

CALIFORNIA GROWER

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FERTILIZER

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So Long Prorate

U.S. Citrus Growers Association
"The battle in which we fall from wounds
we receive in training away"



Last month we reported the passing of Carl Pescosolido, one of the most significant figures in the California citrus industry of the past decade.

This month we report the passing of the navel orange and lemon marketing orders, the victories for which Skip Pescosolido fought so long and tenaciously. They came as a result of departed USDA Secretary Edward R. Madigan's December 14th announcement that USDA would no longer approve weekly volume controls.

This parting shot of twelve years of Republican administrations' deregulation efforts wasn't taken lying down, naturally. Several Sunkist growers obtained a temporary restraining order to block the USDA secretary, but on December 29th the restraining order was lifted and the suspension of prorate was allowed to stand.

As this issue of California Grower went to press that was how the matter stood, but we doubt that's the last we'll hear of the prorate battle. We are sure the proponents of volume control will take every possible legal action to maintain the status quo that has ruled the California citrus world for decades.

Let us make it very clear that we are neither for nor against volume controls in the citrus industry. We are reporters of the California citrus scene with no axes to grind or oxen to gore.

What does concern us is what we perceive as the rather moribund state of the industry's marketing efforts. And we believe that the prolonged debate over prorate has sapped so much of the vitality out of the California citrus industry that the doors have been opened wide to competition from other citrus producing areas. Anyone who watched a New Year's Day Bowl game could not have missed the message the Florida citrus industry was sending the public — Beauty is only skin deep. And if by chance you missed that, the produce trade press has been filled lately with stories about new programs from Florida citrus marketers.

A Florida firm is importing Australian navels to the U.S. outside of our season and that may be acceptable, but they expect volume in 1993 to reach 600,000 cartons and that may not be acceptable. The Spanish are leading the way in development and marketing of mandarin varieties consumers want.

On page 23 you can read a state-of-the-industry interview with Sunkist president Russell Hanlin. In fairness to Russ, we should point out that the interview was conducted before Secretary Madigan took his action.

Next month, we will bring our readers an in depth analysis of navel orange marketing in an open market environment so that growers can share their views of the future of California's leading citrus crop.

In the meantime, we think it is time to call a halt to the internecine California Prorate War and get on with the long overdue task of market building. If we don't, others will. And they won't be Californians.

Willard Thompson

Foliar Urea Improves Yields

by Anwar G. Ali and Carol J. Lovatt

Introduction

Based on 56 "experiment-years" of citrus data, Embleton and Jones (1974) reported that kilogram for kilogram, foliar-applied nitrogen was as effective as soil-applied nitrogen for fruit production. Maximum nutritionally-attainable yields were obtained with annual nitrogen rates of approximately 0.5 to 0.7 kg per tree for oranges, 0.9 kg per tree for lemons, and 0.5 kg foliar-nitrogen and 1.4 kg soil-applied nitrogen per tree for grapefruit. While these requirements can be met with one annual soil application, limitations on the amount of nitrogen that can be applied in one spray, necessitate three to six foliar sprays each year to provide these levels.

The logical extrapolation that applying nitrogen to the foliage is a more costly management strategy has limited its adoption despite the fact that researchers have provided strong evidence that even a program of conjunctive soil and foliar-applied nitrogen can substantially reduce nitrate ground water pollution without adversely affecting fruit yield, size, and quality.

Results of our basic research suggested that a winter foliar-application of low-biuret urea (LBU) may increase yield. Field results, to date, have demonstrated that LBU applied to the foliage at the rate of 28 lbs N per acre (~0.15 kg N per tree) mid-January \pm 30 days increased navel orange yield without reducing fruit size each year of a 3-year trial.

Basic Research

Since citrus trees flower in the spring in response to low temperatures experienced during the winter, controlled-environment

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Carol J. Lovatt is a professor in the Department of Botany and Plant Sciences at U.C. Riverside.

