple Rootstocks. In collaboration with Utah State University we published research on graft union flexural strength which won the 2016 U.P. Hedrick award of the Journal of the American Pomological Society. Apple rootstock 'Geneva® 41' ('G.41') and other rootstocks form weak graft unions with multiple scions, this is a problem in the nursery stage of tree development especially under high wind conditions which may cause losses upwards to 80% of trees in some rootstock/scion combinations – one grower reported the loss of 60,000 trees worth more than \$600,000. Exogenous plant growth regulators (PGR) can influence vascular differentiation and wood formation, and thus may improve graft union strength. A series of commercial and experimental PGR formulations were applied to trees on 'G.41' rootstock over two seasons, and graft union strength and flexibility were measured. Benzyl adenine (BA) applied in paint solution to the graft union significantly increased the flexural strength per scion cross-sectional area and the flexibility of the union. In addition, foliar applications of Prohexadione-Ca also increased graft union flexural strength and flexibility, but temporarily limited scion extension growth. Applying PGRs in the nursery to more brittle rootstock-scion combinations may be an option for improving graft union strength and preventing tree losses. However, more efficient methods of application are needed for this approach to be commercially viable.

We are continuing work to further develop accomplishments in Objective 1: a. we will continue to release new apple rootstocks; b. we continue to work on nutrient uptake genetic and breeding; c. we continue to work on the analysis of micro-CAT scans of graft unions to establish morphometric parameters of comparison between strong and weak unions.

Objective 2: Devise and apply genomic and bioinformatic tools for marker-assisted breeding of apple rootstocks including identification of the genes underlying resistance to the replant disease complex and to nutrient uptake efficiency.

The bioinformatic portion of this objective was accomplished before the separation of Dr. Baldo (20%) from the project early during the course of this reporting period.

Tool for identification of gene variants for rootstock breeding. Once a genomic region is identified as being important for the modulation of a specific important trait it is difficult to identify other apple plants that may contain the trait associated genomic region. To solve this we have analyzed raw Genotyping-by-sequencing data from 1995 accessions of apples (31 species) from the Geneva apple germplasm repository and selected additional breeding material. The SNPs identified were made viewable on the published genome assembly, while diversity is also viewable in chromosome order in Tassel software. This makes it possible to identify SNPs among wild and breeding material near and in candidate genes of interest. This tool has the potential to speed up the breeding process, and identify new sources of important apple rootstock traits. (Baldo, Zhong)



Validation of location and effect of dwarfing genes in the apple genome and relationship to early bearing induction in apple trees. One trait that makes apple rootstocks very special in the realm of fruit production is the ability to dwarf trees and make them more productive earlier in the life of the orchard. It is estimated that the implementation of these traits in U.S. apple production has increased productivity by more than \$0.75B in the past 30 years. Being able to track the origin and effect of these traits will enable the breeding and selection of new disease resistant improved apple rootstocks. In FY 2013 we completed a genetic map that utilized markers developed by the RosBREED consortium to examine the genetics of dwarfing and early bearing in two apple rootstocks breeding populations. The results of this genetic quest confirmed earlier findings by our lab and made possible modeling of dwarfing gene interactions. This accomplishment made quicker the development of new early bearing apple rootstocks and improved prediction of dwarfing potential of such apple rootstocks. (Fazio)

We made a first report about the genetics of nutrient absorption by rootstocks in tree fruits. We utilized quantitative trait analysis in a breeding population to uncover gene locations for leaf mineral concentrations of leaves for important plant nutrients like potassium (K), sodium (Na), phosphorous (P), calcium (Ca), zinc (Zn), magnesium (Mg) and molybdenum (Mo). We also noticed that several nutrient concentrations were correlated indicating the co-absorption or common transport mechanisms for some nutrients. We found significant positive linear correlations between Ca and Cu, Mg, P, and S. A significant correlation was also detected between Cu and K, Cu and P, also between K and P and between S and P. Segregation of a major gene for leaf K concentration in certain rootstocks had strong effects on the concentrations of other nutrients in the leaves, suggesting that it might be a good target for selection in the breeding program. As this is a first report, we are attempting to understand the physiological influence of these genes on other measurable traits in apple rootstocks and scions. It is possible that even subtle changes in plant nutrients caused by variable gene combinations in the rootstocks can affect productivity and disease resistance of apple trees. (Fazio)

Genes activated during infection with components of replant disease. RNA-seq technology was applied to identify the transcriptomic changes associated with apple root defense response to Pythium ultimum infection. Genes encoding homolog proteins with functions of pathogen detection such as chitin elicitor receptor kinase (CERK) and wall-associated receptor kinase (WAK) were among the differentially expressed apple genes. The biosynthesis and signaling of several plant hormones including ethylene, jasmonate and cytokinin were specifically induced in response to P. ultimum inoculation. Genes encoding enzymes of secondary metabolisms, cell wall fortification and pathogenesis related (PR) protein, laccase, mandelonitrile lyase and cyanogenic beta-glucosidase were consistently up-regulated in the later stages of infection.

We are continuing work to further develop accomplishments in Objective 2: we are using data generated in this objective to clone and identify genes and gene networks associated with root and rootstock traits which is related to Objective 2 of the new project plan.

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Past Accomplishments of Investigators

GENNARO FAZIO

EDUCATION

Ph.D. University of Wisconsin-Madison Department of Plant Breeding and Plant Genetics. Area of study: Application of molecular markers for breeding, quantitative genetics, plant variety identification. November 2001.

M.S. Agronomy-Molecular Biology, Brigham Young University, Provo, Utah, April 1997. Area of study: Identification of molecular markers linked to crown rot resistance in tomato.

B.S. Molecular Biology and Agronomy, Chemistry minor, BYU, Provo, Utah, 1995.

University of Bari, Italy, Agronomy Department, attended 1986-1987.

PROFESSIONAL EXPERIENCE

Research Geneticist, Plant Genetic Resources Unit, USDA-ARS, Geneva NY (2001-present). Adjunct Professor, Dept. of Horticulture, Cornell University, Geneva NY (2001-present). Research Assistant, University of Wisconsin-Madison (1997-2001).

ACCOMPLISHMENTS

- 1. Patented and released 13 apple rootstocks (G.41, G.935, G.202, G.210, G.214, G.890, G.969, G.814, G.213, G.778, G.228, G.189 and G.222) in the U.S. and internationally. These new rootstocks provide protection from fire blight, tolerance to replant disease, and increased productivity in the orchard. Production of these new Geneva® rootstocks in 2017 approached 10 million plants in the U.S. and is increasing.
- 2. Discovered inheritance of dwarfing, precocity, fire blight resistance, root morphology, scion branch angle modification in apple rootstocks.
- 3. Developed marker assisted breeding scheme for selection of dwarfing, precocious, disease resistant rootstocks.
- 4. Developed concept and initial experiments for the use of prohexadione (Apogee) in apple rootstock liner production. Several apple rootstock nurseries worldwide have adopted this method to increase quality and yield of propagation beds.
- 5. Discovered quantitative trait loci associated with nutrient absorption and translocation into the scion for important plant nutrients like potassium (K), sodium (Na), phosphorous (P), calcium (Ca), zinc (Zn), magnesium (Mg) and molybdenum (Mo). This study is the first one of its kind performed on apple rootstocks.
- 6. Characterized in a collaborative study the influence of apple rootstocks on the expression of scion genes.

SELECTED HONORS

Co-awardee of the 2016 U.P. Hedrick award of the Journal of the American Pomological Society. Journal of the American Society for Horticultural Science Outstanding Fruit Research Paper Award for the year 2014, awarded August 2015.

Federal Laboratory Consortium for Technology Transfer "Excellence in Technology Transfer" award winner in 2015 for "New Productive, Disease Resistant Apple Trees".

North Atlantic Area Technology Transfer Award Winner in 2014 for development and commercialization of apple rootstocks critical for the U.S. industry.

SELECTED RECENT INVITED PRESENTATIONS in reporting period 2014-2018:

Utah State Horticulture Association Annual meetings Jan. 2017 Keynote "Overview of current rootstock technologies" and "Breeding methods for development of new apple rootstocks"

Kazakh National Agrarian University Dec. 2016 "Review current research on apple breeding" and "Apple rootstock technologies to aid Kazakh apple growers".

International Fruit Tree Association Annual meetings Feb. 2016 "Rootstocks Matched to Varieties".

Europa Fruit Tree Rootstock Consortium Aug. 2015 Angers, France. "Breeding and selection of Geneva® apple rootstocks"

University of Guelph, Department of Plant Agriculture Winter 2015 Seminar Series. "Leveraging genomic resources to breed a difficult perennial crop: apple rootstocks"



Ohio Produce Growers and Marketers (OPGMA) 2015 Congress. January, 2015, Sandusky, OH. "Updates from the National Apple Rootstock Breeding Program"

Washington State Horticulture Society Annual Meetings, Special Rhizosphere Symposium. Kennewick, WA. December 2014. "Optimal tree nutrition and fruit production begins underground – the apple rootstock story"

The Arsenal, Central Park, NYC Parks, New York, NY. October 2014. Title: "Importance of germplasm conservation in context with the loss of wild apple forests in Kazakhstan"

SELECTED PUBLICATIONS in reporting period 2014-2018

- Fazio, G., 2017. Evaluating and improving rootstocks for apple cultivation.
 - http://dx.doi.org/10.19103/AS.2016.0017.08 © Burleigh Dodds Science Publishing Limited, 2017.
- Stuart Adams, Brent L. Black, Gennaro Fazio and Nicholas A. Roberts 2017. The Effect of Plant Growth Regulators on Apple Graft Union Flexural Strength and Flexibility. J Am Pom Soc. (APS) 71:8-18
- Norelli JL, Wisniewski M, Fazio G, Burchard E, Gutierrez B, et al. (2017) Genotyping-by-sequencing markers facilitate the identification of quantitative trait loci controlling resistance to Penicillium expansum in Malus sieversii. PLOS ONE 12(3): e0172949. https://doi.org/10.1371/journal.pone.0172949
- T. Tworkoski, G. Fazio and D.M. Glenn 2016. Apple rootstock resistance to drought. Scientia Horticulturae 204:70-78.
- T. Tworkoski and G. Fazio 2016. Hormone and growth interactions of scions and size-controlling rootstocks of young apple trees. Plant Growth Regulation 78:105-119.
- S. Shin, P. Zheng, G. Fazio, M. Mazzola, D. Main and Y. Zhu 2016. Transcriptome changes specifically associated with apple (Malus domestica) root defense response during Pythium ultimum infection. Physiological and Molecular Plant Pathology 94:16-26.
- Z. Migicovsky, K.M. Gardner, D. Money, J. Sawler, J.S. Bloom, P. Moffett, C.T. Chao, H. Schwaninger, G. Fazio, G.-Y. Zhong and S. Myles 2016. Genome to Phenome Mapping in Apple Using Historical Data. The Plant Genome.
- Fazio G., T.L. Robinson and H.S. Aldwinckle 2015. The Geneva apple rootstock breeding program. Plant Breeding Reviews 39:379-424.
- Tworkoski, T., Fazio, G. 2015. Effects of Size-Controlling Apple Rootstocks on Growth, Abscisic Acid, and Hydraulic Conductivity of Scion of Different Vigor, International Journal of Fruit Science, DOI: 10.1080/15538362.2015.1009973
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- Zhu, Y., Fazio, G., Mazzola, M. 2014. Elucidating the molecular responses of apple rootstock resistant to ARD pathogens: Challenges and opportunities for development of genomics-assisted breeding tools. Nature Horticulture Research. doi:10.1038..
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- Fazio, G. 2014. Breeding apple rootstocks in the 21st century what can we expect them to do to increase productivity in the orchard?. Acta Horticulturae. 1058:421-428.
- Robinson, T., Fazio, G., Aldwinckle, H. 2014. Characteristics and performance of four new apple rootstock from the Cornell-USDA apple rootstock breeding program. Acta Hort. 1058:651-656.
- Jensen P.J., Fazio, G., Altman, N., Praul, C., McNellis, T.W. 2014. Mapping in an apple (Malus x domestica) F1 segregating population based on physical clustering of differentially expressed genes. BMC Genomics. 15: 261
- Fazio, G., Y. Wan, D. Kviklys, L. Romero, R.R. Adams, D. Strickland, and T.L. Robinson, 2014. Dw2, a New Dwarfing Locus in Apple Rootstocks and Its Relationship to Induction of Early Bearing in Apple Scions. J Am Soc Hortic Sci 139:1-12.

Gan-Yuan Zhong, Ph.D.

Research Leader/Supervisory Plant Geneticist, USDA-ARS, Grape Genetics Research Unit, Plant Genetic Resources Unit

Education:

- 1991 Ph.D. Genetics, University of California, Davis.
- 1985 M.S. Crop Genetics and Breeding, Institute of Crop Germplasm Resources, Chinese Academy of Agricultural Sciences, Beijing, China
- 1982 B.S. Agronomy, Jiangsu Agricultural College, China

Professional Experience and Research Accomplishments:

January 2010 - Present, Research Leader, USDA-ARS, Plant Genetic Resources Unit

- Characterized fruit composition and content of polyphenolic compounds in the USDA-ARS *Vitis* germplasm
- ➤ Co-led an effort in genotyping USDA-ARS apple and grape collections and mapping populations using the SNP chips and genotyping-by-sequencing techniques.
- ➤ Contributed to various USDA-ARS NPGS missions and activities, particularly those relevant to the USDA-ARS Geneva genetic resources.

May 2007 - Present, Research Leader, USDA-ARS, Grape Genetics Research Unit

- ➤ Demonstrated genome-scale mRNA transmission between scions and rootstocks in grapevine
- > Determined the likely genetic and molecular basis for several fruit quality traits of grapes
- Investigated genetic factors controlling resistance to root-knot nematodes and evaluated the feasibility of developing a transgenic solution to root-knot nematodes in grapevines
- > Investigated the genetic and molecular mechanisms controlling grapevine plant architecture

2004 - 2007, Senior Research Scientist, Pioneer Hi-Bred International, Inc. A DuPont Business

- ➤ Developed and implemented molecular markers and other molecular breeding technologies in maize research and product development
- Conducted genetic dissection of complex traits in maize
 - Developed and implemented molecular characterization tools for maize transgenic trait and technology development

1995 – 2004, Research Manager/Scientist, Pioneer Hi-Bred International, Inc.

- ➤ Led a Transgene Genetics Project for research on transgene silencing and position effect of transgenes in maize
- ➤ Carried out QTL mapping of seed quality traits in maize
- Managed product development process, regulatory compliance, and field operations for transgenic maize product development

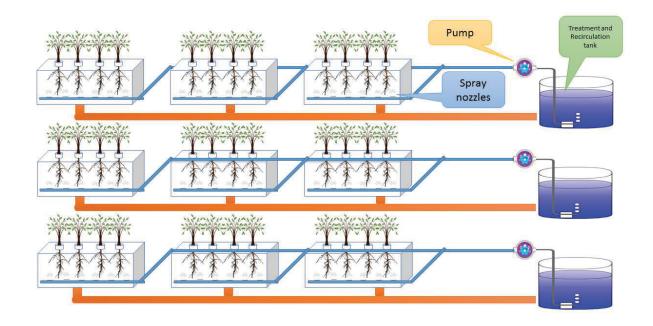
Recent publications

- Fresnedo-Ramírez, J., Sun, Q., Hwang, C. F., Ledbetter, C. A., Ramming, D. W., Fennell, A. Y., M. Andrew Walker, James J. Luby, Matthew D. Clark, Jason P. Londo, Lance Cadle-Davidson, Gan Yuan Zhong, Reisch, B. I. 2016. Toward the elucidation of cytoplasmic diversity in North American grape breeding programs. *Molecular Breeding*, *36*(8), [116]. DOI: 10.1007/s11032-016-0538-z
- Guo, D.-L., F.-F. Xi, Y.-H. Yu, X.-Y. Zhang, G.-H. Zhang, G.-Y. Zhong. 2016. Comparative RNA-Seq profiling of berry development between table grape 'Kyoho' and its early-ripening mutant 'Fengzao'. BMC genomics 2016. 17 (1): 795. doi:10.1186/s12864-016-3051-1.
- Yi Wang, Xianju Liu, Chong Ren, Gan-Yuan Zhong, Long Yang, Shaohua Li, Zhenchang Liang 2016. Identification of genomic sites for CRISPR/Cas9-based genome editing in the *Vitis vinifera* genome. BMC Plant Biol 21;16:96. Epub 2016 Apr 21.

Migicovsky, Z., Gardner, K., Money, D., Sawler, J., Bloom, J., Moffett, P., Chao, C.T., Schwaninger, H.R., Fazio, G., Zhong, G., Myles, S. 2016. Genome to phenome mapping in apple using historical data. The Plant Genome. 9(2) DOI: 10.3835/plantgenome2015.11.0113.

- Wen, Y., Zhong, G., Gao, Y., Lan, Y., Duan, C., Pan, Q. 2015. Using the combined analysis of transcripts and metabolites to propose key genes for differential terpene accumulation across two regions. Biomed Central (BMC) Plant Biology. 15:240. DOI: 10.1186/s12870-015-0631-1.
- Volk, G.M., Chao, C.T., Norelli, J.L., Brown, S.K., Fazio, G., Peace, C., McFerson, J., Zhong, G., Bretting, P.K. 2015. The vulnerability of US apple (*Malus*) genetic resources. Genetic Resources and Crop Evolution. 62(5):765-794. DOI: 10.1007/s10722-014-0194-2.
- Yang, Y., Mao, L., Jittayasothorn, Y., Kang, Y., Jiao, C., Fei, Z., Zhong, G. 2015. Messenger RNA exchange between scions and rootstocks in grafted grapevines. Biomed Central (BMC) Plant Biology. 15:251.
- Money, D., Gardner, K., Migicovsky, Z., Schwaninger, H.R., Zhong, G., Myles, S. 2015. LinkImpute: fast and accurate genotype imputation for non-model organisms. G3, Genes/Genomes/Genetics. Doi: 10.1534/G3.115.021667.
- Bai, Y., Dougherty, L., Cheng, L., Zhong, G., Xu, K. 2015. Uncovering co-expression gene network regulating fruit acidity in diverse apples. Biomed Central (BMC) Genomics. 16(1):612. DOI:10.1186/s12864-015-1816-6.
- Cousins, P., Zhong, G. 2015. Hybrid and selfed seedling progenies of *Vitis* hybrid 'Roger's Red' grape segregate for tendril distribution. Acta Horticulturae Proceedings (ISHS) 1082:373-378.
- Yang, Y., Labate, J.A., Liang, Z., Cousins, P., Prins, B.H., Preece, J.E., Aradhya, M.K., Zhong, G. 2014. Multiple loss-of-function 5-O-Glucosyltransferase alleles revealed in *Vitis vinifera*, but not in other Vitis species. Theoretical and Applied Genetics. 127(11):2433-2451.
- Liang, Z., Cheng, L., Zhong, G., Liu, R. 2014. Total antioxidant and antiproliferative activities of twenty -four *Vitis vinifera* grapes. PLoS One. 9(8): e105146. DOI:10.1371/journal.pone.0105146.
- Yang, Y., Jittayasothorn, Y., Chronis, D.N., Wang, X., Cousins, P., Zhong, G. 2013. Molecular characteristics and efficacy of 16D10 siRNAs in inhibiting root-knot nematode infection in transgenic grape hairy roots. PLoS One. 8(7):e69463. doi: 10.1371/journal.pone.0069463.
- Wan, Y., Schwaninger, H.R., Baldo, A.M., Labate, J.A., Zhong, G. Simon, C 2013. A phylogenomic analysis of the grape genus (Vitis) reveals broad reticulation and concurrent diversification during quaternary climate change. BMC Evolutionary Biology. 13:141.
- Sawler J, Reisch B, Aradhya MK, Prins B, Zhong G-Y, et al. 2013. Genomics Assisted Ancestry Deconvolution in Grape. PLoS ONE 8(11): e80791. doi:10.1371/journal.pone.0080791.
- Miller AJ, Matasci N, Schwaninger H, Aradhya MK, Prins B, Zhong G-Y, et al. 2013. Vitis
- Phylogenomics: Hybridization Intensities from a SNP Array Outperform Genotype Calls. PLoS ONE 8(11): e78680. doi:10.1371/journal.pone.0078680
- Liang, Z., Y. Yang, L. Cheng, and G.-Y. Zhong. 2013. Characterization of polyphenolic metabolites in grape hybrids. Vitis, 52(2):51-59.

Appendix B – Additional Figures.



Appendix Figure 1. Schematics of aeroponics system built in Geneva NY in 2017. We plan to expand capabilities of these systems or build new ones with additional sensors.



Appendix Figure 2. Ability to study root systems without the encumbrance of soil is one of the advantages of growing apple roots in air.

Treatments and Diagnostics Possible with Aeroponics

Integration with robotics will allow multiple automated diagnostics and treatments

- Mineral nutrients
- pH
- Temperature (cold or heat shock) with the addition of a transducer
- Plant growth regulators
- · Root pathogens
- Salinity
- Drought

- Easy access roots RNA, gene expression
- · Root growth
- Architecture
- Genotype specific root metabolites
- Disease resistance
- · Nutrient induced architecture
- Root gas exchange and respiration

Appendix Figure 3. Examples of treatments and diagnostic measurements possible with aeroponic systems.

Marker Assisted Apple Rootstock Breeding Pipeline Discover QTLs and eQTLs co-located in the genome with QTLs for traits of interest Harness DNA sequence variation and develop haplotype specific **PCR** primers Test primer combinations for robustness and GOOD BAD validate on parents. Grow seedlings, Keep **Discard** extract DNA and use markers to cull undesirable plants Plant 1,2,3,.,., One-Way Normal ANOM for Tree Size Validate outcome on 160 existing phenotyped 150.62 150 populations and 145.93 ₽ 140 141.24 older datasets using good statistical 130 methods 120 1974b

Appendix Figure 4. Marker assisted breeding pipeline in the Geneva breeding program.

Effect of gamma irradiation and other post-harvest treatments on ripening and postharvest defects in "Granny Smith" apples

HsuehYuan Chang, Francisco E. Loayza, Anuradha Prakash Food Science Program, Chapman University, Orange, CA

'Granny Smith' apple (*Malus domestica* Borkh.) is susceptible to superficial scald, a postharvest disorder characterized as diffuse browning of fruit skin. Without adequate postharvest treatments, scald symptoms occur on fruit after months of cold storage. A prevalent hypothesis for scald development is associated with the increased ethylene production during fruit ripening. Higher ethylene induces the accumulation of α -farnesene in the wax layer of apple fruit, and its oxidative products, conjugated trienes, which lead to tissue injury manifested as browning. This study aims to test the effects of gamma irradiation on the incidence of superficial scald as compared to treatments commercially used on 'Granny Smith' apples.

This was the second year of this study. Organic 'Granny Smith' fruit were harvested from Central California. Five treatments were applied: 1-methylcyclopropene (1-MCP), diphenyl amine (DPA), methyl bromide (MeBr), and two doses of gamma irradiation, 240 and 860 Gy (G240 and G860). Skin color, fruit firmness, titratable acidity, soluble solids contents, and visual disorders (superficial scald and internal browning) were the postharvest quality attributes evaluated. Respiration rate and ethylene production, and concentrations of α -farnesene and conjugated trienes in apple peel were also measured to understand their relationship with superficial scald. Data were collected after treatment and two months of cold storage at 0 °C followed by 7 days at 20 °C.

1-MCP, DPA, and MeBr inhibited superficial scald, while irradiation treatments (G240 and G860) did not. Irradiated fruit, especially at the higher dose, exhibited skin yellowing and internal browning. The incidence of superficial scald was best correlated with the higher concentrations of conjugated trienes in skin after 2-month storage. However, the concentrations of conjugated trienes had a low correlation with α -farnesene concentrations and ethylene production in most treatments. Notably, the ethylene production of fruit was significantly reduced by irradiation treatments and enhanced by MeBr. These results are contrary to the hypothesized role of ethylene in the development of superficial scald.

Similar to our results last year, the results highlight that superficial scald is not necessarily ethylene-dependent, and other mechanisms affect its development in 'Granny Smith' apple fruit. Unlike x-ray treatment, gamma irradiation was not effective at preventing or reducing superficial scald formation. We would like to explore the differences in fruit response to different modes of irradiation.

Acknowledgements: We would like to thank Elizabeth Carranza and the California Apple Commission, and Sterigenics for carrying out the irradiation treatment. This project was supported with funding from a TASC grant from USDA-FAS.

2021-2022 FUTURE RESEARCH

- 1) Evaluation of new bactericides for controls of fire blight of apples caused by Erwinia amylovora and evaluation of new postharvest fungicides for pome fruits **Dr. Jim Adaskaveg**
- 2) Sterile Codling Moth Release on California Apple Acreage M3 Agriculture Technologies
- 3) Trials on California Apples to test ProTone as an Organic Apple Thinner **Valent U.S.A. LLC**
- 4) Study on Mechanically Mass Harvesting of Cling Peaches (apples are included) **Dr. Stavros Vougioukas**
- 5) Apple Rootstock Breeding Program Field Trials Dr. Gennaro Fazio
- 6) Postharvest Quality and Physiology of 'Gala', 'Granny Smith', and 'Fuji' Apples Subjected to Phytosanitary Irradiation **Dr. Anu Prakash**

2021/2022	<u>Amount</u>
1) Evaluation of Bactericide	\$23,000 ¹
2) Sterile Codling Moth Release	\$33,000 ²
3) Trials on California Apples to test ProTone	\$20,000
4) Mechanically Mass Harvesting	\$0 ³
5) Apple Rootstock Breeding Program	\$0 ⁴
6) Postharvest Quality	\$1,500 ⁵
FISCAL IMPACT FOR 2021/2022:	\$77,500

¹Research done by Dr. Adaskaveg will be done on both organic and conventional apples.

² The CAC has partnered with the Pear Pest Management Research Fund for this research project.

³The CAC has partnered with the California Pear Advisory Board for this research project. The research includes apples and is applicable to our industry as well. Dr. Stavros received a NIFA grant, meaning this project is of no cost to the CAC.

⁴ The CAC received a 2020 Specialty Crop Block Grant to conduct this project in conjunction with USDA-ARS

⁵ This amount was donated by the California Apple Commission for apples that will be used in the study.

AES/CE MAR 84 Workgroup: <u>Apple</u> _____ Department: Plant Pathology/UCR

University of California Division of Agricultural Sciences

PROJECT PLAN/RESEARCH GRANT PROPOSAL

Project Year:	2021-22	Anticipated Duration of Project:	2 nd year of 3 years
	tigators: <u>J. E. Adask</u> D. Thompson, D. C	caveg Cary, and H. Forster	
-	valuation of new by vora and postharve		ucts for management of fire blight caused by
•	*	tural products, organic treatments	

JUSTIFICATION/ BACKGROUND

Epidemiology and management of fire blight. Fire blight, caused by the bacterium *Erwinia amylovora*, is one of the most destructive diseases of pome fruit trees including apples. The disease is indigenous to North America but has spread worldwide. In the spring, flowers are infected through natural openings in nectaries and pistils. From there, the bacteria spread into the peduncle, spur, and twig where it causes a canker. During warm, humid weather, ooze droplets consisting of new inoculum are exuded from peduncles and other infected tissues. Inoculum is spread by wind, rain, insects, birds, or by contaminated pruning tools. Secondary infections may occur throughout the growing season. The pathogen overwinters in cankers, flower buds, and diseased fruit.

Current chemical control programs for fire blight are based on protective schedules using available compounds that are best used as contact treatments. Conventional copper compounds are only effective when disease severity is low to moderate. They may cause fruit russeting and therefore, labeled rates are at low amounts of metallic copper equivalent (MCE) that are at the limit of effectiveness. New re-formulated copper products that can be used at reduced MCE rates and that cause less phytotoxicity are available. Some products are OMRI-approved including Badge X2, CS-2005, Cueva, and MasterCop. Among these, Cueva and MasterCop have been often more effective without causing phytotoxicity. Contributing to the low efficacy of copper is that low to moderate levels of copper insensitivity in pathogen populations have been detected in our surveys. Because only few treatments are permitted for organic apple production, research on OMRI-approved copper and other products needs to be continued.

The antibiotics streptomycin, oxytetracycline and kasugamycin can only be used in conventional pome fruit production. kasugamycin (Kasumin) is organically produced by fermentation and may potentially be an organically approved product by the NOSB because it is not used in human or animal medicine. Resistance in *E. amylovora* has not been found to date among hundreds of strains evaluated from different pome fruit growing areas in California. The incidence of resistance to streptomycin in California orchards has been fluctuating from very high to low in our surveys between 2006 and 2019. Previously, reduced sensitivity to oxytetracycline has only been found sporadically, and isolates were not competitive to wild-type strains. However, from 2018 to 2020, we detected highly resistant, oxytetracycline strains at several locations. These strains had oxytetracycline resistance genes that were similar to those that were previously described from non-plant pathogenic epiphytic bacteria such as *Pantoea agglomerans*. Apparently, these genes have jumped between bacterial genera. Current research is ongoing in characterizing these isolates for their competitive fitness, their genetic origin, and if the genetic determinants are transferable through conjugation.

The biocontrol treatments Blight Ban A506 (*Pseudomonas fluorescens* strain A506) and Bloomtime Biological (*P. agglomerans* strain E325), as well as the fermentation product of *Bacillus subtilis* Serenade (strain QST 713) have been inconsistent over the years in their performance in our trials and were most effective under low inoculum levels and less favorable micro-environments. Serenade, using the new liquid formulation ASO showed higher efficacy in mixtures with copper such as Cueva. Research will need to be continued with new copper products or other additives. The biocontrol Blossom Protect (*Aureobasidium pullulans*) has been very effective under less to moderately favorable disease

conditions, and it is one of the most consistent biologicals that we have evaluated. Biocontrols are most effective when they are actively growing on the plant. Several mechanisms have been described for biocontrol agents that lead to the control of the pathogenic agent including: (1) Competition; (2) Antibiosis or biochemical inhibition; (3) Site exclusion; (4) Parasitism; and (5) Systemic-acquired resistance.

Previous research on apple and pear demonstrated that the non-organic compound acibenzolar-S-methyl (Actigard) and the OMRI-approved LifeGard (Certis) as systemic acquired resistance (SAR) treatments used alone or in combination with copper were inconsistent. Therefore, we are evaluating other bactericide alternatives such as the natural fermentation compounds lactic acid, ϵ -poly-L-lysine, and nisin that have known anti-bacterial activity and are used as US-FDA-approved food preservatives, as well as ningnanmycin, capric acid (decanoic acid), and capric/caprylic acids in different products. They potentially could qualify as biopesticides with the EPA and ultimately as organic compounds with the NOSB and OMRI. Our initial evaluations with these compounds showed high toxicity in in vitro studies, but only moderate activity in the field. Therefore, we continue to try to improve their efficacy by using selected additives. We are currently consulting with a formulation chemist with a major registrant on ways to formulate ϵ -poly-L-lysine, and nisin. Plant extracts such as clove, garlic, and cinnamon oils to be evaluated are EF-400, BacStop, ET91, Guarda, and Gargoil. Other natural products that we plan to continue to evaluate are Alum (KAl(SO₄)₂·12H₂O), RejuAgro, and TD-NC-1 (riboflavin). These products may be registered in the future, and some are part of an IR-4 program that includes this research project to test novel potential solutions for diseases that are difficult to manage such as fire blight.

In a recent international fire blight meeting, information was discussed concerning the pending registration of several mixtures of bacterial phages for reducing *E. amylovora* population levels. Our previous evaluations were unsuccessful. Other researchers have also shown that new composite phage products do not meet expectations, however, mixtures of the phages with biological controls such as *Aureobasidium pullulans* (e.g., Blossom Protect) gave a higher level of control than using either product alone (i.e., phages or *A. pullulans*). Our goal is to develop effective rotational programs for organic farming practices with the use of copper, biologicals, and innovative strategies such as registering kasugamycin, food preservatives, and potential phages as OMRI approved natural products. We also will work on conventional programs with the use of antibiotics alone or in mixtures with copper, biologicals, or natural products during bloom or as cover sprays during early fruit development.

Management of postharvest decays. Apples like other pome fruits can be stored for some period of time using the correct storage environments. Still, postharvest decays caused by fungal organisms can cause losses that are economically detrimental to storing and marketing of fruit. The major postharvest pathogens of apples include *Penicillium expansum*, *Botrytis cinerea*, *Alternaria alternata*, *Mucor piriformis*, and *Neofabraea* spp. causing blue mold, gray mold, black mold, Mucor decay, and bull's eye rot, respectively. In California, the former three are most common. There is a deficiency of postharvest biocontrols and natural products that are available to prevent decays in storage. BioSave 100 is one of the only materials currently available in the United States, but it is not very effective. Other products like Aspire have been discontinued. Still, new biological products have been registered in other countries.

In our studies we demonstrated that the food preservative natamycin is effective against a spectrum of postharvest pathogens including those causing gray mold, Rhizopus rot, Mucor rot, and Alternaria decays, but it was not highly effective against blue mold. Natamycin was registered as the biopesticide BioSpectra 100SC on stone and citrus fruits but not pome fruit. This fungicide has been federally approved by the US-Food and Drug Administration (FDA) as a food additive to prevent mold growth, including *Penicillium* species, on dairy (e.g., cheese and yogurt) and meat products for many years in the United States. Over all the years in use, resistance in *Penicillium* species against natamycin has not occurred. Working with DSM, the producer, and Pace International, the registrant, we submitted a letter of support to the NOSB for approval of natamycin as an organic postharvest treatment of pome fruits. Unfortunately, the first submission request was rejected by the NOSB in the fall of 2019. Other registrants of natamycin will pursue conventional and organic registrations. Natamycin is 'exempt from tolerance' by the US-EPA. Codex is currently developing a similar category for these types of biopesticides. Therefore, our goal is to continue to evaluate natamycin and other new postharvest fungicides such as an organic formulation of polyoxin-D for the management of postharvest decays of apples.

Objectives for 2021-22

Fire blight research

- 1. Evaluate the efficacy of treatments for managing fire blight.
 - A. Laboratory in vitro tests with copper and zinc products in combination with antibacterial food additives (lactic acid, ε-poly-L-lysine, and nisin), natural organic acids (capric acid and capric/caprylic acid mixtures), new and biologicals (yeasts and bacteria).
 - B. Field trials with protective air-blast spray treatments:
 - i. Kasugamycin in combination with organic treatments to support organic petition to NOSB.
 - ii. New formulations of copper (e.g., Badge X2, CS-2005, Cueva, MasterCop) zinc, and chlorine dioxide in combination with food additives (lactic acid, poly-L-lysine, nisin), and biocontrols (e.g., Serenade ASO, Double Nickel 55) or natural products (Alum, EF-400, BacStop, ET-91, Gargoil, Guarda, RejuAgro, TDA-NC-1) as new antibacterial strategies.
 - iii. Bacterial phage-mixture products in combination with other biological control treatments (i.e., Blossom Protect) to provide an integrated strategy (pending agroindustry cooperation).

Postharvest research

- 2. Comparative evaluation of new postharvest fungicides
 - A. Evaluate natamycin (BioSpectra, Cerafruta), other new postharvest fungicides such as organic formulations of polyoxin-D, and Academy at selected rates against gray mold, blue mold, Alternaria decay, and bull's eye rot and compare to fludioxonil.
 - B. Evaluate mixtures of these compounds and new formulations of natamycin to improve performance of the fungicide.

Plans and Procedures

Laboratory assays and small-scale field trials to evaluate the efficacy of treatments for managing fire blight. In laboratory assays, we will evaluate new copper and zinc products, antibacterial food additives such as lactic, poly-L-lysine, and nisin, and capric/caprylic acids for their toxicity to *E. amylovora* in laboratory assays. Growth will be compared between non-amended and amended media, and the most effective additives will be selected for field trials.

In small-scale field tests in an experimental orchard, treatments using the copper products Badge, CS-2005, MasterCop, and/or Cueva, and the biological treatments Blossom Protect, and Serenade, will be applied to during bloom using small field sprayers. Copper treatments will be mixed with newly identified, food grade-additives (e.g., lactic acid, poly-L-lysine, and nisin) based on laboratory results. Additionally, Alum, TDA-NS-1, and chlorine dioxide also will be evaluated based on availability. After a selected time, blossoms will be spray-inoculated with *E. amylovora* (10⁶ cfu/ml), and disease will be evaluated based on the number of diseased blossoms per replication.

