SLOW-RELEASE FERTILIZERS ON POT MUMS

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The idea of a one-shot application of fertilizer to a commercial floricultural crop is not of recent origin. Various materials have been tried, with varying degrees of success. One of the most recent and most successful materials is the coated fertilizer, manufactured by the Archer Daniels Midland Company of Minneapolis, Minnesota.. These coated fertilizers have been tested at numerous research stations and universities throughout the country, and on several crops. In almost all instances the materials have looked promising.

At N. C. State, the slow-release or coated fertilizers have been tried on poinsettias, Philodendron oxycardium, kalanchoe, Easter lilies, hydrangeas, azaleas,

gloxinias, bedding plants, cut mums and pot mums. The most extensive tests have been conducted on pot mums.

Experiment I. The first N. C. State study on pot mums was started May 10, 1962, on the variety Red Star. In that experiment, soils from Wilmington, Raleigh, and Charlotte were used in conjunction with the slow-release fertilizers. Salable plants were produced in the slow-release fertilizer treatments. (The results of this study were reported in the September, 1962 issue of the Bulletin.)

Experiment II. The second study was started November 29, 1962, with the varieties Commander, Cristal, and Yellow Delaware. The treatments were:

A. Ammonium nitrate, treble superphosphate, muriate of potash 200 grams of each/2 cu. ft. of soil.
B. Ammonium nitrate, treble superphosphate, muriate of potash 100 grams of each/2 cu. ft. of soil.
C. Check-soluble fertilizer, applied every 10 days at 2 1/2 lbs./ 100 gals. water.

Dolomitic limestone was incorporated in the potting soil for all treatments (14 oz./ 2 cu. ft.), but superphosphate was only incorporated in the soil for the check treatment (7 oz./2 cu. ft.).

The low leach rate fertilizers (0-10%) were used.

The plants were pinched and shaded on December 20.

The average final heights and numbers of flowers/pot for the 3 varieties in the 3 fertilizer treatments are shown in Table 1.

Table 1. Average final height and number of flowers for the varieties Commander, Cristal, and Yellow Delaware. Study started 11/29/62.

Variety	Treatment	Average final height, inches[z]	Average number of flowers (5 cuttings/pot)
Commander	A. 200 g slow-release	16.4	16.7
	B. 100 g slow-release	14.1	15.5
	C. Check	14.5	19.0
Cristal	A. 200 g slow-release	13.5	20.5
	B. 100 g slow-release	10.9	17.7
	C. Check	12.5	20.7
Yellow Delaware	A. 200 g slow-release	11.9	19.8
	B. 100 g slow-release	10.0	18.7
	C. Check	11.0	22.2

[z]Plant height measured from pot rim.

Typical plants of the variety Cristal, grown in the 3 fertilizer treatments, are shown in Figure 1.

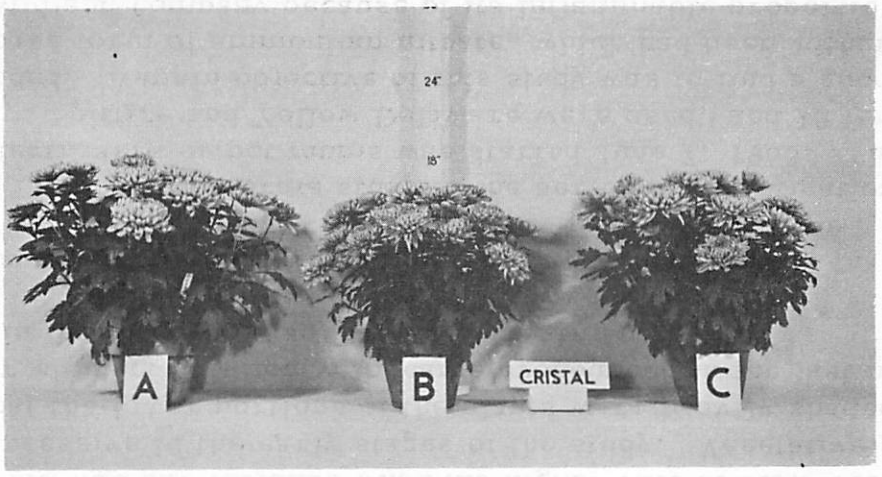

Figure 1. Variety Cristal, grown under fertilizer regimes: A = 200 g slow-release; B = 100 g slow-release; C = Check.

