Effects of Foliar Applied Fertilizers on Yield and Quality of Late Spring Cantaloupes and Honeydews

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Abstract

A number of foliar fertilizers were evaluated for their effects on yield and quality of both cantaloupes and honeydews. None of the treatments or treatment combinations resulted in statistical increases or decreases for numbers of cantaloupes or honeydews when compared with the untreated check. A highly significant increase of one treatment regimen (which contained calcium) was noted for cantaloupe weights when compared with the untreated check. Statistical differences were not noted for honeydew weights for this treatment althought it also resulted in highest calculated weights of honeydew/area of treatments evaluated. All treatments resulted in numerically higher brix for cantaloupes than the untreated check, thought to be a response to pounds of melons/unit area as the untreated check had the least cantaloupe weight. No differerences were noted for cantaloupe seed cavity diameters.

Introduction

Little, if any, work has been completed by University personnel under low desert conditions to determine if foliar fertilizers have any effect on melons grown while receiving adequate to excellent soil fertilization. This trial was initiated to obtain data to document effects of foliar fertilizers on melons in terms of yields, brix, and quantity of spring melons grown in the low desert.

Methods and Materials

Two fields of melons, one of cantaloupes (variety 'Gold Master', planted April 1, 1999) and one of honeydews (variety 'Saturno', planted April 20, 1999) that were contiguous to each other located north of Ripley, CA, were selected for this experiment. Treatments consisted of various foliar fertilizers and plant stimulants (Tables1 and 2), with some treatments applied three times over the course of the experiment, while other treatments or components of foliar fertilizer programs applied only once.

Plot sizes were five beds (80 inch centers) wide by field length (1,230 ft) and most treatments were replicated four times in a randomized complete block design in both the cantaloupes and the honeydews. Exceptions to this were the initial 12 qt. rate of SuperCharge, which had only 2 replications in cantaloupes due to sprayer malfunction, and the initial 0.5 qt and 2 qt rates of SuperCharge in the honeydews which had three replications.

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The first application to both cantaloupes and honeydew fields was made May 28. At this time the cantaloupe field was at first female bloom, and 42% of the honeydew plants had a male flower. Spray band width was 15 inches. Cantaloupes received a second application/treatment on June 8, and the third was applied on June 15. The latter date was when the honeydew melon field received its second treatment; the third treatment to honeydews was made on June 19. Bandwidth was 30 inches on June 8th and 15th, and 45 inches on June 19th. All treatments were applied with an FMC sprayer calibrated to deliver 29 gallons/acre broadcast at 40 psi; amounts of water applied were actually higher per treated acre due to banding. Product amounts in treatments were calculated for treated acreages and adjusted accordingly.

Data collection began on June 9 in the cantaloupes and consisted of measuring vine lengths, number of leaves/vine, counting open male and female flowers/vine in addition to number of fruit/vine and length of the newest five nodes from five vines per plot. Only one replication was so sampled however, and data were not statistically analyzed.

Cantaloupe yield data were collected on July 7-9. Cantaloupes were counted in three 10 ft lengths of row on July 7. Five to ten cantaloupes were collected from these areas in each plot, returned to the laboratory where they were weighed and brix data and cavity diameters collected.

Honeydew numbers were collected on July 10 and 21 by measuring 30 feet of row and counting numbers of honeydews. This was done three times in each plot on July 10 and repeated 1-4 times per plot on July 21. Honeydew weights were collected on July 21 by collecting all melons in 10 ft. of row, counting them and weighing them to determine average melon weight in each plot. Average melon weight for each plot was then used to calculated melon poundage for 30 row feet based on average melon number/plot. No quality data were obtained for the honeydew melons.

Analysis of variance was used for statistical data, with treatment means separated using a Fisher's least significant difference test (Statgraphics Plus for Windows, version 3; Manuguistics, Inc.)

Results

Melon numbers

The treatment with most melons for both cantaloupes (Table 2) and honeydews (Table 3) was the Helena #1 package which consisted of Empower and EleMax PhosCal applied first, Binary CQ and EleMax PhosCal Zinc applied during the second application, and PhosCal and CoRoN 28-0-0 applied last. Although Empower is labeled as an insect repellent, this product did not appear to repel bees based on numbers of melons per 30 ft of row. This may be in part due to how the product was used, as the Empower label indicates that spray tank pH should be no higher than 6.0, but no buffering agent was used in this experiment, and pH of the water was above 7.0 which may have negated potential repellency effects of Empower.