Field studies on the management of fire blight using protective treatments during the growing season. Air-blast sprayer field studies on the relative efficacy of protective treatments will be conducted in experimental apple orchards at KARE and UC Davis. Four applications will be done (at pre-bloom, 10-20%, 60-80%) full bloom, and petal fall). The relative efficacy of protective treatments (Kasumin, copper products, Blossom Protect, Serenade, Alum, ReiuAgro, TDA-NC-1), as well as of selected food grade-additives (e.g., lactic acid, poly-L-lysine, nisin) and essential oils (EF-400, BacStop, ET-91, Gargoil, Guarda) based on laboratory results will be evaluated alone or in selected mixtures to develop integrated programs for resistance management. Additionally, two companies are willing to provide new bacterial phage-mixture products, and they have suggested integration with treatments with A. pullulans (i.e., Blossom Protect). For this, we will initially follow recommended guidelines from the registrant, and we are currently cooperating with one company by providing strains of the pathogen from California to select phages that are possibly more specific for these strains. Incidence of new blight infections on blossoms and leaves in addition to potential phytotoxic effects of the treatments (e.g., fruit russeting) will be evaluated. Application timings will be determined based on temperature, rainfall, and host development. Treatments will be replicated on four to eight trees. Data for chemical and biological control will be analyzed using analysis of variance and LSD mean separation procedures of SAS 9.4.

Efficacy of new postharvest fungicides for managing apple decays in storage. Fruit (cvs. Granny Smith and Fuji apple) will be treated like commercial practices concerning harvest, handling, packing, and temperature-management of fruit. Fruit will be wound-inoculated with conidial suspensions of several

decay fungi (*P. expansum, B. cinerea, Alternaria alternata*) and treated after selected times. Natamycin (BioSpectra 100SC, Cerafruta) and organic formulations of polyoxin-D (Ph-D, Oso) will be evaluated by themselves and in mixtures with other fungicides (e.g., fludioxonil) in experimental packingline trials at Kearney Agricultural Center at selected rates. Four replications of 24 fruit will be used. For the new fludioxonil-difenoconazole pre-mixture (i.e., Academy), we will compare the efficacy of different application methods (in-line drench, CDA, and T-Jet). Treatments will be compared to fludioxonil. Data will be analyzed using analysis of variance and averages will be separated using least significant difference mean separation procedures of SAS 9.4.

Benefits to the industry

Fire blight research. With removal of antibiotics as treatments for organic production due to their use in human medicine and animal agriculture, research on organic alternatives are desperately needed for apple production. Because kasugamycin is not used in human medicine or veterinary science, has a different MOA from other antibacterial products, and is organically produced by fermentation, this pending submission is supported by the registrant (UPL) to the NOSB for approval as an organic treatment. Furthermore, with the limited number of materials available to organic pome fruit growers, new active ingredients that are OMRI approved are needed for managing fire blight in an integrated approach. Our research project has identified biologicals with consistent and inconsistent performance and growth enhancers that may improve their overall performance. Information from this research project will help to develop integrated programs using rotations or mixtures of organic compounds (e.g., copper), biologicals (Serenade, Blossom Protect, etc.), food-grade, antibacterial additives, essential oils (BacStop, EF-400, ET-91, Guarda, Thymox), phage mixtures and possibly residual oxidizers such as Reju-Agro and TDA-NC-1 to effectively manage the disease. Thus, we are testing innovative solutions for managing fire blight potentially without antibiotics for the organic apple industry. This information is being posted on the UCIPM website and in apple industry newsletters.

Postharvest decay management research. For the packer, the challenge is to develop management programs using new fungicides for control of gray mold, blue mold, Alternaria rot, and other decays of apple. The challenge to the industry is to store fruit and provide decay-free, wholesome fruit to local and distant markets. For this, fungicide management programs for apple need to be developed and continually adapted based on new organically certified fungicides that will allow rotations and mixtures to optimize control of postharvest fungal pathogens. The development of several effective postharvest fungicide treatments including materials that are exempt from tolerance (i.e., natamycin), are NOSB approved (i.e., polyoxin-D), and are potentially NOSB- and OMRI-certified (i.e., natamycin) will greatly decrease losses of fruit from various decays during storage in a durable program that will be effective for many years. Thus, information from this research directly benefits growers and packers by identifying and registering new materials, as well as developing improved application practices for control of postharvest diseases of apples.

References

- 1. Van Der Zwet, T. and Keil, H.L. 1979. Fire Blight A Bacterial Disease of Rosaceous Plants. United States Department of Agriculture, Handbook No. 510.200 pp.
- 2. Vanneste, J. (ed.). 2000. Fire Blight: The Disease and its Causative Agent, *Erwinia amylovora*. CAB International, Oxford. 384 pp.

Budget Year: <u>2021-202</u>	<u>22</u> .	
Funding Source:	Apple Commission of Californ	nia
Salaries and Benefits:	Post-Docs/SRA	<u>5,000</u>
	Lab/Field Ass't	<u>1,000</u>
	Subtotal	<u>6,000</u>
	Employees' Benefits	<u>3,500</u>
		Subtotal <u>9,500</u>
Supplies and Expenses*	*	<u>12,000</u>
Equipment		<u>0</u>
Operating Expenses/Eq	uipment Travel (Davis Campus only)	<u>0</u>
Travel		<u>1,500</u>
Department Account N	0	Total <u>23,000</u>
* - Costs include expens	tes of \$12,000 for maintaining an apple orchard at	the Kearney AgCenter.
Originator's Signature:	Vottherine Bollows	Date: 6-29-2021
Department Chair:	THE DISTRIBUTION	Date: <u>6-29-2020</u>

Date:

Budget Request:

Liaison Office:



QUOTE

M3 Agriculture Technologies

530 Vermont Ave. Erie, PA 16505

Phone: 937-626-2122 Email: rob.mahrt@m3cg.us

Bill To:

Todd Sanders
California Apple Commission
2565 Alluvial Ave #152
Clovis, CA 93611
TSanders@calapple.org

DATE: April 5, 2021
INVOICE # QUOTE

FOR: Sterile Codling Moth Release

DESCRIPTION			JNT
Commercial Releases			
Commercial Releases, 20 Weeks (Est. April 26 – September 6, 2021)	\$415/ac/season	x100 ac	\$41,500.00
Shipping Box & Cooling Materials Cost	\$50.00	x20 weeks	\$1,000.00
UPS Shipping Cost	\$250.00	x20 weeks	\$5,000.00
Subtotal			\$47,500.00
CA Apple Commission Discount			\$(14,500.00)
	TOTAL		\$33,000.00

If you have any questions concerning this quote, Rob Mahrt, 937-626-2122, rob.mahrt@m3cg.us

Valent U.S.A. LLC

EVALUATION OF POST-BLOOM APPLICATIONS OF PROTONE SG FOR REDUCING FRUIT SET ON APPLES GRIS Protocol ID: VUSA2021PROTONEFR03.01 Original file licensee: Kevin Forney

Trt		Form	Form	Fm	Product	Appl	Rate	Appl	Appl	Amount
No	Product	Conc	Unit	Тр	Туре	Rate	Unit	Code	Amount	Unit
1	UNTREATED CHECK -UNTREATED CHECK	0	NA	NA	CULT					
2	PROTONE	20	%W/W	SG	PGR	16.6	oz wt/a	Α	100.00	GAL/A
	-S-ABA	20				166				
	SYL-COAT	100	%W/W	SF	ADDI	0.1	% v/v	Α	100	GAL/A
	-SURFACTANT & OSI	100				.13368				
	TRI-FOL	100	%W/W	SF	ADDI	8	fl oz/100 gal	Α	100.00	GAL/A
	-ACIDIFYING AGENT	100				80				
3	PROTONE	20	%W/W	SG	PGR	33.1	oz wt/a	Α	100.00	GAL/A
	-S-ABA	20				331				
	SYL-COAT	100	%W/W	SF	ADDI	0.1	% v/v	Α	100	GAL/A
	-SURFACTANT & OSI	100				.13368				
	TRI-FOL	100	%W/W	SF	ADDI	8	fl oz/100 gal	Α	100.00	GAL/A
	-ACIDIFYING AGENT	100				80				

Replications: 6, Untreated treatments: 1, Design: Randomized Complete Block (RCB), Treatment units: US standard, Treated 'Plot' experimental unit size Width: 12 feet, Treated 'Plot' experimental unit size Length: 35 feet, Application amount: 200 GAL/AC, Mix size: 11.57 GAL, Rows per plot for in-furrow: 4, Format definitions: SCCgroup.def, SCCGroup.frm

No assessment footnotes entered in study						
SE Group No.:	1	2	3	4	5	
Crop: ID / Code:	1 MABSD					
Crop Name:	Apple	Apple	Apple	Apple	Apple	
BBCH Scale:	ВРОМ	BPOM	BPOM	BPOM	BPOM	
Crop Scientific Name:	Malus domestica					
Part Rated - C/P:	LEAF C	LEAF C	LEAF C	LEAF C	FRUIT C	
Rating Data Type:	PHYCHL	PHYNEC	PHYCHL	PHYNEC	COPLPA	
Rating Unit:	%	%	%	%	NUMBER	
Reported Sample Size:					100	
Sample Size Unit:					FLOCLU	
Number of Subsamples:	1	1	1	1	1	
Comment:	%Phytoto-Chlorosis 7>	%Phytoto-Necrosis 7 >	%Phytoto-Chlorosis 1>	%Phytoto-Necrosis 7 >	# Fruit/100 Cluster >	

Valent U.S.A. LLC

EVALUATION OF POST-BLOOM APPLICATIONS OF PROTONE SG FOR REDUCING FRUIT SET ON APPLES
GRIS Protocol ID: VUSA2021PROTONEFR03.01
Original file licensee: Kevin Forney

SE Group No.:	6	7
Crop: ID / Code:	1 MABSD	1 MABSD
Crop Name:	Apple	Apple
BBCH Scale:	BPOM	BPOM
Crop Scientific Name:	Malus domestica	Malus domestica
Part Rated - C/P:	FRUHAR C	FRUHAR C
Rating Data Type:	YIELD	WEIFRE
Rating Unit:	NUMBER	G
Reported Sample Size:	1	1
Sample Size Unit:	PLANT	FRUIT
Number of Subsamples:	1	1
Comment:	Yield (#/Tree)	g/Fruit

Valent U.S.A. LLC

EVALUATION OF POST-BLOOM APPLICATIONS OF PROTONE SG FOR REDUCING FRUIT SET ON APPLES

GRIS Protocol ID: VUSA2021PROTONEFR03.01

Original file licensee: Kevin Forney

Objectives: Evaluate post-bloom applications of ProTone SG for reducing fruit set on apples.

Affiliate Name: VUSA
Product: PROTONE Org: FR Number: 03.01 Year: 2021 Project ID: 202060
Author: KFORN

Interim Report: 8-1-2021 Final Report: 12-1-2021

Guideline	Description
ADM-C-PUB	Confidentiality - Public Trial - No Secrecy Agreement Required

Number of Trials

Total Trials: 1

Trial Design

Experimental Design: R RANDOMIZED COMPLETE BLOCK

No.Reps: 6 No. Trt.: 3

Plot Size: Minimum Plot Size: Single Tree With Buffer

Crop 1: MABSD Apple Malus domestica

Crops and Pests

Α **FOSP** ApMe Application Method **SPRAY** POEMCR **Application Timing** Application Placement FOLIAR **Appl Equipment** AISP AIR BLAST SPRAYER

Application Information

Number of Applications/Interval: Application Timing: 10-20 mm Average Fruit Diameter (Optimal Timing = 12-18 mm)

Trt. Notes: 1) Spray Volume: Apply to Runoff (Minimum 100 GPA).

- Adjust pH of spray solution between 5.0 and 5.5, using Tri-Fol Acidifyer & Buffering Agent.
 Apply ProTone when daytime high temperature is not expected to fall below 80 degrees F.

4) Report average fruit diammeter at the time of application.

100.00 GAL/A

Special Cultural Practices: 1) Standard commercial pest and disease control.

- 2) No other chemical thinners applied to the trees.3) Do not hand thin trees.

Application Amount

Yield: Y

APPLE EDUCATION



APPLE EDUCATION SUMMARY

The California Apple Commission strives to provide educational information for classrooms throughout California. Throughout 2020-2021, the California Apple Commission disseminated informational fact sheets, coloring pages, and other information specific to California apples to the California Foundation for Agriculture in the Classroom. The Foundation provides educational resources for students and facilitates outreach to California teachers and their students who have an interest in California agriculture.

The Commission's goal through this educational sponsorship is to create agriculture awareness in classrooms and create a basis for the appreciation of the importance of agriculture in the everyday lives of students. The Commission will continue to make a positive impact on the way students view agriculture and the world around them.

The Foundation provides informational guides for a variety of agriculture commodities. Their website provides books and videos for students, as well as pamphlets, lesson plans, and informational fact sheets for teachers to use in their classrooms. The learning materials provided on their website are created with all grade levels in mind, assuring the most effective learning material. The California Foundation for Agriculture in the Classroom also funds scholarships and grant opportunities for students in the agriculture industry. To learn more about what the Foundation has to offer, please visit their website: http://learnaboutag.org/index.cfm

The following is the fact sheet that the California Foundation for Agriculture in the Classroom provides on their website for the California Apple Commission. This information will be distributed to schools in California and other educational institutes.

Commodity Fact Sheet

Apples

Information compiled by the California Foundation for Agriculture in the Classroom

How Produced – Grafting, a horticultural technique that joins two plant structures together, is the first step in apple production to ensure that rootstock and varieties will bare

fruit. Once planted, it takes four to five years for the tree to produce the first fruit and will produce fruit for up to 100 years. Most apple varieties are self-sterile, meaning they are unable to pollinate themselves and thus rely upon cross-pollination. The most commonly used pollinator is crab apples (also known as wild apples) in which pollination takes place in the spring, when trees are in blossom. Once pollinated, blossoms fall to the ground and small apples begin to grow in the blossom's place.

During spring and summer, apple trees require frequent watering. Apple trees can tolerate a great deal of heat if they have sufficient water. The apple crop is harvested

by hand in the fall. To insure crop production for the following year, trees must be pruned yearly in the winter to promote new vegetative growth.

History – The first documented history of apples dates back to 300 B.C. in the Persian Empire, where the cultivation and enjoyment of apples was an essential part of civilized life. In the 1400s apples were rediscovered and in the 1500s regained popularity again as a common commodity. During this time, European settlers of the Americas brought with them their English custom varieties, and the first apple orchard was planted in America. William Blackstone was the first pilgrim to plant apples trees grown in the United States in the Massachusetts Bay Colony in 1629.

In the early 1800s, stories began circulating about John Chapman, better known as Johnny Appleseed, who traveled across the Ohio Valley carrying bags of apple seeds. Venturing westward, he planted seeds and grew apple trees wherever he roamed to ensure that settlers living in the western frontier would have nutritious apples to eat. Apples have a place in more recent history, too. In 1962, the first American to orbit the Earth carried pureed applesauce to consume during the flight.

Varieties – The apple, scientifically known as Malus domestica, is a member of the rose family. California has almost 13,000 acres dedicated exclusively to apple

production. California grows four main varieties: Gala, Fuji, Granny Smith, and Cripps Pink. Within the United States, roughly 2,500 varieties of apples are grown. The top 10 apple

varieties grown within the United States are Red Delicious, Golden Delicious, Fuji, Granny Smith, Rome Beauty, McIntosh, Idared, Jonathan, Gala, and York Imperial.

Commodity Value — The United States' 7,500 apple producers grow approximately 240 million bushels of apples each year on 322 thousand total acres of land. The wholesale value of the United States apple crop is approximately \$4 billion annually. Worldwide, the United States ranks second to China in apple production. California ranks fourth in U.S. apple production, generating 12% of the national apple crop which is approximately 1.5 to 2.5 million (40lb.) boxes of apples per year. Seventy-five percent of

the apples produced in California will be shipped domestically and 10% to 15% are exported. Canada, Malaysia, Mexico, Taiwan, and Panama are five of the 27 global destinations California exports to.

Top Producing Counties – There are five major regions in which apples are grown in California. Historically, apple production was limited to the coastal mountains, the Sierra foothills, and in the Southern California mountains. Recently apple production has expanded into the Central Valley with new plantings of Granny Smith, Fuji, Gala, and other varieties. Important coastal apple producing counties are Sonoma, Santa Cruz, and San Luis Obispo. The major apple production areas are in the San Joaquin Valley with Kern, Fresno, San Joaquin, and Madera counties being the leading producers.

Nutritional Value – One medium-sized apple provides 20% (five grams) of the daily requirement for dietary fiber, 8% of the daily requirement for vitamin C, and is a healthy source of potassium. One apple has approximately 80 calories and contains no fat, cholesterol, or sodium.

For additional information:

California Apple Commission Phone: (559) 225-3000 Website: calapple.org

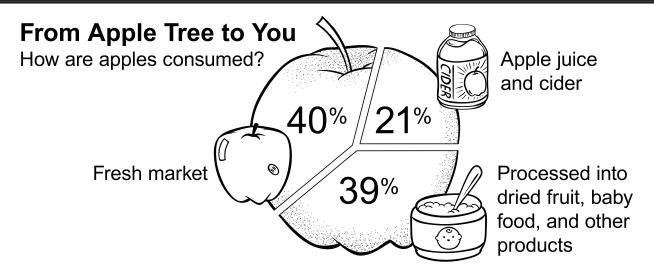




This is one in a series of fact sheets composed by the California Foundation for Agriculture in the Classroom (CFAITC). For additional educational materials: CFAITC, 2600 River Plaza Drive, Suite 220, Sacramento, CA 95833-3293 € (916) 561-5625 € (800) 700-AITC € Fax: (916) 561-5697 Email: info@learnaboutag.org € Website: LearnAboutAg.org ©2020 California Foundation for Agriculture in the Classroom. All rights reserved.



Apples Activity Sheet



Lesson Ideas

- Dissect and examine the anatomical parts of an apple.
 Observe and identify the function of each structure.
- Research and explain the aphorism "an apple a day keeps the doctor away" using nutritional information.
- Observe and practice various grafting techniques used to grow apples.
- Compare hand and machine harvesting methods. Invent a harvesting machine for apples.
- Perform experiments that show the different methods of preserving apples.
- Research and determine what the top ten apple varieties are and why they are most popular amongst consumers.
- Calculate the%age of water weight in apples by dehydrating the fruit.
- Sprout an apple plant from a seed.

Fantastic Facts

- 1. The crabapple is the only apple native to North America.
- 2. Apples are propagated by two methods: grafting or budding.
- 3. The apple variety "Red Delicious" is the most commonly grown apple variety worldwide.
- 4. Apples are a member of the rose family.
- 5. Twenty-five% of an apple's volume is air, which makes it naturally buoyant.
- 6. It takes the energy from 50 leaves to produce one apple.
- 7. World's top apple producers are China, United States, Turkey, Poland, and Italy
- 8. Archeologists have found evidence that humans have been enjoying apples since 6500 B.C.
- Apples account for 50% of the world's deciduous fruit tree production.
- Two-thirds of an apple's fiber and antioxidants are found in the peel.

Lesson Plan: Sugar or Starch

Introduction: Apples naturally contain starch also known as carbohydrates. When an apple begins its ripening process, starches are converted into sugar. This conversion process starts at the core of the apple and moves outward toward the skin. To check the ripeness of the apple an iodine test can be used to identify the amount of starch present.

Objective: Students will investigate the ripening process of apples by conducting an iodine experiment.

Standards: NGSS: 4-LS1-2, 3-5-ETS1-3; CC ELA: L.W.4-5.7

Materials: Variety of apples, iodine tincture, nitrile gloves, safety goggles, paintbrush, knife, paper plates or towels

Procedure:

- Safety note: Iodine tincture is a hazardous material and should be handled with care. Wash hands after use and avoid contact with the eyes and skin.
- 2. Place individual, whole apples on labeled plates (1, 2, 3, 4,

- etc.) and instruct students to observe each apple's size, color, texture, and firmness. Have students hypothesize, based on their previous knowledge, which apples are at peak ripeness.
- Cut apples in half, displaying both sides of the apples on each labeled plate. Have students observe each apple's internal characteristics.
- 4. With the paintbrush, evenly apply iodine across the cut surface of each top apple half. Let the apple sit for two minutes. Leave the other apple half untouched as a control to compare changes in each apple.
- Observe the surfaces of the apples. Large amount of purple indicates high starch/low sugar. Little to no purple indicates low starch/high sugar.
- Place apples on a continuum from least to most ripe. Make concluding observations.
- 7. Write a conclusion paragraph on your experimental findings.



This Fact and Activity Sheet was developed by California Foundation for Agriculture in the Classroom in conjunction with California educators and meets the required education standards of the California Department of Education.



EDUCATION THROUGH SOCIAL MEDIA

In 2020-2021, the California Apple Commission continued to enhance social media efforts in order to motivate consumers to specifically look for and buy California apples when they are in season. Instagram, Facebook, and Pinterest accounts will all be utilized to connect with consumers. All three of these platforms will feature content on how to use apples, information on seasonality of the different varieties most commonly grown in California, and Meet the Grower stories which allow the consumer to see who is growing their apples. CAC content specifically encourages the California consumer to follow the seasons of California apple varieties to guarantee they are eating fresh apples. Educating consumers on the seasonality of apples provides them the tools to ask their retailers to carry California grown apples in their respective seasons. In order to keep content development as cost efficient as possible, the CAC will continue to rely on existing partnerships with CA Grown and US Apple. Additionally, through internal partnership opportunities with the California Wild Rice Advisory Board, California Blueberry Commission, and California Olive Committee, the CAC will be able to engage in new asset development via the creation of recipes that feature a combination of all or some of these additional California commodities.



CA GROWN PARTNERSHIP





California Grown, also known as the Buy California Marketing Agreement (BCMA), is a joint effort of agricultural industry groups representing the products of California's farms, ranches, forests, and fisheries. Working as an advisory board to the California Department of Food and Agriculture, BCMA brings together industry and government resources to increase the awareness, consumption, and value of California agricultural products, helping the state's consumers enjoy the best of the California lifestyle.

California Grown is funded through public and private contributions by the U.S. Department of Agriculture, the California Department of Food and Agriculture, and California agricultural organizations.

The Commission participates as an active member of the California Grown partnership by attending regular board meetings and joining internal committees. Through this partnership, the Commission is able to feature California apples at various events including, California Agriculture Day at the Capitol, the Produce Marketing Association's Fresh Summit Exposition, and many more.



PEST, DISEASE, & STANDARDIZATION



PEST, DISEASE, & STANDARDIZATION SUMMARY

The California apple industry continuously strives to produce a healthy and safe product. Through its work in pest, disease, and standardization, the Commission continues to partner with other entities to represent the industry on critical issues.

The Food Safety Modernization Act (FSMA) was signed into law on January 4th, 2011 by President Barack Obama. The purpose of the law mandates the U.S. Food and Drug Administration (FDA) to implement a comprehensive, science-based, preventative control across the food supply. The FSMA rules are put in place to ensure specific actions are taken at each of the following points to prevent contamination. FSMA consists of seven different final rules, which can be found by following the link listed below. The Produce Safety rule specifically focuses on production practices and ultimately establishes science-based minimum standards for the safe growing, harvesting, packing, and holding of produce. The rule puts more responsibility on farms to protect their crops from contamination by creating requirements for water quality testing, raw manure application, examining grazing areas, employee health and hygiene training, and more. The rule gives special attention to sprouts due to their frequent association with foodborne illness outbreaks.

For more information, please visit the following link to view the most recent publication of the rules for the Food Safety Modernization Act: https://www.fda.gov/Food/GuidanceRegulation/FSMA/

Please see the following pages for information regarding CDFA's Produce Safety Program for industry members, in addition to more information on the FSMA Produce Safety Rule itself.



FSMA TRAINING

Under the Produce Safety Rule, every produce farm must have an individual employed who has completed an FDA-approved Produce Safety Rule Grower Training course. This course provides training to ensure a responsible party employed by the farm understands the required food safety practices. The Produce Safety Rule Grower Training need only be taken once; however, the certificate of completion belongs to the individual and not the farm. California Produce Safety Program inspectors will ask to see your designated food safety employee's certificate as part of your on-farm inspection.

About the Training Program

Currently, only courses that have been accredited by the Produce Safety Alliance will satisfy the requirement for training under the Produce Safety Rule.

The 7-hour Produce Safety Rule Grower Training course covers the following topics:

- Introduction to Produce Safety
- Worker Health, Hygiene and Training
- Soil Amendments
- Wildlife, Domesticated Animals and Land Use
- Agriculture Water (Part I: Production Water, Part II: Postharvest Water)
- Developing a Farm Food Safety Plan
- Postharvest Handling and Sanitation

The California Department of Food and Agriculture has received funding from the FDA to provide Produce Safety Rule Grower Training courses at a reduced rate. Due to the COVID-19 pandemic, there are limited in-person courses in California; however, participants also have the choice of signing up for online or remote delivery of the course.

- In-person course is a traditional classroom style course with instructors, typically presented in a single 7-8 hour training day.
- Online delivery course is a three-week course that can be completed at your own pace. The online course is expected to take 15-30 hours for successful completion. The enrollment cost will be \$125 during the COVID-19 crisis (until 31 December 2021) by applying discount code GROWER21. The standard enrollment cost is \$450.
- Remote delivery course is led in real time by instructors delivered with video conferencing software, such as Zoom or Webex. This is a temporary option being supported during the COVID-19 outbreak.

To sign up please go to https://safefoodalliance.com/events/





May 30, 2018

Re: Produce Safety Program Website

Dear California Produce Associations:

The California Department of Food and Agriculture is pleased to inform you our new Produce Safety Program (PSP) has launched a website that will serve as a resource to California farmers who must comply with new regulations under the Produce Safety Rule (PSR).

The website, which can be found at www.cdfa.ca.gov/producesafety, includes basic information about the PSP and our efforts to help California produce farmers understand how to comply with the requirements of the PSR under the Food Safety Modernization Act (FSMA).

Our hope is that you will use this website and share it with your grower-members as the official resource for information about PSR implementation in California. Additional information will be added to the site in coming months. Currently, California produce farmers can use the website to learn about mandatory Produce Safety Rule Grower training that is required of at least one employee on every produce farm. Our website provides access to registration information for several courses being offered throughout the state that are subsidized by the U.S. Food and Drug Administration so that farms can complete the required training at a reduced price.

The site provides California produce industry members with some initial information about the upcoming PSP <u>inspections</u> that will be conducted by our staff on behalf of the FDA beginning in spring of 2019. To prepare for inspections, the Department is offering on-farm readiness reviews. Growers can <u>schedule a review</u> directly from the website. A <u>Frequently Asked Questions</u> section has been developed, along with some talking points that can be used to explain the new program to <u>consumers</u>. A regular <u>blog</u> is also part of the website and will be used to provide updates on program activities and resources.

In addition to the website, a Facebook page has been created for the program under <u>@CDFAProduce Safety</u>. Interested industry members can also join a <u>mailing list</u> to receive updates and information.

It is estimated over 20,000 farms in California are covered under the PSR, and we will need your assistance in reaching this audience with important information about the







new regulation. We encourage your organization to share these new resources with your membership. We also welcome any questions you may have.

Sincerely,

Karen Ross, Secretary
California Department of Food and Agriculture

Enclosures

cc: Natalie Krout-Greenberg, Director

Inspection Services Division

Steve Patton, Branch Chief Inspection Services Division

Shelley Phillips, Supervising Senior Environmental Scientist Produce Safety Program







September 13, 2017

Steve Patton Branch Chief 1220 N Street Sacramento, CA 95814

Dear Mr. Patton:

On September 12, 2017, the Food and Drug Administration (FDA) announced a postponement of the implementation of routine inspections of farms subject to the Produce Safety Rule until spring 2019. The announcement also addressed the extension of the compliance date for agricultural water standards and described how FDA will work with stakeholders to modify agricultural water standards in the future.

In light of this announcement, we are modifying the approach outlined in the cooperative agreements so that routine inspections will begin in spring 2019. This will allow states and FDA an opportunity to focus on issuing guidance and training plans, along with conducting On-Farm Advisory (Readiness) Reviews (OFRRs) in 2018. "For-cause" inspections (such as those related to outbreak investigations) will still occur, as needed, and will not change in light of this announcement. The new routine inspection timeline is as follows:

- Large Farms
 - o Compliance Date 1/26/2018; Inspection Start Date March June 2019
- Small Farms
 - o Compliance Date 1/28/2019; Inspection Start Date March June 2020
- Very Small Farms
 - Compliance Date 1/27/2020; Inspection Start Date March June 2021

We ask that all State Produce Implementation Cooperative Agreement Program (CAP) grantees adjust their inspection implementation timelines according to the above schedule and reassess their strategic plans and budgets to determine the impact of these decisions, if any. We encourage states to consider reprogramming resources planned for inspections in 2018 to conducting OFRRs.

FDA, working closely with our association partners, is scoping out all activities that can be performed in lieu of routine inspections in Year 2. We will also be finalizing CAP-related information and decisions necessary to implement inspections in 2019. We will share this information with you no later than November 1, 2017, so you will have time to revise your strategic plans and budgets, if necessary, and submit them, along with your mid-year progress reports, by December 1, 2017.





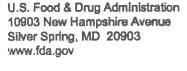
While reassessing your program's strategic plan and budget please be mindful that all other planned activities under your existing cooperative agreement will continue including:

- Developing and continually updating your strategic plan for produce safety (continuation from Year 1)
 - o Developing, documenting, and tracking performance measures
- Conducting a jurisdictional self-assessment (continuation from Year 1)
- Establishing and verifying a farm inventory (continuation from Year 1)
- Conducting legislative research and continuing any efforts to obtain regulatory authority (continuation from Year 1)
- Developing program and program infrastructure (continuation from Year 1 and/or new)
 - Developing and implementing a continuing education program to ensure regulatory jurisdiction personnel are trained
 - o Establishing ties with FDA's Produce Safety Network and FDA's Technical Assistance Network to ensure that any questions or issues are raised and state/territory regulators receive necessary technical assistance
 - o Researching, designing, and implementing a compliance program for applicable produce safety regulations at the jurisdictional level, which includes:
 - Continuing program development work, but adjusting for the new targeted start date; and
 - Delaying implementation of the inspection program and redirecting those resources to OFRRs and other education and outreach programs
 - Continuing communication and collaboration amongst CAP stakeholders
- Performing education and outreach (continuation from Year 1 and/or new)
 - o Evaluating educational needs and implementing an educational system to provide for an informed farming community
 - o Participating in and providing opportunities for OFRRs

The implementation of the Food Safety Modernization Act (FSMA) and the Produce Safety Rule has been and continues to be a top priority for FDA. As you know, states have a long history of effectively working with and understanding your farming communities. Successful implementation of the Produce Safety Rule cannot happen without the support of our state partners who are helping food producers and growers understand and achieve the new requirements.

FDA is committed to ensuring our regulatory partners and industry have the tools needed to implement the new standards. As we continue to work together with FSMA implementation, we recognize that achieving our shared food safety goals is a continuous effort from all of us.

Thanks for your commitment to integration and food safety. We look forward to our continued partnership.





Temporary Policy During the COVID-19 Public Health Emergency Regarding the Qualified Exemption from the Standards for the Growing, Harvesting, Packing, and Holding of Produce for Human Consumption

Guidance for Industry

This guidance represents the current thinking of the Food and Drug Administration (FDA or Agency) on this topic. It does not establish any rights for any person and is not binding on FDA or the public. You can use an alternative approach if it satisfies the requirements of the applicable statutes and regulations. To discuss an alternative approach, contact the FDA staff or Office responsible for this guidance as listed on the title page.

I. Introduction

FDA plays a critical role in protecting the United States from threats such as emerging infectious diseases, including the Coronavirus Disease 2019 (COVID-19) pandemic. FDA is committed to providing timely guidance to support response efforts to this pandemic.

FDA is issuing this guidance to announce flexibility in the eligibility criteria for the qualified exemption from the Standards for the Growing, Harvesting, Packing, and Holding of Produce for Human Consumption (Produce Safety Rule) (21 CFR Part 112) due to disruptions to the supply chain for the duration of the COVID-19 public health emergency.

This policy is intended to remain in effect only for the duration of the public health emergency related to COVID-19 declared by the Secretary of Health and Human Services (HHS) on January 31, 2020, effective January 27, 2020, and renewed for 90 days on April 21, 2020, effective April 26, 2020, including any renewals made by the HHS Secretary in accordance with section 319(a)(2) of the Public Health Service Act (PHS Act) (42 U.S.C. 247d(a)(2)). When the public health emergency concludes, FDA intends to issue additional guidance regarding the eligibility criteria for the qualified exemption from the Produce Safety Rule, which depends on the calculation of a three-year average as described below.

Given this public health emergency, this guidance is being implemented without prior public comment because FDA has determined that prior public participation for this guidance is not feasible or appropriate (see section 701(h)(1)(C) of the Federal Food, Drug, and Cosmetic Act (FD&C Act) (21 U.S.C. 371(h)(1)(C)) and 21 CFR 10.115(g)(2)). This guidance document is being implemented immediately, but it remains subject to comment in accordance with statutory requirement and the Agency's good guidance practices.

In general, FDA's guidance documents, including this guidance, do not establish legally enforceable responsibilities. Instead, guidances describe the Agency's current thinking on a topic and should be viewed only as recommendations, unless specific regulatory or statutory requirements are cited. The use of the word *should* in Agency guidance means that something is suggested or recommended, but not required.

II. Background

A. Coronavirus

There is currently an outbreak of respiratory disease caused by a novel coronavirus. The virus has been named "SARS-CoV-2" and the disease it causes has been named "Coronavirus Disease 2019" (COVID-19). On January 31, 2020, HHS issued a declaration of a public health emergency related to COVID-19 and mobilized the Operating Divisions of HHS. In addition, on March 13, 2020, the President declared a national emergency in response to COVID-19.

State and local governments across the United States have instituted public health orders resulting in the temporary closure or limited operational status of many restaurants, retail food establishments, and institutional food service establishments (including schools). These closures and limitations have had a significant impact on the supply chain for food by significantly reducing the demand for food normally sold to these establishments. These changes in the supply chain have impacted the ability of some farms to sell food to typical buyers and, consequently, may impact some farms' eligibility for a particular exemption under the Produce Safety Rule.³

¹ Secretary of Health and Human Services Alex M. Azar, Determination that a Public Health Emergency Exists. (Jan. 31, 2020, renewed April 21, 2020), available at https://www.phe.gov/emergency/news/healthactions/phe/Pages/default.aspx.

² Proclamation on Declaring a National Emergency Concerning the Novel Coronavirus Disease (COVID-19) Outbreak (Mar. 13, 2020), *available at* https://www.whitehouse.gov/presidential-actions/proclamation-declaring-national-emergency-concerning-novel-coronavirus-disease-covid-19-outbreak/.

³ The Current Good Manufacturing Practice, Hazard Analysis, and Risk-Based Preventive Controls for Human Food (21 CFR Part 117) and the Current Good Manufacturing Practice, Hazard Analysis, and Risk-Based Preventive Controls for Food for Animals (21 CFR Part 507) regulations established criteria for a food facility to be a qualified facility. If you believe your status as a qualified facility under either part 117 or part 507 will be impacted by market disruptions related to COVID-19, please contact us as described in the preface of this guidance.

B. Qualified Exemption under the Produce Safety Rule

As set forth in 21 CFR 112.5(a), a farm is eligible for a qualified exemption and associated modified requirements in a calendar year if during the previous three-year period preceding the applicable calendar year, the average annual monetary value of food the farm sold directly to qualified end-users exceeded the average annual monetary value of the food the farm sold to all other buyers during that period, and the average annual monetary value of all food the farm sold during the three-year period was less than \$500,000, adjusted for inflation. "Qualified end-user" is defined in 21 CFR 112.3 as the consumer of the food (where the term consumer does not include a business); or a restaurant or retail food establishment that is located in the same State or the same Indian reservation as the farm that produced the food or not more than 275 miles from such farm. The modified requirements with which qualified exempt farms must comply are described in 21 CFR 112.6 and include disclosing the name and complete business address of the farm where the produce was grown either on the label of the produce or at the point of purchase. These farms are also required to establish and keep certain documentation.

FDA recognizes that the ability of farms to shift food sales to available buyers during the COVID-19 public health emergency has the potential to help reduce food shortages and food waste and to help support both farms and the U.S. economy. In order to support affected farms in selling food to all available buyers during the COVID-19 public health emergency, under the circumstances described in section III FDA does not intend to enforce the criteria for sales to qualified end-users when determining eligibility for the qualified exemption under the Produce Safety Rule, for the duration of the public health emergency.

III. Discussion

In order to provide flexibility to affected farms during the COVID-19 public health emergency, under the circumstances described below FDA does not intend to enforce the requirement in 21 CFR 112.5(a)(1) that a majority of sales be to qualified end-users for a farm to be eligible for the qualified exemption under the Produce Safety Rule. This policy will apply to any calendar year during which the COVID-19 public health emergency is ongoing and will remain in effect until the public health emergency is terminated. FDA intends to provide timely notice about the eventual withdrawal of this policy. At that time, FDA intends to issue additional guidance, which will take into account comments received on and our experience with the implementation of this guidance, regarding how the three-year averages should be calculated moving forward.

