1956 CROFT LILY FERTILIZER STUDY

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Some commercial flower growers are of the opinion that applying nitrogen to Croft lilies during the forcing season will decrease the length of the floral trumpet. Widmer (10) reported that regular applications of ammonium sulfate to the soil of Croft lilies during the forcing season decreased the length of the flower trumpet by 0.54 inches.

Roberts (3), Stuart (8) and Seeley (5) with their coworkers reported that in some experiments Croft lily plants fertilized with nitrogen during forcing had higher flower production than unfertilized plants, but in other experiments the reverse was true, or there was no significant difference. Bald (1) stated that high nitrogen plants had an average of one less bud than did the low nitrogen plants.

Haney (2) reported that calcium supplied by gypsum plus nitrogen fertilizer during forcing was effective in eliminating leaf burn of Croft lilies. Stuart (7), Roberts (3) and Widmer (9) reported the effectiveness of nitrogen in controlling leaf scorch. Stuart (8), Roberts (4) and Bald (1) indicated that leaf scorch is caused or controlled by a number of factors in addition to nitrogen and calcium content of the soil.

The primary purpose of this study, which was conducted during the 1956 forcing season, was to determine the effect of different forms of nitrogen fertilizers on the length of the floral trumpet of the Croft lily. Other factors studied included the effect of chelated calcium on plant growth and leaf scorch, the effect of fertilization on the number of dried leaves at the base of the plant, soil pH changes and the effect of various forms of nitrogen fertilization on the number of flowers.

Materials and Methods

Bald (1) indicated that calcium as well as nitrogen influences leaf scorch.

Pre-cooled Croft lily bulbs of the 7-8 inch size were used. All bulbs[1] were soaked for 30 minutes in the Lysol - Fermate ($\frac{1}{4}$ pint Lysol and 2 ounces Fermate in 6 gallons of water) solution recommended by Bald (1). The soil was a mixture of three parts composted soil, one part sphagnum peat moss and one part sand to which pulverized limestone was added at the rate of a three-inch pot per three bushels of soil. The pH of the starting soil was 7.2, while nitrate nitrogen was medium low, phosphorus was low, potassium medium and calcium medium. All soil and pots were steam sterilized. The bulbs were planted in five-inch pots on December 6, 1955.

The treatments are listed in table 1.

Unfertilized Croft lily plants do not make plants of salable quality, so the check plants in treatment 11 were given a limited number (two) of applications of the neutral nitrogen fertilizer mixture. Plants in treatments 9 and 10 which were given the same nitrogen fertilizer received five applications.

All plants were grown in the greenhouse at a night temperature of 60° F. Flowers on which the perianth (petals and sepals) had begun to separate were measured for trumpet length each morning. All other measurements were made at the termination of the study on April 4 and 5, 1956. Each treatment consisted of three replicates of six plants each, making a total of 18 plants per treatment.

Results

Visual Observations. The foliage color of plants in treatments which received chelated calcium was, in most instances, a little paler than that of plants in the corresponding treatments which received no chelated calcium.

Plants which were given two applications of Uramite at one-month intervals were greener than were those which were given the same amount in one application. The foliage color of plants fertilized with ammonium sulfate was darker than was the foliage color of plants fertilized with sodium nitrate or the sodium nitrate ammonium sulfate mixture.

The check plants were a much paler green than all other plants, but they were not so pale as to make them unsalable at a reduced price.

The Uramite particles washed out of the pot if the grower failed to use unusual care in watering.

Measurements. The effect of the fertilizer treatments on the growth of the lilies is shown in table 2.

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1 Donated by the United Bulb Company.

Table 1. Fertilizers and rates of application.

Treatment	Fertilizer	Rate of application	Time of application
1	Uramite	1 teaspoonful	Jan. 11
		1 teaspoonful	Feb. 13
2	Uramite	1 teaspoonful	Jan. 11
	plus	1 teaspoonful	Feb. 13
	chelated calcium[1]	1 oz. per 20 gal. water[2]	Jan. 24
3	Uramite	2 teaspoonfuls	Jan. 11
4	Uramite plus	2 teaspoonfuls	Jan. 11
	chelated calcium[1]	1 oz. per 20 gal. water[2]	Jan. 24
5	Sodium nitrate	½ oz. per gal. water[2]	biweekly[3]
6	Sodium nitrate plus	½ oz. per gal. water[2]	biweekly[3]
	chelated calcium[1]	1 oz. per 20 gal. water[2]	Jan. 24
7	Ammonium sulfate	½ oz. per gal. water[2]	biweekly[3]
8	Ammonium sulfate plus	½ oz. per gal. water[2]	biweekly[3]
	chelated calcium[1]	1 oz. per 20 gal. water	Jan. 24
9	Four parts sodium nitrate and one part ammonium sulfate	½ oz. per gal. water[2]	biweekly[3]
10	Four parts sodium nitrate and one part ammonium sulfate	½ oz. per gal. water[2]	biweekly[3]
	plus chelated calcium[1]	1 oz. per 20 gal. water[2]	Jan. 24
11	Four parts sodium nitrate and one part ammonium sulfate	½ oz. per gal. water[2]	Jan. 11, 27

1 EDTA - Na_2Ca 8.5% Ca
2 Applied at the rate of an average watering.
3 Five applications starting on January 11.

Table 2. The effect of fertilizers on the growth of Croft lilies.