Statistical differences existed for numbers of melons between the two extremes in both types of melons. In cantaloupes, two treatments (Helena #1 program, Custom Blend) averaged 55.0 melons in 30 row feet, while Musol X-16 had the fewest at 43.75 (Table 2). In the honeydew field where treatments began earlier in the crop flowering period (just under 50% of plants with first male bloom), Musol X-16 was second highest (37.9 melons/30 row feet) after the Helena #1 treatment program (38.4), followed by Custom Blend. All other treatments had fewer melons than the untreated check.

In the cantaloupe field (Table 2), as amounts of Super Charge applied at first female cantaloupe bloom (May 28th) decreased, numbers of melons increased. The data appear to suggest that applications containing sulfur (SuperCharge =3% S and X-16) applied at first female cantaloupe bloom and again later (mid-bloom) may have reduced fruit set, perhaps due to bee repellency. Sulfur is present in Musol X-16, as several sulfates are listed as sources of secondary plant nutrients, but sulfur is not listed in the guaranteed analysis of Musol X-16 as it contains less than 1% sulfur. Sulfur, however, is not known to repel bees from melons according scientific literature available (pers. comm., Dr. E.H. Erickson, USDA Bee Lab., Tucson, AZ).

Reduction in cantaloupe fruit set in relation to increasing amounts of SuperCharge and other sulfur containing treatments may just be a coincidence, however. This trend was not noted in honeydew melons, but first treatments in this field were applied prior to first female flower. It is also possible that fruit number differences noted may be due to increased attractiveness and/or nutritional content of blossoms and pollen, rather than repellency due to applied treatments.

Although numbers of cantaloupes noted in the Custom Blend and Helena #1 treatment plots were 8.4% higher than the untreated check, these differences were not statistically different and not correlated with any particular element contained in the treatments. Plant tissue analyses were not part of this experiment however, and may help to explain differences noted.

Another aspect of fruit set noted may be the number of female flowers and their overall percentage. Typically under good pollination and bee activity in cantaloupes, flowers consist of approximately 7.5%-9.1% female flowers, roughly a ratio of 1 female:10 male flowers. When bees are excluded and no pollination takes place, female flowers make up about 20% of the overall flower average (McGregor, 1976 and references therein). Lack of fruit set in cantaloupes is thought to stimulate a higher production of hermaphrodite (female) flowers. Bees searching in cantaloupes would supposedly increase visits to females flowers when a higher percentage of such flowers are available, thereby increasing pollination and fruit set.

Data from June 9 (one day after second application to cantaloupes) indicate that differences in percentage of female flowers may exist between the different treatments. Both Helena fertilizer programs had more than 20% female flowers, while all other treatments (with the exception of X-16 at 16.7% female flowers) were between 8.7-11.1% female flowers. Because only one replicate of the field was utilized to gather these data and low numbers of flowers counted, these percentages may not be consistent, and no conclusions should be made until further research is conducted. For example, the highest percentage of female flowers and the fewest total flowers was noted in the Helena #1 treatment plot (first treated with Empower and EleMax PhosCal). The Helena #1 treatment program also had the highest number of fruit/acre (Table 2). A high percentage of female flowers was also noted in the Helena #2 treatment program plot but this treatment had an almost identical number of fruit at harvest as did the untreated check. Well-fertilized crops (increased bee visits) are associated with greater seed numbers, which is highly correlated with cantaloupe size (McGregor, 1976).

Melon weights and yields

In both the cantaloupes and honeydew melons, the Helena #1 program resulted in the most pounds of melons. While part of this is attributed to an increased number of melons in this treatment compared with other treatments, melon weights in this treatment were also heavier than most other treatments as well.

In cantaloupes, both Helena programs and the Musol X-16 treatments produced melons weights in 10 foot of row that was approximately 97% of the melon number in 30 feet of row. Other treatments had melon weights that ranged between 82-93% of number of melons in 30 row ft., while the untreated check melon weight was only 76% of melon numbers in 30 feet of row and had statistically less yield than the Helena #1 program.

