A SLOW RELEASE FERTILIZER[1]

R. E. Widmer

Some growers fertilize their greenhouse crops by applying a dilute fertilizer solution every time they water. The objective is to supply nutrients in accordance with the needs of the plant as it grows and develops. Other growers would prefer to incorporate all of the fertilizer needs of a container-grown crop in the starting soil. In the latter case, fertilizers used should be of such nature that they will release the nutrients gradually over an extended period of time. If the fertilizer release is too rapid, the soil may become excessively rich at the start, and deficient before the finish of the crop.

Widmer (3,4) reported that the use of ureaform and fritted potash as sources of slowly available nitrogen and potassium provided desirable results for periods up to three months in duration. Recently new fertilizer products of various types have been developed which appear to offer additional advantages.

An exchange resin product called Tydes C (Dow Chemical Company) is one of the newer materials now available. Exchange resins have a high capacity to hold ionic nutrients and release them in exchange for other ions that may originate from plant roots or the soil solution. Availability of the nutrients from Tydex C is not affected to any extent by soil temperatures reached during steaming or by bacterial activity. Leaching of nutrients from Tydex C is generally quite limited. The analysis of Tydex C is approximately 3.2 percent nitrogen, 3.5 percent available phosphate, 2.5 percent soluble potash plus trace elements.

Trials were conducted with poinsettias, Easter lilies and geraniums in the University greenhouses to determine (1) the most effective rates of use and (2) the effective life of Tydex C under Minnesota growing conditions.

Procedure

A well prepared soil mixture containing one part soil, one part peat, one part peat moss and one part sand was used for the three crops. A 4 - inch potful of superphosphate (0-20-0) per 3 bushels of soil was added to the poinsettia and geranium soils, and a 4 - inch potful of pulverized limestone per three bushels of soil was added to the lily soil. Nutrient levels of the starting soil were medium, and the pH was 6.0 for the poinsettias and geraniums and 6.6 for the lilies. The poinsettia and lily soils were steam sterilized before adding the Tydex C.

Treatments used included an unfertilized check, a check which received liquid applications of a 20-20-20 soluble fertilizer and/or ammonium sulfate and Tydex C mixed in the starting soil at the rate of 1 part by volume in 5, 10, 20, and 40 parts of soil. Red clay pots which were used were placed on bare concrete benches to discourage root penetration through the drainage opening.

Poinsettias

Sturdy, pale green plants from 2½-inch pots were planted three to a 6-inch pan on October 25, 1960. Ten pans comprised a treatment. All plants greened up following panning.

---

[1] Paper No. 1105 Miscellaneous Journal Series, Minnesota Agricultural Experiment Station. University of Minnesota

On November 4, foliage on plants in the 1 in 10 and 1 in 20 Tydex C treatments was a rich green. Foliage on plants in the other treatments was lighter in color and some leaf loss was evident with the 1 in 5 plants.

On November 25, foliage on plants in both checks and the 1 in 5 treatment was still a bit pale and some leaf loss had occurred.

On December 22, the unfertilized check plants were a light green, but definitely not yellow; fertilized check plants and 1 in 5 plants were a good green color and plants in the 1 in 10, 20 and 30 groups were a healthy dark green color. Bract development in all treatments was good. All visible roots looked healthy but quantity of roots was limited in the 1 in 10 group and even more limited in the 1 in 5 group. No other visual differences were evident.

Leaf and bract retention under simulated home conditions did not vary significantly with the treatments.

This trial was only of two months duration and did not determine the full life of the Tydex C, but it did indicate that rates of 1 in 5 and 1 in 10, while restricting root growth, did not kill or severely injure the crop. If the fertilized check plants had received one more application of fertilizer, the foliage color should have been equivalent to the best in the Tydex C groups.

Easter Lilies

Ace Easter lily bulbs of the 6½-to 7-inch size were planted in 6-inch pans on December 9, 1960. Ten plants comprised a treatment. The night temperature was 60°F. until March 1 and 68°F. thereafter.