Treatment	No. of plants	Average plant height (in.)	Average length (in.) of flower trumpet	Average No. of flowers per plant	Total No. of flowers	No. of buds blasted	Total No. of flower buds	Total No. of shoots	Average No. of spots of leaf scorch per plant	Average No. of dried leaves at base of plant	pH of soil at end of study
# 1 Uramite 1 and 1	18	19.25	6.70	3.11	56	9	65	19	8.67	17.78	7.1
# 2 Uramite 1 and 1 + chelated Ca	18	18.21	6.71	3.11	56	4	60	21	11.56	17.38	7.2
# 3 Uramite 2	18	19.03	6.64	3.39	61	1	62	19	13.33	19.00	7.2
# 4 Uramite 2 + chelated Ca	18	17.88	6.70	2.89	52	4	56	22	17.94	18.86	7.3
# 5 Sodium nitrate	18	18.79	6.52	3.33	60	1	61	20	6.39	16.65	7.9
# 6 Sodium nitrate + chelated Ca	18	17.97	6.57	3.33	60	3	63	20	12.22	17.80	7.9
# 7 Ammonium sulfate	17*	20.24	6.56	3.24	55	5	60	19	9.94	13.95	6.0
# 8 Ammonium sulfate + chelated Ca	18	20.24	6.65	3.28	59	3	62	20	10.22	14.35	5.8
# 9 Sodium nitrate + ammonium sulfate	18	18.89	6.51	3.33	60	5	65	18	2.83	16.72	7.2
#10 Sod. nitr. + amm. sulf. + chelated Ca	18	17.90	6.59	3.50	63	3	66	20	7.05	17.65	7.4
#11 Check	18	17.84	6.81	3.59	65	0	65	19	6.75	18.50	7.6

* One plant undeveloped

As may be seen in table 1, the floral trumpet was longer on the check plants than on all other plants in the study. Plants fertilized with Uramite had longer floral trumpets than did plants fertilized with other forms of nitrogen (other than the check), but the difference was not appreciable.

The addition of chelated calcium to the soil depressed the height of the plants in all treatments except those to which ammonium sulfate had been added. The incidence of leaf scorch was increased appreciably and the length of the floral tube was increased slightly by the addition of chelated calcium.

The addition of two teaspoonfuls of Uramite at one time accompanied by the application of chelated calcium (treatment 4) injured the plants visibly. The injury may also be noted in table 2 which shows that plants in treatment 4 had the lowest bud count, next to the highest number of dead leaves at the base of the stem and the most leaf scorch.

Application of two teaspoonfuls of Uramite at one time in treatment 3 resulted in the highest number of dead leaves at the base of the stem and the second highest number of leaf scorch spots.

The combination of sodium nitrate and ammonium sulfate in treatment 9 was most effective in controlling leaf scorch.

The application of nitrogen decreased the number of dried leaves at the base of the stem in most instances, but did not appear to be the major controlling factor.

Number of flowers per plant was lowered in all instances by the application of nitrogen. The highest number of flowers per plant in the treatments which received a nitrogen fertilizer was developed when the plants were fertilized with either sodium nitrate or a mixture of sodium nitrate and ammonium sulfate. The lowest flower count was obtained in three out of four treatments fertilized with Uramite.

A comparison of treatments 9 and 11, which received the same form of nitrogen but a different number of applications, shows that the additional applications of nitrogen decreased flower size, flower number, leaf scorch and the number of dried leaves at the base of the plants.

The applications of Uramite or the mixture of sodium nitrate and ammonium sulfate applied five times did not alter the soil pH. Ammonium sulfate decreased the pH of the soil, while the pH rose following the application of a mixture of sodium nitrate and ammonium sulfate in the check treatment.

Discussion

The use of ammonium sulfate resulted in a reduction in length of the flower trumpet by 0.25 inches in the 1956 study, as compared to 0.54 inches in the 1952 study. The difference may be accounted for by the fact that the check plants in the 1952 study were not fertilized during the forcing season, while the check plants in the 1956 study were given a limited number of applications of a nitrogen fertilizer.

Seeley (5) and Widmer (10) reported that unfertilized Croft lilies grew taller than did lilies which were fertilized with nitrogen. In this study the fertilized plants were taller than the check plants. although the difference was under two inches in all but one treatment. It should also be pointed out

that the check treatment in this study was provided with a limited supply of nitrogen.

