

Evaluation of Controlled Release Fertilizers and Fertigation in Strawberries and Vegetables

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Objectives

The main objective of this project is to explore research, field demonstrations and educational elements for the nutrient management of strawberries and vegetables.

Procedures

Three fertilizer trials were established in strawberries during 1996-98. All of the trials were located east of Santa Maria. The trials received the same fertigation, irrigation, pest control and picking schedule as the commercial fields.

The strawberries were harvest by the growers commercial strawberry pickers. The fresh and freezer yields were based on the growers high standard for fruit quality.

The preplant fertilizer treatments were applied in October to compare three controlled release fertilizers a standard fertilizer and no preplant fertilizer. The controlled release fertilizers were compared at 2 rates, 80 and 160 pounds of nitrogen per acre. The fertilizers were placed 5" below the bed surface and 2" to the side of the plants. Each fertilizer treatment was replicated four times in a randomized block design. The plots were 1 bed (64") wide. The 1996 and 1997 plots were 25' long and the 1998 plots were 30' long.

1996 Procedures

The variety Camarosa was planted on October 25, 1995 with plants dug from a McArthur nursery on October 22, 1995. The grower's fertilization program applied a total of 180 pounds of nitrogen per acre.

The spring rains delayed the first harvest until March 17, 1996. During April, May, and June, the trial was harvested on a 3 or 4 day schedule and irrigated after each picking. The last fresh fruit harvest was on July 4, 1996. The trial was harvested for freezer fruit from July 10 to August 8, 1996.

1996 Results

The strawberry yields are shown in Table 1. The strawberry yields were not significantly different between the 3 controlled release fertilizers. The controlled release fertilizers with 160 lbs. of Nitrogen per acre produced significantly higher strawberry yields than the plots with 80 lbs. of Nitrogen. The yields are very high for this area indicating a good production management program.

The standard commercial fertilizer at 160 lbs. of nitrogen produced yields similar to the 80 lbs. per acre rate of the controlled release fertilizers. The treatment with no preplant fertilizer produced significantly lower yields than the other 7 treatments.

Soil samples collected in May and June showed non significant differences between fertilizer treatments in NO₃-N and ECe concentrations. The samples ranged from 1.1-12.0 ppm - NO₃-N and 1.2 -3.9 ECe of the soil solution.

Table 1. 1996 Strawberry Fruit Yields with Three Fertilizer Rates and Three Control Release Fertilizers in Combination with Fertigation.

Fertilizer				N Preplant	Fruit Yields*					
					Fresh		Freezer		Season Total	
				----- lbs/A -----						

1	Duration	24-8-15	urea	160	71,36 8	a	9,655	a	81,02 3	a
2	Agricote	22-7-11	urea	160	70,25 9	a	9,295	ab	79,55 3	a
3	Agriform	18-8-13	NH ₄ N O ₃	160	69,74 4	a	9,172	ab	78,91 6	a
4	Duration	24-8-15	urea	80	65,80 4	b	8,672	ab	74,47 6	b
5	Agricote	22-7-11	urea	80	66,07 2	b	8,227	b	74,29 9	b
6	Agriform	18-8-13	NH ₄ N O ₃	80	64,66 8	b	8,306	b	72,97 4	b
7	Growers Commercial	15-15-15		160	63,71 5	b	9,660	a	73,37 5	b
8	Control				56,74 7	c	8,618	ab	65,36 4	c
				CV%:	2.6%		7.4%		2.4%	

*Duncan's multiple range test - Data numbers represented by the same letters are not significantly different at the 5% level.

1997 Procedures

The variety Camarosa was planted on November 7, 1996 with plants dug from a McArthur nursery on October 30, 1996. The grower applied a total of 170 pounds of nitrogen per acre through fertigation.

The first strawberry harvest was on February 24, 1997 and the last fresh fruit harvest on May 18, 1997. The trial was harvested for freezer fruit starting on May 23 and continued until August 1, 1997.

1997 Results

The strawberry yields are shown in Table 2. The fertilizer trial shows the advantage of a preplant fertilizer application. The 3 controlled release fertilizers showed non-significant difference in strawberry yield. The 3 controlled release fertilizers with 160 pounds of nitrogen per acre produced significantly higher strawberry yields than the treatments with 80 pounds of nitrogen.

