Ureaforms in Horticulture

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Data from tests with turf and ornamental plants have proved that ureaform is an excellent source of slow release nitrogen for these crops. Data from Spain, South Africa, and Ecuador indicate that ureaform also has a place in harvested fruit, forest, and vegetable crops. Tomato plants treated with ureaform yielded $1400.00 per hectare more profit to the farmer than tomato plants fertilized with classical nitrogen sources. Higher yields and earlier production were significant. Seedlings of forest trees treated with ureaform produced more growth and survived transplanting significantly better than seedlings handled similarly without ureaform. Data from banana plantations treated with ureaform indicate yield increases greater than 20% over plantations treated with equal amounts of nitrogen from urea applied in the conventional manner. Further testing to determine rates, frequency, and method of application should broaden even further the economic applications of ureaform in horticulture.

Extensive research and more than a decade of commercial usage has proved that ureaform will provide nitrogen at a slow rate for prolonged periods. For long-term maintenance programs, ureaform has been widely accepted.

Professional turf growers responsible for golf courses were among the first to recognize the economic value of this slow-release nitrogen source. A little later, nurserymen, professional gardeners, and landscape contractors started using ureaform and requesting complete fertilizers compounded with ureaform. In recent years most high quality home and garden fertilizers have contained large amounts of water-insoluble nitrogen derived from ureaform.

These users of ureaform recognize its value largely in the enhancement of aesthetic qualities—better color, uniform growth of high quality, and greater tolerance of and recovery from adverse treatment by man, climate, and pests. However, horticulturists who produce fruits, vegetables, and tree seedlings recognize value only in increased dollar return on investment. Recognizing this, producers of commercial ureaform, with the aid of researchers throughout the world, are working to determine the rate, frequency, and method of application of ureaform needed to increase production and/or quality of harvested horticultural crops.

Recent test data and commercial demonstrations have indicated that ureaform *can* be an economical source of nitrogen for some short-term crops. Also, tests indicate that ureaform is economical for use in large fruit plantations under tropical conditions. Characteristics of ureaform such as freedom from burning and resistance to leaching probably are as important in these areas as its slow rate of nitrogen release. Summary data on three tests are presented.

METHODS

Tomatoes. Demonstrations were conducted in 1967 and 1968 using Hybrid 11 tomato plants on sandy loam soil. Four plots were installed and 650 plants were chosen from the center of each plot for observation and recording of test results. Treatment of the plots was as outlined in Table I.

Pine Seedlings. *Pinus elliottii* seeds were sown in March 1968. The seedlings were potted 2 months later in soil containing 2.84 kg per yd^3 of a standard 2–1.32–1.66 (2–3–2) fertilizer. They were planted into 4-in. × 2-in. × 2-in. polyethylene bags containing approximately 15 $in.^3$ of potting soil. This was the standard procedure used by the South African Plant Protection Institute Nursery at Houboshoek, Eastern Transvaal, South Africa, who supervised this test.

On November 10, 1968, one group of seedlings was treated with powdered ureaform (38–0–0) by spraying the material onto the plants with knapsack sprayers; the seedlings were then sprinkle-irrigated. Ureaform (15.89 kg) was applied to 22,000 seedlings. This is equivalent to 2.27 kg per yd^3 of potting soil, or 0.72 g per seedling, surface-applied.

Seedlings with and without the addition of ureaform were planted on mountain slopes on February 7, 1969. Five-hundred trees treated with ureaform and 500 trees as a check were assessed July 15, 1969.

Bananas. Rhizomes of Cavendish Bananas were planted March 12, 1968, in a silty clay loam soil 25 miles from Guayaquil, Ecuador. Spacing was 3.2 m between plants and rows. A randomized complete block design was followed, consisting of two treatments replicated four times. There were 44 plants per random replicate, totaling 176 plants per treatment. Nongerminated rhizomes were replaced May 12, 1968, to ensure that each plot had 44 plants. Irrigation consisted of rainfall plus supplemental gravity irrigation during the dry season.