⁴ In the preamble to the final rule, "Standards for the Growing, Harvesting, Packing, and Holding of Produce for Human Consumption," the Agency described how a new farm can establish eligibility for a qualified exemption if it does not yet have three years of records. When a farm has not yet begun operations, the preamble states that, "it would be reasonable for the farm to rely on a projected estimate of revenue (or market value) when it begins operations. We would evaluate the credibility of the projection considering factors such as the farm's number of employees." The preamble goes on to state that, "After the farm has records for one or two preceding calendar years, it would be reasonable for the farm to make the calculation based on records it has (i.e., for one or two preceding calendar years) and we will accept records for the preceding one or two years as adequate to support its eligibility for a qualified exemption in these circumstances." (80 FR 74354 at 74413 (Nov. 27, 2015).) In section III, we provide examples of how the temporary policy announced in this guidance will apply to farms in these situations.

As described below, for farms that met the criteria for the qualified exemption in 2020 based on sales that were made in 2017-2019, FDA does not intend to enforce the criteria regarding the portion of sales that are made to qualified end-users in 2020 (and any subsequent years that are affected by the COVID-19 public health emergency). This means that farms that are currently eligible for the qualified exemption and associated modified requirements will still be considered eligible even if they shift food sales away from qualified end-users, provided that they continue to meet the requirement that the average annual monetary value of all food they sell is less than \$500,000, adjusted for inflation. Similarly, for farms that did not have three years of sales prior to 2020, but that met the relevant requirements during the years they were in operation prior to 2020, FDA does not intend to enforce the criteria regarding the portion of sales that are made to qualified end-users in 2020 (and any subsequent years that are affected by the COVID-19 public health emergency), provided the farms continue to meet the requirement regarding the average annual monetary value of all food they sell.

This guidance does not affect the status of farms who continue to sell a majority of their food to qualified end-users despite COVID-19 market disruptions. Any farm that is able to meet the requirements of 21 CFR 112.5 using contemporaneous sales data (e.g., using sales data from 2020 as part of their eligibility calculation for 2021) will be eligible for the qualified exemption, even if they are not within the scope of the enforcement discretion policy described below.

All farms are responsible for ensuring that the food they produce is not adulterated under the Federal Food, Drug, and Cosmetic Act (FD&C Act). FDA strongly encourages farms to use good agricultural practices (see, e.g., FDA's "Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables," at https://www.fda.gov/regulatory-information/search-fda-guidance-documents/guidance-industry-guide-minimize-microbial-food-safety-hazards-fresh-fruits-and-vegetables).

How do I determine eligibility for the qualified exemption in 2021 if I met the criteria for the qualified exemption in 2020?

For farms that were eligible for the qualified exemption in 2020, eligibility for qualified exemption status for 2021, and until the end of the public health emergency, may be determined based on:

- (1) Documentation that the farm met all of the criteria for the qualified exemption in 2020, based on records from 2017, 2018, and 2019; and
- (2) Documentation that the average annual monetary value of all food the farm sold during the preceding three-year period (e.g., 2018, 2019, and 2020 for determining status in 2021) was less than \$500,000, adjusted for inflation. FSMA inflation adjusted cut off values can be found at: https://www.fda.gov/food/food-safety-modernization-act-fsma/fsma-inflation-adjusted-cut-offs.

For example:

Farm A had previously determined that they were eligible for the qualified exemption for 2020, based on sales data from 2017, 2018, and 2019. Furthermore, the average annual monetary value of all food sold by Farm A in 2018, 2019, and 2020 was less than \$500,000, adjusted for inflation.

FDA does not intend to enforce the criteria regarding sales by Farm A to qualified end-users in 2020. FDA therefore intends to treat Farm A as eligible for the qualified exemption in 2021, regardless of the monetary value of sales to qualified end-users in 2020.

Farm B did not meet the criteria for the qualified exemption in 2020 because the average monetary value of food sold directly to qualified end-users **did not** exceed the average monetary value of food sold to all other buyers in 2017, 2018, and 2019. The average annual monetary value of all food sold by Farm B in 2018, 2019, and 2020 was less than \$500,000, adjusted for inflation. The temporary policy described in this guidance does not apply to Farm B.

How do I determine eligibility for the qualified exemption if I did not have three years of sales prior to 2020?

If the farm has not been in operation long enough to have annual values of sales for the three-year period prior to 2020, eligibility for qualified exemption status for 2021, and until the end of the public health emergency, may be determined based on:

- (1) Documentation that for the year(s) the farm was in operation prior to 2020, the average annual monetary value of food sold directly to qualified end-users exceeded the average annual monetary value of food sold to all other buyers, and the average annual monetary value of all food the farm sold was less than \$500,000, adjusted for inflation; and
- (2) Documentation that the average annual monetary value of all food the farm sold during the preceding three years (or the year(s) for which the farm was in operation if less than 3 years) was less than \$500,000, adjusted for inflation. FSMA inflation adjusted cut off values can be found at: https://www.fda.gov/food/food-safety-modernization-act-fsma/fsma-inflation-adjusted-cut-offs.

For example:

Farm C began operations in 2018. The average monetary value of food sold directly to qualified end users in 2018 and 2019 exceeded the average monetary value of food sold to all other buyers, and the average annual monetary value of all food the farm sold in 2018 and 2019 was less than \$500,000, adjusted for inflation. Furthermore, the average annual monetary value of food sold by Farm C in 2018, 2019, and 2020 is less than \$500,000, adjusted for inflation. FDA does not intend to enforce the criteria regarding sales by Farm C to qualified end-users in 2020. FDA therefore intends to treat Farm C as eligible for the qualified exemption in 2021, regardless of the monetary value of sales to qualified end-users in 2020.

Farm D began operations in 2018 and the average monetary value of food sold directly to qualified end users in 2018 and 2019 **did not** exceed the average monetary value of food sold to all other buyers. The average annual monetary value of food sold by Farm D in 2018, 2019, and 2020 is less than \$500,000, adjusted for inflation. The temporary policy described in this guidance does not apply to Farm D.

How do I determine eligibility for the qualified exemption if I began sales in 2020?



If a farm was newly operational and began sales in 2020, eligibility for qualified exemption status for 2021, and until the end of the public helath emergency, may be determined based on:

- (1) Documentation (e.g. contracts with buyers) that provides a sufficient basis to establish that, had there not been market disruption due to the COVID-19 pandemic, the average monetary value of food sold directly to qualified end-users in 2020 was reasonably anticipated to exceed the average annual monetary value of food sold to all other buyers; and the monetary value of all food sold in 2020 was less than \$500,000; and
- (2) Documentation that the average annual monetary value of all food the farm sold during the preceding three years (or the year(s) for which the farm was in operation if less than 3 years) was less than \$500,000, adjusted for inflation. FSMA inflation adjusted cut off values can be found at: https://www.fda.gov/food/food-safety-modernization-act-fsma/fsma-inflation-adjusted-cut-offs.

For example:

Farm E began selling food in 2020 and had contracts that demonstrate that the average monetary value of food sold directly to qualified end-users was reasonably anticipated to exceed the average annual monetary value of food sold to all other buyers. Due to market disruptions, in 2020 the monetary value of food sold directly to qualified end-users by Farm E did not exceed the monetary value of food sold to all other buyers. The monetary value of food sold in 2020 was less than \$500,000. FDA does not intend to enforce the criteria regarding sales by Farm E to qualified end-users in 2020. FDA therefore intends to treat Farm E as eligible for the qualified exemption in 2021, even though the monetary value of food sold directly to qualified end-users by Farm E did not exceed the monetary value of food sold to all other buyers, due to market disruptions.

part 112, or the FSVP regulation are still required to make necessary disclosures. Subsequent entities in the distribution chain will continue to be subject to applicable requirements related to food adulteration in Federal and/or state and local laws and regulations, e.g., part 117, part 507, and the Retail Food Code.

C. Enforcement Policy for Importation of Food Contact Substances Under the FSVP Regulation

The FSVP regulation requires food importers to develop, maintain, and follow an FSVP that provides adequate assurances that the foreign supplier uses processes and procedures that provide the same level of public health protection as those required under the preventive controls or produce safety provisions of FSMA (if applicable) and regulations implementing those provisions, as well as assurances that the imported food is not adulterated and that human food is not misbranded with respect to allergen labeling (21 CFR 1.502(a)). Among other things, the FSVP regulation (21 CFR 1.500-1.514) requires most food importers to do the following:

- Analyze the hazards for the foods they import (21 CFR 1.504);
- Evaluate the performance of their potential foreign suppliers and the risk posed by the foods to be imported (21 CFR 1.505); and
- Determine and conduct appropriate foreign supplier verification activities, such as onsite auditing of foreign suppliers, sampling and testing, and review of supplier food safety records (21 CFR 1.506).

The FSVP regulation applies (with certain exceptions) to the importation of food as defined in section 201(f) of the FD&C Act (see 21 CFR 1.500). Food contact substances are included in the definition of "food" for purposes of the FSVP regulation (21 CFR 1.500). However, for the reasons stated below, we intend to exercise enforcement discretion for importers of food contact substances with respect to the FSVP regulation.

A food contact substance is any substance that is intended for use as a component of materials used in manufacturing, packing, packaging, transporting, or holding food if such use of the substance is not intended to have any technical effect in such food (section 409(h)(6) of the FD&C Act (21 U.S.C. 348(h)(6)); 21 CFR 170.3(e)(3)). The term "food" is defined in section 201(f)(3) of the FD&C Act to include articles used as components of food. In the preamble to the FSVP final rule, we stated that the definition of "food" for purposes of FSVP includes food contact substances that are considered "food" in section 201(f) of the FD&C Act (80 FR 74225 at 74233). Therefore, the FSVP regulation applies to importers of food contact substances that meet the definition of "food" in section 201(f).

In the compliance date final rule, we extended the compliance date for the importation of food contact substances by 2 years so that we could consider how best to address concerns raised about the feasibility of importers of food contact substances meeting the FSVP requirements (81 FR 57784 at 57792-57793). As a result of this extension, the earliest that an importer would be required to comply with FSVP for the importation of food contact substances would be May 28, 2019.

- Subpart C of part 507 includes provisions for disclosure statements and written assurances that apply when a manufacturer/processor of food for animals identifies a hazard requiring a preventive control, does not control the identified hazard, and relies on an entity in its distribution chain to control the hazard (§§ 507.36(a)(2), (3), and (4), 507.36(c), 507.36(d), and 507.37). A manufacturer/processor that complies with these provisions of part 507 is not required to implement a preventive control for the identified hazard. The combination of these requirements was intended to provide assurance that the food will be processed to control the identified hazard before it reaches the consumer feeding the food to animals.
- Subpart F of part 507 specifies the elements to be included in the written assurances required by § 507.36(a)(2)(ii), (3)(ii), and (4)(ii). (See § 507.215(b).)

The FSVP regulation includes "customer provisions" that apply when an importer imports a food for which the hazards are controlled after importation (§ 1.507). As with the customer provisions in part 117 and part 507, the requirements in the customer provisions of the FSVP regulation were intended to provide assurance that the food will be processed to control the identified hazard before it reaches the humans or animals that would consume the food.

The produce safety regulation applies to "covered produce" as set forth in §§ 112.1 and 112.2. Produce that would otherwise be covered is eligible for an exemption from most of the requirements of the produce safety regulation if: (1) The produce receives commercial processing that adequately reduces the presence of microorganisms of public health significance (§ 112.2(b)(1)); and (2) certain other conditions are met, including requirements for disclosure statements and written assurances analogous to the requirements for disclosure statements and written assurances in the "customer provisions" required by part 117, part 507, and the FSVP regulation (§ 112.2(b)(2) through (4) and (6)).

FDA has received feedback from industry expressing concern that certain product distribution chains would require vastly more written assurances (and consequently resources to comply with the requirement) than anticipated by FDA during the rulemaking process (Ref. 1). For example, a manufacturing facility may sell food products subject to the customer provisions to a distributor, who may sell numerous items requiring assurances to multiple restaurants, cafeterias, delicatessens, and other distributors. It is estimated that this could result in hundreds or even thousands of written assurances needed by a single distributor (Ref. 1). After considering this feedback from industry, we stated our belief that the requirement for written assurance in the customer provisions of part 117 significantly exceeds the current practices of even the largest facilities; compliance by those facilities by September 19, 2016, may not be feasible; and it is appropriate to extend the compliance dates for 2 years for the written assurance requirements for part 117, part 507, the FSVP regulation, and the produce safety regulation while we considered the best approach to address feasibility concerns (81 FR 57784 at 57786).

FDA intends to initiate a rulemaking that takes into consideration the complex supply chain relationships and resource requirements. To provide sufficient time for us to pursue that rulemaking, we are exercising enforcement discretion with regard to the written assurance requirements of part 117, part 507, part 112, and the FSVP regulation until completion of that rulemaking process. In the meantime, entities with disclosure duties under part 117, part 507,

squash, winter; sweet potatoes; and water chestnuts.

- (2) Produce that is produced by an individual for personal consumption or produced for consumption on the farm or another farm under the same management; and
- (3) Produce that is not a raw agricultural commodity.
- (b) Produce is eligible for exemption from the requirements of this part (except as noted in paragraphs (b)(1), (2), and (3) of this section) under the following conditions:
- (1) The produce receives commercial processing that adequately reduces the presence of microorganisms of public health significance. Examples of commercial processing that adequately reduces the presence of microorganisms of public health significance are processing in accordance with the requirements of part 113, 114, or 120 of this chapter, treating with a validated process to eliminate spore-forming microorganisms (such as processing to produce tomato paste or shelf-stable tomatoes), and processing such as refining, distilling, or otherwise manufacturing/processing produce into products such as sugar, oil, spirits, wine, beer or similar products; and
- (2) You must disclose in documents accompanying the produce, in accordance with the practice of the trade, that the food is "not processed to adequately reduce the presence of microorganisms of public health significance;" and
 - (3) You must either:
- (i) Annually obtain written assurance, subject to the requirements of paragraph (b)(6) of this section, from the customer that performs the commercial processing described in paragraph (b)(1) of this section that the customer has established and is following procedures (identified in the written assurance) that adequately reduce the presence of microorganisms of public health significance; or
- (ii) Annually obtain written assurance, subject to the requirements of paragraph (b)(6) of this section, from your customer that an entity in the distribution chain subsequent to the customer will perform commercial processing described in paragraph (b)(1) of this section and that the customer:

- (A) Will disclose in documents accompanying the food, in accordance with the practice of the trade, that the food is "not processed to adequately reduce the presence of microorganisms of public health significance"; and
- (B) Will only sell to another entity that agrees, in writing, it will either:
- (1) Follow procedures (identified in a written assurance) that adequately reduce the presence of microorganisms of public health significance; or
- (2) Obtain a similar written assurance from its customer that the produce will receive commercial processing described in paragraph (b)(1) of this section, and that there will be disclosure in documents accompanying the food, in accordance with the practice of the trade, that the food is "not processed to adequately reduce the presence of microorganisms of public health significance"; and
- (4) You must establish and maintain documentation of your compliance with applicable requirements in paragraphs (b)(2) and (3) in accordance with the requirements of subpart O of this part, including:
- (i) Documents containing disclosures required under paragraph (b)(2) of this section; and
- (ii) Annual written assurances obtained from customers required under paragraph (b)(3) of this section; and
- (5) The requirements of this subpart and subpart Q of this part apply to such produce; and
- (6) An entity that provides a written assurance under §112.2(b)(3)(i) or (ii) must act consistently with the assurance and document its actions taken to satisfy the written assurance.

§112.3 What definitions apply to this part?

- (a) The definitions and interpretations of terms in section 201 of the Federal Food, Drug, and Cosmetic Act apply to such terms when used in this part.
- (b) For the purpose of this part, the following definitions of very small business and small business also apply:
- (1) Very small business. For the purpose of this part, your farm is a very small business if it is subject to any of the requirements of this part and, on a

FSMA PRODUCE SAFETY RULE



What Produce Associations Need to Know

- California Department of Food Agriculture (CDFA) is launching the California Produce Safety
 Program, which will include educational information designed to assist California produce farms in
 understanding the requirements of the FDA's Produce Safety Rule and how to comply with this new
 regulation.
- Beginning January 26, 2018, California produce farms designated as "large" (those with annual sales greater than \$500,000) are expected to comply with the Produce Safety Rule. Smaller farms will be phased in over the next few years.
- The Produce Safety Rule is mandatory throughout the United States beginning January 26, 2018. Any produce farm found to be out of compliance may be subject to regulatory actions.
- In 2018, the Produce Safety Program will be doing everything possible to inform and educate California produce farmers about the requirements of the Produce Safety Rule.

Who Must Follow the Produce Safety Rule?

- California farms producing fruits, nuts and vegetables must comply with this new rule.
- Multiple rules exist within the federal Food Safety Modernization Act (FSMA). The Produce Safety Program deals specifically with the Produce Safety Rule. Information about other FSMA Rules is available here.
- The exact rule an operation falls under will vary depending upon the type of activities performed. To determine if an operation falls under the Produce Safety Rule, please use this <u>flow chart</u> provided by The National Sustainable Agriculture Coalition.

CDFA Produce Safety Program Website Coming Soon

www.cdfa.ca.gov/producesafety/

CDFA is currently developing a new Produce Safety Program website. This will serve as the go to place for individuals looking for PSR information.



Who is Exempt from the Produce Safety Rule?

- A list of exemptions from the Produce Safety Rule can be found here. Exemptions generally include the following:
- Thirty commodities have been identified by the FDA as exempt from the Produce Safety Rule because they are rarely consumed raw. Farms exclusively producing these commodities are not covered by the Produce Safety Rule. (Examples of exempt commodities include: dried kidney beans, potatoes and pumpkins.)
- Farms that grow produce only for personal consumption or very limited distribution may also be exempt from the law.
- Some farms may qualify for an exemption from the Produce Safety Rule if their sales are below certain levels or if they grow produce that is processed in a way that would kill pathogens.
 Farms falling in these categories will be required to verify their exemption status.
- If your organization represents commodities that may be eligible
 for a qualified exemption because the finished product is processed in a way that kills pathogens, CDFA strongly urges you to
 seek guidance from FDA regarding documentation requirements
 to verify this exemption.
- CDFA is also urging associations to work with industry members to ensure procedures for documentation for qualified exemptions required of both farmers and processers are well understood and communicated.

Education and Training

- FDA has determined that official Produce Safety Rule on farm inspections will begin in 2019. The Produce Safety Program will spend 2018 working to make sure California produce farmers understand the requirements of the Produce Safety Rule.
- An informational website providing detailed information on the Produce Safety Program will be available soon and CDFA will be conducting other outreach efforts to educate California produce farms about this new rule and how to comply.
- One of the first steps toward Produce Safety Rule compliance is for every produce farm to have an individual employed who has completed an FDA-recognized Produce Safety Rule Grower Training Course. The training need only be taken once and the certificate of completion belongs to the individual. Available courses are posted on the Produce Safety Alliance website here.
- CDFA has also contracted with outside organizations to provide subsidized Grower Training that meets Produce Safety Rule requirements. These courses are offered at a reduced rate and are being conducted throughout the state in both English and Spanish. A list of dates and locations of these courses is provided with this packet.
- In addition to the required Produce Safety Rule Grower Training, all produce farms must show documentation of ongoing food safety training of farm and contracted employees as part of the required practices under the Produce Safety Rule.
- Any information or assistance your association can provide to ensure farmers are meeting Produce Safety Rule training requirements is greatly appreciated.
- In preparation for official Produce Safety Rule inspections in 2019, CDFA's Produce Safety Program will be offering a series of On-Farm Readiness Reviews (OFRR). These are designed to give produce farmers a better understanding of what they can expect from a Produce Safety Program routine inspection. Information on how to schedule an OFFR will be available very soon.

Information for the Public and Other Stakeholders

- Please note that California Produce Safety Program inspections are a means of verifying compliance and enforcement of the Produce Safety Rule. They are not meant to replace existing quality assurance activities that may be requested of farmers or handlers by their customers.
- Suggested messaging for use in talking about the Produce Safety Program with trade and consumers is included in this packet.
- CDFA urges you to share information contained in this packet with your membership.

Implementation of Required Food Safety Practices

- Produce farms with sales greater than \$500,000 per year are expected to implement Produce Safety Rule practices beginning January 26, 2018. The full Produce Safety Rule requirements are available on the FDA website here.
- If your association has commodity specific guidelines that are aligned with the Produce Safety Rule, we encourage you to share these with your membership.
- We also urge you to advise your membership that private audit firms should conduct audits that are aligned with the Produce Safety Rule so that farmers are well prepared for Produce Safety Program inspections when they begin taking place in 2019.

Produce Safety Program Inspections

- CDFA has created a new unit as part of its Inspection Services Division specifically to conduct Produce Safety Rule inspections. This unit is known as the Produce Safety Program.
- Produce Safety Rule inspections will be done on behalf of the U.S. FDA. As such, Produce Safety Program inspectors are credentialed by the FDA and have specific education and training.
- As with all other programs within the CDFA's Inspection Services Division, Produce Safety Program inspectors are part of a public agency mandated to protect the food supply. Inspectors are: accountable to the public, legislature and the industry; financially independent and unbiased; consistent and uniform; and are required to report potential public health threats to the California Department of Public Health.
- CDFA is working with an existing database of California farms acquired from other agencies and organizations to identify California produce farms that are likely subject to this new rule. Farms from this list will be selected for routine inspection by the Produce Safety Program on a random basis following verification of the farm's status.



1220 N Street

Sacramento, CA 95814

Suggested Messaging for Retail and Foodservice Produce Buyers



About the Produce Safety Rule -

- Beginning January 26, 2018, the Produce Safety Rule under the new Food Safety Modernization Act will become law on produce farms throughout the U.S.
- All California farms producing fruits, nuts and vegetables must comply with this new law. Some exceptions apply. Your supplier can provide verification if they are exempt from the Produce Safety Rule.
- The law will be phased in according to farm size over the next few years beginning in 2018 with large farms, defined as those with annual sales of \$500,000 or more.
- To implement this new law across the nation, the U.S. FDA is working with State Departments of Agriculture to conduct inspections that will verify produce farms are in compliance with the Produce Safety Rule.
- The U.S. FDA has determined that Produce Safety Rule on-farm inspections will begin in 2019.

Implementation in California-

- It is estimated some 20,000 produce farms in California are subject to the Produce Safety Rule.
- The California Department of Food and Agriculture has created a new unit as part of its Inspection Services Division specifically to conduct inspections that will verify compliance with the Produce Safety Rule. This unit is known as the Produce Safety Program.
- The goal of CDFA's Produce Safety Program is to assist and verify that California produce farms are following FDA's Produce Safety Rule.
- This is a big job and it will take time to fully implement. CDFA's goal is for Produce Safety Rule requirements to become ingrained in the culture of California produce farming so that our state is growing the safest produce possible.
- The California Produce Safety Program's role is to first educate California produce farmers on the requirements of the Produce Safety Rule and then regulate farms to ensure they are following this new rule.

About the Produce Safety Program Inspections -

- California Produce Safety Program inspections are a means of verifying compliance and enforcement of the Produce Safety Rule. They are not meant to replace existing quality assurance activities provided by farmers or handlers.
- Beginning in 2019, California produce farms will be selected for inspection by the Produce Safety Program on a random basis following verification of the farm's status.
- Unlike audit based certification programs, farms may not request an inspection, but will instead be selected by the Produce Safety Program.



Suggested Messaging for Consumers



About New Food Safety Regulations for Produce

- Beginning on January 26, 2018 fruit, vegetable and nut farms in California and throughout the U.S. will be required to follow specific food safety practices under a new federal regulation known as the Produce Safety Rule.
- The U.S. Food and Drug Administration (FDA) has been charged with oversight of this new rule and it is being implemented in California by the California Department of Food and Agriculture (CDFA).
- Food safety practices required on farms are similar to what is required of restaurants or to precautions you might take in your own kitchen. The practices are designed to ensure produce is properly handled by workers who are trained to use good hygiene; to make sure farm equipment is sanitary, to ensure soils where produce is grown are safe and, that measures are in place to prevent contamination of produce by wildlife or nearby domesticated animals. Additionally, farmers are required to keep written records to document their farming practices.
- * Many produce farms have been implementing these kinds of food safety practices on their farms for years.

What Consumers Can Expect from Produce Grown in California

- Routine on-farm Inspections to verify farmers are following new food safety regulation will be conducted through an inspection unit created by the California Department of Food and Agriculture called the Produce Safety Program.
- It's estimated that 20,000 farms in California are subject to the Produce Safety Rule. It is the goal of CDFA that requirements of this new food safety rule become ingrained in the culture of California produce farming so that our state is growing the safest produce possible.
- Over the next year, the role of the California Department of Food and Agriculture's Produce Safety Program will be to educate California produce farmers about the requirements of the Produce Safety Rule.
- Beginning in 2019, CDFA's Produce Safety Program inspectors will conduct random, routine inspections of produce farms to ensure they are following the new law.
- Inspectors in California are credentialed by the FDA and have specialized education and training. The inspectors are part of a government agency charged with protecting the food supply. They provide independent, unbiased, consistent inspections of California produce farms.
- Most grocery stores and restaurants already require farmers to follow food safety practices on their farms. In addition, many organizations conduct research and provide food safety guidelines that produce farmers have been following for years.
- Requirements for produce safety on farms is now the law. Farmers found to be out of compliance with these new requirements may face economic, regulatory and legal consequences.



CALIFORNIA APPLE EXPORT MARKETS



CALIFORNIA APPLE EXPORT AND DOMESTIC OVERVIEW

The California Apple Commission has culminated the final export numbers for the 2020-2021 season. California exported a total of 25,001 boxes. The decrease in apple exports this year is likely attributed to the fact that California has historically relied less on apple exports over the past several years. This has been the case for a number of reasons. First, the domestic pricing and early availability of California apples has priced out most foreign buyers. Further, the main varieties produced in California are better suited for the domestic market rather than the international market. Additionally, the international apple market has become highly competitive. For example, China has been flooding South East Asia with less expensive apples thus squeezing California out of the market. Finally, international trade agreements have created a difficult landscape with the inception of retaliatory tariffs from many countries across the globe. Unfortunately, many of these retaliatory tariff lists contain apples. Despite the industry's challenges, California is still heavily focused on maintaining a presence and supportive role in the international apple arena. The Commission believes that with the assistance of the U.S. Apple Export Council, the entire U.S. apple industry can remain competitive in key international markets, thus relieving pressure on the domestic market.

California is still one of the largest exporters of apples in the United States and actively receives Market Access Program (MAP) dollars through the Foreign Agricultural Service (FAS) in order to maintain crucial export markets. Last season, the Commission, in conjunction with the U.S. Apple Export Council (USAEC), received \$849,572 for 2020-2021 in MAP funding. Additionally, a new funding program, the Agricultural Trade Promotion (ATP) program, was announced by FAS in late 2018 as part of their efforts to provide support in order to offset recent tariffs on U.S. agricultural products. In 2019, FAS announced a second round of ATP funding as well. The CAC applied for ATP program funds and received a combined total of \$202,000. The funds are available for use until 2023 and \$122,825 of these funds will be rolled into the 2021-2022 program year to conduct further activities.

California receives numerous benefits from the total MAP and ATP funding allocation since the state is considered one of the largest exporters on the Council, and has demonstrated a significant level of participation in nearly every export program. Below is a list of the top three countries that California shipped to during the 2020-2021 season; an overview of specific markets that are important to California; information on markets that receive Market Access Program (MAP), Technical Assistance for Specialty Crops (TASC), Emerging Market Program (EMP), or Agricultural Trade Promotion Program (ATP) funding; and all statistical apple shipping and destination information.

Top Countries

- 1. Canada (17,446)
- 2. Taiwan (4,865)
- 3. Mexico (2,641)

FOREIGN AGRICULTURAL SERVICE

The Foreign Agricultural Service (FAS) helps expand and maintain foreign markets for U.S. agricultural products by removing trade barriers and enforcing U.S. rights under existing trade agreements. The FAS works with foreign governments, international organizations, and the office of the U.S Trade Representative to establish international standards and rules to improve accountability and predictability for agricultural trade. Additionally, FAS partners with the cooperators, such as U.S. Apple Export Council, to help U.S. exporters develop and maintain agricultural export markets. FAS distributes funding to these cooperators via the Farm Bill under programs such as the Market Access Program (MAP), Technical Assistance for Specialty Crops (TASC), Emerging Market Programs (EMP), and the limited-time Agricultural Trade Promotion (ATP) Program. Each of these programs keeps U.S. products more competitive and counter the subsidized foreign competition in the international markets.

Continuing into 2020-2021, the USDA Foreign Agricultural Service announced \$12 billion of immediate funding availability to assist farmers impacted by recent tariff retaliations. The Agricultural Trade Promotion Program (ATP) accounts for \$200 million in funding to develop foreign markets for U.S. agriculture. The ATP program will help U.S. agricultural exporters develop new markets and will help mitigate the adverse effects of other countries' tariff and non-tariff barriers. The ATP provides cost-share assistance to eligible U.S. organizations for activities such as consumer advertising, public relations, point-of-sale demonstrations, participation in trade fairs and exhibits, market research, and technical assistance. The ATP is available to all sectors of U.S. agriculture, including fish and forest product producers, mainly through partnerships with non-profit national and regional organizations. FAS administers the ATP under authorities of the Commodity Credit Corporation Charter Act. In May of 2019, the U.S. Department of Agriculture also announced a second round of trade mitigation funding, including additional ATP funds. Specifically, the President has authorized USDA to provide an additional \$16 billion in overall program funding. These funds have already been allocated and are available for use up to the year 2023. The Commission has had the opportunity to benefit from this new funding opportunity through their relationship with the U.S. Apple Export Council.

Currently, the California Apple Commission, through partnership with the U.S Apple Export Council, received a share of \$849,572 in MAP funds for the 2020-2021 season. This funding allocation covered nine export markets, in which California participated in four of the markets. These dollars funded programs such as the Mexico inspection program, import and retail trade servicing within the export markets, consumer communication, trade missions, education, and market research. Also for the 2020-2021 season, the USAEC received a total of \$122,825 in ATP funds for use in Latin America and the Middle East. This brings the total FAS funding for the USAEC to \$972,397 for the 2020-2021 season.

CANADA

The United States remains the largest exporter of apples to Canada with nearly an 80% market share. Unfortunately, this luxury has been decreasing in recent years due to the influx of apples being imported by Canada from China and other countries in the southern hemisphere. Canada is California's largest export market, and remains one of the largest export markets for the California Apple Commission. Several apple varieties are exported to Canada, and the Gala and Granny Smith varieties represent the majority of the volume exported from California.

In 2021-22, the CAC has decided to continue the strategy it began in 2018 in the Canadian market. The strategy includes coordinating with California shippers and targeting specific retailers at specific times based on the shipments that were going to Canada, otherwise referred to as, "Following the fruit." Suitable national online publications were selected to run banner ads to advertise a California Apples Crunch for Cash Contest where entrants could win one of 10, \$100 gift cards, which resulted in the selection of six media outlets that were geo-targeted to reach primary grocery shoppers. This geo-targeted ad campaign resulted in roughly a 20% increase in imports of California apples in October alone. Due to the successes of previous years, the CAC plans to continue this strategy during the upcoming season with the hopes of partnering with other commodities to pool resources. Additionally, the CAC will also be focused on wholesalers or smaller regional retailers that are heavily invested in organics and niche markets. The CAC will also continue to utilize geo-targeted advertising tactics that will focus on individual zip codes to increase location specificity. The CAC has found that in addition to the major retailers, these smaller, regional outlets have been increasing their requests for California fruit and CAC assistance. Finally, the CAC has allocated additional funding to conduct store audits in both the major retailers and small, regional outlets to establish a sense of whether California apples are present throughout the season and to assist in timing the planned advertising tactics.

The Commission has also been closely monitoring and discussing the current U.S./Canada trade situation. Fortunately, in January 2020, the U.S. officially passed and signed the new U.S.-Mexico-Canada Free Trade Agreement (USMCA) into law. It officially went into force on July 1, 2020.

MEXICO

In 2020-2021, the Mexico inspection program operated under the first year of the phaseout process for the newly negotiated work plan. In the new work plan, the inspector was not required to conduct inspections prior to the season. Rather, the inspections were conducted by local USDA-APHIS officials. The Mexico inspector does, however, have the option to return every three years to conduct follow-up inspections, but is not required to.

Additionally, the Commission, in conjunction with USDA-APHIS and Chapman University, was successful in adding irradiation as an additional treatment protocol to the Mexico export program. California apples are now allowed to be irradiated in the U.S. or Mexico (if tarped) as a treatment protocol. California apples are being used as a trial run for other commodities. With the help of Chapman University, research on irradiation and apples will continue throughout the 2021 season. Additionally, Chapman University received federal funding through the most recent USDA Farm Bill to continue their work on irradiation as an alternative treatment method to methyl bromide for apples and also received a Technical Assistance for Specialty Crops (TASC) grant for the 2020-2021 season as well.

The Commission has also been closely monitoring and discussing the current U.S./Canada trade situation. Fortunately, in January 2020, the U.S. officially passed and signed the new U.S.-Mexico-Canada Free Trade Agreement (USMCA) into law. It went into force on July 1, 2020.

SOUTHEAST ASIA- INCLUDING TAIWAN

South East Asia (SEA), a region which includes Malaysia, Thailand, Indonesia, Singapore, Vietnam, Taiwan, and the Philippines, has historically been one of California's largest export markets. While the market has declined in importance for California, SEA continues to be a valuable market to the USAEC. Over the last several years, California has relied less on the SEA market for a number of reasons. First, California has not needed to export to SEA in recent years due to the strong domestic market and a smaller Granny Smith variety crop. Further, competition from China and Washington State have strained the window for California apples in the SEA market. Nearly 80% of China's apple exports are specifically focused on SEA and California is simply not able to compete at this level. Additionally, the USAEC has been focusing on expanding the presence of other varieties, such as the Empire and Honeycrisp, in recent years. These varieties of apples are not grown in California, but are increasing in terms of popularity in growing regions throughout the East Coast and Michigan. The USAEC continues to promote and educate buyers on all U.S. apples, which, in turn, benefits the entire US apple production, including California and Washington State. In 2020, the onset of COVID-19 unfortunately limited the number of activities the USAEC was able to conduct in the SEA market. In-person activities, such as in-store sampling, were not allowed and therefore caused the USAEC to shift the majority of promotional activities to a digital format. This will likely be the case for the majority of the 2021 season as well, however, the CAC is hopeful that as the vaccine continues to be administered, situations in the SEA market will improve to allow for originally planned activities to take place.

The main competition for California in SEA continues to be China and Washington State. The CAC and the USAEC realize that California will simply not be able to compete with China and Washington State in terms of volume. However, the USAEC's objective has been to compete in terms of quality and therefore extend California's marketing window by several weeks. Since many consumers are concerned with quality and food safety, the USAEC believes that California's marketing window can be extended with precise targeting of specific retailers. According to the USAEC representative, health trends and food safety concerns are the key factors in the development of SEA's retail and wholesale markets. The USAEC will attempt to capitalize on these factors by "piggy-backing" on the promotional campaigns conducted by the South East Asian governments which are emphasizing the importance of fruit and vegetable consumption to achieve a healthy lifestyle.

The future of the SEA market is uncertain. The current population of 600 million people has been growing significantly over time, and the opportunity for increased apple exports certainly exists. Unfortunately, the SEA market opportunity becomes less available to the U.S. as China increases their total apple production and other countries such as New Zealand, Australia, and Chile increase their ability to store apples long term. It is simply too difficult to compete with the lower prices and close proximity of these other apple producing countries. Further, it has been a difficult year for U.S. agricultural products as a whole to be exported to other overseas countries due to lack of transportation options and port issues that occurred as a result of COVID-19. For the USAEC, and more specifically California, remaining successful in the SEA market will require an increased emphasis on quality of size, color, taste, and the safety of the product. This must be emphasized by both the USAEC and specific apple handlers.

INDIA

Since India has one of the largest middle classes in the world, the U.S. apple industry has been attempting to expand market access for a number of years. In early 2019, the USAEC contracted the services of a new in-country representative in India to facilitate all market activities. This representative will continue to work on behalf of the USAEC in 2020 as well. In 2021, however, the USAEC made the decision to scale down its program in India temporarily due to the current 75% tariff on all U.S. apples going to India. The USAEC retained enough funds to keep the in-country representative with the hopes that market conditions will improve and the market will become more enticing for U.S. apple shipments in the future. Initial difficulties within the Indian market included lack of infrastructure to transport and store apples. As retail giants such as Costco and Walmart gained access, they began investing in improved infrastructure and transportation methods and, therefore, began to dramatically reduce these initial challenges. Additionally, the retailers' investments were supported by additional outside investments and commitments by the Indian government to open the market to U.S. investments. This made India a very attractive market and helped expand the U.S. apple market share from 100k metric tons in 2009 to over 300k metric tons in 2016. Unfortunately, this growth has been stymied by the implementation of a 75% tariff on all U.S. apples being imported into India in 2019.