The standard commercial fertilizer at 160 pounds of nitrogen produces yields similar to the 80 pounds per acre of controlled release fertilizer. The plots receiving no preplant fertilizer product the lowest strawberry yields.

Soil samples showed non-significant differences between treatments for NO₃-N. The soil NO₃-N ranged from 1.0-8.0 ppm. The surface area had relatively low concentrations. The NO₃-N at the deeper depths had a wider range with 2-8 ppm.

Table 2. 1997 strawberry fruit yields with two fertilizer rates and three controlled release fertilizers in combination with fertigation.

Fertilizers			Nitrogen Preplant lbs/acre	Fruit Yield*			
				Fresh	Freezer	Season Total	
1.	Duration	24-8-15	urea	160	46,802b	40,275a	87077a
2.	Helena	20-7-15	urea	160	46,823b	39,544ab	86,366a
3.	Agriform	18-8-13	NH ₄ NO ₃	160	48,166a	38,368bc	86,534a
4.	Duration	24-8-15	urea	80	42,563c	36,443de	79,006b
5.	Helena	20-7-15	urea	80	42,920c	35,409de	78,329b
6.	Agriform	18-8-13	NH ₄ NO ₃	80	44,666b	35,132e	79,798b
					c		
7.	Commercial	15-15-15		160	43,843b	37,168cd	81,011b
					c		
8.	Control	-	-	-	34,765d	32,561f	67,326c

*Duncan's multiple range test - data numbers represented by the same letters are not significantly different at the 0.05 level.

1998 Procedures

The variety Camarosa was planted on November 1, 1997 with plants from a McArthur nurse dug on October 27, 1997. The grower applied through fertigation a total of 185 pounds of nitrogen per acre through fertigation.

The first strawberry harvest was on March 20, 1997. The trial was harvested as fresh fruit all season with the last harvest on August 3, 1998.

1998 Results

The strawberry yields are shown in Table 3. The yield shows the control treatment was significantly lower than all the other treatments receiving preplant fertilizer.

Table 3. 1998 strawberry fruit yields with two fertilizer rates and three controlled release fertilizers in combination with fertigation.

Fertilizer				Nitrogen Preplant lbs/acre	Season total yield*
1	Duration	24-8-15	urea	160	67890a
2	Helena	20-7-15	urea	160	66279a
3	Agriform	18-8-13	NH ₄ NO ₃	160	67429a
4	Duration	24-8-17	urea	80	69417a
5	Helena	20-7-15	urea	80	65879a
6	Agriform	18-8-13	NH ₄ NO ₃	80	66581a
7	Commercial	15-15-15		160	67376a
8	Control	-	-	-	61914b

*Duncan's multiple range test - data numbers represented by the same letters are not significantly different at the 0.05 level.

Summary

The three fertilizer trials clearly show the response to preplant nitrogen applications in addition to the nitrogen applied by fertigation through the drip system.

Two of the three trials showed a yield response to the 160 pounds per acre controlled release fertilizer over the 80 pound application.

Celery

Santa Maria Valley has been targeted as a nitrate sensitive area.

Procedures

Two celery fertilizers trial were established in commercial celery fields west of Santa Maria. The fields had been cropped to vegetables for many years.

Each fertilizer treatment was replicated four times in a randomized block design with each plot 50 feet long and four beds wide. The two center beds, 25 feet long, were harvested for yield. Ten plants per plot were collected at random from the harvested boxes to evaluate the nutrients removed by the crop.

Petiole samples were collected during the growing season to compare nitrogen levels between treatments. The trials were harvested, graded for size, and boxed by the commercial harvest crews.

Ranch 2

The first celery fertilizer trial was established on January 5, 1996 to compare 7 fertilizer treatments. Three controlled release fertilizers were applied pre-transplant at the rate of 125 and 250 pounds of nitrogen per acre. The plots with 125 pounds of nitrogen received an additional sidedress application of 100 pounds of nitrogen per acre. The standard commercial fertilizer treatment received a pre-transplant application of 30 pounds of nitrogen per acre (6-20-20) and 3 sidedress applications for a total of 260 pounds of nitrogen per acre. All of the plots received a sprinkler application of 40 pounds of nitrogen per acre 14 days prior to harvest.

Prior to the fertilizer trial at the time the beds were established, all of the plots received 30 pounds of nitrogen and 100 pounds of phosphorous and potassium (3-10-10).