Fertilizer treatments were as follows. Ureaform: 1st year, 454 g at planting time, at the bottom of the hole covered with a layer of soil; rhizome placed on top and properly planted. 2nd year, forward, 454 g per year, per place at the beginning of the rainy season. The material was distributed among the productive shoots. Standard Urea Fertilization: 1st year, 114 g at planting time, at the bottom of the hole covered with a layer of soil; rhizome placed on top and properly planted. Subsequent periodic applications of 114 g each to complete 454 g per place per year. 2nd year, forward, 114 g of urea at the beginning of the rainy season; then every 3 months 114 g per place to complete 454 g per place per year. The material was distributed among the productive shoots.

The first stems were harvested in January 1969, and harvests have been made weekly thereafter. Records were kept showing the number of stems harvested, weight per stem, the number of hands per stalk, and the length of the finger.

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Table I. Fertilizer Treatments of Four Demonstration Fields of Hybrid 11 Tomatoes at the Anaya Farm, Malaga, Spain, 1967–1968

Plot	Fertilization of seedlings	Fertilization in the field
A and B	Classical fertilization (250 kg/ha KNO_3, 15 days before transplanting)	Classical fertilization Before fruit set, total 3 applications 1200 kg/ha NH_4NO_3 1500 kg/ha Superphosphate 500 kg/ha K_2SO_4 During fruit set, total 3 applications 750 kg/ha NH_4NO_3
C	500 kg/ha ureaform in seedbed before seeding	Same as A
D	Same as C	Before fruit set, 1 application 300 kg/ha Ureaform 1500 kg/ha Superphosphate 500 kg/ha K_2SO_4 During fruit set Same as A

Table II. Yield Data from Four Demonstration Fields of Hybrid 11 Tomatoes at the Anaya Farm, Malaga, Spain, 1967–1968

Plot	Average yield per plant (kg) after 3rd picking	6th picking	11th picking	Yield kg/ha 20,000 plants/ha	Dollar value[a] per hectare	Increased value over highest classical fertilizer
A	0.364	0.996	1.700	34,000	$4857.00	(−$297.00)
B	0.418	1.024	1.804	36,080	$5154.00	0
C	0.383	1.099	2.017	40,340	$5763.00	$609.00
D	0.605	1.450	2.406	48,120	$6874.00	$1720.00

[a] Based on lowest price of 10 pesetas/kg. Grower actually received 15–20 pesetas/kg through the third picking, and 10–15 pesetas/kg through the sixth picking (70 pesetas = U.S. $1.00).

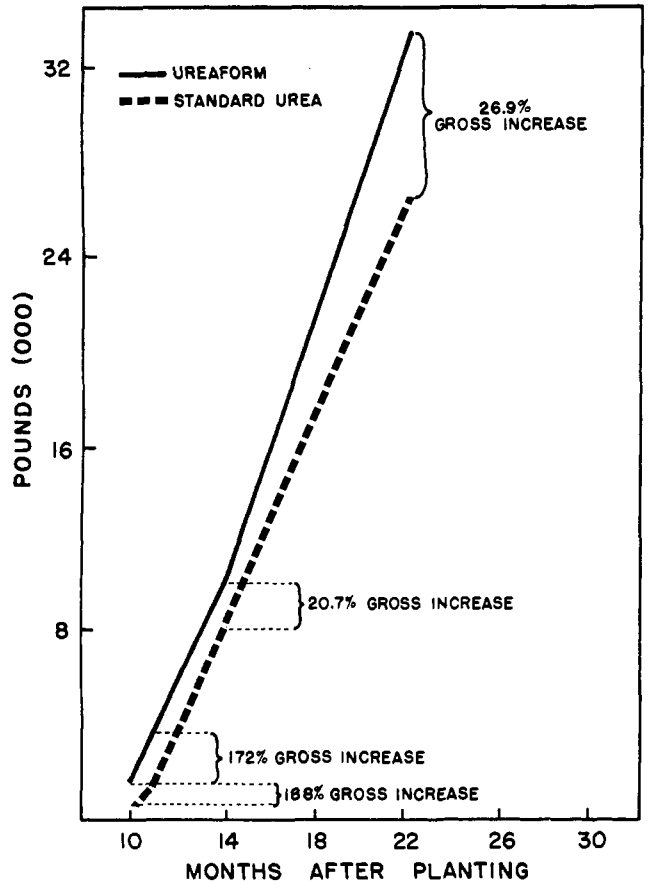

Figure 1. Cumulative weight (lb) and percent increase of fruit harvested from Cavendish banana plants at various intervals after planting, comparing nitrogen sources from urea and ureaform