In almost every instance the tallest plants were produced when 200 grams of the slow-release fertilizers were incorporated in the potting soil. The shortest plants were generally produced at the lower level, while the check plants were in between in height. The highest average numbers of flowers/pot were recorded for the check treatments in most cases, but the differences were often very small. The time of flowering was not affected by the fertilizer treatments in this study, but plants in the slow-release fertilizer treatments had been delayed in flowering in the study conducted the previous summer.

The foliage was intensely green in color on plants in the check treatments and at the higher rate of slow-release fertilizer. Some chlorosis was apparent on Cristal plants in the 100 gram slow-release fertilizer treatment.

Experiment III. On March 2, 1963 a third study was initiated, on the varieties Warhawk, Queen's Lace, Bridesmaid, and Yellow Delaware. The fertilizer treatments were:

A. Ammonium nitrate, treble superphosphate, muriate of potash; 225 grams of each/2 cu. ft. of soil.
B. Ammonium nitrate, treble superphosphate, muriate of potash; 170 grams of each/2 cu. ft. of soil.
C. Check - 2 1/2 lbs. of KNO_3/100 gals. water, alternated with 2 1/2 lbs. of 17-17-17 or 20-20-20/100 gals. water, every 7 days.

The plants were watered throughout the study with a Chapin Watermatics system, and the Moist Scale was adjusted to allow for 4 ounces of drying between waterings.

The plants were pinched March 16, and short days were started on March 23.

The study was concluded on May 27, at which time final height and number of flowers were recorded. The effects of the various treatments in the third study are shown in Table 2.

Yellow Delaware: The tallest plants of this variety were those grown in the check treatment (17.4" vs. 14.2 and 15.2), but these plants had the lowest average number of flowers (17.2 vs. 20.0 and 20.7).

Table 2. Average final heights and numbers of flowers on 4 pot mum varieties. Study started March 2, 1963, and concluded on May 27.

Variety	Treatment	Final plant height in inches[z]	Average number of flowers (5 cuttings/pot)
Yellow Delaware	225 g S-R	14.2	20.0
	170 g S-R	15.2	20.7
	Check	17.4	17.2
Warhawk	225 g S-R	14.2	17.5
	170 g S-R	13.5	18.7
	Check	12.9	18.0
Bridesmaid	225 g S-R	15.7	27.2
	170 g S-R	17.0	27.0
	Check	15.9	28.7
Queen's Lace	225 g S-R	21.6	26.5
	170 g S-R	24.2	20.7
	Check	22.2	21.6

[z]Plant height measured from pot rim.

Warhawk: The shortest plants were those in the check treatment, but the difference was only about one inch. The number of flowers was apparently unaffected.

Bridesmaid: There were no striking differences among the 3 fertilizer treatments, with regard to plant height or floriferousness. However, the foliage on the plants grown in both slow-release fertilizer treatments was grayish-green, and eventually became chlorotic. The flowers on the plants in the slow-release fertilizer treatments also showed evidence of sun-burn, while the flowers on plants in the check treatment were not affected.

Queen's Lace: This was one instance when the higher rate of slow-release fertilizer was apparently excessive in the early stages of the study. Vegetative growth was so lush and dense that the lower portions of the plants were heavily shaded. Chlorosis, typical of a minor element deficiency, became pronounced in the last month of the study, on plants in the slow-release fertilizer treatments.

Time of flowering was not affected by fertilizer treatment.

Experiment IV. The most elaborate study in the series of investigations on the use of slow-release fertilizers on pot mums was started June 7, 1963. The varieties Bravo, Discovery, Spitfire and Yellow Delaware were used, and 10 fertilizer treatments were included. A main objective of this study was to find a good substitute for the slow-release form of ammonium nitrate, which had been withdrawn by the Archer Daniels Midland company because of its inflammable properties. The 3 previous studies had shown ammonium nitrate to be an excellent nitrogen source.

The plants were pinched June 17, and short days ere started June 24.