In the honeydew melons, average melon weights for the treatments were not statistically different, nor were calculated lbs. of melons per 30 row feet, and were similar to numbers of melons (Table 3).

Why was the Helena #1 program the top treatment in terms of overall yield? One reason was the number of melons set as well as the weight per melon. The reason for the fairly high weights of melons may be due to the high amounts of calcium contained in this program. Calcium is one of the main elements that increases the weight of vegetable crops (Johnson, 2000). Most nutritional elements are readily and rapidly translocated from older to newer tissues, but calcium can only be slowly translocated at best, and often not fast enough to keep up with new growth, especially at rapid rates under desert conditions.

Research conducted in California a number of years ago demonstrated interactions between nitrogen and calcium in cantaloupes. When 120 lbs of nitrogen were applied to cantaloupes, a significant increase of sodium was noted, but a significant decrease in calcium percentage of 25-37% and magnesium of 21-30% in petiole samples compared with no nitrogen application. Other macronutrients (P_20_5 and K_20) applied at the same rates did not affect sodium, calcium, or magnesium (Lingle and Wight, 1964).

Large differences are noted for levels of calcium needed in cantaloupes, perhaps indicating that further research and data are needed on this element in cucurbit crops. In Florida, the current adequate range is 1-2% on a dry weight basis of plant tissue analysis at early bloom (Hochmuth, et. al., 1999). In South Carolina, however, 5-7% calcium is noted to be sufficient when based on tissue testing the youngest mature leaves prior to or at initial fruit set (Lipperts, 1999). Australian calcium levels for cucurbits (Weir and Cresswell, 1993) are similar to those from South Carolina.

Brix; seed cavity diameter and as percentage of melon diameter
No statistical differences were noted for brix; all treatments had slightly higher brix than the untreated check however, with the 12 quart rate of SuperCharge and the Helena#1 program having highest brix levels. Seed cavity was very similar in all treatments (Table 2) as was the seed cavity diameter as percent of cantaloupe diameter; the Helena #1 program had a slightly smaller percentage than did other treatments.

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Table 1. Fertilizer constituents.

Bayfolan Plus *(Helena Chemical)*
11-8-5, also contains 0.02% B, 0.0005% Co, 0.05% Cu, 0.1% Fe, 0.05% Mn, 0.0005% Mo, and 0.05% Zn.

Binary CQ *(Helena Chemical)*
8-4-2, also contains 0.0075% Co, 0.15% Cu, 0.2% Fe, 0.16% Mn, and 0.35 Zn. Each gallon weighs 10.1 lbs.

CoRoN *(Helena Chemical)*
28-0-0 A controlled release liquid fertilizer. Each gallon weighs 10.6 lbs and contains 2.97 lbs N/gallon.

Custom Blend Foliar *(Westbridge)*
This product contains no N-P-K fertility, but consists of 2% humic acid (derived from leonardite and decomposed plant and animal tissues). Each gallon weighs 9.08 lbs.

Ele-Max ManZinc FL *(Helena Chemical)*
3% Urea N, 13.9% Mn, 19.5% Zn (0.448 lbs N, 2.07 lbs Mn, and 2.93 lbs Zn). Each gallon weighs 14.96 lbs.

Ele-Max PhosCal LC*(Helena Chemical)*
3-23-0, also contains 3% Ca. Each gallon weighs 10.95 lbs.

Ele-Max PhosCal-Zin *(Helena Chemical)*
4-15-0, also contains 13% Ca, and 7.8% Zn. Each gallon weighs 12.82 lbs.

Empower *(Helena Chemical)*
3.75-0-0. Empower also contains 10% garlic juice (0.83 lbs/gal) and is considered to have insect repellency effects. Empower also contains 0.2% Mg, 0.1% Bo, 0.11% Co, 0.19% Cu, 0.2% Mn, 0.24% Fe, 0.1% Mo, and 0.43% Zn.

