Evaluation of Slow Release Fertilizers for Cool Season Vegetable Production in the Salinas Valley

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Introduction

This project is evaluating the performance of slow release fertilizers on cool season vegetable production in the Salinas Valley. Controlled laboratory studies were conducted in the first year of the project (2000-01) and field studies were conducted the first and second year of the project. The evaluations include the effect of two slow release materials at three rates on broccoli grown over the winter during the rainiest time of the year. Broccoli was selected as the test crop because it is a key cool-season vegetable that is extensively planted in the Salinas Valley (54,899 acres in 2001). In addition, significant acreage is grown in the winter when the potential for losses of nitrogen due to leaching and the risk of being rained out of the field to make sidedress applications is high.

Objective

Evaluate nitrogen release, yield and the economics of a select number of coated urea, slow release fertilizer materials in a field trial conducted on winter broccoli.

Description

A slow release fertilizer trial was conducted in a commercial broccoli field in the Salinas Valley during the winter of 2001-02. An over-wintered field with a medium textured soil was selected for the trial to provide the greatest potential for exposure to the high rainfall months and greatest potential for nitrogen movement from the root zone (i.e. December to February). This was a low rainfall year as a total of only 4.70 inches of rain fell during the trial with no one rainfall event exceeding 0.95 inches in a 24 hour period. The slow release fertilizer was shanked into listed beds on November 30 and the broccoli was direct seeded on December 3. Two hundred pounds of nitrogen was applied as all slow release

fertilizer, or as combinations of slow release fertilizer and sidedress applications of conventional fertilizer (Table 2). The slow release treatments were compared with an untreated control and a standard treatment that received a total of 200 lbs N/A.

Biweekly soil samples were collected during the course of the growing season and analyzed for nitrate and ammonium. Leaf blade and petiole tissue samples of the broccoli were collected at three times during the growing season and analyzed for total nitrogen and nitrate-nitrogen. In order to have a measure of the relative amounts of nitrate removed from the soil by plant removal or leaching, soil samples were collected at one-foot increments to three feet at the beginning and at the end of the growing season. The samples were analyzed for nitrate and ammonium. The trial was harvested by commercial harvesters on two dates (April 18 to 24) and the number and weight of broccoli heads per plot was collected.

Results and Conclusions

There were high levels of residual nitrate-N in the soil at the beginning of the trial and the levels of soil nitrate-N in the untreated plots did not separate from the standard fertilizer treatment until after the February 5th sampling date (Figure 1). The slow release and standard fertilizer treatments had higher nitrate-N in the soil than the untreated on the February 19 and March 5 sampling dates. These differences were not reflected in differences in the total-N in broccoli tissue at the two later sampling dates (Table 1). The soil nitrate-N in the 200 lb N/A slow release treatments declined steadily over the course of the season, while the standard and combination slow release fertilizer treatments spiked higher soil nitrate-N values following fertilizer applications.

There was significantly greater broccoli head biomass in all slow release fertilizer and standard fertilizer treatments than the untreated control on the first harvest date (data not shown). The total number and weight of broccoli heads harvested from the standard and slow release fertilizer treatments were comparable (Table 2). There was no increase in the mean head weight of broccoli in the 2001-02 season as was observed in the first year of the study. The cost of fertilizer programs that utilize 100, 75 and 50% slow release fertilizers in a typical broccoli fertilizer program (i.e. 230 lbs N/A) cost 33, 27 and 22% more than the standard fertilizer program (Table 3). Slow release fertilizers did not increase the yield of broccoli in these trials and they have additional costs. Growers may still be motivated to utilize slow release fertilizers to reduce the risk of being rained out of the field to make side-dress applications during high rainfall growing seasons. Under these conditions, slow release fertilizers can give comparable yields to a standard fertilizer program.

The 2000-01 growing season was a low rain fall year. Further tests with heavier rainfall events during the growing season may provide greater opportunities to

observe the ability of slow release fertilizer to provide nitrogen to winter grown broccoli, as well as its ability to resist leaching by winter rains.

Table 1. Total nitrogen in broccoli tissue on three sampling dates.

Treatments (N/A)	Feb 26	Mar 19	Apr 4
Polyon 200	6.11	4.94	5.22
Polyon 150+50	6.23	4.87	5.74
Polyon 100+50+50	6.24	4.81	5.59
Duration 200	6.09	5.23	5.82
Duration 150+50	6.12	4.67	5.33
Duration 100+50+50	6.07	5.13	5.59
Standard	6.31	4.94	5.64
Untreated	5.64	4.82	5.53
LSD (0.05)	0.17	n.s.	n.s.
Contrast (0.05)			
Slow release vs Standard	n.s.	n.s.	n.s.