The application of chelated calcium to the lily soil provided no appreciable increase in plant quality and in some instances appeared to injure the plants. Under the circumstances, it is doubtful that application at a lesser rate, which might eliminate the harmful effect, would improve plant growth in a soil which already contains an adequate calcium supply.

The application of Uramite which provides a steady nitrogen supply had the advantage of producing the longest floral trumpet and requiring the least labor for application. The Uramite-fertilized plants had a higher incidence of leaf scorch than is desired and a low flower count, however. On the basis of low incidence of leaf scorch and high bud count, the sodium nitrate-ammonium sulfate fertilizer mixture would seem preferable. Shoushan (6) reported that Croft lilies initiated flower buds when the stem tip was three inches above the bulb. On the basis of his findings, it would seem that variable results could be obtained if the first application of nitrogen were supplied when the shoots averaged about three inches long. Flower formation in shoots which were under three inches long would be influenced by the application of nitrogen, and flower formation in shoots over three inches would not be altered unless unfavorable conditions caused blasting. This probably accounts for some of the variation in reports on the effect of nitrogen fertilization on bud count.

The injurious effect of applying two teaspoonfuls of Uramite to a five-inch pot at one time indicates that this rate of application is a little higher than should be recommended.

Extreme care had to be used in watering plants where Uramite was applied to the soil to prevent the washing of the Uramite particles out of the pot. It would seem preferable to incorporate the Uramite in the soil before potting to avoid this difficulty.

The limited control of the number of brown leaves at the base of the plants with nitrogen fertilization indicates that other factors contribute to this condition. These factors might include watering, spacing, amount of sunlight and handling of the bulb before it is received by the greenhouse operator.

The rise in pH of the soil in treatment 11 which received two applications of a neutral nitrogen fertilizer may be attributed to the alkaline water supply.

Although the application of a nitrogen fertilizer to the soil of Croft lily plants may decrease flower size and in some instances flower count, the application of a nitrogen fertilizer is essential in the production of quality Croft lily plants.

Summary

1. The application of nitrogen decreased the length of the floral trumpet slightly, but the longest floral trumpet obtained in the fertilized treatments resulted from the use of Uramite.

2. The application of two teaspoonfuls of Uramite per five-inch pot of Croft lilies at one time was a little too heavy. The application of one teaspoonful twice at one-month intervals is preferable.

3. The application of chelated calcium to Croft lily soil was of doubtful value.

4. A combination of sodium nitrate and ammonium sulfate was the most effective nitrogen fertilizer for the control of leaf scorch in this study.

5. The development of dried leaves at the base of the plant did not appear to be controlled primarily by nitrogen fertilization.

6. The application of nitrogen fertilizers decreased the flower count, but sodium nitrate or a mixture of sodium nitrate and ammonium sulfate reduced the flower count less than did the other nitrogen fertilizers used in this study.

7. Ammonium sulfate lowered the soil pH, sodium nitrate raised the soil pH and Uramite or a mixture of sodium nitrate and ammonium sulfate did not alter the soil pH.

8. The application of a nitrogen fertilizer in the production of quality Croft lily plants is recommended under Minnesota growing conditions.

Literature Cited

1. Bald, J. G., Kofranek, A. M. and Lunt, O. R. Leaf scorch and Rhizoctonia on Croft lilies. Phytopathology 45, 3:156-162. March 1955.

2. Haney, W. J. Lily leaf scorch control. Michigan Florist Bul. 249:10-16. January 1952.

3. Roberts, A. N., Stephenson, R. E., Wadsworth, S. E., McWhorter, F. P., and Stuart, N. W. Croft lilies, effects of fertilizers on growth, bud count and leaf scorch. Flor. Rev. 108(2788):25-27. May 3, 1951.

4. Roberts, A. N., Stephenson, R. E. and Wadsworth, S. E. Effectiveness of lime in preventing scorch of Croft lilies during forcing. Flor. Exch. 117(17):14-15. October 27, 1951

5. Seeley, J. G. and Velazquez, D. The effect of fertilizer applications on leaf burn and growth of croft lilies. Proc. Amer. Soc. Hort. Sci. 60:459-472. 1952.

6. Shoushan, A. A. Lily investigations. Ohio Florists' Assoc. Bul. 249:2-4. June 1950.

7. Stuart, N. W. Leaf burning of Croft lilies linked to nutrients. Flor. Rev. 104(2693):23-24. July 7, 1949.

8. Stuart, N. W., Skou, W., and Kiplinger, D. C. Further studies on the causes and control of leaf scorch. Proc. Amer. Soc. Hort. Sci. 60:434-438. 1952.

9. Widmer, R. E. Croft Easter lily scorch. Minn. State Florists' Bul.:2-3. December 1, 1951.

10. Widmer, R. E. 1952 lily leaf scorch experiments. Minn. State Florists' Bul.:2-5. December 1, 1952.

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