In early 2018, India notified the World Trade Organization of their intention to impose a retaliatory tariff on U.S. apples, among other goods, in response to America's tariffs on steel and aluminum from India. The proposed tariff of 25% will be added to the existing 50% tariff, thus totaling a 75% tariff on fresh U.S. apples to India. The tariff was initially set to be implemented on August 4, 2018, and after being delayed 7 times, was officially applied on June 16, 2019 and still remains in effect in 2021.

For California specifically, India is not a market of priority. The varieties grown in California and the availability of California apples are not conducive to California's marketing/shipping window to India. That being said, the CAC supports the U.S. Apple Export Council's push to gain a larger market segment for other U.S. apple producing states. If large volumes of apples from Washington State and the Eastern U.S. are exported to India, it would greatly decrease the pressure domestically and could ease the pressure on localized export markets such as Mexico and Canada. India has historically been a market of great importance for the United States in general, and roughly 9.2 million boxes were exported to India from the U.S. in 2017-18 just before the tariffs went into effect. However, exports in 2018-19 dropped to roughly 3 million boxes, and the downward trend has continued since..

LATIN AMERICA

The Latin American region of focus for the CAC/ USAEC refers to the countries within both South and Central America. This region is not a major market of concern for California specifically, however California exported a small amount of apples to both Columbia and El Salvador in 2018-2019. While California is not specifically focused on this market, other states in the U.S. have been relying on these markets more since the implementation of tariffs on other key U.S. apple export markets. Increasing exports to Latin American will potentially eliminate pressure on markets that California does ship to, such as Mexico.

In 2019, members from the USAEC traveled to Columbia and Peru to conduct a trade mission aimed to increase overall U.S. apple shipments to these markets in addition to gain further market information. Additionally, in 2021, the CAC participated in a virtual trade event for the Colombian market. The CAC presented industry information, and had the opportunity to connect with many Colombian buyers. The strategy in the Latin American market thus far has been to conduct broad-scale retail promotions during the U.S. apple shipping season without limiting working relationships to specific retailers or importers. The USAEC has found that volumes tend to fluctuate between importers from season to season, depending on price and availability, and it was more feasible to focus on a larger group of retailers/importers rather than a specific few. With this, the USAEC aims to conduct in-store promotions with at least 2 supermarket chains this year, and implement cooking workshops and recipe sampling programs for consumers. The USAEC has previously coordinated a school program and other activities targeting children. The purpose of these projects was to provide information to kids about U.S. apple varieties and the importance of fruit and vegetables in a nutritious diet. This year, however, the USAEC did not find significant value in this approach, and decided to allocate these funds elsewhere. Further, technical training has been one of the most important activities conducted in Central American for the trade. The purpose of this is to educate supermarkets and importers and retailers' personnel in order to assure greater quality product, proper handling procedures, and lesser product damage, all factors that can negatively impact sales.

In early 2019, the U.S. was granted market access to Brazil following the completion of successful negotiations on a systems approach between the two countries. The CAC plans to continue to explore opportunities in the Brazilian market in 2021.

CHINA

China continues to be the world's largest producer of both fresh and processed apples. In 2020, they produced a record-breaking total of 41 million tons. Until recently, China's domestic production has historically been consumed by the Chinese population. However, with rising unemployment and an economy that remains sluggish, China is expected to increase its focus on exports. Despite disruptions due to COVID-19, exports are estimated to exceed 1 million tons, making China the lead exporter of apples in the world. As China's apple production rises, China will continue to rely more on exports to neighboring countries, particularly South East Asia. Additionally, China was recently granted access to export apples to the United States. Apple exports to the United States from China are currently minimal, however, there is potential for dramatic increases due to their large population and overall demand for apples. However, due to recent trade conflicts between the United States and China, there is a 40% retaliatory tariff being applied to all apples exported from the U.S. to China. This radically decreases the competitiveness of U.S. apples in China and could significantly affect exports from Washington. Since California does not currently export apples to China, California is more concerned with the ripple effect this disruption will have on other international markets and domestic markets.

ISRAEL

The process of establishing access into the Israeli market for U.S. apples has been difficult and burdensome. Shipments to Israel have been limited to only a few shippers, all of which are located on the East Coast, due to the country's strict phytosanitary issues and pest control measures. Since California does not have a proximity or varietal advantage, the state does not currently view Israel as a market of potential. However, the USAEC sees Israel as a potential niche market for apples from the East Coast. Packers from the East Coast have been reluctant to export to Israel in any significant volume due to the high risks involved with shipment rejection concerns. The USAEC continued its partnership with their current in-market representative throughout 2020-2021. The USAEC evaluates the potential of each market on an annual basis, and the level of commitment to Israel was discussed in terms of the level of involvement the USAEC wants to commit to for 2021-2022. It was agreed that the USAEC should remain in Israel for the foreseeable future due to the potential shipping window for the East Coast. Additionally, as other markets reduce apple trade opportunities with the U.S., alternative markets will be needed to offset these losses.

MIDDLE EAST

During the 2020-2021 season, the U.S. faced sharp competition from competing apple producing countries when importing to the Middle East. Exports to the Middle East were down this year once again when compared to previous seasons due to increased prices that resulted from overall lower production levels. The U.S. is finding it difficult to compete with the lower priced apples being imported from countries including Russia, Italy, Poland, Turkey, and the Ukraine. Additionally, the ongoing war in Yemen, coupled with increased taxes in Dubai and Saudi Arabia to cover the cost of the war, are resulting in a 20 percent reduction in the region's overall economy. This is thought to also have an impact on apple imports as Saudi Arabia and Dubai are the two largest markets for U.S. Apples in the Middle East.

The Middle East is a new market for the USAEC, and representatives from the Commission and USAEC travelled to the Middle East in 2019 in order to meet with members of the trade and gather a sense of opportunities that might exist for future in-market activities and potential for market expansion. Despite the trade mission, recent decreases in export volume to the region, coupled with increased competition from other apple producing countries, has led the USAEC to adjust its priorities within this market. As a result, the USAEC decided not to allocate funding to conduct activities in this market for 2021-2022, however, there is potential to revisit this market in the future.

RUSSIA AND THE EU

Unfortunately, the ban on western products to Russia is still in effect. This not only has an effect on the U.S., but has also resulted in a ripple throughout the global apple industry. Initially, it was anticipated that China would fill the majority of the western apple export gap through traditional avenues, and other avenues would be utilized by Poland in order to meet Russia's demand. While China did account for roughly 15% of total apple exports to Russia in 2020, Moldova is by far the main supplier of apples to the Russian market, accounting for 29% of total Russian imports. Russia has also imported a significant amount of apples from Serbia and Azerbaijan, and despite sanctions imposed by the Government of Russia Federation, small amounts of apples were also imported from Poland and the Ukraine via back channels.

While apple exports from China to Russia have increased over the past year, the amount of apples that did go to Russia from China have done little to alleviate the pressure on the overall international market. China has instead continued to remain heavily focused on exporting to SEA. While Poland has used other avenues to export apples to Russia, they have continued to remain heavily focused on the EU market. In addition, Poland has been aggressively pursuing access into the U.S. by claiming that they should fall under the parameters of the existing EU work plan. This is extremely problematic and would result in additional pressure on an already overcrowded domestic market. As of now, access has not been granted and the current political climate in regards to trade agreements could work in favor of the U.S.

The EU has been notorious for implementing strict pesticide regulations in the past, and continues to disrupt trade opportunities for U.S. apples. Specifically, EU action on pesticides, particularly diphenylamine (DPA) and morpholine wax, have eroded the U.S.' access for apples to the EU market. While California does not ship to the EU, these regulations heavily affect the East Coast apple producing states. The East Coast must now find new markets for these apples, thus increasing competition for California in both the domestic and alternative international markets. Additionally, the EU has historically purchased significant volumes of specific varieties, such as Empire and Macintosh. However, with trade volumes to the EU in decline, the U.S. must now find alternative outlets for these varieties, thus placing undue pressure on other varieties that California does produce, such as Gala.

Due to the consistent decline in U.S. apples shipments to the EU, the USAEC decided not to allocate funding for this market in 2021-2022. However, the USAEC will continue to fund and plan to participate with a booth at the Fruit Logistica trade show held annually in Berlin. However, the trade show was unfortunately not held in 2021 due to the COVID-19 pandemic. The CAC will plan to attend once clear plans for the next trade show are announced.

CALIFORNIA APPLE DOMESTIC AND EXPORT STATISTICS



CALIFORNIA APPLE COMMISSION- UNITED STATES DOMESTIC SHIPMENTS 2020-2021 (MEASURED IN 40 lb. BOXES)

STATE	GALA	GRANNY SMITH	FUJI	CRIPPS PINK	OTHER	TOTAL
ALABAMA	31,755	343	3,722			35,820
ARIZONA	37,730	22,682	11,702			72,114
ARKANSAS	1,430					1,430
CALIFORNIA	197,566	131,502	45,590	20,838	7,632	403,128
COLORADO	1,374	5				1,379
CONNECTICUT	4,312					4,312
FLORIDA	34,597	5,690	4,323	98		44,708
GEORGIA	2,113	3,224				5,337
ILLINOIS	27,458	8,095	2,981			38,534
INDIANA	26,076	1,175	4,227			31,478
KENTUCKY	16,275	3,038	1,705			21,018
LOUISIANA	2,150	3,646				5,796
MARYLAND	4,753	1,677				6,430
MASSACHUSETTS	343	4,221				4,564
MICHIGAN	20,709	1,568	196			22,473
MINNESOTA	392	510	1,667			2,569
MISSOURI	9,456	4,910	4,070			18,436
NEVADA	46,879	29,381	11,996	834		89,090
NEW HAMPSHIRE	98					98
NEW JERSEY	5,039	3,423				8,462
NEW MEXICO		980				980
NEW YORK	3,203	7,284	28	113		10,628
NORTH CAROLINA	720	1,600	715			3,035
ОНЮ	12,932	1,428	663			15,023
OKLAHOMA	12,006	6,425	2,540			20,971
OREGON		28				28
PENNSYLVANIA	21,337	6,135	1,705			29,177
SOUTH CAROLINA	13,863	420	1,485			15,768
TENNESSEE			2,430			2,430
TEXAS	15,591	37,413	390	2,548		55,942
UTAH	807	2,700	1,793			5,300
VIRGINIA	11,220		1,291			12,511
WASHINGTON	394					394
WISCONSIN	5,097	391	196			5,684
WYOMING	1,744	1,633	1,577			4,954
TOTAL	569,419	291,527	106,992	24,431	7,632	1,000,001

CALIFORNIA APPLE COMMISSION- UNITED STATES DOMESTIC SHIPMENTS 2019-2020 (MEASURED IN 40 lb. BOXES)

STATE	GALA	GRANNY SMITH	FUJI	CRIPPS PINK	BRAEBURN	OTHER	TOTAL
ALABAMA	47,685	10,615	8,470	385			67,155
ARIZONA	54,674	30,538	12,458	1,320			98,990
ARKANSAS			715	385			1,100
CALIFORNIA	226,839	120,442	93,078	41,777	689	4,266	487,091
COLORADO	196		49	1,648	49		1,942
CONNECTICUT	196						196
FLORIDA	5,684	27,599	14,877	1,496	49		49,705
GEORGIA	3,976	6,788	6,113	1,047			17,924
ILLINOIS	4,998	4,523	1,624	495			11,640
INDIANA	40,765	442	3,279		84		44,570
IOWA	294	179					473
KANSAS	28		1,389	49			1,466
KENTUCKY	9,711	746	1,632	98			12,187
LOUISIANA	2,852	980	713				4,545
MAINE	9,575						9,575
MARYLAND	329	1,748	42				2,119
MASSACHUSETTS	490	231					721
MICHIGAN	10,046	392	490				10,928
MINNESOTA	5,220	8,129	533	1,418	98		15,398
MISSISSIPPI	6,445	2,255	2,475				11,175
MISSOURI	1,259	49	1,589	770			3,667
NEBRASKA	1,045	220	605	1,045			2,915
NEVADA	54,708	34,988	14,374	12,491			116,561
NEW JERSEY	395	1,740					2,135
NEW MEXICO	13,151	5,538	2,090	1,373			22,152
NEW YORK	14,509	3,443	280	165			18,397
NORTH CAROLINA	1,223	70	407	56	59		1,815
OHIO	6,531	182	832				7,545
OKLAHOMA	1,030		1,250	275			2,555
OREGON	49		1,274				1,323
PENNSYLVANIA	8,366	5,560	911	576	142		15,555
SOUTH CAROLINA	9,145	91	3,740				12,976
TENNESSEE			2,920				2,920
TEXAS	39,134	19,823	6,855	4,103			69,915
UTAH	246	140	2,504	1,320			4,210
VIRGINIA	4,900		1,029	98			6,027
WASHINGTON	917	98	2,441				3,456
WISCONSIN	21,621	110	1,100	1,834	49		24,714
WYOMING	1,370	220	770	2,815			5,175
TOTAL	609,602	287,879	192,908	77,039	1,219	4,266	1,172,913

CALIFORNIA APPLE COMMISSION- UNITED STATES DOMESTIC SHIPMENTS 2018-2019 (MEASURED IN 40 lb. BOXES)

STATE	GALA	GRANNY SMITH	FUJI	CRIPPS PINK	BRAEBURN	OTHER	TOTAL
ALABAMA	17,490	3.0					17,490
ARIZONA	14,316	1,112					15,428
ARKANSAS	11,601	,	440				12,041
CALIFORNIA	257,288	354,123	93,051	47,975	2,448	15,237	770,122
COLORADO	609		49	245	294	196	1,393
CONNECTICUT	245					637	882
FLORIDA	10,777	2,138	2,233		49	349	15,546
GEORGIA	21,045	8,198	1,395	805	7	121	31,571
HAWAII	98						98
ILLINOIS	22,383	1,877	2,095	294		84	26,733
INDIANA	9,769	5,821	3,486	126	168	280	19,650
IOWA	966						966
KENTUCKY	8,939	3,279	1,066	1,791	36	146	15,257
LOUISIANA	5,935		605				6,540
MAINE	,		550				550
MARYLAND	2,481		4	449		196	3,130
MASSACHUSETTS	539						539
MICHIGAN	10,417	10,249	2,574	2,847			26,087
MINNESOTA	13,683	3,801	1,192	931	306	133	20,046
MISSISSIPPI	6,215	·	55				6,270
MISSOURI	15,800	7,593	984	147	70	429	25,023
NEBRASKA	6,215		220	110			6,545
NEVADA	43,006	19,279	18,486	6,768			87,539
NEW HAMPSHIRE						21	21
NEW JERSEY	539	844	98	49	98	322	1,950
NEW MEXICO	3,905	882					4,787
NEW YORK	13,004	2,924	858	98			16,884
NORTH CAROLINA	16,655	196	2,234	98	49	195	19,427
OHIO	7,091	16,288	4,727	196			28,302
OKLAHOMA	15,567		2,445				18,012
OREGON	415						415
PENNSYLVANIA	5,559	2,254	2,274	660		343	11,090
SOUTH CAROLINA	960	2,730	825				4,515
TENNESSEE	9,392	6,668	1,540	660			18,260
TEXAS	77,571.00	31,267.00	19,126	14,167			142,131
UTAH	7,532			3,513			11,045
VIRGINIA	11,204	2,540					13,744
WASHINGTON		440	330	110		25	905
WISCONSIN	15,915	1,021	879	676			18,491
WYOMING	8,930		440				9,370
TOTAL	674,056	485,524	164,261	82,715	3,525	18,714	1,428,795

CALIFORNIA APPLE COMMISSION- UNITED STATES DOMESTIC SHIPMENTS 2017-2018 (MEASURED IN 40 lb. BOXES)

STATE	GALA	GRANNY SMITH	FUJI	CRIPPS PINK	BRAEBURN	OTHER	TOTAL
ALABAMA	833	196					1,029
ARIZONA	15,402	12,684	2,952	1,876	44		32,958
ARKANSAS	16,638	3,338	3,420				23,396
CALIFORNIA	353,753	163,117	85,418	58,329	2,259	16,220	679,097
COLORADO	13,291	9,120	207		383	786	23,787
CONNECTICUT	1,127	308				1,960	3,395
FLORIDA	14,461	3,956	1,156		98	973	20,644
GEORGIA	58,261	52,056	8,825		7	497	119,646
HAWAII	280	515					795
ILLINOIS	10,380	7,154	1,586	784		321	20,225
INDIANA	12,528	7,679	1,813		68	651	22,739
IOWA	7,104	4,981					12,085
KANSAS	5,697	2,778	635				9,110
KENTUCKY	12,139	8,658	1,770	559	147	684	23,957
LOUISIANA	12,011	3,233	1,020				16,264
MAINE	8,880	3,000	1,380	1,003			14,263
MARYLAND	4,326	4,036	114	75		534	9,085
MASSACHUSETTS	2,177	4,141	294				6,612
MICHIGAN	22,080	4,465	3,786	1,875			32,206
MINNESOTA	14,802	17,265	2,176	98	410	420	35,171
MISSISSIPPI	1,320	·	·				1,320
MISSOURI	9,896	2,882	5,880				18,658
NEBRASKA	1,334		2,580				3,914
NEVADA	3,332	1,257					4,589
NEW JERSEY	87,023	36,474	2,296	490	343	344	126,970
NEW MEXICO		980					980
NEW YORK	8,808	16,276	7,668	477			33,229
NORTH CAROLINA	5,490	817	77		227	271	6,882
OHIO	33,762	18,563	3,971			98	56,394
OKLAHOMA	8,280	5,094	5,739			357	19,470
OREGON	1,470	389	98		229	469	2,655
PENNSYLVANIA	6,511	3,302	2,041	2,311	126	530	14,821
SOUTH CAROLINA	1,421						1,421
TENNESSEE	9,151	5,599	1,591	3,548			19,889
TEXAS	114,599	35,204	17,319	5,379		1,263	173,764
UTAH	8,649	2,891					11,540
VIRGINIA	9,282	5,593	1,568				16,443
WASHINGTON	52,905	7,332	147		294	501	61,179
WISCONSIN	6,743	335	3,436		28	155	10,697
WYOMING	4,392		2,620				7,012
TOTAL	960,538	455,668	173,583	76,804	4,663	27,034	1,698,290

CALIFORNIA APPLE COMMISSION- UNITED STATES

DOMESTIC SHIPMENTS 2016-2017

(MEASURED IN 40 lb. BOXES)

	(INIEASORED IN 40 ID. BOXES)							
STATE	GALA	GRANNY SMITH	FUJI	CRIPPS PINK	BRAEBURN	OTHER	TOTAL	
ALABAMA	6,429	588	5,640				12,657	
ARIZONA	36,216	28,494	7,365	4,837	400		77,312	
ARKANSAS	13,800		3,840				17,640	
CALIFORNIA	208,719	169,507	146,279	66,989	3,611	26,982	622,087	
COLORADO	10,465	882	588		559	547	13,041	
CONNECTICUT		686	98				784	
FLORIDA	58,350	8,882	10,836		98	2,104	80,270	
GEORGIA	31,989	13,808	6,062	88	98		52,045	
HAWAII	405		1,614				2,019	
ILLINOIS	50,886	5,547	5,141				61,574	
INDIANA	19,781	1	4,367		363	1,324	25,836	
IOWA	3,905	2,086	175	147	7	,-	6,320	
KANSAS	560	,	176				736	
KENTUCKY	10,359	419	3,584		441	1,882	16,685	
LOUISIANA	10,197	784	720		1112	1,002	11,701	
MAINE	8,880	3,000	1,380	1,003			14,263	
MARYLAND	436	1,302	49	1,003		1,470	3,257	
MASSACHUSETTS	1,918	702	294			1,470	2,914	
MICHIGAN	30,174	2,922	4,507				37,603	
MINNESOTA	24,279	42,951	6,100	1,213	294	1,987	76,823	
MISSISSIPPI		98		1,213	234	1,307		
MISSOURI	10,143 28,121	1,958	2,640 4,679				12,881 34,758	
	+	1,936						
NEBRASKA	10,620	21.000	180	F 06F			10,800	
NEVADA	12,019	21,686 70	14,809	5,065			53,579	
NEW HAMPSHIRE	1.652				47		70	
NEW JERSEY	1,653	1,504	2.020	240	47		3,204	
NEW MEXICO	16,100	10,329	2,820	240			29,489	
NEW YORK	10,811	16,276	3,525	1,564	10	4 407	32,176	
NORTH CAROLINA	16,502	247	4,285		49	1,407	22,490	
OHIO	34,717	836	5,943			686	42,182	
OKLAHOMA	16,406	12,214	4,020	4,100			36,740	
OREGON	70	46	98		49	70	333	
PENNSYLVANIA	26,187	24,401	7,969	2,311		364	61,232	
SOUTH CAROLINA	11,620	441	2,040				14,101	
TENNESSEE	15,066	2,352	3,479				20,897	
TEXAS	83,273	20,873	16,661	8,012	23	3,422	132,264	
UTAH	30,975	3,120	9,747	4,350			48,192	
VERMONT			98		484		582	
VIRGINIA	13,200	196	2,141				15,537	
WASHINGTON	6,144	3,430	3,128		98	191	12,991	
WISCONSIN	19,219	2,688	3,157		343		25,407	
WYOMING	5,180		200				5,380	
TOTAL	895,774	405,326	300,433	99,919	6,964	42,436	1,750,852	

CALIFORNIA'S TOP 5 STATES

(MEASURED IN BOXES)

2011-201	12	2016-20	117
1 CALIFORNIA	651,580	1 CALIFORNIA	622,08
2 TEXAS	218,016	2 TEXAS	132,26
3 ILLINOIS	92,009	3 FLORIDA	80,270
4 MINNESOTA	90,347	4 ARIZONA	77,312
5 OHIO	75,800	5 MINNESOTA	76,823
2012-201		2017-20	
1 CALIFORNIA	678,730	1 CALIFORNIA	679,097
2 TEXAS	197,916	2 TEXAS	173,764
3 MICHIGAN	60,972	3 NEW JERSEY	126,970
4 ILLINOIS	54,998	4 GEORGIA	119,646
5 FLORIDA	54,230	5 WASHINGTON	61,179
2013-201	<u>14</u>	2018-20) <u>19</u>
1 CALIFORNIA	969,932	1 CALIFORNIA	770,122
2 TEXAS	248,105	2 TEXAS	142,131
3 WASHINGTON	59,851	3 NEVADA	87,539
4 ILLINOIS	53,648	4 GEORGIA	31,571
5 FLORIDA	42,993	5 OHIO	28,302
<u>2014-201</u>		<u>2019-20</u>	
1 CALIFORNIA	661,422	1 CALIFORNIA	487,091
2 TEXAS	195,680	2 NEVADA	116,561
3 FLORIDA	70,100	3 ARIZONA	98,990
4 PENNSYLVANIA	64,343	4 TEXAS	69,915
5 NEW YORK	57,448	5 ALABAMA	67,155
2015-201		<u>2020-20</u>	
1 CALIFORNIA	612,547	1 CALIFORNIA	403,128
2 TEXAS	164,500	2 NEVADA	89,090
3 FLORIDA	73,892	3 ARIZONA	72,114
4 ILLINOIS	73,031	4 TEXAS	55,942
5 PENNSYLVANIA	51,881	5 FLORIDA	44,708

EXPORT TOTALS 2020-2021 (MEASURED IN BOXES)

COUNTRY	GALA	GRANNY SMITH	FUJI	CRIPPS PINK	BRAEBURN	OTHER	TOTAL
CANADA	9,841	7,605					17,446
MALAYSIA		49					49
MEXICO		2,641					2,641
TAIWAN	14		4,851				4,865
TOTAL	9,855	10,295	4,851	0	0	0	25,001

EXPORT TOTALS 2019-2020 (MEASURED IN BOXES)

COUNTRY	GALA	GRANNY SMITH	FUJI	CRIPPS PINK	BRAEBURN	OTHER	TOTAL
CANADA	17,708	8,715	448	88	147		27,106
MALAYSIA		49					49
MEXICO	7,056	8,232					15,288
PANAMA	294						294
TAIWAN	3,360		12,018				15,378
TOTAL	28,418	16,996	12,466	88	147	0	58,115

EXPORT TOTALS 2018-2019 (MEASURED IN BOXES)

COUNTRY	GALA	GRANNY SMITH	FUJI	CRIPPS PINK	OTHER	TOTAL
CANADA	25,997	24,830	13,959	196	3,584	68,566
COLUMBIA		2,009				2,009
EL SALVADOR	1,840					1,840
MEXICO	18,542	11,229				29,771
TAIWAN			5,468			5,468
TOTAL	46,379	38,068	19,427	196	3,584	107,654

EXPORT TOTALS 2017-2018

(MEASURED IN BOXES)

COUNTRY	GALA	GRANNY SMITH	FUJI	CRIPPS PINK	OTHER	TOTAL
CANADA	35,203	17,737	1,368	4,671	196	59,175
MALAYSIA	49		49			98
MEXICO	427	7,593				8,020
PUERTO RICO	294	245				539
THAILAND	290					290
TOTAL	36,263	25,575	1,417	4,671	196	68,122

EXPORT TOTALS 2016-2017 (MEASURED IN BOXES)

COUNTRY	GALA	GRANNY SMITH	FUJI	CRIPPS PINK	BRAEBURN	OTHER	TOTAL
CANADA	53,736	15,360	245	147	225	483	70,196
MEXICO	1,896	8,820					10,716
TAIWAN			5,552				5,552
TOTAL	55,632	24,180	5,797	147	225	483	86,464

CALIFORNIA'S TOP 5 COUNTRIES

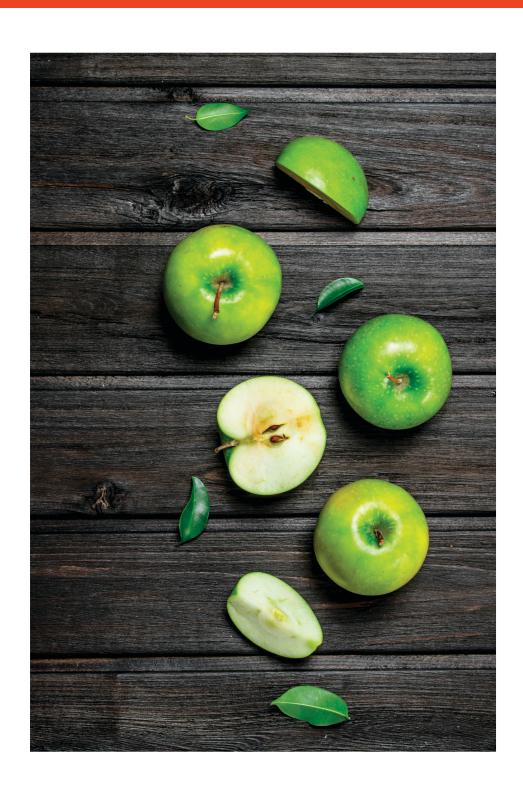
(MEASURED IN BOXES)

2011-20	012	
L CANADA	232,788	
2 MALAYSIA	30,818	
3 MEXICO	20,825	
4 TAIWAN	15,629	
5 ECUADOR	5,965	
2012-20		
1 CANADA	216,027	
2 MEXICO	39,703	
3 TAIWAN	36,536	
4 MALAYSIA	31,713	
5 THAILAND	9,775	
2013-20	<u>014</u>	
1 CANADA	132,105	
2 MALAYSIA	46,509	
3 MEXICO	31,184	
4 SRI LANKA	11,680	
5 TAIWAN	10,309	
<u>2014-20</u>		
1 CANADA	94,599	
2 TAIWAN	28,852	
3 MALAYSUA	17,933	
4 MEXICO	11,151	
5 THAILAND	9,690	
2015-20		
1 CANADA	44,984	
2 MEXICO	19,908	
3 TAIWAN	13,682	
4 PANAMA	661	
5 PUERTO RICO	49	

HISTORICAL PACK OUT REPORT (MEASURED IN BOXES)

VARIETY	2011/2012	2012/2013	2013/2014	2014/2015	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021
FUJI	227,475.0	213,223.0	245,745.0	262,849.8	232,140.0	306,231.0	175,000.0	183,688.0	205,374.0	111,843.0
GALA	1,011,727.0	801,831.0	761,904.0	758,736.9	977,006.4	951,408.4	996,801.2	720,435.0	638,020.0	579,274.0
GRANNY SMITH	1,113,778.0	905,965.0	969,320.0	763,849.3	443,648.0	429,506.2	481,242.9	523,591.6	304,875.0	301,822.0
CRIPPS PINK	119,219.0	95,446.0	142,530.0	63,208.6	75,355.3	100,066.0	81,475.0	82,911.0	77,127.0	24,431.0
BRAEBURN	7,201.0	10,675.0	18,460.0	6,694.1	13,519.6	7,189.4	4,663.0	3,525.0	1,366.0	
GOLDEN DELICIOUS					5.0					
HONEYCRISP			8,998.0	6,192.0						
RED DELICIOUS	639.0	671.0	2,015.0	2,778.0	1,366.0	2,547.0	182.0			
SUNDOWNER							155.0		42.0	
SWEETIE				2,766.0						
OTHER	169,775.0	30,146.0	37,499.0	57,679.0	30,277.0	40,372.0	26,893.0	22,298.0	4,224.0	7,632.0
Total Packed	2,649,814.0	2,057,957.0	2,186,471.0	1,924,753.7	1,773,317.3	1,837,320.0	1,766,412.1	1,536,448.6	1,231,028.0	1,025,002.0
Total Shipped	2,649,814.0	2,057,957.0	2,186,471.0	1,924,753.7	1,773,317.3	1,837,320.0	1,766,412.1	1,536,448.6	1,231,028.0	1,025,002.0

COVID-19 PANDEMIC UPDATES AND IMPACTS



COVID-19 EFFECTS ON THE CALIFORNIA APPLE INDUSTRY

The COVID-19 pandemic presented unforeseen challenges to nearly every sector and industry in the country with the California apple industry being no exception. COVID-19 impacted and changed the day-to-day operations of the apple industry, as employees are now mandated to wear face-coverings when at work, employers must stagger work shifts in effort to limit crew size, and employers must also provide additional shade structures and seating to allow employees to take breaks while maintaining proper social distancing.

Despite the obstacles, the California Apple Commission has continued to work through the challenges on behalf of the California apple industry as efficiently and timely as possible. A notable bright spot amidst the pandemic included the Paycheck Protection Program (PPP) loan forgiveness that was granted an extension by President Trump on June 5th. The bill extended the covered period for loan forgiveness from 8 weeks, after the date of loan disbursement, to 24 weeks after the date of loan disbursement. In addition, on behalf of the California Apple Commission, the U.S. Apple Association submitted a proposal to USDA in an effort to obtain funding for direct payment to apple growers through the Coronavirus Food Assistance Program (CFAP) which was ultimately granted on July 9th. Growers had the ability to apply for direct payments under the CFAP program if they could demonstrate at least a 5% loss in sales between January 15 and April 15, 2020. The CAC understood that these dates unfortunately eliminated the majority of California apple producers from funding eligibility, so the CAC team worked closely with USDA and members of Congress to advocate for additional funding opportunities to benefit the California apple industry as well. On September 18, 2020, USDA announced a second round of funding through the CFAP 2.0 program which eliminated the arbitrary dates from the original CFAP opportunity and thus allowed apple producers to easily apply and receive assistance.

The CAC has also had daily calls with Kahn, Soares & Conway, LLP to stay up-to-date on how COVID-19 continues to affect the California apple industry and agriculture as a whole. For more information in regards to how the California Apple Commission has attempted to mitigate the effects of COVID-19, please refer to our weekly COVID-19 updates that are included in the following pages. As this pandemic has not come to end yet, the California Apple Commission will continue to work on behalf of the California apple industry to ensure that growers are continuously updated on how COVID-19 will impact their industry.

June 10, 2021



COVID-19 UPDATE



CAL/OSHA READOPTS COVID-19 EMERGENCY TEMPORARY STANDARD

June 3, 2021- The California Division of Occupational Safety and Health Standards Board readopted the the Emergency Temporary Standards (ETS) for COVID-19 prevention, which was originally adopted in November of last year.

The changes adopted by the Board phase out physical distancing and make other adjustments to better align with the state's June 15 goal to retire the Blueprint. Without these changes, the original standards, would be in place until at least October 2. These restrictions are no longer required given today's record low case rates and the fact that we've administered 37 million vaccines.

The proposal will now be submitted to the Office of Administrative Law (OAL), where the OAL will have ten calendar days to review and decide whether they will file the regulation with the Secretary of State to make effective for 180 days, with possible extensions pursuant to Governor Newsom's Executive Orders N-40-20 and N-66-20.

Though the state is scheduled to fully reopen on June 15, the ETS applies to all employees and places of employment, with the following exceptions:

- · Work location with one employee who does not have contact with other persons.
- · Employees working from home.
- · Employees with occupational exposure defined by section 5199, when covered by that section.
- \cdot $\,$ Employees teleworking from a location of the employee's choice, which is not under the control of the employer.

CHANGES TO THE EFTS THAT CALIFORNIA EMPLOYERS SHOULD BE AWARE OF

- **Physical distancing**: The 6 feet physical distancing requirements will remain in place until July 31, 2021. However, the amended ETS adds the following exceptions to physical distancing:
 - An employee wearing a respirator if required by the employer and used in compliance with the Respiratory Protection Standard in Cal. Code. Regs., tit. 8, section 5144.
 - Locations at which all employees are fully vaccinated, except for employees who require a reasonable accommodation or exception to vaccination under federal or state law.
- **Face coverings**: Employers are still required to provide face coverings and ensure face coverings are worn when indoors, when outdoors and less than 6 feet away from others, and where required by orders from the California Department of Public Health or local orders. However, the following exceptions apply:
 - When an employee is either alone in a room or when all persons in a room are fully vaccinated.
 - Employees who wear respirators as required by other sections.
 - Employees who are fully vaccinated when they are outdoors and do not have any COVID-19 symptoms.
- **Respirators for unvaccinated employees:** Effective July 31, 2021, employers must provide filtering facepiece respirators (i.e., NIOSH-approved devices that are able to filter particulate matter, such as the N95s) to employees that are not vaccinated for voluntary
- **Testing**: Employers must continue to make COVID-19 testing available at no cost during paid time to all employees who have had a close contact except for those who are fully vaccinated before the close contact or certain individuals who have recovered from COVID-19.

For more information on the updated ETS, please visit - https://www.dir.ca.gov/OSHSB/documents/Jun032021-COVID-19-Prevention-Emergency-txtbrdconsider-Readoption.pdf

BLUEPRINT FOR A SAFER ECONOMY UPDATE

The June 8th county tier status is:

- Purple (Widespread) 0 counties
- Red (Substantial) 3 counties
 - o Del Norte, Shasta and Yuba
- Orange (Moderate) 31 counties
 - Every other county not listed in the other tiers.
- Yellow (Minimal) 24 counties
 - Alameda, Alpine, Amador, Inyo, Lassen, Los Angeles, Marin, Mariposa, Mendocino, Mono,
 Monterey, Napa, Orange, San Benito, San Diego, San Francisco, San Luis Obispo, San Mateo,
 Santa Barbara, Santa Clara, Santa Cruz, Sierra, Trinity and Ventura

For more information on a county's status, please visit - https://covid19.ca.gov/safer-economy/



UPDATED CDPH GUIDANCE ON TESTING

The California Department of Public Health (CDPH) appears to recommend the following:

- Weekly or twice-weekly testing of non-vaccinated individuals.
- Effected workplaces:
 - Those which face the public (specifically calling out "workplaces where workers are in close and/or frequent contact with the public, such as public transit, restaurants, theaters or stadiums, amusement parks, transportation hubs, or workplaces in communities with substantial to high community transmission").
 - "High-density workplaces where there is a higher risk of SARS-CoV-2 transmission (e.g., indoor workplaces where physical distancing is difficult and workers might be in close contact, such as manufacturing or food processing plants, or workplaces that provide congregate housing for employees such as fishing vessels, offshore oil platforms, farmworker housing or wildland firefighter camps)".

CalOSHA Standards Board has an emergency meeting June 9, 2021. They may attempt to rescind the action from last week and amend the modified ETS to include this guidance and then resend the document to OAL. If they do so, it will become required, rather than guidance.