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mutual concerns

Fruit Fly Coalition

Working in virtual obscurity with a skimpy budget is a group of individuals who are striving to develop an offense against future fruit fly infestations while focusing on eradication efforts. They have toiled for almost two years with tacit support from agricultural entities. Ultimately, utopia would be both the elimination of present and potential fruit fly problems. The objective of the group is to hold bureaucrats accountable for ongoing efforts and to keep agriculture focused on these issues.

The Exotic Fruit Fly Coalition was the brain child of Hank Brokaw and Dean Buchinger. It materialized out of their belief that we can do something to eliminate flies from our borders, that we must educate the urban citizen that an infestation is a problem for all of California, and to insure that political pressure is maintained for all eradication efforts.

As the Task Force formalized, Rich Matoian of the California Grape & Tree Fruit League assumed the role of coordinator. One of its first accomplishments was a response to a California Department of Food and Agriculture (CDFA) request for \$400,000 to help fund a sterile Mexican fruit flies facility in Mexico. The facility, a joint project with Mexican officials, will provide sufficient steriles to eradicate fly infestation near our border and eventually create a growing buffer zone.

In exchange for financial help, California has access to sterile Mexican fruit flies as the need arises. Just as important is that the coalition will monitor "our investment" to insure the quality of the flies and operational status of the facility.

Representatives of the coalition have traveled to Washington, D.C. to ensure



BY JOEL NELSEN

Federal cooperation on projects in Central America. They have traveled to Sacramento to ensure maximum focus on all fly programs. They have picked the brains of scientists from around the world and provided input to our own programs. Working with the

Alliance For Food & Fiber, they conducted a public outreach program with elected officials in six key Southern California counties.

Exclusion and eradication has been the direction. The group will seek research programs. At a meeting scheduled for late January or early February, they hope to reach out to these programs and present a case for dollars for fly research. The variance of fiscal years within the different entities precludes any commitment at this time. However, if the research boards are cognizant of the need and potential for success, then perhaps a few dollars from each entity could lead us to a time when California's fly efforts will be state of the art.

Again, in conjunction with the Alliance, a renewed public information program will commence. It will focus on newly elected officials, area opinion leaders, educators and other appropriate audiences.

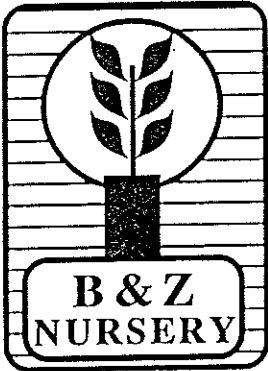
The coalition has been remarkably successful. The tenacity of Brokaw, Buchinger and Matoian has kept the group focused and in a progressive mode. They have helped shore up a governmental inspection system that resembled a leaky dike, they have kept diverse agricultural organizations focused on the fly problem and potential solution, they have developed an action plan and communicated their concerns, and they have held CDFA and United States Department of Agriculture (USDA) officials accountable.

Joel Nelsen is the president of California Citrus Mutual

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citrus marketing report

Navels

While the industry closely watched market prices for a reaction to USDA Secretary Madigan's suspension of volume regulation for the rest of the 1992/93 navel season, any possible market level reaction has been delayed by "Mother Nature." According to Holly Rees of the Navel Orange Administrative Committee, heavy rains the first week of January, with more expected, delayed harvesting and limited supply. At the start of the New Year, the 1992/93 navel crop continued to have good size, with texture above average, high sugar and maturity. Rees warns that this could indicate over-maturity late in the season.

Limes

Into the first week of the New Year, Warren Carrier of the California Lime Growers Association reported that "lime prices appear to have stabilized as a result of more rational harvesting by Mexican growers. California's problem has been cool weather that has turned limes yellow. Good green limes are yielding growers in excess of 25 cents, but supplies are very limited."

