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SLOW RELEASE FERTILIZERS FOR STRAWBERRY FRUIT PRODUCTION

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Abstract. **Slow release N sources of methylene urea, oxamide, sulfur coated urea (SCU), isobutylidene diurea (IBDU), plus NH_4NO_3 and urea and combinations of these sources in the 1988-89 season and formaldehyde coated ammonium sulfate, methylene urea, and SCU in the 1989-90 season were applied to fruiting strawberry (*Fragaria* × *ananassa* Duch.). Nitrogen was applied at 224 kg/ha except for a control which received no N in 1989. Except for the zero N treatment in 1989, there were no significant seasonal differences either season because of N source for fruit yield, average fruit weight, and plant size or color. The 1:1 mixture of SCU and NH_4NO_3 produced the highest Dec. yield and the 3:1 oxamide/urea treatment produced the highest Apr. yield in 1989. During both seasons, leaf N contents varied little because of N source.**

Introduction

Slow release N fertilizer is usually included as a portion of the total N applied by most strawberry growers. The objective is to reduce the leaching that occurs with readily soluble N sources (Albregts and Howard, 1973; Volk, 1964). Generally, the slow-release N source is applied in various combinations with soluble N sources. If the fertilizer is banded properly (Albregts and Howard, 1984), leaching is reduced and the importance of the slow release fertilizer is diminished. A slow-release N source with a N release rate correlated to the plant's requirements may reduce the amount of N required to grow the crop as well as the amount leached. An N source that meets these requirements would be of economic and environmental value.

Studies reported here were conducted to evaluate the fruiting response of strawberry to several slow release N sources.

Materials and Methods

Strawberry was grown during the 1988-89 and 1989-90 winter seasons at AREC-Dover on a Seffner fine sand (sandy siliceous, hyperthermic, Quartzipsammentic Haplumbrepts) using the annual hill cultural system. For the 1988-89 and 1989-90 seasons, pre-fertilization pH was 6.6 and 6.2 and Mehlich I extractable nutrients were 46 and 36 ppm K, 296 and 303 ppm P, 1111 and 1428 ppm Ca, and 30 and 38 ppm Mg, respectively. A randomized complete block design was used the first season, and a factorial with a randomized complete block design was used the second season. Plots were 3 and 2.7 m long and 1.2 wide with 18 plants and 4 replicates and 16 plants and 5 replicates per treatment the first and second seasons, respectively. Fruit production beds were fumigated at 392 kg/ha of bed area with a mixture of 98% methyl bromide and 2% chloropicrin and mulched with black polyethylene. 'Chandler' transplants from Canadian nurseries were grown both seasons and Florida breeding line 79-1126 transplants from Florida nurseries were grown the second season. Treatments each season were N sources and the percent of N applied from each source. During 1988-89, treatments were oxamide 100%, oxamide 75% and urea 25%, oxamide 75% and methylene urea 25%, oxamide 50% and methylene urea 50%, methylene urea 100%, SCU 100%, SCU 50% and NH_4NO_3 50%, IBDU 100%, IBDU 50% and urea 50%, and no N applied. During 1989-90, N treatments were each from a single source. Treatments were SCU, formaldeyde coated ammonium sulfate, and methylene urea. Fertilizer was applied preplant at 224-28-206-33 kg/ha N-P-K-Mg plus 28 kg/ha of a micronutrient mix with 3% B and Cu, 7% Mn and Zn, and 9% Fe. Fertilizer was banded in the bed center 2 inches deep. Transplants were set on 18 Oct. 1988 and 16 Oct. 1989 with 2 rows/bed spaced 11 inches between plants and 12 inches between rows. Recently matured leaves were obtained on 7 Feb. and 5 Apr. 1989 during the first season and 12 Dec. 1989, 29 Jan. and 29 Mar. 1990 during the second season and were analyzed for N using the modified Kjeldahl method (Anonymous, 1980). Overhead sprinkler irrigation was provided for plant establishment, soil moisture, and freeze protection. Soil moisture was maintained between –5 and –20 cb. Fruit were harvested twice weekly from Dec. through Apr., graded, counted and weighed. Marketable fruit were those free of rot, not misshapen, and weighed 10 g or more. Plants were rated visually for size and foliage color (1 = yellow red, 6 = dark green) 3 times each season.