For more information, please visit - https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/COVID-19/Updated-COVID-19-Testing-Guidance.aspx

OTHER HELPFUL LINKS

- Mask Guidance https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/COVID-19/guidance-for-face-coverings.aspx
- When Do You Need Your Mask? https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/COVID-19/Use-of-Face-Coverings-Fact-Sheets--en.pdf
- Recommendations for Fully Vaccinated People https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/COVID-19/COVID-19-Public-Health-Recommendations-for-Fully-Vaccinated-People.aspx
- Updated Moving Beyond the Blueprint https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/COVID-19/Beyond-Blueprint-Framework.aspxCDPH
- News Alerts https://www.cdph.ca.gov/Programs/OPA/Pages/News-Releases-2021.aspx
- Vaccination Progress https://covid19.ca.gov/vaccines/#California-vaccines-dashboard
- Travel Advisory https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/COVID-19/Travel-Advisory.aspx
- Employees & Workplaces https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/COVID-19/EmployeesAndWorkplaces.aspx
- Sector Guidelines https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/COVID-19/Dimmer-Framework-September_2020.pdf
- Updated Testing Guidance https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/COVID-19/Updated-COVID-19-Testing-Guidance.aspx





COVID-19 UPDATE



STATE COVID-19 WORK RULES TO BE REVISED FURTHER

May 26, 2021- Revised rules governing COVID-19 precautions in the workplace have been sent back for changes that are due this week, after farm groups and others raised objections.

The California Division of Occupational Safety and Health Standards Board, acting on the advice of staff, agreed to table consideration of updated Emergency Temporary Standards governing how employers must mitigate COVID-19 risks and respond to positive cases in the workplace.

The board acted in light of recent guidance from the federal Centers for Disease Control and Prevention, to the effect that people vaccinated against COVID-19 need not wear masks in most cases.

The Cal/OSHA board adopted the original emergency temporary standards, or ETS, in November 2020. The ETS requires employers to develop a written COVID-19 prevention program or incorporate its elements into an Injury and Illness Prevention Program. This includes identifying and correcting COVID-19 hazards; maintaining social distancing of at least 6 feet unless the nature of the work makes this impossible; requiring masks; procedures to investigate and respond to COVID-19 cases and outbreaks at the workplace; and clear communication with employees about all of those activities.

Revised standards are due May 28, to be considered at a special meeting of the Standards Board June 3. The present standards are due to expire October 2, unless the board acts otherwise.

CDPH PROVIDES CALIFORNIA REOPENING UPDATE

May 21, 2021- On May 21st, the California Department of Public Health (CDPH) released details surrounding the state's plan to move beyond the Blueprint for a Safer Economy on June 15th. With the limited exceptions noted for Mega Events, all other sectors listed in the current <u>Blueprint Activities</u> and <u>Business Tiers Chart</u> may return to usual operations based on the general public health recommendations below.

Restrictions Applying to Indoor and Outdoor Settings

- Vaccine verification/negative testing: Required for indoor mega events. Recommended for outdoor mega events.
- Capacity limitations: No restrictions.
- Physical distancing: No restrictions for attendees, customers, and guests.
- Masking: Follow current <u>CDPH Guidance for Face Coverings</u>.
- Travelers: Follow <u>CDC</u> recommendations and <u>CDPH Travel Advisory</u>.

CDPH will continue to provide guidance for youth, healthcare, and high-risk congregate settings. Please note that **employers will remain subject to the** <u>Cal/OSHA COVID-19 Prevention Emergency Temporary Standards (ETS)</u>, with three exceptions:

- Workplaces where there is only one employee who does not have contact with other people.
- Employees who are working from home.
- Employees who are covered by the <u>Aerosol Transmissible Diseases</u> regulation.

BLUEPRINT FOR A SAFER ECONOMY UPDATE

May 25, 2021- Four counties have moved to a less restrictive tier. From Red (substantial) to Orange (moderate): Merced and Placer. From Orange (moderate) to Yellow (minimal): Inyo and Mariposa. No counties moved to a more restrictive tier.

The May 25th county tier status is:

- Purple (Widespread) 0 counties
- Red (Substantial) 8 counties
 - o Del Norte, Nevada, Sacramento, San Joaquin, Shasta, Solano, Stanislaus and Yuba
- Orange (Moderate) 35 counties
 - Every other county not listed in the other tiers.
- Yellow (Substantial) 15 counties
 - Alpine, Amador, Inyo, Lassen, Los Angeles, Mariposa, Mendocino, Mono, Orange, San Francisco, San Mateo, Santa Clara, Santa Cruz, Sierra and Trinity

For more information on a county's status, please visit - https://covid19.ca.gov/safer-economy/.





CDPH RECOMMENDATIONS FOR FULLY VACCINATED INDIVIDUALS

May 5, 2021- The California Department of Public Health (CDPH) updated its recommendations for individual who are fully vaccinated. Key points from this <u>guidance</u> are listed below.

Fully vaccinated people can:

- Spend time with other fully vaccinated people, including indoors, without wearing masks or physical distancing (outside a workplace setting).
- Spend time with unvaccinated people from a single household who are at low risk for severe COVID-19 disease indoors without wearing masks or physical distancing.
- Refrain from wearing face coverings outdoors except when attending crowded outdoor events, such as live performances, parades, fairs, festivals, sports events, or other similar settings.
- Refrain from quarantine and testing following a known exposure if asymptomatic.
 - Following a known exposure at work, fully vaccinated workers do not need to quarantine if asymptomatic.
 - In the workplace, employers subject to the <u>Cal/OSHA COVID-19 Prevention Emergency</u> <u>Temporary Standards (ETS)</u> must ensure that employees are following the current ETS face covering and testing requirements.

Fully vaccinated people should continue to:

- Take precautions in public including wearing a well-fitted mask indoors, and when attending crowded outdoor events, as described above.
 - Check <u>CDPH guidance for face coverings</u> for updates.
 - Follow CDPH's <u>Guidance for Gatherings</u> when gathering with people who are not vaccinated, groups with both vaccinated and unvaccinated people, and persons of unknown status. Maintain physical distancing and adhere to other prevention measures when visiting with unvaccinated people who are at increased risk for severe COVID-19 disease or who have an unvaccinated household member <u>who is at increased risk for severe COVID-19 disease</u>.

- Get tested if experiencing COVID-19 symptoms.
- If fully vaccinated people test positive for SARS-CoV-2, they should follow CDPH and local health department guidance regarding isolation and/or exclusion from high-risk settings.
 - For workplace settings, employers should follow the exclusion provisions of the Cal/OSHA COVID-19 Emergency Temporary Standards.*
- Follow <u>CDC</u>, local and <u>state</u> health department travel requirements and recommendations.

GOV. NEWSOM ANNOUNCES \$5.1 BILLION PACKAGE FOR WATER INFRASTRUCTURE AND DROUGHT RESPONSE AS PART OF \$100 BILLION CALIFORNIA COMEBACK PLAN

May 10, 2021- California Governor Gavin Newsom proposed a \$5.1 billion package of immediate drought response and long-term water resilience investments to address immediate, emergency needs, build regional capacity to endure drought and safeguard water supplies for communities, the economy and the environment. In addition to the \$5.1 billion investment, the Governor is proposing \$1 billion to help Californians pay their overdue water bills. The package includes billions for drinking water and wastewater infrastructure, with a focus on small and disadvantaged communities. The Governor's \$100 billion in total California Comeback Plan is a comprehensive recovery plan to tackle five of the state's most persistent challenges.

The Governor's \$5.1 billion proposed investment, over four years, aligns with his July 2020 Water Resilience Portfolio, a roadmap to water security for all Californians in the face of climate change. It is shaped by lessons learned during the 2012-16 drought, such as the need to act early and gather better data about water systems. To learn more about current conditions, the state's response and informational resources available to the public, visit the state's new drought preparedness website at https://waterresilience.ca.gov/drought/preparedness/.

CALIFORNIA TO OPEN PFIZER-BIONTECH VACCINATION APPOINTMENTS FOR 12-15 AGE GROUP

May 12, 2021- California parents and legal guardians can schedule appointments for young people in their families aged 12+ to receive the Pfizer-BioNTech COVID-19 vaccine using the statewide booking system starting Thursday (May 13, 2021) morning.

This expanded eligibility comes after the Centers for Disease Control and Prevention's (CDC) vaccine safety review panel and the Western States Scientific Safety Review Workgroup recommended on Wednesday that the vaccine is safe and effective in protecting this age group against severe illness, hospitalization, and death. On May 10, the U.S. Food and Drug Administration (FDA) amended the Pfizer vaccine's Emergency Use Authorization to allow administration for 12- to 15-year-olds, following clinical trials that proved it safe for this age group with only non-serious side effects like fatigue and headache. About 2.1 million Californians are in this next eligible age group.

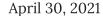
Parents, legal guardians or emancipated young people can check vaccine availability and book an appointment at MyTurn.ca.gov or by calling California's COVID-19 Hotline at 1-833-422-4255. They can also contact their family doctor, local community health clinic or public health office for more information.

Please visit <u>covid19.ca.gov</u> for answers to questions on vaccinations for the 12+ age group. For more information on the COVID-19 vaccine, visit <u>VaccinateALL58.com</u>.



FOOD SAFETY COMMUNITY UPDATE

- Food Safety Meet Up on Tuesday, May 25, 2021- "What makes a good produce safety professional?"
 Sponsored by Ecolab and hosted by Produce Safety Immersion participants, join United Fresh on May 25 for small group discussions highlighting what you look for when hiring.
- FDA issued a report titled, "Resiliency Roadmap for FDA Inspectional Oversight," outlining the agency's inspectional activities during the COVID-19 pandemic. FDA is behind on their targets on routine inspections, but the information shows what can reasonably be done in this fiscal year, and how they adapted based on risk in the past 14 months.
- In Canada, CFIA published a <u>4 year analysis of biological hazards (bacteria, parasites, and viruses) in foods including fresh fruits and vegetables</u> sampled at grocery stores. Every one of the 967 samples of imported romaine were satisfactory. One out of 1100+ berry samples was positive for Cyclospora. there is a summary table with details on other items.
- A United Fresh <u>webinar on Cyclospora</u> can be accessed on demand.
 - AFDO published guidance on how regulators should investigate Cyclospora outbreaks.
- FDA is once again sampling lettuce (iceberg, romaine, and leaf) from coolers in the Salinas region, starting next week until the end of the harvest season, targeting 500 samples. Unlike the spring assignment in Yuma, they will be using FDA labs and not a third party lab, meaning time to results will be longer (3 days for a negative). UFPA and other associations continue to try to understand the factors that influenced FDA's decision.
- <u>FDA opened a portal where importers can submit their FSVP records to the agency electronically.</u> The rule specifies that inspections can be done solely through a review of electronic records (versus onsite) and the portal is a way to transmit those files.
- There are many food safety sessions as part of United Fresh's <u>Reimagine Conversations</u> education series.





CFAP 2 APPLICATIONS STILL BEING ACCEPTED

The U.S. Department of Agriculture (USDA) <u>Farm Service Agency</u> is continuing to accept applications for <u>Coronavirus Food Assistance Program 2 (CFAP 2</u>). This program is providing additional financial assistance to farmers, ranchers, and producers impacted by COVID-19 market disruptions. Commodities eligible for this round of assistance include those who were originally eligible for CFAP 2 and commodities included in CFAP Additional Assistance. Cattle producer who applied for CFAP 1 will automatically receive additional payments. Visit the <u>CFAP website</u> for more information.

BLUEPRINT FOR A SAFER ECONOMY UPDATE

The April 27th county tier status is:

- Purple (Widespread)- 0 counties
- Red (Substantial) 13 counties
 - Del Norte, Inyo, Madera, Merced, Nevada, Placer, Sacramento, San Joaquin, Shasta, Solano, Stanislaus, Tehama, and Yuba
- Orange (Moderate) 41 counties
 - Every other county not listed in the other tiers.
- Yellow (Minimal)- 4 counties
 - o Alpine, Lassen, Mendocino, and Sierra

For more information on a county's status, please visit - https://covid19.ca.gov/safer-economy/.

CALIFORNIA LEGISULATURE PASSES TAX RELIEF BILL FOR PAYCHECK PROTECTION PROGRAM RECIPIENTS

On April 26, 2021, the California Legislature sent the Governor AB 80, which seeks to "provide assistance to small businesses operating in the state that have been harmed economically by the COVID-19 pandemic." Specifically, the bill will:

- Allow eligible entities to deduct business expenses that were paid for using forgiven Paycheck Protection Program (PPP) or Economic Injury Disaster Loan (EIDL) funds.
- Allow loans forgiven as an "advance grant amount" under the EIDL program to be excluded from income for California taxpayers.
- Not require eligible entities to adjust their tax attributes as a result of forgiven PPP or EIDL funds.

AB 80 defines an "ineligible entity" as a taxpayer that either:

- Is a publicly-traded company, as described in the Federal Consolidated Appropriations Act, 2021 (Public Law 116-260).
- Does not meet the reduction in gross receipts of 25 percent or more in 2020 as compared to the same time period in 2019, as defined in the Federal Consolidated Appropriations Act of 2021 (Public Law 116–260).

The 25 percent reduction in gross receipts was an eligibility requirement for the second round of PPP loans, Unfortunately, the Legislature and Governor extended this requirement to all businesses that received a PPP loan for purposes of business deduction which means many essential sectors will not be eligible because they have been operating throughout the pandemic.

The language of the bill can be found <u>here</u>.

HELPFUL COVID-19 LINKS

- CDPH News Alerts https://www.cdph.ca.gov/Programs/OPA/Pages/News-Releases-2021.aspx
- Vaccination Progress https://covid19.ca.gov/vaccines/#California-vaccines-dashboard
- Travel Advisory https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/COVID-19/Travel-Advisory.aspx
- Employees & Workplaces https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/COVID-19/EmployeesAndWorkplaces.aspx
- Sector Guidelines https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/COVID-19/Dimmer-Framework-September_2020.pdf

April 15, 2021



COVID-19 UPDATE



CFAP 2 APPLICATIONS STILL BEING ACCEPTED

Has your operation been directly impacted by the coronavirus pandemic? USDA is implementing updates to the Coronavirus Food Assistance Program for producers of agricultural commodities marketed in 2020 who faced market disruptions due to COVID-19. This is part of a larger initiative to improve USDA pandemic assistance to producers.

USDA's Farm Service Agency is currently accepting new and modified CFAP 2 applications. To apply, please visit https://www.farmers.gov/pandemic-assistance/cfap or contact your local FSA office.

CDFA/USDA WORKSHOP TO PARTNERS WORKING WITH UNDERSERVED FARMERS AND RANCHERS

CDFA and USDA are partnering to hold a workshop to Partners working with underserved farmers and ranchers in California.

You are invited on Monday April 19, 2021 from 1:00-3:00 pm:

- CDFA Underserved and Small Producer Program
- USDA Pandemic Assistance for Producers
- Coronavirus Food Assistance Program (CFAP) & Cooperative Agreement Program

Registration link: https://attendee.gotowebinar.com/register/3456781409008512015

For more information, contact Brooke Raffaele at brook.raffaele@usda.gov or Christine Chavez at christine.chavez2@usda.gov.

BLUEPRINT FOR A SAFER ECONOMY UPDATE

April 14, 2021- CDPH announced five counties are moving to a less restrictive tier. From Purple (widespread) to Red (substantial): Inyo and Merced. From Red (substantial) to Orange (moderation): Kern and Lake. From Orange (moderate) to Yellow (minimal): Lassen. No counties moved to a more restrictive tier.

The April 14th county tier status is:

- Purple (Widespread)- 0 counties
- Red (Substantial) 22 counties
 - Amador, Calaveras, Del Norte, Fresno, Glenn, Inyo, Kings, Madera, Merced, Mono, Nevada,
 Placer, Sacramento, San Joaquin, San Luis Obispo, Santa Barbara, Shasta, Solano, Stanislaus,
 Sutter, Tehama, and Yuba
- Orange (Moderate) 33 counties
 - Every other county not listed in the other tiers.
- Yellow (Minimal)- 3 counties
 - o Alpine, Lassen, and Sierra

For more information on a county's status, please visit - https://covid19.ca.gov/safer-economy/.

Other helpful links:

- CDPH News Alerts https://www.cdph.ca.gov/Programs/OPA/Pages/News-Releases-2021.aspx
- Vaccination Progress https://covid19.ca.gov/vaccines/#California-vaccines-dashboard
- Travel Advisory https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/COVID-19/Travel-Advisory.aspx
- Employees & Workplaces https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/COVID-19/EmployeesAndWorkplaces.aspx
- Sector Guidelines https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/COVID-19/Dimmer-Framework-September_2020.pdf





BLUEPRINT FOR A SAFER ECONOMY UPDATE

March 30, 2021- CDPH has once again made updates to the state's Blueprint for a Safer Economy. This week, thirteen counties moved to a less restrictive tier. From Purple (widespread) to Red (substantial): Fresno, Glenn, Kings, Madera, and Yuba. From Red (substantial) to Orange (moderate): Alameda, Butte, Colusa, Los Angeles, Modoc, Orange, Santa Cruz, and Tuolumne. No counties moved to a more restrictive tier.

The March 20th county tier status is:

- Purple (Widespread) 3 counties
 - Inyo, Merced, and San Joaquin
- Red (Substantial) 36 counties
 - Every other county not listed in other tiers.
- Orange (Moderate) 17 counties
 - Alameda, Butte, Colusa, Lassen, Los Angeles, Marin, Mariposa, Modoc, Orange, Plumas, San Francisco, San Mateo, Santa Clara, Santa Cruz, Trinity, Tuolumne, and Yolo
- Yellow (Minimal) 2 counties
 - Alpine and Sierra

For more information on a county's status, please visit - https://covid19.ca.gov/safer-economy/. For more information on the vaccination progress, please visit - https://covid19.ca.gov/vaccines/#California-vaccines-dashboard.

EXPANDED VACCINE ELIGIBILITY IN CALIFORNIA

March 25, 2021 - With supply of vaccines expected to significantly increase in the coming weeks, the state is expanding vaccine eligibility to more Californians. Starting April 1, individuals aged 50+ will be eligible to make an appointment, and individuals 16+ will be eligible to make an appointment to be vaccinated starting on April 15.

For more information on the vaccination progress, please visit - https://covid19.ca.gov/vaccines/#California-vaccines-dashboard.

USDA ANNOUNCES 'PANDEMIC ASSISTANCE FOR PRODUCERS'

March 24, 2021- Agriculture Secretary Tom Vilsack announced that USDA is establishing new programs and efforts to bring financial assistance to farmers, ranchers and producers who felt the impact of COVID-19 market disruptions. This new initiative - **USDA Pandemic Assistance for Producers** - will reach a broader set of producers than previous COVID-19 aid programs. USDA is dedicating at least \$6 billion toward the new programs. The Department will also develop rules for new programs that will put a greater emphasis on outreach to small and socially disadvantaged producers, specialty crop and organic producers, timber harvesters, as well as provide support for the food supply chain and producers of renewable fuel, among others. Existing programs like the Coronavirus Food Assistance Program (CFAP) will fall within the new initiative and, when statutory authority allows, will be refined to better address the needs of producers.

USDA will reopen sign-up for CFAP 2 for at least 60 days beginning on April 5, 2021. The Pandemic Assistance for Producers program has 4 parts: New Programs (\$6B); Existing Programs (\$500M); CFAP 1, CFAP 2, and CFAP AA Adjustments; and, Reopening the CFAP 2 Sign-up.

Please stay tuned for additional information and announcements under the **USDA Pandemic Assistance to Producers** initiative, which will help to expand and more equitably distribute financial assistance to producers and farming operations during the COVID-19 national emergency. Please visit www.farmers.gov for more information on the details of this announcement.

Please feel free to contact our office for more information regarding this announcement.

CAN EMPLOYERS REQUIRE EMPLOYEES TO BE VACCINATED AGAINST COVID-19?

Can an employer require its employees to be vaccinated against COVID-19?

According to the California Department of Fair Employment and Housing (DFEH) the short answer is, "an employer may require employees to receive and FDA approved vaccination against COVID-19 infection so long as the employer does not discriminate against or harass employees or job applicants on the basis of a protected characteristic, provides reasonable accommodations related to disability or sincerely-held religious beliefs or practices, and does not retaliate against anyone for engaging in protected religious beliefs or practices, and does not retaliate against anyone for engaging in a protected activity (such as requesting a reasonable accommodation.

What if an employee refuses to vaccinate based on disability or religion?

If an employer mandates vaccination in its workforce, and an employee objects to vaccination on the basis of disability, the employer must engage in the interactive process with, and reasonably accommodate, the employee with a disability-related reason for not being vaccinated, and the



employer may not retaliate against an employee for requesting such an accommodation. However, if the employer shows that the accommodation imposes an undue hardship, the employee is unable to perform the employee's essential duties even with reasonable accommodations, or the employee cannot perform those duties in a manner that would not endanger the employee's health or safety or the health or safety of others even with reasonable accommodations, the employer may exclude the employee from the workplace. Whether a reasonable accommodation exists is a fact-specific determination. Among the accommodations that an employer and employee might consider are whether the employee is able to work from home or whether reasonable procedures and safeguards could be put in place at the worksite that would enable to employee to work without endangering the employee or others.

If an employee holds a sincerely held religious belief or practice employers should engage in an interactive process with the employee similar to the disability context. Generally, a reasonable accommodation is one that eliminates the conflict between the religious belief or practice and the vaccination requirement and may include, but is not limited to, job restructuring, job reassignment, or modification of work practices. However, unless specifically requested by the employee, an accommodation related to religious creed is not considered reasonable if such accommodation results in the segregation of the individual from other employees or the public. If the employer shows that an accommodation imposes an undue hardship, the employer may exclude the employee from the workplace.

What if an employer requires employees to be vaccinated but the employee objects to receiving because they do not trust that the vaccine is safe?

If an employee does not have a disability reason or sincerely held religious reason for not being vaccinated with an FDA-approved vaccine, the employer is not legally required by the FEHA to reasonably accommodate the employee. Employers are permitted to enforce reasonable disciplinary policies and practices but the FEHA prohibits employers from retaliating against any employee for engaging in protected activity. For example, an employer may not retaliate against someone who alleges that the employer's vaccination policy intentionally discriminates on the basis of race, national origin, or another protected characteristic, or has a disparate impact on a protected group.

Is asking an employee to show proof of receipt of a COVID-19 vaccination a disability-related inquiry subject to ADA regulations?

Simply requesting proof of receipt of a COVID-19 vaccination is not likely to elicit information about a disability and, therefore, is not a disability-related inquiry. However, subsequent employer questions, such as asking why an individual did not receive a vaccination, may elicit information about a disability and would be subject to the pertinent ADA standard that they be "job-related and consistent with business necessity." If an employer requires employees to provide proof that they have received a COVID-19 vaccination from a pharmacy or their own health care provider, the employer may want to warn the employee not to provide any medical information as part of the proof in order to avoid implicating the ADA.

Is the administration of a COVID-19 vaccine to an employee by an employer (or by a third-party with whom the employer contracts to administer the vaccine) a "medical examination" for purposes of the ADA?

If a vaccine is administered to an employee by an employer for protection against contracting COVID-19, the employer is not seeking information about an individual's impairments or current health status and, therefore, it is not a medical examination. Although the administration of a

vaccination is not a medical examination, pre-screening vaccination questions may implicate the ADA's provision on disability-related inquiries, which are inquiries likely to elicit information about a disability. If the employer administers the vaccine, it must show that such pre-screening questions it asks employees are "job-related and consistent with business necessity." To meet this standard, an employer would need to have a reasonable belief, based on objective evidence, that an employee who does not answer the questions and, therefore, does not receive a vaccination, will pose a direct threat to the health or safety of her or himself or others.

There are two circumstances in which disability-related screening questions can be asked without needing to satisfy the "job-related and consistent with business necessity" requirement. First, if an employer has offered a vaccination to employees on a voluntary basis (i.e. employees choose whether to be vaccinated), the ADA requires that the employee's decision to answer pre-screening, disability-related questions also must be voluntary. 42 U.S.C. 12112(d)(4)(B); 29 C.F.R. 1630.14(d). If an employee chooses not to answer these questions, the employer may decline to administer the vaccine but may not retaliate against, intimidate, or threaten the employee for refusing to answer any questions. Second, if an employee receives an employer-required vaccination from a third party that does not have a contract with the employer, such as a pharmacy or other health care provider, the ADA "job-related and consistent with business necessity" restrictions on disability-related inquiries would not apply to the pre-vaccination medical screening questions.

Does an employer who requires employees to get vaccinated have to abide by Cal OSHA COVID-19 Emergency regulations or other guidelines?

Yes. As long as the regulations are in effect, employers must implement and enforce COVID-19 safety procedures required by the Cal-OSHA Emergency regulations.

Are there any other issues that might result?

In agriculture there may be some employees whose name and/or birthdate on their vaccination card does not match the information provided on their I-9. Such individuals may have to provide a reason as to why the information does not match and documentation to rectify the situation.





BLUEPRINT FOR A SAFER ECONOMY UPDATE

March 16, 2021- CDPH has once again made updates to the state's Blueprint for a Safer Economy. This week, eleven counties moved to a less restrictive tier, from Purple (widespread) to Red (substantial): Lake, Monterey, Riverside, Sacramento, San Diego, Santa Barbara, Sutter, Tehama, Tulare, and Ventura. One county, San Mateo, moved from Red (substantial) to Orange (moderate). No counties moved to a more restrictive tier.

The March 16th county tier status is:

- Purple (Widespread)- 11 counties
 - Fresno, Glenn, Inyo, Kern, Kings, Madera, Merced, Nevada, San Joaquin, Stanislaus, and Yuba
- Red (Substantial)- 42 counties
 - Every other county not listed in the other tiers
- Orange (Moderate)- 4 counties
 - Mariposa, Plumas, San Mateo, and Sierra
- Yellow (Minimal)- 1 county
 - Alpine

For more information on a county's status, please visit https://covid19.ca.gov/safer-economy/.

Statewide metrics can be found below:

- 6.5 New COVID-19 positive cases per day per 100k
- 2.3% Positivity rate (7-day rate)
- 28.7% ICU availability

Percent of state population in each tier:

- Purple (Widspread) 10.3%
- Red (Substantial) 87.7%
- Orange (Moderate) 2.0%
- Yellow (Minimal) 0.0%

STATE UPDATES BLUEPRINT TO ALLOW ADDITIONAL ACTIVITIES FOR A SAFE AND SUSTAINABLE REOPENING

March 11, 2021- Today, the CDPH updated public health guidance in the Blueprint for a Safer Economy to allow for additional safe and sustainable reopening activities in the state.

Breweries, Wineries and Distilleries

Beginning March 13, breweries, wineries, and distilleries that do not serve meals may open outdoors with modifications in the Purple (widespread) and Red (substantial) tiers. The modifications include ensuring that patrons have reservations and patrons observe a 90-minute time limit. Service for onsite consumption must end by 8 p.m. (Previously, and through March 12, breweries and distilleries not serving meals were closed in the Purple and Red tiers).

In the Orange (moderate) tier, indoor operations may begin with 25 percent of maximum capacity or 100 people, whichever is fewer. In the Yellow (minimal) tier, indoor operations may increase to 50 percent of maximum capacity or 200 people, whichever is fewer.

The updated guidance does not apply to breweries, wineries, and distilleries that provide meals. Those establishments should continue to follow the restaurant guidance.

Bars

Beginning March 13, bars that do nor serve meals remain closed in the Purple (widespread) and Red (substantial) tiers. In the Orange (moderate) tier, bars may begin outdoor operations with modifications. In the Yellow (minimal) tier, bars may begin indoor operations with modifications of 25 percent maximum capacity or 100 people, whichever is fewer.

Overnight Sleepaway Camps

Beginning June 1, overnight sleepaway camps will be allowed to resume with modifications in the Red, Orange, and Yellow tiers.

More information about these updates, and which activities are allowed in various tiers, is here.





UPDATE ON CFAP 2.0

The Biden-Harris administration has suspended the processing of payments under the Coronavirus Food Assistance Program (CFAP) in order to evaluate the program.

The deadline of February 26 has been eliminated, and USDA's Farm Service Agency (FSA) will continue to accept applications during the evaluation period. Interested applications will have at least an additional 30 days for producers to sign up after any decision is announced.

For more information please access the USDA announcement <u>here</u>

CA SUPREME COURT ISSSUES DECISON ON ROUNDING EMPLOYEE MEAL PERIODS

February 25, 2021-CA Supreme Court decided the case of Donohue v. AMN Services, LLC,. This case addressed the validity of an employer's rounding of an hourly employee's time taken for meal periods.

The Court stated, "We hold that employers cannot engage in the practice of rounding time punches — that is, adjusting the hours that an employee has actually worked to the nearest preset time increment — in the meal period context."

If an employee's meal period needs to be rounded up to 30 minutes, then that employee's meal period was not in compliance with the labor code.

To read the full decision, click <u>here</u>.

NEW CENTRAL VALLEY VACCINE INITIATIVES SERVING HARDEST-HIT COUNTIES

February 22, 2021- As California continues to ramp up vaccination efforts statewide, Governor Gavin Newsom announced that the state is partnering with OptumServe and local counties to open up to 11 vaccination sites within the next week to serve some of the hardest-hit or most at-risk communities in the Central Valley, in addition to other steps to bolster vaccination efforts in the region.

The state is also increasing vaccine allocations to the Central Valley by 58 percent above last week, based on recent changes in our state's allocation methodology that better reflect the region's workforce. As soon as Friday, the state is also making available an additional 34,000 doses on a one-time basis to vaccinate food and agricultural workers through the development of OptumServe mobile teams. These doses are in addition to existing county allocations.

For more information on the vaccination process, please visit https://covid19.ca.gov/vaccines/#California-vaccines-dashboard.

CAL/OSHA WEBINARS ON COVID-19 REGULATIONS

The Cal/OSHA Consultation Unit has announced additional webinars on COVID-19 regulations for Employers and supervisors, provided by Cal/OSHA Consultation Services.

The intended audience for this webinar is geared towards:

- Business Owners
- Managers
- Supervisors
- Human Resources Staff
- Environmental, Health and Safety Staff

To register, please visit our COVID-19 <u>Webinar website</u> to view all available dates and to self-register. Attendance is limited to 1000 registered participants per webinar session. A question and answer session will follow after the presentation. Dates and times are listed below:

- Tuesday, February 23 1:00-5:00 pm
- Thursday, February 25 8:00-12:00 pm
- Tuesday, March 2 8:00-12:00 pm
- Thursday, March 4 1:00-5:00 pm
- Wednesday, March 10 8:00-12:00 pm
- Friday, March 12 8:00-12:00 pm

- Tuesday, March 16 1:00-5:00 pm
- Thursday, March 18 8:00-12:00 pm
- Saturday, March 20 8:00-12:00 pm
- Tuesday, March 23 8:00-12:00 pm
- Tuesday, March 30 8:00-12:00 pm





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February 22, 2021- As California continues to ramp up vaccination efforts statewide, Governor Gavin Newsom announced that the state is partnering with OptumServe and local counties to open up to 11 vaccination sites within the next week to serve some of the hardest-hit or most at-risk communities in the Central Valley, in addition to other steps to bolster vaccination efforts in the region.

The state is also increasing vaccine allocations to the Central Valley by 58 percent above last week, based on recent changes in our state's allocation methodology that better reflect the region's workforce. As soon as Friday, the state is also making available an additional 34,000 doses on a one-time basis to vaccinate food and agricultural workers through the development of OptumServe mobile teams. These doses are in addition to existing county allocations.

For more information on the vaccination process, please visit https://covid19.ca.gov/vaccines/#California-vaccines-dashboard .

BLUEPRINT FOR A SAFER ECONOMY UPDATE

February 23, 2021- CDPH announced that five counties moved to a less restrictive tier, from Purple (widespread) to Red (substantial): Humboldt, Marin, San Mateo, Shasta, and Yolo. Marin and Shasta were moved due to the blueprint's Health Equity Metric. One county, Trinity, moved to a more restrictive tier, from Orange (moderate) to Red (substantial).

The February 23rd county tier status is:

- Purple (Widespread) 47 counties
- Red (Substantial) 9 counties
 - o Del Norte, Humboldt, Marin, Mariposa, Plumas, San Mateo, Shasta, Trinity, and Yolo
- Orange (Moderate) 2 counties
 - Alpine and Sierra
- Yellow (Minimal) 0 counties

For more information on a county's status, please visit https://covid19.ca.gov/safer-economy/.





STATE OFFICIALS ANNOUNCE LATEST COVID-19 FACTS

February 9, 2021- The California Department of Public Health (CDPH) released the most recent statistics on COVID-19, including updated data and tiers for reducing COVID-19 in the state under the Blueprint for a Safer Economy.

One county, Del Norte moved to a less restrictive tier, from Purple (widespread) to Red (substantial). Fifty-three counties remain Purple (widespread). Two counties, Del Norte and Mariposa are in the Red (substantial) tier. Three counties, Alpine, Sierra and Trinity, remained in the Orange (moderate) tier.

Statewide COVID-19 Data as of February 9th:

- California has 3,354,591 confirmed cases to date. Numbers may not represent true day-over-day change as reporting of test results can be delayed.
- There were 8,251 newly recorded confirmed cases Monday (2/9/2021).
- The 7-day positivity rate is 4.8% and the 14-day positivity rate is 5.6%.
- There have been 44,583,304 tests conducted in California. This represents an increase of 259,754 during the prior 24-hour reporting period.
- As case numbers continue to rise in California, the total number of individuals who will have serious outcomes will also increase. There have been 44,477 COVID-19 deaths since the start of the pandemic.
- As of February 9, providers have reported administering a total of 4,914,630 vaccine doses statewide. Numbers do not represent true day-to-day change as reporting may be delayed. The CDC reports that 7,385,225 doses have been delivered to entities within the state, and 7,634,975 vaccine doses, which includes the first and second dose, have been shipped.

COVID-19 VACCINE UPDATE

As of February 9, 2021, over 4,900,000 COVID-19 vaccines have been administered to residents of the state of California. Currently, individuals eligible to receive a COVID-19 vaccine include healthcare workers, long-term care residents, individuals 65 and older, as well as employees in the sectors of education and childcare, emergency services, and food and agriculture. The rest of the California population should have access to the COVID-19 vaccine by spring 2021.

For more information on COVID-19 vaccines in California, visit https://covid19.ca.gov/vaccines/.

To sign up for notifications for when you will be eligible to receive a COVID-19 vaccine, click here.

ABILITY TO MODIFY OR CREATE CFAP 2.0 APPLICATION ENDS ON FEBRUARY 26, 2021

USDA'S Farm Service Agency will accept new or modified CFAP applications from eligible producers through February 26, 2021. This assistance is for certain agricultural producers whose operations were directly impacted by the coronavirus pandemic. For more information, visit farmers.gov/cfap.

To make modifications to your CFAP 2.0 application, contact your local Farm Service Agency. <u>Click here to find the number for your local FSA office</u>.





FARMERS ENCOURAGED TO SUBMIT APPLICATIONS FOR FEDERAL CONSERVATION ASSISTANCE

February 1, 2021-All farmers and ranchers interested in conservation are encouraged to submit their applications for the Environmental Quality Incentives program (EQIP) for financial and technical assistance. Administered by the USDA Natural Resources Conservation Service (NRCS), EQIP applications will be screened and ranked on an ongoing basis, with the best projects receiving priority consideration.

Each EQIP application must include a conservation plan, co-developed by the landowner and the NRCS conservationist, spelling out the actions that will be undertaken to improve the natural resource condition being addressed and the timeline for doing so. The second batching period for applications for Fiscal Year 2021 closes on March 3, 2021.

ABILITY TO MODIFY EXISTING CFAP 2.0 APPLICATIONS ENDS ON FEBRUARY 26, 2021

On January 15, 2021 U.S. Secretary of Agriculture Sonny Perdue announced USDA will allow producers to modify existing CFAP 2.0 applications based on updated payment calculations. Producers who already applied for the CFAP 2.0 program and submitted their application by December 11, 2020, may now modify their applications between **January 19 and February 26, 2021**.

The Farm Service Agency (FSA) adjusted the payment calculation to use the producer's eligible 2019 calendar year sales, as well as 2019 crop insurance indemnities. To make modifications to your CFAP 2.0 application, contact your local Farm Service Agency.

Click Here to Find the Number for your local FSA office







REGIONAL STAY AT HOME ORDER LIFTED FOR ALL REGIONS

January 25, 2021-The California Department of Public Health announced that they were lifting the Regional Stay at Home Order statewide. The San Joaquin Valley, Bay Area and Southern California were still under this public health order due to their limited ICU capacity, however 4 week projections show their ICU capacity hitting the threshold allowing the region to exit the order.