Specialty Varieties

Sources reported in early January that demand for specialty varieties looked strong going into the New Year. Fairchild Tangerines were expected to finish up the first week of January, with large size fruit, stem and leaf, selling at \$7.00 F.O.B. and bald selling at \$6.00. Orlando Tangelos show good demand, with 28 lb. carton Jumbo size selling at \$6.50, Mammoth at \$7.00 and Colossal at \$8.50. Minneolas out of Arizona are bringing in predominantly \$14.00 on prime sizes, 64's, 80's and 100's. The Central Valley was expected to begin shipment the last week of January. Kinnow Mandarins were expected to begin shipment in mid-January.

Foliar Urea Yields
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chambers have been used to apply low temperatures in a quantitative manner so that changes in plant growth regulators, carbohydrates, and nitrogen compounds could be monitored in relation to floral intensity. In such experiments, flower number was consistently correlated with the duration of the low-temperature period. However, no correlation between flower number and the endogenous level of any of several plant growth regulators nor between leaf concentrations of starch, glucose, total nitrogen, or nitrate could be demonstrated. In contrast, there was a significant correlation between the ammonia content of leaves collected 1 week after the end of the low-temperature treatment and both the duration of low-temperature stress ($p < 0.01$; $r = 0.6$) and flower number ($p < 0.0001$; $r = 0.8$).

To determine whether or not the ammonia accumulating in the leaves of citrus trees subjected to low temperature was physiologically related to floral intensity, 5-year-old rooted cuttings of the 'Washington' navel orange were subjected to short periods of low temperature which do not result in significant flower production. At the end of the treatment period, the ammonia status of the trees was artificially increased with a foliar-application of LBU (Table 1). This resulted in an increase in flower number.

In addition, foliar LBU increased the proportion of the total flower population

Mutual Concerns
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Utopia has obviously not yet been accomplished. But, if we all give the Fruit Fly Coalition a little more support, just imagine what it might accomplish. Who knows, we may be able to get more inspectors at key travel points. We may finally get cooperation from postal authorities, we just may get all of California to recognize that this subject is a statewide concern, not just agriculture's. We may even develop a buffer zone as large as Mexico and Central America.

There is definitely something tangible happening at the Fruit Fly Coalition; and, it deserves our support.

borne on leafy inflorescences (shoots bearing leaves and flowers). For example, when 5-year-old rooted cuttings of the 'Washington' navel orange induced to flower by 6 weeks of low-temperature treatment were also given a foliar application of LBU, the number of leafless inflorescences doubled, but the number of leafy inflorescences increased 4-fold, increasing the number of flowers borne on leafy inflorescences from 25 to 40 percent of

Table 1

The effect of LBU (1.5 g per tree) applied to the foliage of 5-year-old rooted cuttings of the "Washington" navel orange at the end of the low-temperature treatment

Weeks of low-temperature treatment at 15-18°C for 8h/day and 10-13°C for 16h/night	Increase in leaf ammonia content during the first week after transfer to warm temperature as a percent of the control without urea for each treatment	Increase in flower number as a percent of the control without urea for each treatment
4	166%	215%
6	194%	230%

the total flower population. Furthermore, foliar LBU increased the average number of leaves per inflorescence 3-fold. It is well documented for citrus that leafy inflorescences set more fruit that persist to harvest than leafless inflorescences.

These results provide the scientific rationale for the idea that a winter foliar application of LBU to commercially-producing citrus trees, in some years, may sufficiently increase the ammonia status of the trees over the level accumulating in response to low winter temperatures to result in increased flowering, fruit set, and yield.

Field Research

LBU was applied to commercially producing 30-year-old 'Washington' navel orange trees on Troyer citrange rootstock

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on November 14, December 14, January 14, or February 14 at the rate of 10 lbs LBU (Unocal PLUS, donated by the