The following slow-release fertilizer treatments were included in this study:

	Material	Rate
A.	Urea, treble superphosphate, muriate of potash	170 grams of each/2 cu. ft.
B.	17-8-4	170
C.	9-9-9	170
D.	15-7-7	170
E.	Check. . applications of a soluble fertilizer (KNO_3, 17-17-17, 20-20-20)	
F.	Ammonium sulphate, treble superphosphate, muriate of potash	170 grams of each/2 cu. ft.
G.	14-14-14	170
H.	Urea	170
	Treble superphosphate	85
	Muriate of potash	85
I.	Ammonium sulphate	170
	Treble superphosphate	85
	Muriate of potash	85
J.	15-7-7	225

There were 4 pots of each variety in each fertilizer treatment. In previous studies 12 pots per variety per treatment had been used, but the variation within treatments was so slight the authors felt that 4 pots would be almost as revealing as 12, and more treatments could be included.

The results with the variety Discovery will not be reported, as considerable difficulty was encountered with this variety, even in the check treatment. The fertilizer treatments were apparently not responsible for these difficulties.

The study was concluded on September 1, 1963, at which time data were collected, and plants typical of each treatment were photographed.

The effects of the fertilizer treatments on plant height and floriferousness for the variety Bravo are shown in Table 3.

Table 3. The effects of the fertilizer treatments on plant height and floriferousness for the variety Bravo. The study was conducted during the summer of 1963.

Treatment	Plant height, in inches[1]	Number of flowers
A. Urea, treble superphosphate, muriate of potash 170 g/2 cu. ft.	15.4	17
B. 17-8-4 170 g.	15.7	22
C. 9-9-9 170 g.	13.7	20
D. 15-7-7 170 g.	14.1	22
E. Check	15.2	22
F. Ammonium sulphate, treble superphosphate, muriate of potash 170 g.	16.1	20
G. 14-14-14 170 g.	15.4	20
H. Urea 170 g. Treble superphosphate 85 g. Muriate of potash 85 g.	15.0	18
I. Ammonium sulphate 170 g. Treble superphosphate 85 g. Muriate of potash	13.7	22
J. 15-7-7 225 g	14.8	19

[1]Plant height measured from top of pot rim, when plants were considered to be in full flower.

Typical plants of the variety Bravo, for the fertilizer treatments H, I, J and E, are shown in Figure 2.

Figure 2. Variety Bravo, photographed on September 1, 1963. See Table 3 for treatments.

The variety Yellow Delaware was used in 3 of the 4 experiments, and the results are summarized in Table 4.

Table 4. Effects of slow-release fertilizer treatments on the variety Yellow Delaware, grown in Spring, Summer, and Winter.

Treatment	Average final height			Average number of flowers		
	11/29/62	3/2/63	6/7/63	11/29/62	3/2/52	6/7/63
High rate S-R	11.9"	14.2"	14.6"	20	20	20
Low rate S-R	10.0	15.2	13.3	19	21	19
Check	11.0	17.4	15.3	22	17	19

Plant height was apparently more affected by time of year than by rate or type of fertilizer. However, the high and low rates were not achieved with the same source (ammonium nitrate in Experiments 2 and 3, and ammonium sulphate in Experiment 4).

The average number of flowers was not greatly affected by time of year or fertilizer treatment.

Conclusions

Several different rates of slow-release fertilizers on pot mums have been suggested by research workers throughout the United States. The best results at N. C. State have been achieved with 6-8 ounces (170-225 grams) of a complete fertilizer to 2 cubic feet of soil, incorporated into the soil at the time of potting.

High quality pot mums can be produced with slow-release fertilizers, just as high-quality pot mums can be produced with readily soluble fertilizers. Some growers would benefit greatly from a fertilizer program composed of slow-release fertilizers, growers with good fertilizer injector systems might benefit less.

A consideration that warrants further study is the keeping quality of pot mums grown with slow-release fertilizers versus the readily soluble fertilizers. When a pot mum leaves the commercial greenhouse, fertilization of that plant generally ceases. The slow-release fertilizer would naturally accompany the plant into the home. Investigations on this aspect of the slow-release fertilizers are now being conducted at N. C. State.

Workers in Florida and California have had good results when a portion of the slow-release fertilizer was applied in the potting soil, and the remainder 5-6 weeks later. They reported fertilizer burn if the total amount were applied in the initial application. Fertilizer burn has not occurred under such conditions at N. C. State when pot mums were used, but poinsettias and azaleas have been defoliated.

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