Observations made on February 10, 1961, were as follows:

Unfertilized check - plants a little pale
Fertilized check - plants a medium green
Tydex C 1 in 5 - plants quite pale and somewhat smaller
Tydex C 1 in 10 - plants a little pale
Tydex C 1 in 20 - plants a little pale
Tydex C 1 in 40 - plants a medium green

On April 8, plants in the unfertilized check were a bit pale and all other plants were a healthy dark green. Foliage on the bottom 2 to 4 inches of the stem was dried on the unfertilized check plants, while in other treatments, 0 to 1 inch of dried leaves was evident. Other observations are shown in Table 1.

Table 1 The effect of fertilizers on the growth of the Ace Easter lilies as observed on April 8, 1961

Treatment	Days to Bloom	Height (inches)	No. of Leaves	No. of Flowers	Plant Appearance	Root Appearance
Unfert. Ck.	112	17.1	74	4.2	fair	very good
Fert. Ck.	114	14.4	72	5.1	very good	some discoloration
Tydex C, 1 in 5	117	13.4	67	3.7	good but short	1/3 as many, discoloration + dead roots
Tydex C, 1 in 10	115	14.1	75	5.4	good	2/3 as many, discoloration
Tydex C, 1 in 20	114	14.6	74	5.0	very good	very good
Tydex C, 1 in 40	114	16.3	67	4.2	good	very good

Data on soil nutrient content are shown in Tables 2 and 3.

Table 2 Nutrient content of the original potting soil and the fertilized soils on March 2, 1961.[1]

Date	Dec. 9	March 2					
		Unf. ck.	Fert. ck.	1-5	1-10	1-20	1-40
pH	6.6	7.5	6.8	5.6	6.1	6.5	6.9
Soluble salts[2]	42	10	14	50	32	18	14
Nitrate-Nitrogen[3]	32	14	28	153+[4]	120[4]	81	40
Phosphorus[3]	4	4	6	12	10	9	7
Potassium[3]	36	14	27	95[4]	60	35	30
Calcium[3]	110	119	112	75	90	101	108
Ammonia-Nitrogen[3]	8	1	2	4	3	2	1

[1] Analysis courtesy of the Soils Department, University of Minnesota
[2] A 1-5 dilution
[3] p.p.m. Spurway (with modifications)
[4] Considered excessive

Table 3 Nutrient content of the soil in the various fertilizer treatments on April 21, 1961.[1]

Treatment	Unfert. Check	Fert. Check	1-5	1-10	1-20	1-40
pH	7.7	6.7	5.6	6.2	6.8	7.0
Soluble salts[2]	17	50	60	34	13	13
Nitrate-Nitrogen[3]	12	123[4]	153+[4]	153[4]	26	14
Phosphorus[3]	3	3	9	10	7	4
Potassium[3]	3	30	96[4]	53	8	5
Calcium[3]	130	123	90	99	112	108
Ammonia-Nitrogen[3]	1	1	2	2	1	1

[1] Analysis courtesy of the Soils Department, University of Minnesota
[2] A 1-5 dilution
[3] p.p.m. Spurway (with modifications)
[4] Considered excessive

Tydex C was shown to be an effective fertilizer for Ace Easter lilies when used at appropriate rates. Although the plants in the 1 in 40 treatment looked satisfactory, plants in the 1 in 20 treatment were 1.7 inches shorter, had 0.8 more flowers per plants and had a better appearance. The difference between the two treatments might have been greater if a starting soil lower in nutrients had been used. Plants in the 1 in 10 treatment were quite satisfactory in appearance, height and flower count, but root quantity and appearance indicated that this rate was higher than is desired.

Discoloration of the roots of plants in the fertilized check was probably caused by having a nitrate-nitorgen level just a little higher than desired at the finish. In other respects the fertilized check and Tydex C 1 in 20 plants were quite similar.

Incorporation of Tydex C in the soil lowered the pH and increased the soluble salt, nitrate-nitorgen, phosphorus, potash and ammonia-nitrogen levels in proportion to the quantity used.

Some of the fertilizer from Tydex C was still evident in the soil analysis results after 4½ months when used at the 1 in 20 or stronger rate. The nitrate-nitrogen was higher than desired, even after 4½ months when Tydex C was mixed in the soil at the 1 in 5 and 1 in 10 rates.

The pH of the unfertilized check soil increased because of an alkaline water supply. The pH of the fertilized check was only slightly changed because the fertilizer applications counteracted the effect of the alkaline water supply.

