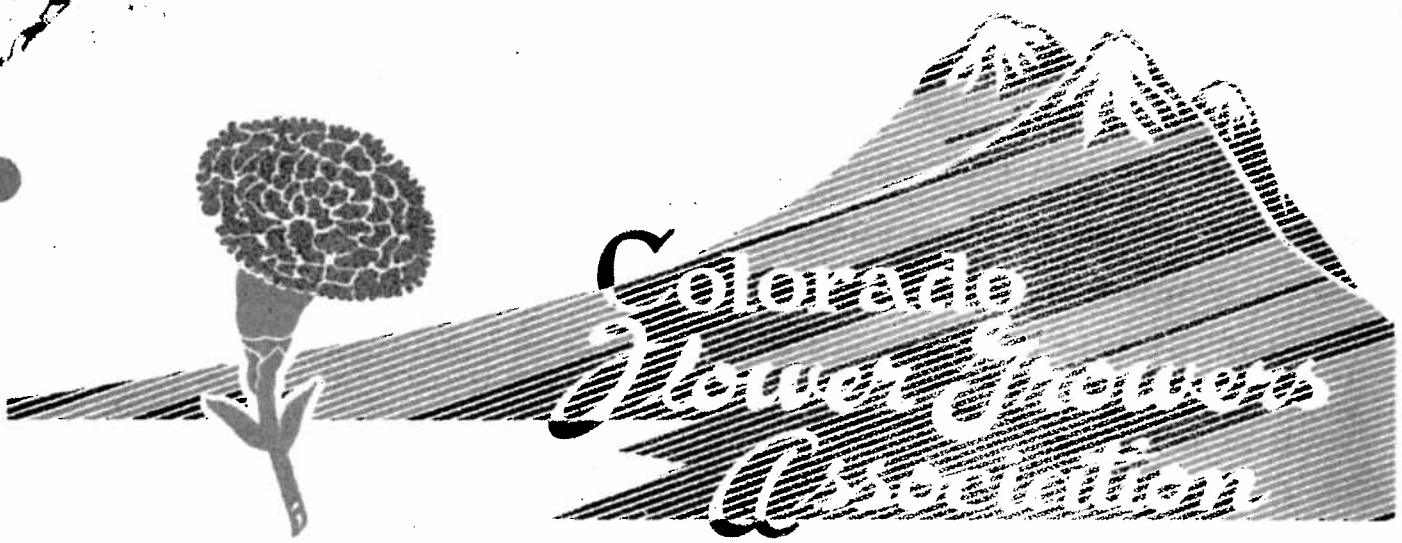

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The Response of Carnation Varieties William Sim and White Patrician to Various Levels of Nitrate and Soil Moisture

by

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Soil moisture and available nitrates are two major factors effecting the growth and quality of carnations which are controllable by the grower. To attempt to determine a range of optimum levels or combinations of levels for carnations a greenhouse was planted with the varieties William Sim and White Patrician on June 15, 1949. The plants had been propagated during the late spring and grown in nursery beds. They were benched in new soil that had previously been steam sterilized.

Three different moisture levels were maintained by watering with a hose at Lark Tensiometer readings of 30 for low, 20 for medium and 10 for high moisture. A Lark reading of 10 is approximately the same as 3" of mercury. Within the moisture levels three different levels of soil nitrate were maintained as follows: 0-15 ppm for low, 20-40 ppm for medium and 40-100 ppm for high. This made a combination of nine different moisture-nitrate combinations. Each set of nine treatments was replicated throughout the house five times making a total of 45 plots. Each plot contained 21 plants of each variety at a spacing of 6 x 9 inches. Plots were separated by water tight dividers and the drainage water from the bottom of the bench on all but low nitrate plots was caught and returned to the bench.

After the plants were established the first summer, several shoots on each plant were soft-pinched to develop the plants. The first flowers

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*Many others of the staff and students helped with this work. Special acknowledgement is due Prof. Andrew G. Clark for his assistance in the statistical analysis of results.

were cut in late October 194: and the crop was continuous until July 1950. By cutting the flowers to hard wood from February through June, the summer crop was greatly reduced and the plants were brought down for the second year's production. The second year's crop began producing freely in October 1950 and continued until May 15, 1951, when the plants were taken out.