Each county will now fall into one of four colored tiers-Purple(Widespread), Red (Substantial), Orange (Moderate), Yellow (Minimal)

Current County Count Per Tier:

- Purple (Widespread): 54 counties
- Red (Substantial): 3 counties-Alpine, Mariposa, Trinity
- Orange (Moderate): 1 county-Sierra

USDA TEMPORARILY SUSPENDS DEBT COLLECTIONS, FORELCOSURES AND OTHER ACTIVITIES ON FARM LOANS DUE TO COVID-19

January 27, 2021-USDA will temporarily suspend non-judicial foreclosures, debt offsets or wage garnishments, and referring foreclosures to the Department of Justice; and USDA will work with the U.S. Attorney's Office to stop judicial foreclosures and evictions on accounts that were previously referred to the Department of Justice.

USDA has also extended deadlines for producers to respond to loan servicing actions, including loan deferral consideration for financially distressed and delinquent borrowers. In addition, for the Guaranteed Loan program, flexibilities have been made available to lenders to assist in servicing their customers.

According to USDA data, more than 12,000 borrowers-approximately 10% of all borrowers-are eligible for the relief announced today.

• For the full Press Release Click Here

CERTIFICATION OF STATEWIDE VACCINE DELIVERY NETWORK

January 26, 2021-Governor Newsom's office released information regarding a new statewide COVID-19 vaccine delivery network. After administering 2.5M vaccines in seven weeks, the state has 3 main changes to the vaccine program based on lessons learned from the 10-Day Vaccine Challenge.

- 1. Simplifying Eligibility: The state will implement a statewide standard under which health care workers, individuals 65+ and education and child care, emergency services and food and agriculture workers will be eligible to start making appointments to receive the vaccine, pending vaccine availability. These are the group identified in Phase 1B, Tier 1.
- 2. Standardizing Information and Data: The state is officially launching My Turn today, a new system for Californians to learn when they are eligible to be vaccinated, a place to make an appointment when eligible and a mechanism to easily track vaccination data. To access My Turn, visit the link https://myturn.ca.gov/.
- 3. Addressing Available Supply by Streamlining Vaccination Process: The state through a Third Party Administrator will allocate vaccines directly to provides to maximize efficiency. The vaccine provider network is expected to include public health systems, pharmacies, health systems, public hospitals, and community health centers.





PRODUCERS MAY NOW MODIFY EXISTING CFAP 2.0 APPLICATIONS

January 15, 2021-U.S. Secretary of Agriculture Sonny Perdue announced USDA will allow producers to modify existing CFAP 2.0 applications based on updated payment calculations. Producers who already applied for the CFAP 2.0 program and submitted their application by December 11, 2020, may now modify their applications between **January 19 and February 26, 2021**.

The Farm Service Agency (FSA) adjusted the payment calculation to use the producer's eligible 2019 calendar year sales, as well as 2019 crop insurance indemnities, To make modifications to your CFAP 2.0 application, contact your local Farm Service Agency.

<u>Click Here to Find the Number for your local FSA office</u>

COVID-19 VACCINE FAQ'S

- 1. Who will pay for the vaccinations?
 - a. Vaccines are being provided free of charge to all participants.
- 2. Can a Phase 1B Essential Worker have their immediate family vaccinated?
 - a. No, the Phase 1B is only for the worker employed in agriculture (not their spouse, children, or other family members)
- 3. How does an ag employee verify their eligibility?
 - a. A paycheck stub, or a letter from an employer verifying they work in the county offering vaccinations and are employed by your farm or agriculture business will suffice.

HOUSING FOR AGRICULTURAL WORKERS WHO HAVE COVID-19

Housing for the Harvest is a program that offers temporary hotel housing to agricultural workers who need to isolate due to COVID-19. It helps positive or exposed workers protect their loved ones and coworkers by giving them a space to self-isolate.

Participants must meet the below criteria to qualify:

- 1. Work in California food processing or agriculture
- 2. Meet FEMA non-congregate sheltering criteria for COVID-19:
 - a. Have tested positive, or
 - b. Been exposed as documented by a public health official or medical health professional
 - c. Be unable to self-isolate at home

How agricultural workers can get a hotel room: contacting the administrator for the specific county

For More Information on This Program Click Here

U.S. DEPARTMENT OF LABOR ISSUES FINAL RULE ON H-2A CHANGES

The Department of Labor has published a final that will modernize the H-2A agricultural worker program. The rule is available online but will be published to the Federal Register at a later date.

Agriculture Secretary Sonny Perdue stated on January 15, 2021 that the rule will streamline the H-2A application process by mandating electronic filing of job orders and applications, and it adds flexibility to cut down on unnecessary burdens on the agricultural employers using the program. That includes the ability to stagger the entry of workers into the county over a 120-day period and allowing employers to file a single application for different dates instead of multiple applications.

Click Here for The Rule







STATE ISSUES RECOMMENDATIONS TO LOCAL HEALTH DEPARTMENTS AND PROVIDERS TO ACCELERATE SAFE VACCINE ADMINISTRATION

On January 7, 2021, the State issued vaccine recommendations focused on accelerating the pace of COVID-19 vaccine administration. The recommendations clarify the vaccine prioritization process stating that health departments and providers may offer doses to lower priority groups when high-priority demand subsides, or when doses are about to expire.

Local health departments have been instructed to allocate doses on the assumption that immunization will be accepted by some but not all who are offered the vaccine, and then continue to offer vaccinations in progressive priority tiers.

Click Here to View Full Vaccine Reccomendations

COVID-19 DATA

The California Department of Public Health announced the most recent statistics on COVID-19, including data on ICU capacity across the state. Based on ICU data, the San Joaquin Valley, Southern California, Greater Sacramento and the Bay Area are to continue the Regional Stay at Home Order.

California has 2,518,611 confirmed cases to date. Numbers may not represent true day-over-day change as reporting of test results can be delayed. There have been 34,760,355 tests conducted in California. There have been 28,045 COVID-19 deaths in California since the start of the pandemic.

Read the Full Regional Stay Home Order Here.



CAL/OSHA REGULATIONS RELATED TO COVID-19 EFFECTIVE JANUARY 1, 2021

AB 685:

AB 685 creates a notice requirement at the workplace if an employee is exposed to COVID-19. The employer must notify exposed employees within one business day of the exposure as well as the employees' rights to sick leave and other COVID-19 related policies. AB 685 will require an

employer, if the employer or representative of the employer is notified of the number of cases that meet the definition of a COVID-19 outbreak, within 48 hours, to report prescribed information to the local public health agency in the jurisdiction of the worksite. AB 685 will require an employer that has an outbreak to continue to give notice to the local health department of any subsequent laboratory-confirmed cases of COVID-19 at the worksite.

For more information on AB 685, see the link below to view a Webinar recording, Sailing Through Uncharted OSHA Waters, hosted by Gallagher Bradford & Barthel. This hour long webinar provides great clarification on AB 685 and how it may differ from other COVID-19 related legislation such as SB 1159.

CLICK HERE TO VIEW WEBINAR RECORDING

GOVENOR NEWSOM INTRODUCES PROPOSED CALIFORNIA BUDGET FOR 2021-2022

On Friday, January 8, 2021, Governor Gavin Newsom presented a proposed \$227 billion budget for the 2021-2022 fiscal year, of which \$164.5 billion is from the General Fund. The Administration's budget has proposed \$4.4 billion related to COVID-19 relief:

- \$2 billion for Testing
- \$473 million for Contract Tracing
- \$372 million for Vaccine roll-out
- Additional funding for state response



USDA ANNOUNCES CONTINUATION OF FARMERS TO FAMILIES FOOD BOX PROGRAM

USDA will purchase an additional \$1.5 billion worth of food for nationwide distribution through the Farmers to Families Food Box Program. In total, USDA has distributed more than 132 million food boxes in support of American farmers and families affected by the COVID-19 pandemic.

"This new round of Farmers to Families Food Boxes will go a long way in helping American families access nutritious and healthy meals as we recover from the COVID-19 pandemic. Thanks to President Trump's leadership, we have helped tons of millions of families and countless farmers with this program" said Secretary Purdue.

Click Here to access the full Press Release.

CALIFORNIA COVID-19 VACCINE PLAN

California has prioritized individuals to receive the vaccine in the following three phases:

- Phase 1A (about 3 million people): Healthcare workers and Long-term care residents
- Phase 1B:
 - 1B Tier One: Individuals 75 and older. Those at risk of exposure at work in the following sectors: education, childcare, emergency services, and food and agriculture.
 - 1B Tier Two: Individuals 65-74 years of age. Those at risk of exposure at work in the following sectors: transportation and logistics; industrial, commercial and residential, and sheltering facilities and services; critical manufacturing. Congregate settings with outbreak risk including the incarcerated and homeless.
- Phase 1C: Individuals 50-64 years of age. People 16-64 years of age and have an underlying healthy condition or disability which increases their risk of severe COVID-19. Those at risk of exposure at work in the following sectors: water and wastewater; defense; energy; chemical and hazardous materials; communications and IT; financial services; government operations/community-based essential functions.



PRESIDENT TRUMP SIGNS COVID RELEF, FEDERAL FUNDING PACKAGE

On Sunday, President Trump signed a year-end spending bill that included \$900 billion in COVID-19 relief, some of which is earmarked for agriculture. This legislation provides \$26 billion in funding to agriculture-related programs, including the following:

- \$1.5 billion to purchase food and agriculture products for distribution, especially fresh produce, dairy, and meat, to those in need.
- \$225 million in supplemental payments to producers of specialty crops if they lost their crop in 2019.
- \$100 million as part of a specialty crop block grant program.
- Additional \$100 million for specialty crop state block grants to mitigate challenges related to COVID at the state level.
- \$100 million for the Local Agriculture Market Program (LAMP), originally established in the 2018 Farm Bill designed to target small and medium sized producers for a broad range of eligible support, to mitigate COVID-19 impacts.
- \$75 million in increased funding for retail SNAP fruit and vegetable incentive projects.
- \$5 million to expand SNAP online purchasing program.
- Additional \$300 billion in funding for a second round of Paycheck Protection Program (PPP) loans, which were used widely by produce companies.

In addition, there are other aspects of the COVID-19 economic stimulus and government funding package that will be helpful for farmers in California:

- Reauthorization of the Water Resources Development Act (WRDA) and authorization of funding for California water projects, including \$206 million for the Friant-Kern Canal, \$13.7 million for Sites Reservoir, and additional funding for the Delta-Mendota Canal and the Del Puerto Canyon Project.
- \$7 billion to expand broadband access, including \$300 million for rural broadband and \$250 million for telehealth, and \$635 million in FY 2021 for USDA's ReConnect broadband program.





CALIFORNIA TO LAUNCH SMALL BUSINESS COVID-19 RELIEF GRANT PROGRAM

The "California Small Business COVD-19 Relief Grant Program" will deliver grants of \$5,000 to \$25,000 for businesses with annual revenues between \$1,000 and \$2.5 million. \$475 million in grant funds are available via a streamlined, online application process. Both businesses (including sole proprietors, home-based businesses, and independent contractors) and nonprofits can qualify for this California grant. The grant award ranges from \$5,000 to \$25,000 based on your operation's annual gross revenue as reported in your most recent (2019 or 2018) federal tax return, as follows:

- Annual Gross Revenue \$5,000 to \$100,000--Grant award \$5,000
- Greater than \$100,000 up to \$1,000,000--Grant award \$15,000
- Greater than \$1,000,000 up to \$2,500,000--Grant award \$25,000

The award is a true grant, not a loan that has to be forgiven. The grant funds are to be used for working capital for your business's operating expenses – e.g., for payroll, rent, business loan payments, COVID-protective measures, etc.

The grant process is being administered for the State of California by an experienced online lender called <u>Lendistry</u>, and it looks like it will be very straightforward to apply and qualify via the online process that has been developed.

The California grant opportunity will be offered in two "Rounds" – with the first Round running from **December 30**, **2020 at 8am to January 8**, **2021 at 11:59pm**. Everyone who applies during a Round will be given equal consideration. What is important is that you apply completely during the time the Round is open, and not the order in which your application is submitted. Awards will be announced shortly after the Round closes, around January 13, and a second final Round will be held probably sometime in February. If you apply in the Round 1 and are not successful, your application will be carried over for consideration in Round 2 without the need to reapply. A business can only receive one grant even though there will be two Rounds.

For more information about this CA Relief Grant, you can visit the California State website explaining the program: <u>California Small Business COVID-19 Relief Grant Program (careliefgrant.com)</u>.

We strongly encourage you to attend one of the daily webinars being put on by California's Small Business Development Center network to explain the program: Webinar Registration - Zoom

PRESIDENT TRUMP SIGNS COVID RELEF, FEDERAL FUNDING PACKAGE

President Donald Trump on Sunday signed a year-end spending bill that included \$900 billion in COVID-19 relief, some of which is earmarked for agriculture. In the coronavirus stimulus bill, \$13 billion, which is about 1.4 percent of the total spending, is allocated for direct assistance to farmers and ranchers.

In the \$13 billion for agriculture, funding will go to:

- \$11.2 billion to the Office of the Agriculture secretary
- \$870 million to supplemental Dairy Margin Coverage program, as well as a dairy donation program
- \$300 million to the Commerce Department to assist fisheries
- \$200 million over 10 years (\$20 million per year) to address gaps in nutrition research
- \$100 million for specialty crop block grant programs
- \$100 million for local agriculture market programs
- \$75 million for farming opportunities training and outreach
- \$75 million for Gus Schumacher nutrition program
- \$60 million for interstate shipment grants
- \$28 million for farm stress programs

Additionally, the \$11.2 billion of direct financial assistance to farmers will be made through a new round of Coronavirus Food Assistance Program (CFAP) payments. The legislation makes two important amendments to the second Coronavirus Food Assistance Program (CFAP 2). First, it allows producers to amend their CFAP 2 applications to include crop insurance payments in their total sales data. Second, it gives CFAP 2 recipients the choice of reporting sales data from 2018 instead of 2019.

This was included to assist growers who experienced severe losses in 2019. However, the option is open to all CFAP 2 recipients. If reporting 2018 data yields a larger payment than 2019, you may resubmit. We will provide additional information on this resubmittal process once it becomes available. Please note: the legislation does not create a CFAP 3 program nor does it change the current rule that sales data must be based on "raw" - not packed or finished - commodities. If you have any questions regarding this new funding package, please do not hesitate to contact our office.

2021 LEGISLATIVE UPDATE

As 2021 approaches, please see below for a brief overview of several new laws that will go into effect in 2021.

Minimum Wage Increases

In 2017, California's minimum wage began a series of increases intended to raise the state minimum wage to \$15 per hour. Effective on January 1, 2021, the state minimum wage will increase to \$13 per hour for employers with 25 or fewer employees, and \$14 per hour for employers with 26 or more employees. It is important to remember that these increases also raise the minimum salary requirement for exempt personnel. Effective January 1, 2021, the minimum salary for exempt employees will increase to \$54,084 per year (or \$4,507 per month) for employers with 25 or fewer employees, and \$58,248 per year (or \$4,854 per month) for employers with 26 or more employees.



Wage Order 14 Overtime Thresholds Decrease

In 2016, AB 1066 set in motion the gradual lowering of the daily and weekly hours of work thresholds for paying overtime to agricultural employees working under Wage Order 14. Effective January 1, 2021, the new overtime threshold for employers with 26 or more employees will be 8 ½ hours per day or 45 hours per week. For employers with 25 or fewer employees, the overtime threshold will remain at 10 hours per day.

AB 685

AB 685 creates a notice requirement at the workplace if an employee is exposed to COVID-19, with "exposed" defined as, "exposure to a person with any of the following": (1) "a positive COVID-19 test," (2) "a COVID-19 diagnosis," (3) "a COVID-19-related order to quarantine" or (4) "a fatality that was caused by COVID-19. The employer must notify exposed employees within one business day of the exposure as well as the employees' rights to sick leave and other COVID-19 related policies. AB 685 will require an employer, if the employer or representative of the employer is notified of the number of cases that meet the definition of a COVID-19 outbreak, within 48 hours, to report prescribed information to the local public health agency in the jurisdiction of the worksite. AB 685 will require an employer that has an outbreak to continue to give notice to the local health department of any subsequent laboratory-confirmed cases of COVID-19 at the worksite.

SB 1383

The California Family Rights Act (CFRA) makes it an unlawful employment practice for an employer with 50 or more employees to refuse to grant a request by an employee to take up to 12 workweeks of unpaid protected leave during any 12-month period to bond with a new child of the employee or to care for themselves, a child, a parent, or spouse. SB 1383 amended the CFRA to make it unlawful for any employer with five or more employees to refuse to grant a request by an employee to take up to 12 workweeks of unpaid protected leave during any 12-month period to bond with a new child of the employee or to care for themselves or a child, parent, grandparent, grandchild, sibling, spouse, or domestic partner. This expansion creates an inconsistency with the federal Family and Medical Leave Act (FMLA), which also provides employees of employers with 50 or more employees with up to 12 weeks of unpaid, job-protected leave per year. This means employees of employers with 50 or more employees could take up to 24 weeks of unpaid, job-protected leave per year.

If you have any questions regarding these new laws slated to take effect in 2021, please do not hesitate to contact our office.





CONGRESS PASSES COVID-19 RELIEF BILL

Yesterday evening, Congress approved \$900 billion in Coronavirus relief, including \$26 billion specified for agriculture and nutrition.

The legislation makes two important amendments to the second Coronavirus Food Assistance Program (CFAP 2). First, it allows producers to amend their CFAP 2 applications to include crop insurance payments in their total sales data. Second, it gives CFAP 2 recipients the choice of reporting sales data from 2018 instead of 2019.

This was included to assist growers who experienced severe losses in 2019. However, the option is open to all CFAP 2 recipients. If reporting 2018 data yields a larger payment than 2019, you may resubmit. We will provide additional information on this resubmittal process once it becomes available. Please note: the legislation does not create a CFAP 3 program nor does it change the current rule that sales data must be based on "raw" - not packed or finished - commodities.

The legislation directs the Secretary of Agriculture to use a minimum of \$1.5 billion for the purchase of food and agricultural products (specifically including produce) and to assist in protecting workers from the Coronavirus. It also provides a 15 percent increase in Supplemental Nutrition Assistance Program (SNAP) benefits for the next six months and \$75 million for the Gus Schumacher Nutrition Incentive Program (GusNIP), which incentivizes fruit and vegetable purchases by SNAP recipients. The legislation also provides an additional \$100 million for specialty crop block grants administered by the State Departments of Agriculture. An additional \$635 million through the end of FY 2022 was allocated to APHIS to cover the funding shortfall in the Agriculture Quarantine Inspection (AQI) program caused by the global COVID pandemic. Further, \$15 million was allocated for the Value-Added Producer Grants Program. This will be added to the \$19 million already available.

Outside of the agriculture title, the relief bill provides additional aid to business, including renewed funding for the Payroll Protection Program (PPP).

Finally, Congress passed a budget for the remainder of fiscal year 2021, averting the threat of government shutdown, and the Centers for Disease Prevention & Control (CDC) recommended that agricultural workers be given priority access to vaccinations along with other frontline workers under Category 1B. Please do not hesitate to reach out if you have any questions regarding this new relief bill.

ESSENTIAL AGRICULTURAL WORKERS NEXT IN LINE FOR COVID-19 VACCINES IN CALIFORNIA

Teachers, agricultural workers, first responders, and grocery and restaurant workers were among those recommended last week to receive the next round of scarce vaccines in California, as were florists and sawmill operators who fall into the same broad category of those deemed essential workers.

The next round of about 8 million doses are expected early next year, and have been allocated on three broad sectors in no particular order:

- 1.4 million education and child care providers, a category that includes preschools, K-12, and higher education including trade schools.
- 1.1 million emergency services providers, including not only police and firefighters but those who provide child and youth services, shelters, social services for the elderly and those with disabilities, the criminal justice system, and businesses that provide goods used by the safety workers.
- 3.4 million food and agriculture workers, from farm to table including those working in food and drinking establishments as well as farmworkers and grocers, bakers and butchers. Plant nurseries, florists and sawmills all fall into that category, as do community food services and pharmacies.

The nearly 6 million in those sectors make up about half of all those deemed essential workers in California — and that roughly 12 million makes up nearly two-thirds of the state's entire workforce. Many eligible workers will get their vaccines at their work sites or through appointments with providers at which their employment can be verified. As more information regarding vaccine distribution and availability becomes available, we will be sure to provide relevant updates to the industry. If you have any questions in the meantime, please do not hesitate to contact our office.





CAL/OSHA EMERGENCY REGULATIONS NOW IN EFFECT

The California Occupational Safety and Health (Cal/OSHA) Standards Board approved an emergency temporary regulation on COVID-19 prevention governing virtually all employers and workplaces in California. This new regulation went into effect on November 30th and will expire in six months unless it is readopted.

The regulation imposes several significant requirements related to testing and return-to-work requirements.

Testing:

- The employer must inform exposed employees that testing is available, the reason for the testing and the possible consequences of a positive test.
- Testing is required when there has been even one positive COVID-19 case in the workplace. In that situation, the employer must offer testing to all employees who have potentially been exposed to COVID-19.
- If three or more COVID-19 cases occur within a 14-day period, employers must test all employees in the exposed workplace and then test them again one week later.
- Employers must continue to test employees who remain in the workplace at least once per week, until there are no new COVID-19 cases detected over a 14-day period.
- If the workplace experiences 20 or more cases in a 30-day period, COVID-19 testing must be provided to all exposed employees twice per week until there are not any new cases detected for a 14-day period.

Return-to- Work Protocol: Following quarantine or isolation due to a positive test, employers must prevent the employee from working until specific requirements are met. Employees who experienced symptoms cannot return to work:

- Until at least 24-hours since employees had a fever of 100.4+ without the use of fever-reducing medications.
- COVID-19 symptoms must have improved.
- It has been at least 10 days since symptoms first appeared.

Employees who have tested positive but did not develop any symptoms:

- The employee must not return to work until a minimum of 10 days have passed since the date of the specimen collection of their first positive COVID-19 test.
- If a public health authority issues the order to isolate or quarantine, the employee shall not return to work until either period of isolation or quarantine is lifted. If no period is specified, then the period shall be 10 days from the time the order to isolate was effective, or 14 days from the time the order to quarantine was effective.
- Employers cannot require a negative COVID-19 test for an employee to return to work.

See below for a variety of additional resources available regarding these emergency regulations:

FAQ's on emergency COVID-19 regulation

A short summary of the regulation

A model of company policy, click here.

Full text of regulation

CA FARMWORKER FOUNDATION OFFERING FREE COVID-19 TESTING FOR FARM EMPLOYEES

The California Farmworker Foundation announced on December 4th that it is now providing FREE COVID-19 testing for farm employees in the Central Valley. CFF has been selected as the first farmworker non-profit organization in the State of California to conduct testing. CFF will be working directly with the California Department of Food and Agriculture and California Department of Public Health to ensure agricultural employees have access to COVID-19 testing at their worksites and within their communities. In the upcoming weeks, CFF will continue to expand its capacity to test farmworkers throughout the Central Valley.

The COVID-19 testing performed by CFF is in the format of self-swab and will have a two to three-day turnaround time for results. The testing services provided by CFF are FREE to farmworkers and agricultural employers. If you are interested in testing your employees or would like more information, please contact CFF COVID-19 testing lead, Daity Tapia at (661) 778-0015.

December 8, 2020



COVID-19 UPDATE



LAST CHANCE TO APPLY! CFAP 2 APPLICATION DEADLINE THIS FRIDAY, DECEMBER 11TH

The deadline for the U.S. Department of Agriculture (USDA) Coronavirus Food Assistance Program 2 (CFAP) program is **December 11th**.

CFAP 2 payments will provide eligible producers with financial assistance that gives them the ability to absorb some of the increased marketing costs associated with the COVID-19 outbreak. USDA has incorporated improvements in CFAP 2 based on stakeholder engagement and public feedback to better meet the needs of impacted farmers and ranchers.

Additional commodities are eligible in CFAP 2 that were not included in the first round of the program. CFAP 2 payments will be made for three categories of payment calculations:

- Sales Commodities, including specialty crops, tobacco, and aquaculture, use a sales-based approach, where producers are paid based on five payment gradations associated with their 2019 sales.
- Price trigger commodities, including row crops, livestock, and dairy, are major commodities that meet a minimum 5-percent price decline from January through July.
- Flat-rate row crops that do not meet the 5-percent price decline trigger or do not have data available to calculate a price change will have payments calculated based on eligible 2020 acres multiplied by \$15 per acre.

Apples have been included in CFAP 2. A complete list of eligible commodities, payment rates and calculations can be found on www.farmers.gov/cfap.

Producers can apply for assistance through USDA's Farm Service Agency (FSA). Customers seeking one- on-one support with the CFAP 2 application process can call 877-508-8364 to speak directly with a USDA employee ready to offer assistance. This is a recommended first step before a producer engages with the team at the FSA county office. More information can be found at

www.farmers.gov/coronavirus. Please notify the CAC office if you plan to or have already applied for the CFAP 2 program so that we can communicate our industry's participation level with local government representative contacts.



REGIONAL STAY AT HOME ORDER IN EFFECT ACROSS CALIFORNIA

The <u>Regional Stay Home Order</u>, announced December 3, 2020, and a supplemental order, signed December 6, 2020, will go into effect at 11:59 PM the day after a region has been announced to have less than 15% ICU availability. In the San Joaquin Valley and Southern California regions, this order went into effect at 11:59 PM on Sunday, December 6, 2020.

Regions

The state released a map of the five regions being measured. When a region first falls below 15% ICU bed availability, the Regional Stay Home Order goes into effect there the next evening at 11:59 PM.

Northern California: Del Norte, Glenn, Humboldt, Lake, Lassen, Mendocino, Modoc, Shasta, Siskiyou, Tehama, Trinity

Bay Area: Alameda, Contra Costa, Marin, Monterey, Napa, San Francisco, San Mateo, Santa Clara, Santa Cruz, Solano, Sonoma

Greater Sacramento: Alpine, Amador, Butte, Colusa, El Dorado, Nevada, Placer, Plumas, Sacramento, Sierra, Sutter, Yolo, Yuba

San Joaquin Valley: Calaveras, Fresno, Kern, Kings, Madera, Mariposa, Merced, San Benito, San Joaquin, Stanislaus, Tulare, Tuolumne

Southern California: Imperial, Inyo, Los Angeles, Mono, Orange, Riverside, San Bernardino, San Diego, San Luis Obispo, Santa Barbara, Ventura

This Order requires many non-essential businesses to close and prohibits private gatherings of any size. It allows access to (and travel for) critical services and allows outdoor activities to preserve Californians' physical and mental health. Businesses permitted to remain open are required to enforce 100% masking and physical distancing. All non-essential travel is temporarily restricted statewide.

Sectors that will be temporarily closed in affected regions include:

- · Indoor and outdoor playgrounds
- Indoor recreational facilities
- Hair salons and barbershops
- Personal care services
- · Museums, zoos and aquariums
- Movie theaters
- Bars, breweries and distilleries
- Wineries
- Family entertainment centers
- Cardrooms and satellite wagering
- Limited services
- Live audience sports
- Amusement parks

The following sectors will have additional modifications in addition to 100% masking and physical distancing:

• Outdoor recreational facilities: Allow outdoor operation only without any food, drink or alcohol sales. Additionally, overnight stays at campgrounds will not be permitted.



- Retail: Allow indoor operation at 20% capacity with entrance metering and no eating or drinking in the stores. Additionally, special hours should be instituted for seniors and others with chronic conditions or compromised immune systems.
- Shopping centers: Allow indoor operation at 20% capacity with entrance metering and no eating or drinking in the stores. Additionally, special hours should be instituted for seniors and others with chronic conditions or compromised immune systems.
- Hotels and lodging: Allow to open for critical infrastructure support only.
- Restaurants: Allow only for take-out, pick-up, or delivery.
- Offices: Allow remote only except for critical infrastructure sectors where remote working is not possible.
- Places of worship and political expression: Allow outdoor services only.
- Entertainment production including professional sports: Allow operation without live audiences. Additionally, testing protocol and "bubbles" are highly encouraged.

The following sectors are allowed to remain open when a remote option is not possible with appropriate infectious disease preventative measures including 100% masking and physical distancing:

- Schools that are already open for in-person learning
- Critical infrastructure
- Non-urgent medical and dental care
- Child care and pre-K

To keep up with the State's response to COVID-19, please visit their website at covid19.ca.gov.

December 1, 2020



COVID-19 UPDATE



IMMEDIATE ASSISTANCE FOR BUSINESSES IMPACTED BY COVID-19 INCLUDING TEMPORARY TAX RELIEF AND \$500 MILLION IN GRANTS

Yesterday afternoon, Governor Gavin Newsom announced additional efforts to provide immediate assistance for California businesses in the midst of the COVID-19 pandemic. Some of these relief efforts, based off recommendations made by the Governor's Task Force on Business and Jobs Recovery, include:

Tax Relief for Businesses Impacted by COVID-19

Earlier this year, Governor Newsom signed an Executive Order allowing taxpayers to apply for penalty and interest relief for 90 days for any taxpayer reporting less than \$1 million in sales on their tax return. Through November 22nd, some 9,287 plans with almost \$149 million in tax relief have taken advantage of this program.

The Governor will direct the California Department of Tax and Fee Administration to do the following:

- Provide an automatic three-month extension for taxpayers filing less than \$1 million in sales tax on the return and extend the availability existing interest and penalty free payment agreements to companies (with up to \$5 million in taxable sales)
- Broaden opportunities for more businesses to enter into interest-free payment arrangements.
- Expand interest-free payment options for larger businesses particularly affected by significant restrictions on operations based on COVID-19 transmissions.

\$500 Million for New COVID Relief Grant for Small Business

The Governor announced the creation of a \$500 million COVID Relief Grant administered by the California Office of the Small Business Advocate (CalOSBA) at the Governor's Office of Business and Economic Development for small businesses that have been impacted by COVID and the health and safety restrictions.

Funds would be awarded to selected intermediaries with established networks of Community Development Financial Institutions to distribute relief through grants of up to \$25,000 to underserved micro and small businesses throughout the state by early 2021. Non-profits would also be eligible for these grants. CalOSBA is establishing the program and will make it available to small businesses as soon as possible - for updates on availability visit here.

Increase Funding for the California Rebuilding Fund by \$12.5 Million

Last week, the Governor announced the opening of the California Rebuilding Fund which makes available \$25 million to help impacted small businesses rebuild from the economic crisis and keep local economies strong. This program is built to be a resource in the market for the next year as businesses pivot and recover.

An increase of \$12.5 million, bringing the total investment to \$37.5 million, would allow the Fund to be fully capitalized. The additional funding will help the 3rd party administrator of the fund raise \$125 million to make more low-interest loans to small businesses with less access to loans from traditional banking institutions.

Today's announcements build on the state's ongoing business support throughout the pandemic, including the Main Street Hiring Tax Credit, which authorizes \$100 million in hiring tax credit for qualified small businesses. The credit is equal to \$1,000 per qualified employee, up to \$100,000 for each small business employer. The application opens today, December 1. A full list of existing state support for businesses can be found here. To view Governor Newsom's press release, click <a href=here.

CFAP 2 APPLICATION DEADLINE APPROACHING

The deadline for the U.S. Department of Agriculture (USDA) Coronavirus Food Assistance Program 2 (CFAP) program is **December 11th**.

CFAP 2 payments will provide eligible producers with financial assistance that gives them the ability to absorb some of the increased marketing costs associated with the COVID-19 outbreak. USDA has incorporated improvements in CFAP 2 based on stakeholder engagement and public feedback to better meet the needs of impacted farmers and ranchers.

Additional commodities are eligible in CFAP 2 that were not included in the first round of the program. CFAP 2 payments will be made for three categories of payment calculations:

- Sales Commodities, including specialty crops, tobacco, and aquaculture, use a sales-based approach, where producers are paid based on five payment gradations associated with their 2019 sales.
- Price trigger commodities, including row crops, livestock, and dairy, are major commodities that meet a minimum 5-percent price decline from January through July.
- Flat-rate row crops that do not meet the 5-percent price decline trigger or do not have data available to calculate a price change will have payments calculated based on eligible 2020 acres multiplied by \$15 per acre.

Apples have been included in CFAP 2. A complete list of eligible commodities, payment rates and calculations can be found on www.farmers.gov/cfap.

Producers can apply for assistance through USDA's Farm Service Agency (FSA). Customers seeking one- on-one support with the CFAP 2 application process can call 877-508-8364 to speak directly with a USDA employee ready to offer assistance. This is a recommended first step before a producer engages with the team at the FSA county office. More information can be found at www.farmers.gov/coronavirus. Please notify the CAC office if you plan to or have already applied for the CFAP 2 program so that we can communicate our industry's participation level with local government representative contacts.



STANDARDS BOARD UNANIMOUSLY ADOPTS EMERGENCY TEMPORARY STANDARDS TO PROTECT WORKERS FROM COVID-19

The Department of Industrial Relations' (DIR) Occupational Safety and Health Standards Board unanimously adopted emergency temporary standards to protect workers from hazards related to COVID-19. The emergency standards will be in effect immediately if approved by the Office of Administrative Law in the next 10 calendar days. The temporary standards apply to most workers in California not covered by Cal/OSHA's Aerosol Transmissible Diseases standard. Under the new regulations, employers must have a written COVID-19 Prevention Plan that addresses the following:

- System for communicating information to employees about COVID-19 prevention procedures, testing, symptoms and illnesses, including a system for employees to report exposures without fear of retaliation.
- Identification and evaluation of hazards screening employees for symptoms, identifying workplace conditions and practices that could result in potential exposure.
- Investigating and responding to cases in the workplace responding immediately to potential
 exposures by following steps to determine who may have been exposed, providing notice within
 one business day about potential exposures, and offering testing to workers who may have been
 exposed.
- Correcting COVID-19 hazards including correcting unsafe conditions and work practices as well as providing effective training and instruction.
- Physical distancing implementing procedures to ensure workers stay at least six feet apart from other people if possible.
- Face coverings providing face coverings and ensuring they are worn.
- Adopting site-specific strategies such as changes to the workplace and work schedules and providing personal protective equipment to reduce exposure to the virus.
- Positive COVID-19 case and illness recording requirements and making the COVID-19 Prevention Plan accessible to employees and employee representatives.
- Removal of COVID-19 exposed workers and COVID-19 positive workers from the workplace with measures to protect pay and benefits.
- Criteria for employees to return to work after recovering from COVID-19.Requirements for testing and notifying public health departments of workplace outbreaks (three or more cases in a workplace in a 14-day period) and major outbreaks (20 or more cases within a 30-day period). Specific requirements for infection prevention in employer-provided housing and transportation to and from work.

The Standards Board will file the rulemaking package today with the Office of Administrative Law, which has 10 calendar days to review and approve the temporary workplace safety standards enforced by Cal/OSHA. Once approved and published, the full text of the adopted emergency standards will appear in the new Title 8 sections 3205 (COVID-19 Prevention), 3205.1 (Multiple COVID-19 Infections and COVID-19 Outbreaks), 3205.2 (Major COVID-19 Outbreaks) 3205.3 (COVID-19 Prevention in Employer-Provided Housing) and 3205.4 (COVID-19 Prevention in Employer-Provided Transportation to and from Work) of the California Code of Regulations. Pursuant to the state's emergency rulemaking process, after an initial effective period the board will have two opportunities to readopt the temporary standards.

Cal/OSHA will expeditiously convene a stakeholder meeting that will include industry and labor representatives to review the requirements of the emergency regulation and solicit feedback and recommend updates. The Occupational Safety and Health Standards Board, a seven-member body appointed by the Governor, is the standards-setting agency within the Cal/OSHA program. The Standards Board's objective is to adopt reasonable and enforceable standards at least as effective as federal standards. The Standards Board also has the responsibility to grant or deny applications for variances from adopted standards and respond to petitions for new or revised standards. The new Cal/OSHA standards are expected to go into effect by the end of the month. For more information, please visit: https://www.dir.ca.gov/oshsb/COVID-19-Prevention-Emergency.html







CALIFORNIA ISSUES LIMITED STAY AT HOME ORDER

Late last week, Governor Gavin Newsom and the California Department of Public Health (CDPH) announced a <u>Limited Stay At Home Order</u> requiring that non-essential work, movement and gatherings stop between the hours of 10 p.m. and 5 a.m. in counties that are in the purple tier. The order will take effect at 10 p.m. on Saturday, November 21st and remain until 5 a.m. on Monday, December 21st.

Agriculture is deemed an essential business however, employers should be prepared to ensure that employees who may be working during night shifts have documentation on-hand as they did when COVID-19 first began.

Please feel free to use this <u>sample letter</u> as a template for your essential agricultural employees.

If you have any issues or concerns, please do not hesitate to contact the Commission office. Thank you!

OGCC WORKS TO ADDRESS RECENT PORT ISSUES

The Commission has recently been informed of some challenges agricultural exporters are currently facing at the ports, particularly concerning lack of container equipment and delayed and/or cancelled appointments.