Table III. Average Height and Percent Mortality of *Pinus elliottii* Fertilized With and Without (Control) Ureaform in the Potting Soil, 5 Months after Planting Out on a Mountain Slope at Three Elevations

Level	Ureaform Height in inches	Ureaform % Mortality	Control Height in inches	Control % Mortality
I	14.24	4.6	9.52	23.6
II	14.57	3.6	9.62	23.2
III	15.04	2.4	9.40	26.5
Average	14.59	3.6	9.54	24.8

RESULTS AND DISCUSSION

Tomatoes. Yield data are presented in Table II. It was not the intention to replace classical forms of nitrogen fertilizers completely by ureaform. The objective was to use ureaform to complement classical nitrogen applications to obtain larger and earlier crops.

During the growing period visual observations showed that plants in plot D were larger, had better color, and had a heavier fruit set than the other plots. It should be noted that after the eleventh collection of fruits, the fields were abandoned because the price of tomatoes fell steeply as large supplies from later varieties were thrown on the market.

The data from this test indicate that treatment D, ureaform in the seed beds (5 kg/100 m^2) plus a base dressing of 300 kg/ha ureaform in the field at planting time as a substitute for a portion of the nitrogen in classical fertilization, gave the highest yield and largest dollar return. After deducting the cost of ureaform, the farmer realized an *extra* profit of about U.S. $1400/ha.

Pine Seedlings. Table III summarizes the average height

in inches and the percent mortality of the control and ureaform treated seedlings. The data show that the *Pinus elliottii* seedlings treated with ureaform produced more growth and survived transplanting better than seedlings handled similarly without ureaform.

The better seedling survival probably could be attributed to a stronger root system, as was observed in a previous trial using ureaform in the same nursery.

The cost for the ureaform treatment used in this trial was U.S. 26¢ per acre, based on the retail price for powdered ureaform in South Africa of U.S. $460 per short ton and a tree density of 730 per acre.

It is still too early to determine what benefit the increased growth will have, but it is obvious that the considerable increase in seedling survival after planting out will more than compensate for the cost of the ureaform.

Bananas. Work done as early as 1954 at the IFAC Research Station in French Guinea, West Africa (Soubies and Gadet, 1957) showed that the use of ureaform instead of sulfate of ammonia during 5 consecutive years resulted in banana yield increase of 30 metric tons per hectare, or 6 metric tons per hectare per year.

Obviously a yield increase of 6 metric tons per hectare per year would more than offset the added cost of ureaform. To gain more information on this potential market for ureaform, Hercules started tests in Ecuador. Results to date (Table IV and Figure 1) show that after 22 months, plants fertilized with Nitroform yielded 26.9% more fruit by weight than those fertilized with urea. Allowing for the added cost of ureaform over urea, the net increase in yield was 23.15%, or an added profit of approximately U.S. $500 per hectare (based on 1000 plants per hectare and early 1970 banana market prices).

Table IV. Cumulative Weight (lb) of Fruit Harvested from Cavendish Banana Plants[a] at Various Intervals after Planting, Comparing Nitrogen Sources from Urea and Ureaform

Nitrogen source	Months after planting			
	10	11	14	22
Standard urea	510	1334	8288	26,791
Ureaform	1468	3631	10,003	33,851

[a] Total of 4 reps, 176 plants.

Projecting the gross yield increase to 1 ha of 1000 plants, yield increases in this test amount to 9.8 metric tons per hectare per year, compared with the French report of 6 metric tons per hectare per year.

LITERATURE CITED

Soubies, L., Gadet, R., *Fruits* **12**(3), 96 (1957).

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