Soil testing by the Spurway method was practiced at monthly intervals during the entire period. Since there is difficulty in converting one grower's test to another's, the amount of actual ammonium sulfate required to maintain the different levels is as follows:

Low nitrate level.....½ lb. per 100 sq. ft. per month
Medium nitrate level.....1 lb. per 100 sq. ft. per month (2 applications)
High nitrate level.....2 lbs. per 100 sq. ft. per month (2 applications)

Nutrients other than nitrate were supplied as needed.

These amounts were modified only in the hottest weather and during the shortest days of winter when fertilizer was applied on three-week intervals. Occasionally an individual plot would be out of line so one application would be skipped. Actually to maintain the desired levels for two years required approximately 5½ lbs, 11 lbs. and 20 lbs. of ammonium sulfate per year, per 100 square feet of bench area. Bear in mind also that leaching was kept to a minimum by catching the leachate from all but the low nitrate plots and returning it to the bench. No plants were lost throughout this study.

Moisture Levels on Total Production

Table 1 gives the average total production per plot of two varieties as influenced by the three different moisture levels. Each figure is an average production of five randomized plots of 126 plants each, watered at the same moisture level for two years.

Table 1. The effect of soil moisture on carnation production -- 2 years.

Moisture level	Total production	Fls. per sq. ft.
High	2450.0	51.7
Medium	2388.8	50.47
Low	2325.0	49.08

The differences in total production between the different moisture levels were so small as to be insignificant statistically. Even if they were slightly significant, the cost of the additional watering would be prohibitive. The time interval between waterings made at soil moisture tensions of 0.1, 0.2 and 0.3 atmospheres is approximately 1 -2 - 4. In other words, water must be applied twice as frequently on a 0.1 reading as on a 0.2 reading of the tensiometer, and four times as frequently on a 0.1 reading as on a 0.3 reading.

The Effect of Nitrate Levels on Total Production

Table 2 gives the average total production of two varieties as influenced by the three different nitrate levels. Each figure is an average production of 15 randomized plots of 42 plants each, growing at the same nitrate level for two years.

Table 2. The effect of soil nitrates on carnation production. -- 2 years.

Nitrate level	Total production	Fls. per sq. ft.
High	866.50**	54.9
Medium	818.40**	51.8
Low	703.07	44.5

** A difference of 13.66 blooms is significant with odds of 99:1

The differences in total production between the three nitrate levels were highly significant. From an economic standpoint the difference of three flowers per square foot of bench area would probably more than compensate for the additional fertilizer required. As will be shown later, quality as well as total production was increased at the higher nitrate levels. These results are similar to those obtained by George Beach several years ago on White Patrician. In case you have forgotten his results, a summary of them are in Colorado Flower Growers Bulletin No. 2.

Moisture and Nitrate Levels on Production

The combined effects of soil moisture and nitrate on total production are shown in Table 3. The figure for each combination of levels represents the average 2-year production per plot from five plots of 42 plants each.

Table 3. The effect of moisture and nitrates on carnation production.

		Nitrate levels			
		High	Med.	Low	Ave.
Moisture levels	High	892.2	850.8	707.0	816.7
	Medium	868.8	802.2	717.8	796.3
	Low	838.4	802.2	684.4	775.0
	Average	866.5	818.4	703.1	---
Ave. flowers per sq. ft. per year		27.45	25.90	22.25	

Significantly higher production was obtained with high nitrates at all moisture levels and with medium nitrates and high moisture. Under no conditions should the soil nitrate level be allowed to go below the medium level which in this work was 20-40 ppm. The low point of this level is still above the point at which nitrate hunger signs are easily discernible. To maintain the medium level of soil nitrates in this experiment, with a minimum of leaching, required 11 pounds of ammonium sulfate per 100 sq. ft. per cropping year.

The nitrate requirements of a crop can be put on a unit basis so that regardless of the rate of application or the fertilizer used, the total amount used will be equivalent. By multiplying the number of pounds applied per hundred square feet of bench area by the percentage of nitrogen in the fertilizer the number of units per application is obtained. Ammonium sulfate is 20% nitrogen. Using this method of calculation, 11 x 20 = 220 units of nitrogen were required per year to maintain a medium nitrate level.

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These nitrate and soil moisture levels did not effect keeping quality. They did effect the quality of the production. The higher nitrates produced more top grade blooms. Several other interesting bits of information came from this work which will appear as rapidly as space permits.

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