It seems as though a surge in Asian imports bound for U.S. retailers stocking up for the holiday season is leading to a shortage of shipping capacity for U.S. exporters. This is especially true for agricultural producers who are now struggling to find containers to send products to overseas buyers.

The Commission has engaged with other agricultural coalitions across the nation to remain up to date on this ongoing issue and develop potential solutions moving forward. If you or someone you know has been impacted by these ongoing port issues, please communicate with the Commission as to how we can best be of service to address your specific challenges. Thank you, and please do not he sitate to reach out with any questions as well.





40 OF 58 CALIFORNIA COUNTIES MOVED BACK IN STATE'S REOPENING TIER SYSTEM

As coronavirus cases spiral in California, 40 of the state's 58 counties are being moved backward in the tiered reopening system. Some are even being moved back two tiers. The state typically announces new tier assignments on Tuesdays, but as the virus spreads rampantly once again, the Department of Public Health is changing its policy. "Tier assignments may occur any day of the week and may occur more than once a week," the department says.

Here are the latest tier changes:

Orange to Purple: Alameda, Butte, El Dorado, Napa, Nevada, Santa Clara, Siskiyou, Trinity, Tuolumne

Orange to Red: Colusa, Del Norte, Marin, Modoc, Mono, Plumas, San Mateo

Yellow to Orange: Calaveras, Sierra Yellow to Red: Humboldt, San Francisco

Red to Purple: Contra Costa, Fresno, Glenn, Kern, Kings, Mendocino, Merced, Orange, Placer, San Benito, San Joaquin, San Luis Obispo, Santa Barbara, Santa Cruz, Solano, Stanislaus, Sutter, Ventura,

Yolo, Yuba



ASEAN, CHINA, OTHER PARTNERS SIGN WORLD'S BIGGEST TRADE PACT

On Sunday, November 15, 2020, China and 14 other countries agreed to set up the world's largest trading bloc, encompassing nearly a third of all economic activity, in a deal many in Asia are hoping will help hasten a recovery from the shocks of the pandemic. The Regional Comprehensive Economic Partnership, or RCEP, was signed virtually on Sunday on the sidelines of the annual summit of the 10-nation Association of Southeast Asian Nations.

The accord will take already low tariffs on trade between member countries still lower, over time, and is less comprehensive than an 11-nation trans-Pacific trade deal. Apart from the 10 ASEAN members (Cambodia, Indonesia, Laos, Myanmar, the Philippines, Thailand, Brunei, Singapore, Malaysia and Vietnam), it includes China, Japan, South Korea, Australia and New Zealand, but not the United States. Officials said the accord leaves the door open for India, which dropped out due to fierce domestic opposition to its market-opening requirements, to rejoin the bloc.

It will take time to fully assess exact details of the agreement encompassing tariff schedules and rules for all 15 countries involved — the tariffs schedule just for Japan is 1,334 pages long.

The RCEP agreement is loose enough to stretch to fit the disparate needs of member countries as diverse as Myanmar, Singapore, Vietnam and Australia. Unlike the CPTPP and EU, it does not establish unified standards on labor and the environment or commit countries to open services and other vulnerable areas of their economies, but it does set rules for trade that will facilitate investment and other business within the region. For more information regarding this trade agreement, please contact the Commission office.





FEDERAL FARM ASSISTANCE AVAILABLE TO FARMERS WITH WILDFIRE DAMAGE

In October 2020, the federal government amended its major disaster declaration (FEMA-4558-DR) for California due to wildfires that occurred August 14 – September 26, 2020. As a result, the U.S. Department of Agriculture Farm Service Agency's (FSA) Emergency Loan Program has been made available to farmers in Fresno, Kern, Kings, and Tulare counties who suffered physical and crop production losses as a direct result of the wildfire disasters. The maximum loan assistance is \$500,000. The deadline to apply is June 15, 2021.

If you are interested in applying, please contact your local FSA office.

PROPOSITION 15 DEFEATED IN 2020 ELECTION

As of Nov. 11, Proposition 15 trailed 51.8% to 48.2%, a difference of 562,488 votes, according to the California Secretary of State's office. The Associated Press projected the measure's defeat late Nov. 10, judging that the remaining ballots were unlikely to alter the outcome. Nearly 1.5 million ballots, most of them mailed in, remained to be counted as of Nov. 10, according to the secretary of state.

Proposition 15 would have modified California's landmark 1978 property-tax measure, Proposition 13, by reassessing commercial and industrial property at current market value every three years. Residential property would continue to be reassessed only when sold or when improvements are made. Although Proposition 15 included an exemption for agricultural land, any fixtures or improvements on that land—such as barns, fruit and nut trees, milking parlors, irrigation systems, processing plants and the like—would have been subject to higher taxes.

The defeat of Prop 15 is a significant victory not only for our industry but for the entire California agricultural community, both present and future. If you have any questions regarding Prop 15, please do not hesitate to contact our office.







DEPARTMENT OF LABOR ANNOUNCES FINAL RULE REFORMING AEWR CALCULATION

Yesterday, the U.S. Departments of Agriculture (USDA) and Labor (DOL) announced a final rule updating the methodology for calculating the wage rate in the H-2A program. For nearly all H-2A jobs including harvest workers, the Adverse Effect Wage Rate (AEWR) will be frozen at the 2020 level for 2021 and 2022.

Beginning in 2023, DOL will adjust these AEWRs by the percentage change in the Bureau of Labor Statistics' Employment Cost Index (ECI) for wages and salaries for the preceding 12-month period. This should provide some relief for the apple industry as average increases to the ECI from 2015 to 2019 averaged 2.54% compared to the Labor Survey which increased by 4.48%. Going forward all states will increase by the same percentage year over year but state and regional variations in wage rates will remain based on the 2020 rates.

This announcement was expected as USDA recently announced it would discontinue the Farm Labor Survey. The rule is scheduled to go into effect at the end of the year though it could be challenged in court or rescinded by a future Administration.

The DOL intends to issue a second final rule to finalize the remainder of the July 29, 2019 proposed rule that will govern other aspects of the certification of agricultural labor or services performed by H-2A workers, and enforcement of the contractual obligations applicable to employers of such nonimmigrant workers. If you have any questions regarding this rule, please do not hesitate to contact the Commission office.

RESOURCE FOR EMPLOYER GUIDANCE ON AB 685

AB 685 (Chapter 84, Statutes of 2020) is a new California law that requires employers to notify employees who may have been exposed to COVID-19 and to report workplace outbreaks of COVID-19 to the local health department.

In its requirements for employers, AB 685 refers to terms "as defined by the California Department of Public Health (CDPH)." CDPH definitions for these terms are below. CDPH also uses these terms in other contexts; the definitions here are intended for employer use in relation to AB 685.

COVID-19 outbreak:

- A COVID-19 outbreak in a non-healthcare workplace is defined as at least three COVID-19 cases among workers at the same worksite within a 14-day period.
- Under AB 685, a COVID-19 case is someone who:
 - Has a positive viral test for COVID-19,
 - Is diagnosed with COVID-19 by a licensed health care provider,
 - Is ordered to isolate for COVID-19 by a public health official, OR
 - Dies due to COVID-19, as determined by a public health department.
- Under AB 685 Section 4 (Labor Code Section 6409.6, subsection (a)(4(b)), if an employer or their representative is notified of the number of cases meeting the definition of a COVID-19 outbreak, they must notify the local public health agency in the jurisdiction where the worksite is located.
- Non-healthcare employers must therefore report to the local public health agency when three or more workers with COVID-19 are identified within a 14-day period.
- Health facilities, who are exempt from AB 685's mandate to report outbreaks to local health departments, should follow <u>CDPH reporting guidance for healthcare facilities</u>.

Infectious period:

- For an individual who develops symptoms, the infectious period for COVID-19 begins 2 days before they first develop symptoms. The infectious period ends when the following criteria are met: 10 days have passed since symptoms first appeared, AND at least 24 hours have passed with no fever (without use of fever-reducing medications), AND other symptoms have improved.
- For an individual who tests positive but never develops symptoms, the infectious period for COVID-19 begins 2 days before the specimen for their first positive COVID-19 test was collected. The infectious period ends 10 days after the specimen for their first positive COVID-19 test was collected.
- Under AB 685 Section 4 (Labor Code Section 6409.6, subsection 1), employers must provide notice to all employees who were present at the same worksite as someone with COVID-19 during their infectious period.

Laboratory-confirmed case of COVID-19:

• A laboratory-confirmed case of COVID-19 is defined as a positive result on any viral test for COVID-19.

Please see CDPH's Employer Questions about AB 685 web page for additional information about AB 685 requirements.

Additionally, on behalf of the California Fresh Fruit Association, please click <u>HERE</u> to view an additional resource outlining steps for implementing policy to comply with AB 685. Please do not hesitate to reach out with any questions.







USDA ANNOUNCES FOURTH ROUND OF FARMERS TO FAMILIES PROGRAM

As part of the Coronavirus Food Assistance Program Secretary Perdue announced on April 17, USDA is exercising authority under the Families First Coronavirus Response Act to purchase and distribute agricultural products to those in need. Through this program, USDA's Agricultural Marketing Service (AMS) is partnering with national, regional and local distributors, whose workforces have been significantly impacted by the closure of restaurants, hotels and other food service businesses, to purchase up to \$4 billion in fresh produce, dairy and meat products from American producers of all sizes. The program will supply food boxes of fresh fruits and vegetables, dairy products, meat products and a combination box of fresh produce, dairy or meat products. Distributors will package these products into family-sized boxes, then transport them to food banks, community and faith-based organizations, and other non-profits serving Americans in need.

Last week, USDA announced <u>Round 4</u> of the Farmers to Family program, allocating an additional \$500 million to the program through December 31st. The new solicitation will be available to current <u>Basic Ordering Agreement (BOA) holders</u> to distribute combination boxes to those in need. USDA is expected to award contracts by October 30th with deliveries to occur shortly thereafter.

To date, the Farmers to Families program has delivered nearly 110 million boxes of domestic fresh fruits and vegetables, dairy, and meat to food banks and nonprofits. More information can be found on USDA's website **here.**

USDA BEGINS ALLOCATIONS OF CFAP 2 FUNDING

To date, the U.S. Department of Agriculture (USDA) Farm Service Agency (FSA) has approved more than \$7 billion in payments to US agricultural producers in the second round of the Coronavirus Food Assistance Program (CFAP 2). In total, the USDA is making available up to \$14 billion for US crop and livestock producers who continue to face market disruptions and associated costs because of COVID-19.

Thus far, the FSA has approved more than 443,000 applications since CFAP 2 enrollment began on September 21. The U.S. states seeing the most in payments are Iowa, Nebraska, Minnesota, Illinois, and Kansas. Applications for CFAP 2 are available through December 11, 2020.

CFAP 2 application are available on the FSA website **HERE**.

If you plan to or have already applied for the CFAP 2 funding, please notify the CAC office so that we may report back to USDA our industry's participation in the program. If you have any further questions regarding this information, please do not hesitate to contact the CAC office.

October 21, 2020



COVID-19 UPDATE



CFAP 2 APPLICATION REMINDER

As you may recall, the U.S. Department of Agriculture (USDA) announced last month that it is implementing the Coronavirus Food Assistance Program 2 (CFAP) for agricultural producers who continue to face market disruptions and associated costs because of COVID-19. Producers can begin to apply for CFAP 2 on September 21st through December 11th.

CFAP 2 payments will provide eligible producers with financial assistance that gives them the ability to absorb some of the increased marketing costs associated with the COVID-19 outbreak. USDA has incorporated improvements in CFAP 2 based on stakeholder engagement and public feedback to better meet the needs of impacted farmers and ranchers.

Additional commodities are eligible in CFAP 2 that were not included in the first round of the program. CFAP 2 payments will be made for three categories of payment calculations:

Sales Commodities, including specialty crops, tobacco, and aquaculture, use a sales-based approach, where producers are paid based on five payment gradations associated with their 2019 sales.

Price trigger commodities, including row crops, livestock, and dairy, are major commodities that meet a minimum 5-percent price decline from January through July.

Flat-rate row crops that do not meet the 5-percent price decline trigger or do not have data available to calculate a price change will have payments calculated based on eligible 2020 acres multiplied by \$15 per acre.

The CAC would like to remind the industry that apples have been included in CFAP 2. A complete list of eligible commodities, payment rates and calculations can be found on www.farmers.gov/cfap.

Producers can apply for assistance through USDA's Farm Service Agency (FSA). Customers seeking one- on-one support with the CFAP 2 application process can call 877-508-8364 to speak directly with a USDA employee ready to offer assistance. This is a recommended first step before a producer engages with the team at the FSA county office. More information can be found at www.farmers.gov/coronavirus.



If you plan to or have already applied for the CFAP 2 funding, please notify the CAC office so that we may report back to USDA our industry's participation in the program. If you have any further questions regarding this information, please do not hesitate to contact the Commission office.

UFW FILES LAWSUIT AGAINST USDA OVER FARM LABOR DATA COLLECTION SURVEY SUSPENSION

Last week, the United Farm Workers union (UFW) filed a <u>lawsuit</u> to reverse an <u>order</u> from the United States Department of Agriculture Secretary Sonny Perdue, filed on September 30, 2020, to cease the government's collection of farm worker data that is typically used to used to calculate the U.S. Department of Labor's Adverse Effect Wage Rates, a minimum wage that must be paid to guest farmworkers under the H-2A temporary agricultural workers program.

In its Sept. 30 decision, the USDA said it found other data sources can be used to replace the information collected in the biannual survey. It lists six other potential sources: the Agricultural Resources Management Survey, Census of Agriculture, American Community Survey, Quarterly Census of Employment and Wages, National Economic Accounts, and the National Agricultural Workers Survey. The USDA said its National Agricultural Statistics Service would not be collecting farmworker wage data in October or publishing a report in November as previously planned.

In its 26-page lawsuit, United Farm Workers — the largest agricultural union in the U.S. — claims the USDA failed to provide an adequate justification, consider all issues relevant to its decision or provide notice and an opportunity for public comment as required by the Administrative Procedure Act.





SBA & TREASURY ANNOUNCE SIMPLER PPP FORGIVENESS LOANS

Last week, The U.S. Small Business Administration, in consultation with the Treasury Department, released a simpler loan forgiveness application for Paycheck Protection Program (PPP) loans of \$50,000 or less. This action streamlines the PPP forgiveness process to provide financial and administrative relief to America's smallest businesses while also ensuring sound stewardship of taxpayer dollars.

SBA and Treasury have also eased the burden on PPP lenders, allowing lenders to process forgiveness applications more swiftly. SBA began approving PPP forgiveness applications and remitting forgiveness payments to PPP lenders for PPP borrowers on October 2, 2020. SBA will continue to process all PPP forgiveness applications in an expeditious manner.

Click **here** to view the simpler loan forgiveness application.

Click here to view the instructions for completing the simpler loan forgiveness application.

Click <u>here</u> to view the Interim Final Rule on the simpler forgiveness process for loans of \$50,000 or less.

TEN CALIFORNIA COUNTIES CHANGE TO NEW COVID REOPENING TIERS

As you are likely aware, Governor Newsom announced a new color coded tier system to determine which counties can move forward with reopening businesses. There are four tiers: yellow, orange, red and purple. Yellow indicates minimal COVID-19 spread and allows for nearly all businesses to reopen indoor operations (as long as physical distancing and face-covering requirements are in place). Purple means there is widespread COVID-19 transmission in the county and nearly all businesses have to keep indoor operations closed or severely limited.

Earlier this week, Ten California counties were moved to a different reopening tiers on Tuesday. Colusa, Kern, Kings, San Benito, Stanislaus and Sutter counties were moved from "purple" to "red." Alameda, Placer and Santa Clara counties were moved from "red" to "orange." Sierra County was moved into the least restrictive tier, "yellow." See what that means for each county's ability to reopen below. Please do not hesitate to reach out with any questions.







CALIFORNIA COUNTY REOPENING CLASSIFICATIONS

As you are likely aware, Governor Gavin Newsom's reopening plan classifies counties in one of four tiers, to determine when and how businesses reopen. The state now classifies counties by a color-coded, four tier system of coronavirus risk, based rates of new cases and positive coronavirus testing, in each of the state's 58 counties. The tiers determine how much of each county's economy can reopen. As of Oct. 7, 18 counties are at the highest level of restriction for widespread COVID-19 risk. For more information regarding this county classification system, please click **HERE**.



CAC WEBSITE TO INCLUDE COVID-19 RESOURCE SECTION

In an effort to provide all necessary resources to our industry, the CAC is currently constructing a COVID-19 Resource Page that will be added to the website. Our goal is to provide a platform for industry to access important announcements and information related to the ongoing pandemic. Our weekly COVID-19 updates will also be included on this portion of our website. The page is expected to go live this month, and the CAC will be sure to update the industry when it is available. Please do not hesitate to contact the CAC office with any questions.

CALIFORNIA LEGISLATURE UPDATE

The California State Legislature adjourned the second year of the 2019-2020 Legislative Session at 1:30 a.m. on Tuesday, September 1, 2020. Below are a list of bills involving COVID-19 that were dealt with during the second year of Session, which began January 6, 2020. Legislation that passed out of the Assembly and Senate were sent to the Governor. The Governor had until midnight September 30, 2020 to sign or veto legislation presented to him. Please do not hesitate to contact our office with any questions regarding these pieces of Legislation.

AB 196 (Gonzalez)

Summary: AB 196 would create a conclusive presumption of work-relatedness for COVID-19 infections of every "Essential Critical Infrastructure Worker", resulting in workers' compensation coverage in cases of infection that occur inside and outside the workplace.

Outcome: The bill was not brought up for a vote, so failed passage.

AB 685 (Reyes)

Summary: AB 685 creates a notice requirement at the workplace if an employee is exposed to COVID-19, with "exposed" defined as, "exposure to a person with any of the following": (1) "a positive COVID-19 test," (2) "a COVID-19 diagnosis," (3) "a COVID-19-related order to quarantine" or (4) "a fatality that was caused by COVID-19. The employer must notify exposed employees within one business day of the exposure as well as the employees' rights to sick leave and other COVID-19 related policies. The bill would require an employer, if the employer or representative of the employer is notified of the number of cases that meet the definition of a COVID-19 outbreak, within 48 hours, to report prescribed information to the local public health agency in the jurisdiction of the worksite. The bill would require an employer that has an outbreak to continue to give notice to the local health department of any subsequent laboratory-confirmed cases of COVID-19 at the worksite. Outcome: The bill passed the Assembly 52-17 and the Senate 26-9. The Governor signed AB 685 on September 17, 2020 and it will go into effect January 1, 2021.

AB 2043 (R. Rivas)

Summary: AB 2043 will require CalOSHA to disseminate information on best practices for COVID-19 infection prevention and employee protections.

Outcome: AB 2043 was passed out of the Assembly 67-0 and the Senate 33-0. The Governor signed AB 2043 on September 28, 2020 and it will go into effect on January 1, 2021.

SB 729 (Portantino)

Summary: SB 729 would prohibit an employee from recovering civil penalties from an employer under the Private Attorney General Act (PAGA) for violations of provisions requiring the employer to provide meal and rest breaks, if the employee engaged in remote work.

Outcome: The bill failed in Assembly Labor Committee.



SB 1159 (Hill)

Summary: SB 1159 would define "injury" for an employee to include illness or death resulting from COVID-19 under specified circumstances, until January 1, 2023. The bill would create a disputable presumption that the injury arose out of and in the course of the employment and is compensable if there is an outbreak at a worksite. The bill would require an employee to exhaust their paid sick leave benefits and meet specified certification requirements before receiving any temporary disability benefits. The bill would also make a claim relating to a COVID-19 illness presumptively compensable, as described above, after 30 days or 45 days, rather than 90 days.

Outcome: SB 1159 passed the Assembly 69-4 and the Assembly 30-8. The Governor signed SB 1159 on September 17, 2020 and it went into effect immediately.





CFAP 2.0 FACT SHEET

As you are likely aware, the U.S Department of Food and Agriculture (USDA) has announced a second round of available funding of the Coronavirus Food Assistance Program (CFAP) for agricultural producers who continue to face market disruptions and associated costs because of COVID-19. Please see below for additional information on the CFAP 2.0 application process. Additionally, USDA has also released a fact sheet which can be found **HERE**.

When to file:

September 21, 2020 – December 11, 2020

What to file:

- 1. CFAP 2 application: AD-3117
 - *If you did not participate in CFAP 1 or are not an existing customer with FSA, the additional forms below may be needed:
- CCC-901: Identifies members of a farm or ranch that is a legal entity.
- CCC-941: Reports your average adjusted gross income for programs where income restrictions apply.
- <u>ccc-942</u>: If applicable this certification reports income from farming, ranching, or forestryrelated activities for those exceeding the adjusted gross income limitation.
- 4. AD-1026: Ensures compliance with highly erodible land conservation and wetland conservation.
- 5. AD-2047: Provides basic customer contact information.
- <u>SF-3881</u>: Collects your banking information to allow USDA to make payments to you via direct deposit.

How to file:

- Online: To complete online, first establish an eAuthentication account here. Producers with an eAuthentication account can apply for CFAP 2 via the CFAP 2 Application Portal. For instructions on how to use the portal access the CFAP 2 Application Portal User Guide.
- Manually: You can work directly with your local Farm Service Agency to fill out your necessary forms. Access the <u>Instruction guide</u> for help on filling out AD-3117.

Help with filing:

- Contact your local Farm Service Agency to establish an appointment to receive help with your
 application. Call 877-508-8364 to speak directly with a USDA employee for assistance.
- For more information on CFAP 2 for Specialty Crop Producers: https://www.farmers.gov/cfap/specialty

Payment Rate for Apples:

- Apples are eligible to receive funding under the Sales Commodity category. Payments will be
 calculated by multiplying the amount of the producer's sales in the 2019 calendar year by the
 payment rate for that range.
- *IMPORTANT NOTE: Eligible sales only include sales of raw commodities grown by the producer.
 The portion of sales derived from adding value to the commodity, such as processing and



packaging, and from sales of products purchased for resale, is not included in the payment calculation.

2019 Sales Range	Percent Payment Factor for the Producer's 2019 Sales of Eligible Commodities Falling in the Range
\$0 to \$49,999	10.6%
\$50,000 to \$99,999	9.9%
\$100,000 to \$499,999	9.7%
\$500,000 to \$999,999	9.0%
Sales over \$1 million	8.8%

Example: A producer's 2019 sales of eligible commodities totaled \$75,000. The payment is
calculated as (\$49,999 times 10.6%) plus (\$25,001 times 9.9%) equals a total payment of \$7,775.

Eligibility Requirements:

A person or legal entity must have an average adjusted gross income of less than \$900,000 for
tax years 2016, 2017, and 2018. However, if 75% of their adjusted gross income comes from
farming, ranching, or forestry-related activities, the AGI limit of \$900,000 does not apply and the
person or legal entity is eligible to receive CFAP 2 payments up to the application payment
limitation.

Payment Limitations:

- CFAP 2 payments are subject to a per person and legal entity payment limitation of \$250,000.
- Payment Limitations for Corporations, Limited Liability Companies, Limited Partnerships, Trusts, and Estates:
 - o Legal entities with 1 member: payment limit is \$250,000.
 - Legal entities with 2 members: payment limit is \$500,000 if at least two members contribute at least 400 hours of active personal labor or active personal management, or a combination thereof, with respect to the operation of the corporate entity.
 - Legal entities with 3 members: payment limit is \$750,000 if at least three members contribute at least 400 hours of active personal labor or active personal management, or a combination thereof, with respect to the operation of the corporate entity.

Link to Frequently Asked Questions:

https://www.farmers.gov/cfap/faq

GOVERNOR NEWSOM ANNOUNCES MAJOR CLIMATE INITIATIVE

Last week, Governor Gavin Newsom signed an Executive Order announcing California's plan to eliminate the sale of the internal combustion engine by 2035. This Order comes as an effort to keep the State on track with its goal to be carbon-free by 2045. During his press conference, the Governor cited transportation as the number one sector contributing to over 50% of the State's greenhouse gas emissions, however assured Californians that they would be able to keep their internal combustion engine cars, and the used car sales market will continue to include these engines. The press release states:

"Following the order, the California Air Resources Board will develop regulations to mandate that 100 percent of in-state sales of new passenger cars and trucks are zero-emission by 2035 – a target which would achieve more than a 35 percent reduction in greenhouse gas emissions and an 80 percent improvement in oxides of nitrogen emissions from cars statewide. In addition, the Air Resources Board will develop regulations to mandate that all operations of medium- and heavy-duty vehicles shall be 100 percent zero emission by 2045 where feasible, with the mandate going into effect by 2035 for drayage trucks."



Additionally, the Order sets forth the goal "that 100 percent of medium- and heavy-duty vehicles in the State be zero-emission by 2045 for all operations where feasible and by 2035 for drayage trucks. It shall be further a goal of the State to transition to 100 percent zero-emission off-road vehicles and equipment by 2035 where feasible."

The Air Resources Board will be given authority to propose regulations consistent with getting California to its target of 100 percent zero-emission vehicles sold in the State, including passenger vehicles and trucks, and medium- and heavy-duty vehicles. They are also given the authority to work with other State agencies, U.S. Environmental Protections Agency and local air districts to propose strategies for California to accomplish its goal of 100 percent zero-emission from off-road vehicles and equipment operations in the State by 2035.

Governor Newsom closed his press conference stating that California is just getting started as leaders in the fight against climate change.

The Commission is working closely with Kahn, Soares, and Conway and their partners in the business community to remain up to date on the Governor's announcement and Executive Order.

SUPPLEMENTAL COVID-19 PAID SICK LEAVE (AB 1867) FACT SHEET

As you may recall, on September 9, 2020, California Governor Gavin Newsom signed AB 1867 into law. The provisions are effective immediately, and require all private businesses with 500 or more employees nationwide (as well as certain health care providers and emergency responders) to provide their California employees with COVID-19 related supplemental paid sick leave no later than September 19, 2020.

The bill was intended to close the gaps between federally mandated paid COVID19 related sick days and the Governor's previous Executive Order that only provided paid sick leave for "food sector" workers. The new law implicates all private employers in California with over 500 employees, as well as public and private employers of first responders and health care employees who opted not to provide leave under the federal law.

Please click <u>HERE</u> to access a fact sheet on AB 1867 provided by the CA Fresh Fruit Association. Feel free to reach out to the Commission office with any questions.

September 22, 2020



COVID-19 UPDATE



CDFA ANNOUNCES HOUSING FOR THE HARVEST PROGRAM IN KINGS, TULARE AND RIVERSIDE COUNTIES

The California Department of Food and Agriculture (CDFA) announced on September 16th that the counties of Kings, Riverside and Tulare will participate in Housing for the Harvest, a program to provide temporary hotel housing and benefits to farm and food processing employees who are unable to work due COVID-19.

The state is securing hotel rooms in participating counties, with local governments identifying administrators to manage the program and local community organizations to provide additional services, like meals, wellness checks and in-language assistance.

Kings County

Kings County has partnered with Kings Community Action Organization (KCAO) to administer Housing for the Harvest as part of Kings Cares. In addition to hotel quarantine support such as transportation, meals, wellness checks and laundry service.

Farm employees in Kings County who are in need of these services are urged to visit www.thehealthyharvest.org or call 559-710-2000. For agricultural business on-site testing scheduling, please visit www.thehealthyharvest.org. Click here for additional information.

Riverside County

The Riverside County program will include meals, food, transportation, and direct financial assistance for each family participating in the program.

Farm or food processing workers in Riverside County who are in need of these services are urged to contact the TODEC Legal Center at 888-863-3291 or via email at campo@todec.org. Click here for more information.

Tulare County

Tulare County's program will be administered by Proteus, Inc. in coordination with the county's Community Care Coalition. The Central Valley Community Foundation has formed a regional Healthy Harvest program and will provide additional funding for support services and outreach. Farm employees in Tulare County who are in need of these services are urged to visit www.thehealthyharvest.org or www.cosechasana.org or call 559-710-2000. For agricultural business on-site testing scheduling, please visit www.thehealthyharvest.org. Click here for more information.

For more information on Housing for the Harvest, please click <u>here</u>.

USDA TO HOST CORONAVIRUS FOOD ASSISTANCE PROGRAM 2.0 PRODUCER WEBINAR

Join the U.S. Department of Agriculture Farm Service Agency as they introduce a NEW round of the Coronavirus Food Assistance Program (CFAP 2). CFAP 2 provides direct support for producers who have been impacted by the COVID-19 pandemic since April 2020. The webinar will feature information regarding the expanded eligibility for certain commodities, new payment categories including a sales-based approach to specialty crops and other specific commodities, and information on how to apply. Producers can apply for CFAP 2 between September 21, 2020 through December 11, 2020. Producers can find more information at https://www.farmers.gov. Webinar information is listed below:

When: Thursday, September 24th

Time: 12:00 PM PST To register, click **HERE**.

USDA ANNOUNCES CONTRACTS FOR ROUND 3 OF THE FARMERS TO FAMILIES FOOD BOX PROGRAM

Following President Donald Trump's approval to include up to an additional \$1 billion in the Farmers to Families Food Box Program, U.S. Secretary of Agriculture Sonny Perdue announced the U.S. Department of Agriculture (USDA) has approved up to \$1 billion in contracts to support American producers and communities in need through the USDA Farmers to Families Food Box Program. Early last week, USDA reached a milestone of having distributed more than 90 million food boxes in support of American farmers and families affected by the COVID-19 pandemic.

These contract awards are a result of the third round of Farmers to Families Food Box program announced on July 24, 2020, and President Trump's announcement on August 24 that up to an additional \$1 billion was being made available for deliveries through October 31, 2020. A full list of approved suppliers will be posted on the Farmers to Families Food Box Program webpage after 5 p.m. ET, Thursday, Sept. 17, 2020. For more information, please click **HERE**.





GOVERNOR NEWSOM SIGNS BILL EXTENDING PAID SICK LEAVE FOR CALIFORNIA EMPLOYEES

On September 9, 2020, Governor Newsom signed AB 1867, legislation that immediately extends critical paid sick days protections to California's workforce. Building on historic early action to expand paid sick days to employees in the food sector at the beginning of this crisis, this legislation means that every California employee that has been exposed to or tests positive for COVID-19 will have access to paid sick days for the rest of the 2020 calendar year.

AB 1867, a budget trailer bill, closes the gaps in paid sick days provided in federal law and the Governor's Executive Order by including employers with over 500 employees and public and private employers of first responders and health care employees who opted not to cover their employees under federal law. The bill also allows California's Labor Commissioner to cite workplaces for a lack of paid sick days, a critical enforcement tool that will promote safety for employees and customers alike.

Expanding access to paid sick days and protecting employees has been a priority of the Newsom Administration before and during the COVID-19 pandemic. Governor Newsom has taken several actions to benefit employees on the front lines, including paid sick days for food sector employees; workers' compensation benefits for employees who contract COVID-19 during the stay-at-home-order; critical child care services for essential employees and vulnerable populations; additional weekly unemployment benefits; and support for employees to isolate and quarantine outside their home.

For more information on this bill, please click **HERE**.

WORLD AG. EXPO 2021 CANCELLED

The 2021 World Ag Expo, held in Tulare, CA, has been canceled due to the ongoing COVID-19 pandemic. "After working with the Tulare County Health Department and other officials, it has become evident that given health and safety restrictions from the State of California, holding a live, international event is not responsible in February," said Jerry Sinift, International Agri-Center CEO. The initial deadline for a decision on the expo was in November, but officials say the decision came earlier in order to those involved the proper time to make adjustments. The 2022 World Ag Expo is scheduled for February 8-10 in Tulare.

WILDFIRE AIR QUALITY REGULATIONS

Earlier this spring, the Cal/OSHA Standards Board adopted Wildfire Smoke Regulations, which apply when employees in outdoor workplaces may be exposed to wildfire smoke. These regulations require employers to have N-95 or equivalent masks on hand when the Air Quality Index (AQI) for PM2.5 exceeds 151 and provide medical evaluation and fit testing. If the AQI exceeds 151, employees have the option of wearing an N-95 respirator but are not required to do so. If the AQI rises to 500 or higher, employees must be provided N-95 respirators.

If an employer cannot maintain a stockpile of these respirators for optional use at AQI 151 and above, outdoor worksites must shut down until the AQI has dropped below the threshold. In addition to providing masks and respirators, employers need to communicate the hazards of wildfire smoke to all employees in a readily understandable form and train employees on protective measures that are available, such as increasing rest time and frequency. Employers shall allow employees to seek medical treatment if they show signs of injury or illness due to wildfire smoke exposure.

The easiest way to find the current and forecasted AQI for PM2.5 is to go to www.airnow.gov and enter the zip code of the location where you will be working. For local updates, please locate your air district click here.

More information about the Wildfire Smoke Regulations is available <u>here</u>. The text of the regulations is can be accessed by <u>clicking here</u>.

Additionally, the CA Fresh Fruit Association (CFFA) has reported that they have N-95 masks available on a first come, first serve basis. Please contact the CFFA office at 559-226-6630.





GUIDANCE FOR IMPLEMENTATION AND COMPLIANCE WITH DEFERRING EMPLOYEE SOCIAL SECURITY WITHHOLDINGS

The Department of Treasury and Internal Revenue Service issued guidance (PDF) implementing the Presidential Memorandum issued on August 8, 2020, allowing employers to defer withholding and payment of the employee's portion of the Social Security tax if the employee's wages are below a certain amount. Notice 2020-65, posted today on IRS.gov, makes relief available for employers and generally applies to wages paid starting September 1, 2020, through December 31, 2020. The employee Social Security tax deferral may apply to payments of taxable wages to an employee that are less than \$4,000 during a bi-weekly pay period, with each pay period considered separately. No deferral is available for any payment to an employee of taxable wages of \$4,000 or above for a bi-weekly pay period. Today's notice postpones the time for employers to withhold and pay employee Social Security taxes. Additional tax relief related to the COVID-19 pandemic can be found on IRS.gov.

Further, the CA Fresh Fruit Association provided additional guidance on the implementation and compliance of this memo. This can be viewed at the following link:

 $\underline{https://files.constantcontact.com/35cbbf3f001/f774862f-498c-492d-b36b-305e76aaf026.pdf}$

CORONAVIRUS FOOD ASSISTANCE PROGRAM APPLICATION DEADLINE APPROACHING

As you may recall, in early July, the United States Department of Agriculture (USDA) issued a modification to its original Coronavirus Food Assistance Program (CFAP) ruling. Apples were initially left out of the program's component dealing with price declines, but have been reconsidered by USDA and growers will now be eligible for a payment rate of \$0.05/pound. However, it is important to note that the growers applying for these funds must demonstrate at least a 5% loss in sales during the eligibility time frame set by USDA from January-April 15, 2020. The application deadline for this program is September 11, 2020.



It is also important to note that while the USDA has not yet extended its eligibility dates, the CAC is now working with USDA and Members of Congress to urge them to extend these dates to include the California apple season. At this point, there have been discussions regarding a "CFAP 2.0" plan and it has been reported that analysts expect the next round of payments to compensate growers for losses between April 15 and August 15. We will continue to provide updates on this program as they become available.

WILDFIRE AIR QUALITY REGULATIONS

Earlier this spring, the Cal/OSHA Standards Board adopted Wildfire Smoke Regulations, which apply when employees in outdoor workplaces may be exposed to wildfire smoke. These regulations require employers to have N-95 or equivalent masks on hand when the Air Quality Index (AQI) for PM2.5 exceeds 151 and provide medical evaluation and fit testing. If the AQI exceeds 151, employees have the option of wearing an N-95 respirator but are not required to do so. If the AQI rises to 500 or higher, employees must be provided N-95 respirators.

If an employer cannot maintain a stockpile of these respirators for optional use at AQI 151 and above, outdoor worksites must shut down until the AQI has dropped below the threshold. In addition to providing masks and respirators, employers need to communicate the hazards of wildfire smoke to all employees in a readily understandable form and train employees on protective measures that are available, such as increasing rest time and frequency. Employers shall allow employees to seek medical treatment if they show signs of injury or illness due to wildfire smoke exposure.

The easiest way to find the current and forecasted AQI for PM2.5 is to go to www.airnow.gov and enter the zip code of the location where you will be working. For local updates, please locate your air district click here.

More information about the Wildfire Smoke Regulations is available <u>here</u>. The text of the regulations is can be accessed by <u>clicking here</u>.

Additionally, the CA Fresh Fruit Association (CFFA) has reported that they have N-95 masks available on a first come, first serve basis. Please contact the CFFA office at 559-226-6630.

