Harvest of oil-treated Minneolo tangelos March 2002.

The object of the second new experiment is to determine how an application of petroleum oil will affect the alternate bearing characteristics of Minneola tangelo. The first oil application was made to tangelo in August 2001 and the fruit harvested March 4, 2002. The second oil application was made in August 2002 and the harvest has not yet been scheduled. Further research in this experiment should provide information on the ability of petroleum oil to moderate alternate bearing. The results obtained from this season s harvest of the Washington navel and the tangelo experiment will determine if this project will be terminated this season or continue for an additional two years.

Application of Plant Growth Regulators and/or Fertilizers to Increase Fruit Size and Yield of Clementine Mandarin

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The overall objective of this research is to develop production management strategies for Clementine mandarins in California. We use foliar-applied fertilizers and plant growth regulators to enhance fruit set, fruit size, fruit maturity, fruit quality, fruit color, yield, and to delay pre-harvest fruit drop. There are three separate experiments designed to address different production issues of Clementine in California.

OBJECTIVE 1:

Study the use of fertilizers and/or PGRs to increase fruit set, fruit size, fruit quality, fruit color, and yield.

Eleven treatments designed to improve fruit size of Clementine mandarin were applied on July 16, 2001 near Grapevine: (1) 1% Urea; (2) 1% Urea + Kerry Cytokinin; (3) K_2HPO_3 + Kerry Cytokinin; (4) K_2HPO_3; (5) 15 ppm GA_3 + 1% Urea; (6) 15 ppm GA_3; (7) 3,5,6-TPA; (8) CPPU; (9) Tryptophan; (10) Compound X; (11) 12 ppm 2,4,-D; (12) control. The fruit was harvested November 27-28, 2001. Individual yields of all treatment trees and control trees (kg/tree) were recorded. Diameter and weight of up to 50 individual fruit from each tree were determined. Samples from each tree were also collected for fruit quality analysis.

Results of that first year of harvest were very positive. The results showed there were significant treatment and block effects. Seven treatments resulted in yield increases compared to control trees. The 3,5,6-TPA and compound X treatments significantly increased the fruit size and fruit weight versus control. The 3,5,6-TPA treatment also gave the highest total yield among all treatments. However, 3,5,6-TPA had a negative effect on juice weight and total soluble solids. Compound X gave the second highest fruit size and fruit weight. It had no negative effect on the fruit quality. Based on that first year of data, compound X looks most promising in increasing fruit size and fruit weight of Clementine mandarin.

Based on our results from 2001, the following example is provided. The 1% Urea treatment increased total fruit weight per tree by 18.99 lb. compared to the control trees. Per acre, this is an increase of 18.99 lbs. x 210 trees/ac = 3,988 lbs./ac. If the farm gate price of Clementine is $0.40/lb., then this is an increase in gross income of 3,988 lbs. x $0.40/lb. = $1,595/ac. Based on the same calculation, the gross income increase is $1,621/ac for the 3,5,6-TPA treatment, $1,154/ac for the Tryptophan treatment, $859/ac for the K_2HPO_3 + Kerry cytokinin treatment, $820/ac for the 2,4-D treatment, and $492/ac for the K_2HPO_3 treatment (Table 1). The 3,5,6-TPA, compound X, 2,4-D, Urea + Kerry cytokinin, and K_2HPO_3 treatments also increased individual fruit size and weight that could also result in additional income to the growers.

The same treatments were applied once again on July 8-9, 2002. We will harvest the fruit in mid-late November, 2002. The effect on fruit size and yield may be larger in 2002. In 2001, there was a large amount of fruit drop due to high temperatures in May 2001. We are expecting an on year crop in 2002. A minimum of two additional years of research is needed to confirm the 2001 results. We also need to fine-tune the timing of application to achieve maximum effect. Additional compounds like 2,4-DP were added to the experiment (see objective 3) in 2002 to increase fruit size and yield of Clementine mandarins. We will obtain the first results with these compounds at the end of 2002 (2002-2003 season.)

OBJECTIVE 2:

Study the use of PGRs and other compounds to delay harvest or increase fruit quality of late-harvested fruit.