Geraniums

Rooted geranium cuttings of the varieties Olympic Red and Salmon Supreme were planted in 4-inch pots on February 6, 1961. There were 15 plants of Olympic Red and 8 plants of Salmon Supreme per treatment. The night temperature was 60°F until March 1, 68°F from March 1 until April 24, and 60°F thereafter.

Observations recorded on April 26, 1961 are summarized in Table 4.

Table 4 Growth of geraniums as of April 26, in response to various fertilizer treatments.

Treatment	Plant Size	Habit of growth	Foliage color	Comments
1. Unfert. check	smallest	stubby	pale	-
2. Fert. check	larger than #1	-	medium green	-
3. Tydex C, 1 in 5	smaller than #2	-	medium green	-
4. Tydex C, 1 in 10	similar to #6	-	pale	-
5. Tydex C, 1 in 20	similar to #6	quite leggy	medium green	long petioles
6. Tydex C, 1 in 40	larger than #2	leggy	medium green	some leaves larger than desired

All plants were in bud or bloom by April 26.

Visual observations taken on June 1 are recorded in Table 5.

Table 5 Growth of geraniums as of June 1, in response to various fertilizer treatments.

Treatment	Plant Size	Habit of growth	Foliage Color	Comments
1. Unfert. Check	smallest	stubby	very pale	small flower clusters.
2. Fert. Check	good	sturdy	medium green	-
3. Tydex C, 1 in 5	similar to #2	sturdy	medium green	-
4. Tydex C, 1 in 10	largest	sturdy	slightly pale	best plants at end of study
5. Tydex C, 1 in 20	slightly bigger than #2	bushy	pale	-
6. Tydex C, 1 in 40	similar to #2	sturdy	quite pale	-

Tydex C again proved to be a satisfactory fertilizer when used at appropriate rates. Plants in the 1 in 40 treatment were satisfactory after 2 2/3 months, but plants in the 1 in 20 group were the best throughout the 4-month growing season. They did show some nutrient deficiency symptoms after 3½ months. At the end of 4 months, plants in the 1 in 10 group were the largest and looked good except for slightly pale foliage color. The fertilized check plants should have been fertilized a little more frequently.

Discussion and Conclusions

Hopkins (1) reported that when young carnation plants were grown in 10-inch pots in volcanic scoria (an inert medium) at the 1 in 20 rate of Tydex C, slight nitrate hunger signs began to develop after 15 weeks.

Kofranek and Lunt (2) grew the chrysanthemum variety Criterion in a U.C. mix in 6-inch pans and found that the best plants were produced with a ratio of 1 in 10. Similar quality was obtained by using a 1 in 20 ratio to start and top-dressing with a like amount nine weeks after planting. Equal amounts of Tydex C were added to both treatments.

Based on results obtained with poinsettias, Easter lilies and geraniums in this study, Tydex C should be incorporated in the starting soil at the ratio of 1 part to 19 parts of soil (1 in 20). This rate is in agreement with the manufacturer's recommendations. The use of Tydex at the 1 in 10 ratio also gave good results, but limited root development and top growth to some extent in the earlier part of the study. Kofranek and Lunt's idea of using a 1 in 20 ratio and applying a top dressing would seem to make the higher total rate of application safe, but it also eliminates the advantage of doing away with fertilizer applications following potting.

The effective life of Tydex C at the 1 in 20 rate was approximately 4 months as judged by plant appearance.

Top-quality plants were produced when Tydex C was incorporated in the soil. Relatively large amounts of Tydex C must be used, however, and the price of fertilizer used per container is higher than with most other types of fertilizers. The individual grower will have to decide whether the advantages outweigh the cost of the product for his particular establishment.

Literature Cited

1. Hopkins, H. W. 1961. One shot fertilizers for container plants. Colorado Flower Growers Bull. 140:3.
2. Kofranek, A.M. and O.R. Lunt. 1961. Slow release fertilizers on pot chrysanthemums. Florist's Review CXXIX, 3343: 7, 42-44.
3. Widmer, R. E. August 1, 1957. Poinsettia fertilization. Minnesota State Florists' Bull. 3-5.
4. Widmer, R. E. December 1, 1957. 1957 lily study. Minnesota State Florists' Bull. 1-6.

****