Table 2. Fertilizer application schedule and total yield of broccoli

Treatment	11/30/01 lbs N/A	Sidedress #1 1/15/02	Sidedress #2 1/29/02	Sidedress #3 2/22/02	Sidedress #4 3/18/02	Total No. Heads	Total Wt. (lbs)	Mean Head Wt.
Polyon	200	0	0	0	0	149.4	84.1	0.56
Polyon	150	0	0	0	50	152.7	87.9	0.57
Polyon	100	0	50	0	50	148.8	84.6	0.57
Duration	200	0	0	0	0	140.1	83.7	0.59
Duration	150	0	0	0	50	146.5	85.1	0.58
Duration	100	0	50	0	50	142.2	79.4	0.55
Standard	0	50	50	50	50	141.5	83.5	0.59
Untreated	0	0	0	0	0	148.5	77.4	0.52
LSD (0.05)						n.s.	7.0	0.05
Contrasts (0.05)								
Polyon vs Duration						n.s.	n.s.	n.s.
Slow release vs Standard						n.s.	n.s.	n.s.
200 slow release vs standard						n.s.	n.s.	n.s.
200 slow release vs 100 slow release						n.s.	n.s.	n.s.

Table 3. Cost comparison summary for standard and slow release fertilizer applied to winter grown broccoli (230 lbs N/A applied)

		Cost per Application and Total Costs/A			
		Standard Fertilizer	Slow Release Fertilizers[4]		
Application	Material		100%	75%	50%
Preplant	15-15-15[1]	43	179	138	97
Sidedress #1	AN 20[2]	48	0	0	34
Sidedress #2	AN 20	48	0	34	34
Water run	CAN 17[3]	26	26	26	26

Total		156	207	198	191

1 - $0.47/lb N assigned to the nitrogen cost; 2 – $0.47/lb N; 3 - $0.59/lb N; 4 - $0.82/lb N.

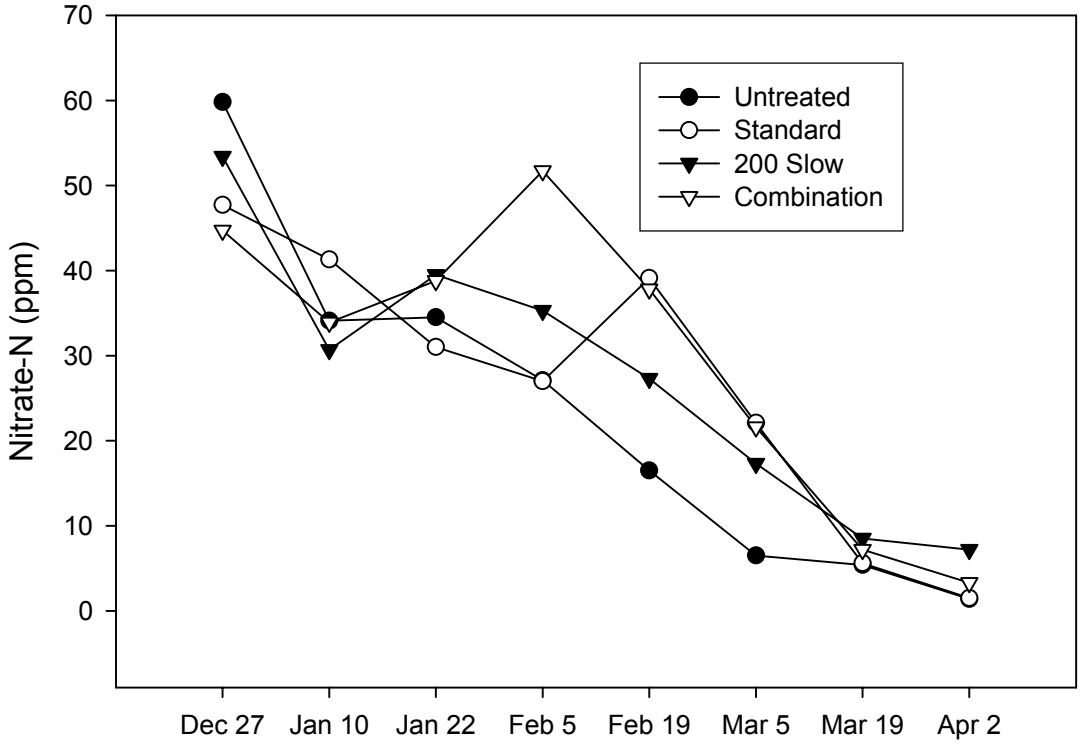

Figure 1. Nitrate-N in the soil over the course of the season in selected slow release fertilizer treatments (combination = 100 lbs slow release + 100 lbs standard fertilizer)