Unocal Corporation) per 100 gallons. It is important to note that the increased yield resulting from the winter foliar application of LBU had no negative

effect on fruit size in any year of the study. For 1989-90 and 1990-91, the LBU treatment had the greatest number of fruit per tree with diameters from 7.0 to 8.0 cm (carton sizes 88 and 72); an additional carton per tree in 1989-90 and an additional half carton per tree in 1990-91. The increase in yield resulting from the winter foliar application of LBU was not a result of improved nitrogen status of the trees. At the end of the three-year experiment, leaf total nitrogen content of the 1991 spring flush leaves collected in September was not significantly different at the 5 percent level for control trees receiving soil LBU versus trees receiving foliar LBU. Leaf total nitrogen content was between 2.5 to 2.6 percent. There was no significant correlation between total N and yield. In Tables 3 and 4, we report the results of a cost-benefit analysis which used the following values: (i) The 1989-90 average price of \$3.20 per carton; (ii) 15 gallons Unocal PLUS, per acre at \$1.10 per gal-

Conclusion

California citrus growers are proactive. In response to the accusation that the Citrus industry has contributed to nitrate contamination of groundwater in California, growers decreased the amount of nitrogen applied to the soil and increased the use of foliar nitrogen. Our research results suggest that using low-biuret urea (LBU) as the source of nitrogen and shifting one application of 28 lbs nitrogen per acre to mid-January \pm 30 days, in some years, may sufficiently augment the ammonia accumulating in response to low winter temperatures to increase flowering and/or fruit set and yield without reducing fruit size, while providing 15 to 30 percent of the nitrogen required annually. This management strategy is economically viable and environmentally sound.

Table 2

Effect of LBU (1.5 g per tree) applied to the foliage at the end of 6 weeks of low-temperature treatment on inflorescence type of the 'Washington' navel orange.

Treatment	# of Flowers borne of leafless inflorescences	# of Flowers borne on leafy inflorescences	# Of Leaves borne on leafy inflorescences	Vegetative shoots
No urea	290	110	136	112
With urea	615	406	499	51

Unocal Corporation) per 100 gallons

Table 3

Three-year net cumulative increase in packing cartons and in total and net dollar return per acre for trees receiving foliar LBU versus soil LBU.

	Date LBU applied to the foliage			
	November	December	January	February
Packing cartons	288	319	452	400
Total return	\$924	\$1024	\$1451	\$1284
Net return	\$814-845	914-945	1341-1372	1174-1205

water sprayed to the drip point. (The equivalent of 60-lbs LBU per 600 gallons water per acre was used to provide 28 lbs N per acre; ~0.15 kg N per tree.) There were 12 individual tree replicates per treatment to make it possible to detect yield differences at the 5 percent level. All trees received 0.5 kg N per tree as LBU applied to the soil each year in November or December.

Yield Results

For three consecutive years, a winter application of foliar LBU in January or February increased the yield of 30-year-old 'Washington' navel orange trees in terms of both total fruit weight per tree and number of fruit per tree (without significantly reducing fruit size).

A January or February foliar application of LBU increased yield by just over one carton (17 kg, 37.5 lbs) per tree in 1989-90, just under one carton per tree in 1990-91, and by 2.5 cartons per tree in 1991-92, compared to trees receiving only soil LBU.

additional carton per tree in 1989-90 and an additional half carton per tree in 1990-91.

The increase in yield resulting from the winter foliar application of LBU was not a result of improved nitrogen status of the trees. At the end of the three-year experiment, leaf total nitrogen content of the 1991 spring flush leaves collected in September was not significantly different at the 5 percent level for control trees receiving soil LBU versus trees receiving foliar LBU. Leaf total nitrogen content was between 2.5 to 2.6 percent. There was no significant correlation between total N and yield.

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Table 4

Average net dollar return per acre per year for trees receiving foliar LBU versus soil LBU.

Date LBU applied to the foliage

November	December	January	February
\$271-282	\$305-315	\$447-457	\$391-402

In each year of this study, the winter foliar application of LBU more than paid for itself (Tables 3 and 4).

Editor's note:

This preliminary report represents a portion of the dissertation research conducted by Anwar G. Ali in partial fulfillment of the requirements for the Ph.D. in Botany at the University of California. A full report will be submitted to the Journal of the American Society for Horticultural Science.