Musol X-16 *(Flim USA)*
10.5-11.25-5.4, also contains 0.0456% B, 0.0045% Co, 0.394% Cu, 0.1% Fe, 0.0726% Mn, 0.0093% Mo, and 0.0908% Zn. Each gallon weighs 10.23 lbs

SuperCharge *(J & T Enterprises)*
7-25-4, also contains 3% S, 0.1% Fe, and 0.05% Zn, as well as 0.3% humic acids derived from leonardite. Each gallon weighs 11.8 lbs.

Tracite 8-30-2 *(Helena Chemical)*
8-30-2, also contains 0.02%B, 0.0005% Cu, 0.1% Fe, 0.05% Mn, 0.0005% Mo, and 0.05% Zn. It also contains 2% humic acid derived from leonardite. Each gallon weighs 11.78 lbs.

TABLE 2. Mean numbers of cantaloupes per 30 foot of row, cantaloupe poundage/10 ft of row, brix, seed cavity diameter and cavity as percent of cantaloupe diameter following various fertilizer treatments, Blythe, CA, 1999.

	Amounts applied per acre & treatment date						Seed cavity	
Treatment	**May 28**	**June 8**	**June 15**	**#/30 ft**	**Lbs/10 ft**	**Brix**	**Diam**	**% of melon**
							(cm)	
Helena #1				55.0a	53.1a	8.4a	6.3a	45.9a
Empower	1.5 qts							
Ele-Max PhosCal	2 qts		2 qts					
Binary CQ		2 qts						
Ele-Max PhosCal Zinc		2 qts						
CoRoN 28-0-0			4 qts					
Helena #2				49.5ab	47.45ab	8.1a	6.4a	47.2a
Binary CQ	2 qts							
ELE-Max ManZin FL		1 qt	1 qt					
Bayfolan		2 qts						
Tracite 8-30-2			2 qts					
Musol X-16	2 qts	2 qts	2 qts	43.75b	42.90ab	7.0a	6.6a	47.3a
Super Charge	12 qts			46.5ab	42.81ab	9.5a	6.3a	46.7a
Super Charge	2 qts	2 qts	3 qts	49.75ab	41.27ab	6.6a	6.2a	47.9a
Super Charge	0.5 qt	0.5 qt	3 qts	53.25a	49.35ab	8.1a	6.3a	46.5a
Custom Blend		1.25 qts		55.0a	45.43ab	8.1a	6.3a	46.6a
Untreated check				50.75ab	37.95 b	6.2a	6.3a	47.1a
				$p \leq 0.05$	$p \leq 0.01$	$p \leq 0.05$	$p \leq 0.05$	$p \leq 0.05$

Means in columns followed by the same letter are not significantly different at the probability level indicated beneath the column when utilizing a Fishers LSD test. Means in columns were not significantly different at the $p \leq 0.05$ level when utilizing the more conservative Newmans-Kuhls multiple range test, however.

TABLE 3. Mean honeydew poundage and numbers per 30 ft of row and average melons weights in response to various fertilizer treatments and timings.

	Amounts applied per acre & treatment date				Ave. melon	Calculated lbs
Fertilizer Treatment	May 28	June 15	June 19	Melons/30 ft	weight (lbs)	melons/30 ft
Helena #1				38.4a	4.66a	178.8a
Empower	1.5 qts					
EleMax PhosCal	2 qts		2 qts			
Binary CQ		2 qts				
EleMax PhosCal Zinc		2 qts				
CoRoN 28-0-0			4 qts			
Helena #2				35.0 b	4.28a	150.4a
Binary CQ	2 qts					
Ele-Max ManZin FL	1 qt	1 qt				
Bayfolan		2 qts				
Tracite 8-30-2			2 qts			
Musol X-16	2 qts	2 qts	2 qts	37.9ab	4.41a	167.5a
SuperCharge	12 qts			35.5ab	4.62a	163.8a
SuperCharge	0.5 qt	3 qts	3 qts	35.9ab	4.44a	162.6a
SuperCharge	2 qts	3 qts	3 qts	34.4 b	4.89a	171.3a
Custom Blend		1.25 qts		37.7ab	4.29a	161.4a
Untreated check				37.0ab	4.60a	169.7a

Means in columns followed by the same letter are not significantly different at the $p \leq 0.05$ level (Fishers LSD).