The variety, Conquistador, was transplanted on January 8, 1996. The trial was harvested on April 30, 1996.

Ranch 6

The second celery fertilizer trial was established on February 2, 1996 to compare 5 fertilizer treatments. Two controlled release fertilizers were applied pre-transplant at the rate of 80 and 160 pounds of nitrogen per acre. The plots with 80 pounds of nitrogen received an additional sidedress application of 80 pounds of nitrogen per acre. The standard commercial fertilizer treatment received a pre-transplant application of 30 pounds of nitrogen per acre (6-20-20) and sidedress applications of 8-8-8, for a total of 210 pounds of nitrogen per acre. Fertigation applications of 30 pounds of nitrogen per acre were applied on May 1, 14, and 28, through the drip tape on all the plots compared to the controlled release fertilizer treatments.

All of the treatments received 2 tons/acre of chicken manure prior to bedding-up. During bedding-up, 21 pounds of nitrogen per acre was applied as 3-10-10. On March 30, 1996, the controlled release fertilizer treatments received a sidedress application of 90 pounds per acre of phosphorus and potassium as 0-8-8.

The variety, Conquistador, was transplanted on February 23, 1996. The trial was harvested on June 11, 1996. The soil type is a Corralitos loamy sand.

Results: Ranch 2

The celery yields were high, ranging from 77,376 to 96,270 pounds per acre. Celery yields and stalk size is shown in Table 4. The celery yields were not significantly different between the three controlled release fertilizers. The three controlled release fertilizer treatments with 250 pounds of nitrogen produced significantly higher celery yields than the plots with 125 pounds of nitrogen. The standard commercial fertilizer plots produced the lowest yield and the smallest size stalks. During the early growth stages, the celery was smaller and a lighter green color in the commercial fertilizer plots.

The celery stalks were graded as 24, 30, and 36 stalks per box. The celery size distribution was the major factor affecting yields.

Table 4. Celery yield and size distribution.

Fertilizer	Nitrogen Lbs/Acre	Yield Lbs/A	Size Distribution		
			24	30	30
			% of Stalks		
Duration 27-9-9	250	96,270 A	50.7 AB	47.9	1.4 B
Scotts 25 25-7-11	250	96,332 A	55.0 A	40.5	4.0 B
Scotts 24 24-7-7	250	95,273 A	53.5 A	41.3	5.3 B
Duration 27-9-9	125	89,323 B	45.9 AB	44.6	9.6 B
Scotts 25 25-7-11	125	88,759 B	45.3 AB	48.4	6.3 B
Scotts 24 24-7-7	125	90,355 B	42.7 AB	47.1	10.2 B
Commercial	300	77,376 C	24.1	52.7	23.2 A
				NS	

Ranch 2

Duncan Multiple Range Test - Data numbers represented by the same letters are not significantly different at the 5% level. Size Distribution Data on size 30 values are not significantly different at the 5%

Ranch 6

The celery yields on ranch 6 were higher than ranch 2. Celery yields and stalk size is shown in Table 5. The yields ranged from 104,819 to 115,659 pounds per acre. The celery yields were not significantly different between the two controlled release fertilizers. The two controlled release fertilizers at 160 pounds per acre produced significantly higher celery yields than the plots with 80 pounds of nitrogen. The standard commercial fertilizer produced the lowest yield. During early growth stages the celery was smaller and a lighter green color in the commercial fertilizer plots compared to the controlled release fertilizer treatments.

The stalks were graded into 18, 24, and 30 stalks per box. There was a trend for the higher yielding treatments to produce larger stalks.

Table 5. Celery yield and size distribution.

Fertilizer	Nitrogen Lbs/Acre	Yield Lbs/A	Size Distribution		
			18	24	30
			% of Stalks		
Duration 27-9-9	160	115,659 A	41	92	24
Scotts 25 7-7	160	114,916 A	36	100	22
Duration 27-9-9	80	108,011 BC	32	98	26
Scotts 24 7-7	80	109,049 B	35	87	31
Commercial	300	104,819 C	23	86	45
			NS	NS	NS

Ranch 6

Duncan Multiple Range Test - Data numbers represented by the same letters are not significantly different at the 5% level.

Size Distribution Data values are not significantly different at the 5% level.

Summary

Celery yields may be increased through the use of controlled release fertilizers during year with heavy winter rainfall