TREATMENTS	AVERAGE YIELD /TREE	% INCREASE	YIELD INCREASE/AC*	$ INCREASE/AC**
3,5,6-TPA***	74.38 lb	+ 35.04%	+ 4,053 lb	+ $1,621
Urea	74.07 lb	+ 34.47%	+ 3,988 lb	+ $1,592
Tryptophan	68.82 lb	+ 24.95%	+ 2,886 lb	+ $1,154
K_2HPO_3 + K.Cytokinin	67.11 lb	+ 21.84%	+ 2,526 lb	+ $1,010
2,4-D	64.85 lb	+ 17.73%	+ 2,051 lb	+ $ 820
K_2HPO_3	60.93 lb	+ 10.62%	+ 1,229 lb	+ $ 492
GA_3	56.89 lb	+ 3.28%	+ 380 lb	+ $ 152
Control	55.08 lb	0.00%	0 lb	$ 0
Urea + K. cytokinin	52.79 lb	- 4.16%	- 481 lb	- $ 192
CPPU	52.20 lb	- 5.25%	- 606 lb	- $ 121
Compound X***	51.41 lb	- 6.67%	- 772 lb	- $ 308
GA_3 + Urea	49.60 lb	- 9.96%	- 1,152 lb	- $ 461

* Based on a calculation of 210 trees per acre.
** Based on price of $0.40/lb.
*** Also significantly increased fruit size of Clementine mandarin compared with control trees that could also result in additional income to the growers.

Table 1. The average yield (total fruit weight per tree) (lb.) of treatments, the percentage of increase vs. control, estimated yield increase per acre, and estimated gross income increase per acre from Objective 1 treatments in 2001.

Nine treatments designed to improve fruit quality of late-harvested Fina Sodea Clementine mandarin were applied on October 16, 2001 near Grapevine: (1) 10 ppm of GA_3; (2) 40 ppm of GA_3; (3) AVG (Retain); (4) Accel; (5) Tryptophan; (6) CPPU; (7) K_2HPO_3; (8) compound X; (9) 10 ppm GA_3 + 30 ppm 2,4-D; (10) control. Fruit quality analyses of all treatments were sampled weekly from late October 2001 to January 2002.

The fruit quality analyses from 2001-2002 data showed that 10 ppm GA_3, 40 ppm of GA_3, and the GA_3 + 2,4-D treatment can delay the harvest by at least one month. However, both the 10 ppm and 40 ppm could cause leaf drop. The combination of GA_3 + 2,4-D may be the best treatment for maintaining fruit quality and delaying harvest of Clementine mandarin to December. The 50 ppm AVG treatment had no effect in maintaining fruit quality. The 12 ppm CPPU treatment caused leaf burn of Fina Sodea Clementine mandarin. We reduced the concentration of CPPU to 6 ppm for 2002 application. The same treatments were applied once again on October 2-3, 2002.

OBJECTIVE 3:

Study the use of PGRs and/or fertilizer to increase fruit set and yield.

A new set of treatments was added to the trial in 2002. These treatments were designed to increase fruit set and yield of Clementine mandarin. These treatments were applied at full bloom and at 30 days after 75% petal fall. These treatments included (1)10 ppm GA_3 at full bloom + 10 ppm GA_3 at 30 days after 75% petal fall; (2) 10 ppm GA_3 at 30 days after 75% petal fall; (3) 10 ppm GA_3 + 1% urea at 30 days after 75% petal fall; (4) Accel at full bloom; (5) Accel at full bloom + Accel at 30 days after 75% petal fall; (6) Accel & 1% urea at full bloom + Accel & 1% urea at 30 days after 75% petal fall; (7) Compound X at full bloom; (8) Compound X at full bloom + Compound X at 30 days after 75% petal fall; (9) Tryptophan at full bloom; (10) Tryptophan at 30 days after 75% petal fall; (11) CPPU at 30 days after 75% petal fall; (12) 12 ppm 2,4-D at 30 days after 75% petal fall; (13) 24 ppm 2,4-D at 30 days after 75% petal fall; (14) 10 ppm 2,4-DP at maximum peel thickness (objective 1); (15) 25 ppm 2,4-DP at maximum peel thickness (objective 1); and (16) control.

All treatments of full bloom were applied on April 18, 2002 and second treatments were applied June 6-7, 2002. Based on the suggestion from the CRB plant management and physiology committee, 10 ppm and 25 ppm of 2,4-DP were added to this set of treatments. These two treatments were designed to increase fruit size and yield of Clementine mandarin (Objective 1). Due to delay in getting 2,4-DP samples from Europe, these two treatments were applied on July 24, 2002.

Production and Management Strategies for New Mandarins in California

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The overall goal of this research is to develop proper management strategies for new mandarin production in California. There are three objectives for this research: (1) Study the phenology of new mandarins in California; (2) Study the pollination, fertilization and seediness of new mandarins; (3) Develop postharvest treatments and storage conditions for new mandarins.

OBJECTIVE (1):

Study the phenology of new mandarins in California.

During the 2001-2002 season, we collected data on calendar date for 10% anthesis, full bloom, and 75% petal fall at all sites. We sampled fruit of TDEs , Afourer , Gold Nugget , and 16 Clementine mandarins (Algerian , Arufatina , Caf fin , Carte Noir , Corsica #1 , Corsica #2 , Fina , Fina Sodea , Hernandina , Marisol , Nour , Nules , Oroval , Sidi Aissa ,