CALIFORNIA STATE LEGISLATURE BILL UPDATE

- AB 685: Amended in Senate August 25, 2020. Introduced by Assembly Member Reyes. PASSED
 - Deals with occupational safety and was amended to address how employers should proceed when an employee contracts COVID-19. Current law lacks clarity on an employers' reporting requirements, including to their own workforce. Employers who receive notice of potential exposure to COVID-19 are required to provide written notice to all employees who were in contact with the exposed person as well as information regarding COVID-19 related benefits such as workers' compensation or sick leave. Employers must also notify all employees on the disinfection and safety plan that will be implemented and completed per Disease Control guidelines. If an employer has number of cases that classifies as COVID-19 outbreak, within 48 hours they have to notify the local public health agency of the name, numbers, and occupation of positive employees.
- SB 1102: Amended in Assembly August 25, 2020. Introduced by Senator Monning and Coauthored by Assembly Member Robert Rivas. PASSED
 - Adds new required disclosures among employers to their employees employed under the H-2A farm labor visa program. Relevant to COVID-19: Adds that employers disclose to employees the existence of either a federal or state emergency or disaster declaration applicable to the county where the employee is going to work that may affect the health and safety of the employee. This written notice must be issued 30 days prior to their first day of work. A template will be made available for employers in January 2021 by the Labor Commissioner.



- SB 1159: Amended August 30, 2020. Introduced by Senator Hill. PASSED
 - Deals with Workers' Compensation as related to COVID-19. Notable section: If an employee has paid sick leave benefits available in response to COVID-19, these should be used before temporary disability benefits. If an employee does not have these sick leave benefits, temporary disability benefits should be applied to them with no waiting period.
- AB 196: Amended in Senate August 25, 2020. Introduced by Assembly Member Gonzalez. WAS NOT BROUGHT UP FOR VOTE.
 - The bill defines "injury" for essential employees who are employed in an occupation that was exempt from the Governor's stay at home orders. Injury can now include COVID-19 that was contracted during the period employment where employees were deemed essential. This bill shortens the investigatory time frame for denial or presumed acceptance of a claim to 30 days, rather than 90 days.
- SB 1383: Introduced by Senator Jackson. PASSED
 - Deals with unlawful employment practices in regards to family leave. This bill was amended to make it unlawful for an employer to refuse to grant a request by an employee to take up to 12 work weeks of unpaid protected leave during any 12-month period to bond with a new child or to care for themselves or a family member. Employees are defined as those who have 1,250 hours of service with the employer during the previous 12-month period.
- AB 1659: Amended in Senate August 28, 2020. Introduced by several Assembly members with multiple coauthors. HAS NOT PASSED YET.
 - Deals with wild fire mitigation. Establishes a Wildfire Prevention and Community Resilience Fund in the State Treasury. Money in the fund will be used to reduce wild fire risks. It shall be initially started with a loan of five hundred million dollars from the state's Surplus Money Investment Fund. The loan should be repaid within the 2020-2021 fiscal year. Each large electrical corporation must impost and collect a non-bypass able charge on ratepayers of the electrical companies to support the fund.
- AB 6: Amended in Senate August 27, 2020. Introduced by Assembly Member Reyes. NOT BROUGHT UP FOR A VOTE YET.
 - Deals with duties of the Attorney General. Recent amendments have to do with DIVISION 10.10 the Statewide Opioid Settlement Agreement Act. The state legislature intends to facilitate a statewide opioid settlement agreement. It will encourage government entities that filed a lawsuit before August 24, 2020 to participate in negotiations and to join the settlement. The state legislature will also provide legislative oversight of the use of state funds acquired by the Agreement related to the claims regarding the opioid crisis.
- SB 54: Amended in Assembly August 25, 2020. Introduced by several Senators. FAILED.
 - Deals with waste that derives from the packaging of products. The bill attempted to impose stricter regulations on single-use packaging and single-use plastic products. Producers of single-use products would have to ensure that all single-use packaging that are manufactured on or after January 1, 2032 are to recyclable or compostable.

INDUSTRY COMMUNICATIONS



APPLE COMMUNICATIONS

The California Apple Commission takes pride in ensuring that our audience is kept up to date with issues concerning the apple industry. The CAC is on social media. Please follow us on the following social media outlets and let us know what you think. We would love to know what you want to hear more about.



Facebook.com/CaliforniaAppleCommission



Pinterest.com/calapple



Instagram.com/calapples

The Commission has published a series of newsletters throughout the season and they are included in the following pages. The Commission encourages you to sign up for our online newsletters. To sign up for the California Apple Commission's newsletter, visit calapple.org under the "About Us" tab. You can subscribe in the "Newsletter" section. The Commission sends out newsletters on a bi-monthly basis.



Newsletter

Issue No. 146

July/August 2021

CALIFORNIA APPLE COMISSION ATTENDED US APPLE OUTLOOK CONFERENCE

In August, the CAC staff traveled to Chicago, IL to attend the annual U.S. Apple Outlook Conference meeting. The conference was attended by leaders from every facet of the apple industry, including production, packing, processing, sales, marketing, and new product development. In addition, the conference was attended by a diverse range of speakers who covered topics ranging from production practices, COVID-19 effects on the industry, retail market trends, etc. Further, the CAC's Chairman, Jeff Colombini was awarded the Apple Champion Award. Please do not hesitate to reach out to the CAC office with any questions regarding this event.



KASUGAMYCIN REGISTRATION WITH THE NATIONAL ORGANIC STANDARDS BOARD (NOSB)

The Fall 2021 NOSB meeting will be taking place October 19th through October 21st. The NOSB will be providing a final ruling on the petition to register kasugamycin to fight bacterial and fungal diseases such as fire blight. CAC staff will be providing a Letter of Support for kasugamycin registration prior to the written comment due date, September 30th. CAC staff will update the industry when a final decision is made.

CALIFORNIA APPLE COMMISSION APPLIES FOR ONE-TIME SPECIALTY CROP BLOCK GRANT

In July, the California Department of Food and Agriculture (CDFA) announced a one-time Specialty Crop Block Grant request for proposals under House Resolution 133 (HR 133 Stimulus Funding). This request for proposals is in addition to the regular SCBGP funding authorized by the Agriculture Improvement Act of 2018 ("Farm Bill") and is a response to the United States Congress awarding additional one-time SCBGP funding to state departments of agriculture due to the COVID-19 impacts on the food system. CDFA anticipates that up to \$10 million will be awarded to projects enhancing the competitiveness of California specialty crops. Grant amounts range from \$250,000 to \$1,000,000. The maximum grant duration is three years. The CAC submitted a proposal entitled, "Analysis and consumer education of quality characteristics of California apples." The CAC should be notified whether the concept proposal was selected to submit a full proposal by November, and funding decisions will be announced in January 2022. If you have any questions regarding this grant program or the CAC's proposal, please do not hesitate to contact the CAC office.

U.S. APPLE FEAUTURES SPRINGVILLE, CA

U.S. Apple features CAC board member Kelley Hansen and Springville, CA in their latest edition of Apple Town Postcards. The postcard, pictured below, was made available to U.S. Apple Outlook Conference attendees in Chicago. Additionally, U.S. Apple has displayed the postcard on their social media platforms.







CA GROWN RETAIL PROMOTION

CA Grown conducts various retail promotions on behalf of its participating members throughout the course of the year. The CAC and CA Grown in partnership with Ralphs grocery store, promoted California Gala Apples in their most recent August advertisement (see picture below). CA Grown is beginning to plan retail opt-ins for 2022 and would love to feature California apples in a larger promotion. If there are particular grocery chains you would like the CAC and CA Grown to target in 2022, please do not hesitate to reach out Program Supervisor, Elise Oliver at eoliver@calapple.org



STATE WATER RESOURCES CONTROL BOARD (SWRCB) ENACTS EMERGENCY WATER RESTRICTIONS

On August 3, 2021 the SWRCB voted unanimously on emergency water restrictions that will affect thousands of Central Valley farmers. The new restriction prevents 5,700 farmers and landowners from diverting water from the Sacramento and San Joaquin River watersheds for agricultural use. Those who fail to comply with the order could face fines up to \$1,000 a day, as well as \$2,500 per acre-foot of illegally diverted water.

To view the SWRCB's statement regarding actions taken, please access it <u>here</u>.



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USDA UPDATES CFAP 2.0 PROGRAM GUIDELINES

The U.S. Department of Agriculture (USDA) has agreed to update the CFAP 2 program for producers of specialty crops, including apples. CFAP 2, which assists producers who faced market disruptions in 2020 due to COVID-19, is part of USDA's broader Pandemic Assistance for Producers initiative. USDA is amending the CFAP 2 payment calculation for salesbased commodities, which are primarily comprised of specialty crops, to allow producers to substitute 2018 sales for 2019 sales.

Applicants should ensure whether it is worthwhile for them to modify their original application. Newly eligible producers who need to submit a CFAP 2 application or producers who need to modify an existing one can contact their local FSA office. Producers can find their local FSA office by visiting farmers.gov/service-locator. The deadline for all eligible producers to apply for or modify applications for CFAP 2 is October 12, 2021.

CALENDAR OF EVENTS

- OFFICE CLOSED- Labor Day
 - September 6, 2021
- United Fresh Washington Conference, Washington, DC
 - o September 20-22, 2021
- National Organic Standards Board (NOSB), Sacramento, CA
 - October 19-21, 2021
- Produce Marketing Association (PMA) Fresh Summit, New Orleans, LA
 - October 28-30, 2021

Some events are being held virtually. Please contact the CAC office for more information.

Find us on social media!











Issue No. 145

May/June 2021

KASUGAMYCIN REGISTRATION WITH THE NATIONAL ORGANIC STANDARDS BOARD (NOSB)

The CAC provided a letter of support to the NOSB supporting the registration of kasugamycin to fight bacterial and fungal diseases such as fire blight. The NOSB will be delivering its decision on this request for registration in the Fall of 2021. CAC staff will update the industry when the decision is made.

CAC 2021-2022 RESEARCH PROJECTS

Below are approved CAC research projects that will be happening in the 2021-2022 Fiscal Year. Please do not hesitate to contact the CAC office with any questions regarding the below projects. CAC staff will keep the industry updated with Interim and Final Reports.

ТОРІС	LEADERS
Sterile Codling Moth Release in California Apples	M3 Agriculture Technologies
ProTone Trials on CA apple varieties to gain efficacy data for use of ProTone as an organic apple thinner	Valent
Evaluation of New Bactericides for Controls of Fire Blight of Apples Caused by Erwinia Amylovora and Evaluation of New Postharvest Fungicides for Pome Fruits	Dr. Jim Adaskaveg

CAL/OSHA UPDATES ON REGULATIONS FOR EMPLOYERS AND SUPERVISORS

The Cal/Osha Emergency Temporary Standards (ETS) for COVID-19 was updated on June 17th and become effective immediately through an executive order signed by Governor Gavin Newsom. Cal/Osha will be hosting a series of free, two-hour webinars to discuss the updated changes to the ETS for employers. See below for dates and registration information:

- Tuesday, June 22nd, 9 a.m. to 11 a.m. <u>Click here to</u> register
- Friday, June 25th, 1 p.m. to 3 p.m. <u>Click here to register</u>
- Tuesday, June 29th, 1 p.m. to 3 p.m. Click here to register
- Thursday, July 1st, 9 a.m. to 11 a.m. Click here to register

STATE WATER RESOURCES CONTROL BOARD (SWRCB) RUSSIAN RIVER WATERSHED EMERGENCY REGULATION

On June 16th, the SWRCB unanimously passed an emergency regulation that will implement curtailments in both the Upper and Lower Russian River Watersheds to ultimately protect water supplies and threatened and endangered fish in the Watershed. Although the SWRCB does not view Agricultural water use as unnecessary, they do believe that human/fish health and safety is the current priority. The SWRCB noted that this regulation is not necessarily indicative of what will happen with other Watersheds. CAC staff will update the industry if changes in regulations are implemented in other Watersheds.

To view the SWRCB's press release regarding actions taken, please access it <u>here</u>. Also, please click <u>here</u> to view a statement regarding water availability for Delta water right holders.

AB 710 AND AB 778 UPDATE

In December 2020, the CAC Board of Directors voted to support AB 710 which would prohibit the sale of listed agricultural produce that does not meet California's pesticide and labor regulations, and AB 778 which would require all state institutions to purchase California grown produce when available. As both bills have been moving through various Assembly and Senate Committees, CAC staff have been providing Letters of Support along the way. A final vote on both bills is expected to be announced in late June/early July. CAC staff will keep the industry updated on the outcome of both bills.



CAC Social Media Update

Don't forget to follow @calapples on Instagram! CAC staff will continue to expand the CAC's social media presence in the 2021-2022 Fiscal Year by continuing our existing partnership with CA Grown and fostering a new partnership with the California Wild Rice Advisory Board, which will be of no extra cost to the CAC. See below for a sample of @calapples Instagram grid.



Find us on social media!









CHAMP WG SPECIAL LOCAL NEED REGISTRATION APPROVED BY CA DEPARTMENT OF PESTICIDE REGULATION (CDPR)

In June, the California Department of Pesticide Regulation (CDPR) issued their approval for the Champ WG Special Local Need registration for aerial application to almond, citrus, peach/nectarine, pear, apple, and walnut orchards with standing water. This decision comes after an over a year review process that began in early 2020. For more information regarding this decision, please do not hesitate to contact the Commission office.

CALENDAR OF EVENTS

- OFFICE CLOSED- Independence day o July 5, 2021
- USApple Annual Meeting, Chicago, IL • August 19-20, 2021
- United Fresh Washington Conference, Washington, DC
 - o September 20-22, 2021
- Produce Marketing Association (PMA) Fresh Summit, New Orleans, LA
 - o October 28-30, 2021

Some events are being held virtually. Please contact the CAC office for more information.



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Issue No. 144

March/April 2021

CAC SWITCHING TO VIRTUAL NEWSLETTERS

In an effort to save paper and resources, the CAC has decided to switch to an entirely virtual format for our bimonthly newsletters. To remain on the newsletter list, please enter your email in the newsletter subscription box on our website, calapple.org, email intern@calapple.org, or call 559-225-3000 requesting to be added to the CAC newsletter email list. Be sure to subscribe to receive the next newsletter in your email inbox!

CALIFORNIA DROUGHT UPDATE

On April 21, 2021, Governor Gavin Newsom declared a drought emergency in two Northern California counties in response to arid conditions affecting much of the state and west coast. The declaration included Mendocino and Sonoma counties, where drought conditions are especially bad. It's likely that a broader drought declaration will come as conditions change. The Commission office will provide more information as the situation progresses.

CA LEGISLATURE PASSES TAX RELIEF BILL FOR PAYCHECK PROTECTION PROGRAM RECIPIENTS

On April 26, 2021, the California Legislature sent the Governor AB 80, which seeks to "provide assistance to small businesses operating in the state that have been harmed economically by the COVID-19 pandemic." Specifically, the bill will:

- Allow eligible entities to deduct business expenses that were paid for using forgiven Paycheck Protection Program (PPP) or Economic Injury Disaster Loan (EIDL) funds.
- Allow loans forgiven as an "advance grant amount" under the EIDL program to be excluded from income for California taxpayers.
- Not require eligible entities to adjust their tax attributes as a result of forgiven PPP or EIDL funds.

AB 80 defines an "ineligible entity" as a taxpayer that either:

- 1. Is a publicly-traded company, as described in the Federal Consolidated Appropriations Act, 2021 (Public Law 116-260).
- 2. Does not meet the reduction in gross receipts of 25 percent or more in 2020 as compared to the same time period in 2019, as defined in the Federal Consolidated

Appropriations Act of 2021 (Public Law 116-260).

The 25 percent reduction in gross receipts was an eligibility requirement for the second round of PPP loans, Unfortunately, the Legislature and Governor extended this requirement to all businesses that received a PPP loan for purposes of business deduction which means many essential sectors will not be eligible because they have been operating throughout the pandemic.

The language of the bill can be found here.

APPLE RESEARCH PROJECTS

ProTone- Organic Apple Thinner

The CAC is currently working with Valent to conduct trials on California apples to obtain efficacy data for use of ProTone as an organic apple thinner with the intent of pursuing a Section-3 registration with the California Department of Pesticide Regulation (CDPR). ProTone currently has a Section-3 federal registration label issue by the Environmental Protection Agency (EPA). Additionally, ProTone has a Section-3 registration in California for use on table grapes as a color enhancer as well as a Section-3 registration in the state of Washington for apple thinning. ProTone contains the active ingredient S-abscisic acid or S-ABA which is already naturally occurring in table grapes and is responsible for the development of pigments within the fruit skin. Trials on California apples are currently taking place on the following varieties: Granny Smith, Pink Lady, Gala, and Modi. Efficacy data along with a final report can be expected in the Winter of 2022. Please do not hesitate to reach out to the CAC office with any questions regarding this research project.



Sterile Codling Moth Releases

The CAC, in conjunction with M3 Agriculture Technologies, is conducting sterile codling moth releases on 100 acres of California apples. Sterile Insect Technology (SIT) is an emerging way to control pests and is both advantageous for conventional and organic growers. M3 conducted their first sterile release on April 26th using drones to deploy 800 sterile Codling Moths per acre. This technique is meant to demonstrate greater control over the Codling Moth population over time. M3 will be analyzing existing trapping regimes to evaluate the reduction of non-sterile Codling Moths and assessing damage control by establishing a Control block. This project can be expected to conclude by the Fall of this year, at which time CAC staff will send out to the industry a final report. Please do not hesitate to reach out to the CAC with any questions regarding this research project.

USAPPLE "CORE CONNECT"

This May, the US Apple Association is hosting their second *USApple Core Connect:* a one-on-one appointment event to help members efficiently evaluate products and services. If your company is in the market for any product or service this year, then Core Connect can be of value to you. All you have to do is register (a 5-minute process) and take at least one vendor meeting (20 minutes in length): (*Continued to the right*)

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Did you know you can receive an e-newsletter instead of the snail mail version? If you would like to sign up, please email intern@calapple.org

- 1. Visit US Apple Core Connect (https://usapple.converve.io/index.html), click "Register Now" at the top of the screen to create your account and set your calendar availability for appointments on May 20,
- 2. Once registration closes in early May, you'll be able to view vendor profiles, request appointments, and respond to inbound appointment requests.
- 3. The 20-minute appointments take place within the platform on a video conference platform similar to Zoom. That's it!

To make meeting even more rewarding, for every appointment you complete, you'll be entered into a drawing to win one of three \$100 Amazon gift cards!

CALENDAR OF EVENTS

- OFFICE CLOSED- Memorial Day
 - o May 31, 2021

21, and 26.

- CAC Annual Meeting
 - June, Date TBD
- USApple Annual Meeting
 - August, Date TBD
- United Fresh Washington Conference, Washington, DC
 - September 20-22, 2021
- Produce Marketing Association (PMA) Fresh Summit, New Orleans, LA
 - o October 28-30, 2021

Some events are being held virtually. Please contact the CAC office for more information.



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Issue No. 143

January/February 2021

FORM 700

As outlined by CDFA and the Fair Political Practices Commission (FPPC), all Board of Directors must complete the necessary Form 700. Board members can submit their Form 700s electronically through eDisclosure. To access the eDisclosure system and complete e-filing Form 700, please log on to www.form700.fppc.ca.gov . You will see a list of positions that you are required to file a Form 700 for. Once completed, your Form 700 will be saved in your online-filing cabinet under "Previous Filings" menu.

As a reminder, the Form 700 is due April 1, 2021.

Should you have any problems accessing or completing your eDisclosure Form700, please contact your assigned filing officer, Andrea Carey, at (916) 323-3213 or via email at Form700@fppc.ca.gov. As always, the Commission can help you file your Form 700. Please contact the Commission office for assistance.

INTERN SELECTED FOR 2021 YAL PROGRAM

The CAC's intern, Delaney Woolwine, has been selected to participate in the 2021 US Apple Young Apple Leaders (YAL) Program. Over the next six months, Delaney will be participating in virtual meetings and events with apple industry leaders and peers. As a Young Apple Leader, she will learn about the federal regulatory and legislative issues that impact the apple industry, how to advocate for the industry, and will connect with apple leaders from around the country. The YAL program sponsors cover all costs associated with participation.

SPECIALITY CROP BLOCK GRANT: TESTING NEW APPLE ROOSTOCKS IN CALIFORNIA

The CAC was recently awarded a Specialty Crop Block Grant from the California Department of Food and Agriculture's 2020 Specialty Crop Block Grant Program (SCBGP). The project, titled "Testing New Apple Rootstocks in California," is being conducted by Dr. Gennaro Fazio, Apple Rootstock Breeder and Geneticist of the United States Department of Agriculture, Agricultural Research Service (USDA, ARS) from the National Apple Rootstock Breeding Program in

Geneva, New York. This grant will assist the industry in implementing rootstock trials that have the potential to increase the overall productivity of California apple growers, reduce the number of pesticides and post-harvest treatments, and create resistance to the destructive disease, fire blight. The rootstocks developed through the National Apple Rootstock Breeding Program have proven to be highly beneficial to other apple producing states and, to remain a relevant player in the apple industry, California hopes to reap some of these same benefits.

The CAC and Dr. Fazio are now searching for different test site locations in California. If you are interested in participating in the research project or would like more information, please contact the CAC office.

COVID-19 UPDATES FROM THE CAC

Since March of 2020, the CAC has been providing weekly COVID-19 updates via email. The purpose of these updates has been to share critical and up-to-date information with the industry regarding the pandemic. The CAC has now switched to a biweekly schedule for these updates. All past updates are available online at http://www.calapple.org/covid-19-updates.html. If you would like to be added to the email list to receive our biweekly COVID-19 updates electronically, please contact the CAC office.

CDPR BUDGET CHANGE PROPOSAL

The California Department of Pesticide Regulation (CDPR) has introduced a budget change proposal (BCP) that would replace the current flat-fee mill tax on pesticide sales with a new "tiered system," which would generate approximately \$45 million in new revenue. In a letter to California legislators, the California Apple Commission (CAC), alongside other agricultural organizations, expressed their concerns with the BCP. Concerns include the underlying assumptions made to justify the new approach, the timing of a substantial tax increase given the fragility of the economy, unintended consequences if this structure is adopted, and disagreement with how the additional funds will be allocated. For example,

none of the additional revenue will be directed toward improving pesticide registration timelines, while many of the formulations awaiting registration are likely to be more sustainable formulations. Whether or not CDPR has the statutory authority to attempt to influence the market in this way is also being questioned by the organizations who supported this letter. For more information regarding the CDPR BCP, please contact the CAC office. The CAC will provide more information as it becomes available.

UPDATES ON PORT CLOSURES AND CONGESTION IN CALIFORNIA

Over the past few months, the ports of Los Angeles and Long Beach have struggled with detention and demurrage issues as well as a deluge of container imports that have ultimately resulted in numerous shipments of produce from California ports being denied or delayed. Consequently, US agriculture, food and forestry product exports have been prevented from delivering affordably and dependably to foreign markets. Unless the Shipping Act and other tools available to our government are applied promptly, agriculture industries will continue to suffer great financial losses; these carrier practices will render US agriculture noncompetitive for years to come. The United Fresh Produce Association and other industry colleagues will be sending a letter to President Biden regarding this issue in the near future.

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Did you know you can receive an e-newsletter instead of the snail mail version? If you would like to sign up, please email intern@calapple.org

KASUGAMYCIN UPDATE

The National Organic Standards Board (NOSB) Crops Subcommittee is still discussing the CAC's petition which requests the inclusion of kasugamycin in section 205.601 of the National Organic Program's (NOP) National List of Allowed and Prohibited Substances (National List). A technical report has been prepared for this substance and is available at the following website: https://www.ams.usda.gov/rules-regulations/organic/national-list/k .

In the near future, there will be an opportunity for growers to express their support regarding the use of kasugamycin on organic products. The CAC will make the industry aware of the comment period when more information is provided. Please contact the CAC office with any questions.

CALENDAR OF EVENTS

- CFAP 2.0 APPLICATION DEADLINE
 - February 26, 2021
- OFFICE CLOSED- Good Friday
 - o April 2, 2021
- FRUIT LOGISTICA (Virtual)
 - o May 18-20, 2021

All events are being held virtually. Please contact the CAC office for more information.



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Wishing you a Happy New Year! Newsletter

Issue No. 142

November/December 2020

CONGRESS PASSES COVID-19 RELIEF BILL

On December 21, 2020, Congress approved \$900 billion in Coronavirus relief, including \$26 billion specified for agriculture and nutrition. The legislation makes two important amendments to the second Coronavirus Food Assistance Program (CFAP 2). First, it allows producers to amend their CFAP 2 applications to include crop insurance payments in their total sales data. Second, it gives CFAP 2 recipients the choice of reporting sales data from 2018 instead of 2019. This was included to assist growers who experienced severe losses in 2019. However, the option is open to all CFAP 2 recipients. If reporting 2018 data yields a larger payment than 2019, you may resubmit. We will provide additional information on this resubmittal process once it becomes available. Please note that the legislation does not create a CFAP 3 program nor does it change the current rule that sales data must be based on "raw" - not packed or finished - commodities.

2021 LEGISLATIVE UPDATE

Minimum Wage Increases: Effective January 1, 2021, the state minimum wage will increase to \$13 per hour for employers with 25 or fewer employees, and \$14 per hour for employers with 26 or more employees. As for exempt personnel, effective January 1, 2021, the minimum salary for exempt employees will increase to \$54,084 per year (or \$4,507 per month) for employers with 25 or fewer employees, and \$58,248 per year (or \$4,854 per month) for employers with 26 or more employees.

Wage Order 14 Overtime Thresholds Decrease:

Effective January 1, 2021, the new overtime threshold for employers with 26 or more employees will be 8 ½ hours per day or 45 hours per week. For employers with 25 or fewer employees, the overtime threshold will remain at 10 hours per day.

COVID-19 Exposure Notice: AB 685 creates a notice requirement at the workplace if an employee is exposed to COVID-19. The employer must notify exposed employees within one business day of the exposure as well as the employees' rights to sick leave and other COVID-19 related policies. AB 685 will require an employer, if the employer or representative of the employer is notified of the number of cases that meet the definition of a COVID-19 outbreak, within 48 hours, to report prescribed information to the local public health agency in the jurisdiction of the worksite. AB 685 will require an employer that has an outbreak to continue to give notice to the local health department of any subsequent laboratory-confirmed cases of COVID-19 at the worksite.

SB 1383: The California Family Rights Act (CFRA) makes it an unlawful employment practice for an employer with 50 or more employees to refuse to grant a request by an employee to take up to 12 workweeks of unpaid protected leave during any 12-month period to bond with a new child of the employee or toc are for themselves, a child, a parent, or spouse. SB 1383 amended the CFRA to make it unlawful for any employer with five or more employees to refuse to grant a request by an employee to take up to 12 workweeks of unpaid protected leave during any 12-month period to bond with a new child of the employee or to care for themselves or a child, parent, grandparent, grandchild, sibling, spouse, or domestic partner. This expansion creates an inconsistency with the federal Family and Medical Leave Act (FMLA), which also provides employees of employers with 50 or more employees with up to 12 weeks of unpaid, job-protected leave per year. This means employees of employers with 50 or more employees could take up to 24 weeks of unpaid, job-protected leave per year.



ESSENTIAL AGRICULTURAL WORKERS NEXT IN LINE FOR COVID-19 VACCINES IN CALIFORNIA

Agricultural workers are among those recommended to receive the next round of scarce COVID-19 vaccines in California. The next round of doses are expected early next year. An estimated 3.4 million vaccines have been allocated to food and agriculture workers, from farm to table including those working in food and drinking establishments as well as farmworkers, grocers, bakers, and butchers. Plant nurseries, florists, and sawmills all fall into that category, as do community food services and pharmacies.

Happy Holidays from the CAC!



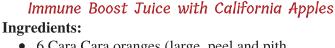
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APPLE BITES

- 6 Cara Cara oranges (large, peel and pith removed)
- 4 large carrots (for juicing, peeled)
- 2 California Fuji apples (cored)
- 1 knob ginger (2-inch to 4-inch, peeled; choose size based on how spicy you would like the juice to be)
- 1 lime (peel and pith removed)

Directions:

- If you have a juicer: Run all of the ingredients through a juicer, stirring to combine before serving.
- If you do not have a juicer: Combine all ingredients in a high powered blender wit 2 cups water. Blend until all of the fruits and vegetables are broken down, drink as is if you like a pulpy juice OR strain through a sieve or cheesecloth to remove the pulp.

Recipe courtesy of www.yummly.com and thismessisours.com

CALENDAR OF EVENTS

- OFFICE CLOSED- MLK Day
 - January 18, 2021
- OFFICE ČLOSED- Presidents' Day
 February 15, 2021

All events are being held virtually. Please contact the CBC office for more information.



California Apple Commission

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Issue No. 141

September/October 2020

CORONAVIRUS FOOD ASSISTANCE PROGRAM 2.0 UPDATE

To date, the U.S. Department of Agriculture (USDA) Farm Service Agency (FSA) has approved more than \$7 billion in payments to US agricultural producers in the second round of the Coronavirus Food Assistance Program (CFAP 2.0). In total, the USDA is making available up to \$14 billion for US crop and livestock producers who continue to face market disruptions and associated costs because of COVID-19. Thus far, the FSA has approved more than 443,000 applications since CFAP 2.0 enrollment began on September 21st. The U.S. states seeing the most in payments are Iowa, Nebraska, Minnesota, Illinois, and Kansas. Applications for CFAP 2.0 are available through December 11, 2020, on the FSA website at: www.farmers.gov/cfap/apply

If you plan to or have already applied for the CFAP 2.0 funding, please notify the CAC office so that we may report back to USDA our industry's participation in the program. If you have any further questions regarding this information, please do not hesitate to contact the CAC office.

NEW ORGANIZATION: CALIFORNIA COALITION FOR TRUTH IN OLIVE OIL LABELING

The California Apple Commission staff will now manage the California Coalition for Truth in Olive Oil Labeling! This is a newly created organization and was established to improve conditions in the California olive oil industry by protecting consumers, retailers, farm families, and California olive oil producers from deceptive advertising and labeling practices that undermine the integrity of the California-grown olive oil industry.

2019-2020 CALIFORNIA APPLE COMMISSION ANNUAL REPORT

The new 2019-2020 California Apple Commission Annual Report is finally here! Within the annual report, you will find information pertaining to California apple research projects, pest, disease, and standardization, California apple domestic and export statistics, export market summaries, the COVID-19 situation, and more. The 2019-2020 Annual Report can be found online at http://www.calapple.org/annual-reports.html. We hope you enjoy the Commission's newest annual report.

CALIFORNIA APPLE COMMISSION WEBSITE MAKEOVER

The new and improved California Apple Commission website is live! The new website features CAC publications such as annual reports and newsletters, educational resources, statistics, research projects, COVID-19 information, and more. Feel free to check out the updated www.calapple.org and please let the CAC office know if you have any suggestions. See below for a before and after of the CAC website.

Before:





After:



CAC BOARD MEETING TO BE HELD IN DECEMBER

The California Apple Commission will be holding a board meeting via Zoom in December. The date is to be determined and further information will be provided soon.

Find us on social media!







πcatappie @catappies

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InstantPot California Gala Applesauce

Ingredients:

- 12 California Gala apples
- 1/2 cup water
- 1/4 cup sugar (optional)
- 1/4 teaspoon fresh nutmeg

Directions:

- Core, peel and chop the apples.
- Add the apples, water, sugar, and nutmeg to the InstantPot.
- Cook for five minutes and vent for 15 minutes.
- Using an immersion blender, blend the apples until smooth.
- Allow to cool.
- Enjoy!

Recipe courtesy of www.yummly.com and californiagrown.org

CALENDAR OF EVENTS

- OFFICE CLOSED- Veterans Day
 - November 11, 2020
- Asia Fruit Logistica (Virtual)
 - November 18-20, 2020
- OFFICE CLOSED- Thanksgiving
 - November 26-27, 2020

All events are being held virtually. Please contact the CAC office for more information.



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Issue No. 140

July/August 2020

COVID-19 PANDEMIC

Over the past several months, the CAC staff have been compiling and distributing weekly updates regarding the COVID-19 pandemic. Additionally, the CAC has been involved in daily conference calls covering California's Legislature in order to remain updated on any time sensitive developments regarding the industry. On June 16, the CAC, in conjunction with the U.S. Apple Association, urged the USDA to reconsider apple growers for Coronavirus Food Assistance Program (CFAP) funding. In a letter sent to USDA, the CAC/USApple argued that the department's analysis that determined apple prices and grower eligibility is fatally flawed and inaccurate. USDA had previously concluded that apple growers did not qualify because, according to its methodology, apple prices had not declined at least 5 percent between January 15 and April 15. At this point, there have been discussions regarding a "CFAP 2.0" plan and it has been reported that analysts expect the next round of payments to compensate growers for losses between April 15 and August 15. The CAC/USApple submitted more than 30 pages to USDA detailing actual sales data on more than 43 million bushels of apples, more than half of all the apples marketed in the three-month period. Bringing the massive databases of USApple and the Washington State Tree Fruit Association to bear, bolstered with sales data provided by multiple USApple leaders across the country, the actual accounting of sales data paints a drastic picture.

USApple's data further demonstrates:

- Shipping volumes in the study period declined 24 percent.
- Apples being stored are 15 percent larger than the previous record, and 26 percent above the five-year average.
- With less than two months until the new crop harvest, a record-setting 19 percent of the 2019 crop remains to be marketed.

This data makes the case that apple growers meet the criteria for the direct financial support intended by Congress. The CAC will continue to provide updates on the CFAP program.

NEW BOARD SET FOR 2020-2021

Congratulations to the California Apple Commission's Board of Directors for the 2020 – 2021 year!

District 1	District 2	District 3	PUBLIC MEMBER
PRODUCER MEMBER	PRODUCER MEMBER	PRODUCER MEMBER	
Kelly Hansen	Chris Britton	Jeff Colombini	Steve Blizzard
Zea Sonnabend	Virginia Hemly- Chhabra	Steve Chinchiolo	
HANDLER MEMBER	HANDLER MEMBER	HANDLER MEMBER	
Bill Denevan	VACANT	Tim Sambado	
ALTERNATE MEMBER	ALTERNATE MEMBER	ALTERNATE MEMBER	ALTERNAT E MEMBER
VACANT	Doug Hemly	VACANT	VACANT

The California Apple Commission is actively searching for a mid-term Handler Alternate for District 1, District 3. and a mid-term Handler Member for District 2. If you are interested in any of these positions or have any questions, please telephone the Commission office at (559) 225-3000.

PROP 15 CAMPAIGN

Prop 15 will be appearing on the statewide ballot this November. If Prop 15 passes, Prop 13's property tax protections will be put to an end, resulting in the largest property tax increase in California's history. Proponents of Prop 15 have insured that agriculture will continue to be protected by Prop 13. However, if Prop 15 passes in November, California agriculture could be financially negatively impacted by hundreds of millions of dollars annually beginning in 2021. The total impact to California business will be at least \$12 billion a year. If you would like to learn more about the Prop 15 campaign, please refer to https://ballotpedia.org/California_Proposition_15,_Tax_on_Commercial_and_Industrial_Properties_for_Education_and_Local_Government_Funding_Initiative_(2020)



COMMISSION TRAINED BY POPPY SOCIAL MEDIA

In mid-July, the CAC team was provided a two-day training from Poppy Social Media that was funded by the California Olive Committee. The training focused on techniques to grow newly created accounts that the CAC team will be utilizing in order to establish a social media presence. Social media platforms will focus on educating the consumer on the seasonality of California apples so that when apples are in season, the consumer will specifically look for California apples to purchase. We will be relying on our existing partnership with CA GROWN to curate content. Speaking of gathering content, October is California Farmer and Farmworker Month, so the CAC team would like to highlight and recognize California apple growers on our new Instagram! If you have pictures of you and your family, that you are comfortable with being posted on our social media accounts, please send them our way to eoliver@calapple.org.



Find us on social media!







#calapple @calapples

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CAC ANNUAL REPORT

In the near future, please be on the lookout for the California Apple Commission Annual Report. The Annual Report includes information on current and future research, education projects, market reports, and other pertinent industry information. If you would like a copy, please contact the Commission office or email us at calapple@calapple.org. The Annual Report will also be available on the CAC website.

CAC WELCOMES NEW PROGRAM SUPERVISOR AND NEW INTERN

In June, Elise Oliver joined the CAC as the new Program Supervisor. Elise is a graduate of the University of California, Davis where she completed her Bachelor's Degree in Political Science. Delaney Woolwine joined the CAC as the new intern in May. She is starting her senior year at California State University, Fresno, where she is pursuing a Bachelor's Degree in Agricultural Business. Elise and Delaney are excited to serve the industry in their new roles.

CALENDAR OF EVENTS

- OFFICE CLOSED- Labor Day
 - September 7, 2020
- PMA Fresh Summit (Virtual)
 - October 13-15. 2020
- Asia Fruit Logistica (Virtual)
 - November 18-20, 2020

All events are being held online. Please contact the CAC office for more information.



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