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Results and Discussion

During the first season, total marketable fruit yield did not vary because of N source except for the no N treatment (Table 1). Monthly marketable fruit yield generally followed the same pattern (not presented). The seasonal average fruit weight was lowest with no N treatment. Strawberry fertilized with only oxamide or methylene urea as an N source produced fruit of greater size than with no N. The

Table 1. Effect of nitrogen sources on fruiting response and leaf N concentration (7 Feb. 1989) of strawberry for 1988-89 season.

N-source[z] (% of N)	Marketable yield (Mg/ha)	Fruit wt (g/fruit)	Mkt (%)	Leaf N (%)
OX-100	20.6 a[y]	15.6 a	72.4 ab	2.59 a
OX-75, U-25	20.1 a	15.2 ab	72.8 ab	2.57 a
OX-75, MU-25	19.8 a	15.0 ab	72.6 ab	2.61 a
OX-50, MU-50	21.1 a	15.2 ab	73.3 ab	2.60 a
MU-100	19.7 a	15.6 a	71.6 ab	2.46 a
SCU-100	21.7 a	15.2 ab	75.5 a	2.57 a
SCU-50, AN-50	20.8 a	15.1 ab	71.5 ab	2.67 a
IBDU-100	21.0 a	15.3 ab	74.7 a	2.62 a
IBDU-50, U-50	21.0 a	15.3 ab	72.4 ab	2.53 a
No N	10.2 b	14.5 b	69.3 b	1.92 b

[z]OX = Oxamide, MU = methylene urea, U = urea, SCU = sulfur coated urea, AN = ammonium nitrate, and IBDU = isobutylidene diurea.
[y]Mean separation in columns by Duncan's Multiple Range Test, 5%.

Table 2. Effect of nitrogen sources on fruiting response of strawberry for 1989-90 season.

Cultivar	Treatment	Marketable yield (Mg/ha)	Fruit wt (g/fruit)	Mkt (%)	Decayed[z] fruit (%)
79-1126	SCU[y]	23.1 a	14.0 a	68.6	20.5 a[x]
	AS	24.9 a	14.5 a	68.7	20.9 a
	M-U	22.6 a	14.3 a	*69.3*	*12.0 b*
Chandler	SCU	19.1 a	15.1 a	61.1 a	52.5 a
	AS	17.9 a	14.6 a	59.6 a	52.5 a
	M-U	15.8 a	14.7 a	59.2 a	49.8 a
	Clone[w]	*	NS	*	**

[z]Percent of cull fruit rated as decayed.
[y]SCU = sulfur coated urea, AS = formaldehyde coated ammonium sulfate, and M-U = methylene urea.
[x]Mean separation within clones by Duncan's Multiple Range Test, 5%.
[w]Mean effect of clones were not significant (NS) or significant at 5% level (*) or 1% level (**) by F test.

seasonal percentages of marketable fruit were lowest with no N and highest with IBDU and SCU. The leaf N contents on 7 Feb. 1989 were near the optimum levels of 2.6 to 3.0% with all N sources (Bould, 1964; Ulrich et al., 1980) except for zero N. Nitrogen concentrations in leaves sampled on 5 Apr. 1989 were not significantly different and varied from only 2.10 to 2.23% (not presented). Since fruit production was near completion at time of sampling, lower N levels would be expected (Bould, 1964). At this time foliage was moderately green with all plants but the zero N, which were light green to red. Evidently foliage color was not indicative of N contents at this sampling date.

During the second season, N source had little effect on fruit yields. Differences were mostly related to the clone. Clone FL-79-1126 produced higher yields, greater percent marketable fruit, and a lower percent of the cull fruit with rots than with 'Chandler' (Table 2). More of the fruit of FL-79-1126 than 'Chandler' were cull because of small size. Leaf N contents were not different because of N source. Leaf N contents of 'Chandler' and FL-79-1126 averaged 3.16 and 2.86%, 3.26 and 2.76%, and 2.56 and 2.23%, respectively, for sampling dates of 8 Dec. 1989, 24 Jan. and 30 Mar. 1990 (data not presented), respectively. Foliage color was dark green all season with all treatments.

The data suggest that all of the slow-release N sources evaluated provided sufficient N for maximum yields when applied at the 224 kg/ha. Evaluating these fertilizers at lower rates may provide more variation in fruiting response.

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