Colorado Flower Growers Association

IN COOPERATION WITH COLORADO A AND M COLLEGE

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Further Investigations on the Effects of Nitrogen Sources on Carnation Growth

by W. D. Holley

A preliminary report on carnation response to various nitrogen fertilizer sources was given in Bulletin 81. Up to that time plants had grown equally well when fed with diammonium phosphate, ammonium nitrate, calcium nitrate, and sodium nitrate. Growth was reduced by ammonium sulphate. Two different urea fertilizers had not been tested adequately.

Further results are now available from plantings made May 21, and August 21, 1956, which enable the separation of the seven nitrogen sources into classes of good, medium, and poor.

Four-gallon glazed crocks of volcanic ash were used as the medium. This material is porous and cinder-like and almost inert chemically. Each planting consisted of 3 crocks with 5 plants per nitrogen source, or a total of 21 crocks.

Previous to planting, treble superphosphate and gypsum were added and the crocks and medium steam sterilized. The plants were fed by a slop culture method a nutrient solution containing 112 ppm nitrogen, 250 ppm potash, 50 ppm magnesium and minor elements in trace quantities. All treatments received the same amount of nitrogen although from 7 different nitrogen carrying fertilizer chemicals.

After the cuttings were established they were pinched. They were watered with the nutrient solutions exclusively throughout their life. The May 21 planting was harvested and weighed on July 25. The August 21 planting was harvested November 17. After fresh weights were taken, plants were wrapped individually, and dried to constant weight in an oven. Table 1 shows the fresh weights, dry weights and the percentages of dry matter from plants grown with the 7 nitrogen fertilizers.

Table 1. The effects of 7 nitrogen sources on mean fresh weight, mean dry weight and percentage of dry matter of Red Sim carnations.

Nitrogen source	Mean fresh weight in grams	Mean dry weight in grams	Percentage of dry matter
Diammonium phosphate	68.2	11.1	16.2
Ammonium nitrate	78.8	13.3	16.9
Ammonium sulphate	45.9	8.6	18.7
Calcium nitrate	72.5	12.8	17.6
Sodium nitrate	75.1	11.6	15.4
Urea 45	60.6	10.4	17.1
Urea USP	66.6	11.5	17.3

Urea 45 = a commercial fertilizer
Urea USP = reagent grade chemical

The nitrates of ammonium, sodium and calcium produced the best plants in appearance and in diameter and strength of stem (Fig. 1). Plants fed with these three nitrogen sources were the highest in mean fresh weight. Ammonium and calcium nitrates also produced the highest mean dry weights.

Fig. 2 illustrates the appearance of plants grown with diammonium phosphate and the two ureas. These plants were weaker and thinner, being intermediate in mean fresh and dry weights.

Plants grown with ammonium sulphate (Fig. 3) were stunted and hardened, which are typical nitrogen hunger signs.

Ammonium sulphate increased the percentage of dry matter by this stunting, while sodium nitrate decreased the percentage of dry matter. The percentages of dry matter in plants grown with the other 5 nitrogen fertilizers were reasonably close together.

The pH of the media from the several treatments following the first harvest varied from 5.7 for ammonium sulphate to 7.0 for sodium nitrate and urea 45. This pH range should not limit carnation growth.

Fig. 1--Typical growth produced by Ammonium nitrate, Sodium nitrate, and Calcium nitrate

Fig. 2--Typical growth produced by Diammonium phosphate, Urea USP, and Urea 45.

Fig. 3--Typical growth produced by Ammonium sulphate.

Discussion and Conclusions

The nitrogen metabolism of plants is a series of complicated processes which are pretty well understood by plant physiologists. Before nitrogen is used inside the plant it is changed to ammonia. However, only minute amounts of ammonia can be detected in healthy plant tissue. On the contrary, large quantities of nitrate nitrogen are present in healthy plants of most species. Urea nitrogen must also be converted to ammonia inside the plant before it can be utilized.

Nitrate nitrogen is taken in readily by carnation plants and is stored in this form for later use. If ammonium nitrogen accumulates in a plant, it depresses nitrogen metabolism and plant growth.

Much of the ammonium or urea nitrogen would be changed to the nitrate form in a soil or medium which has optimum growing conditions for soil microflora. Conditions were not good for microflora in the medium used in this investigation for it was steamed every three months and its organic matter content was low. Our present greenhouse practices seldom favor the growth of soil microflora. With low soil temperatures and frequent sterilization we often have low populations of the bacteria which change nitrites and ammonia to nitrates.

On the basis of these comparisons of nitrogen fertilizer sources, it seems safe to assume that at least half the nitrogen supplied carnations should be in the nitrate (NO_3) form.

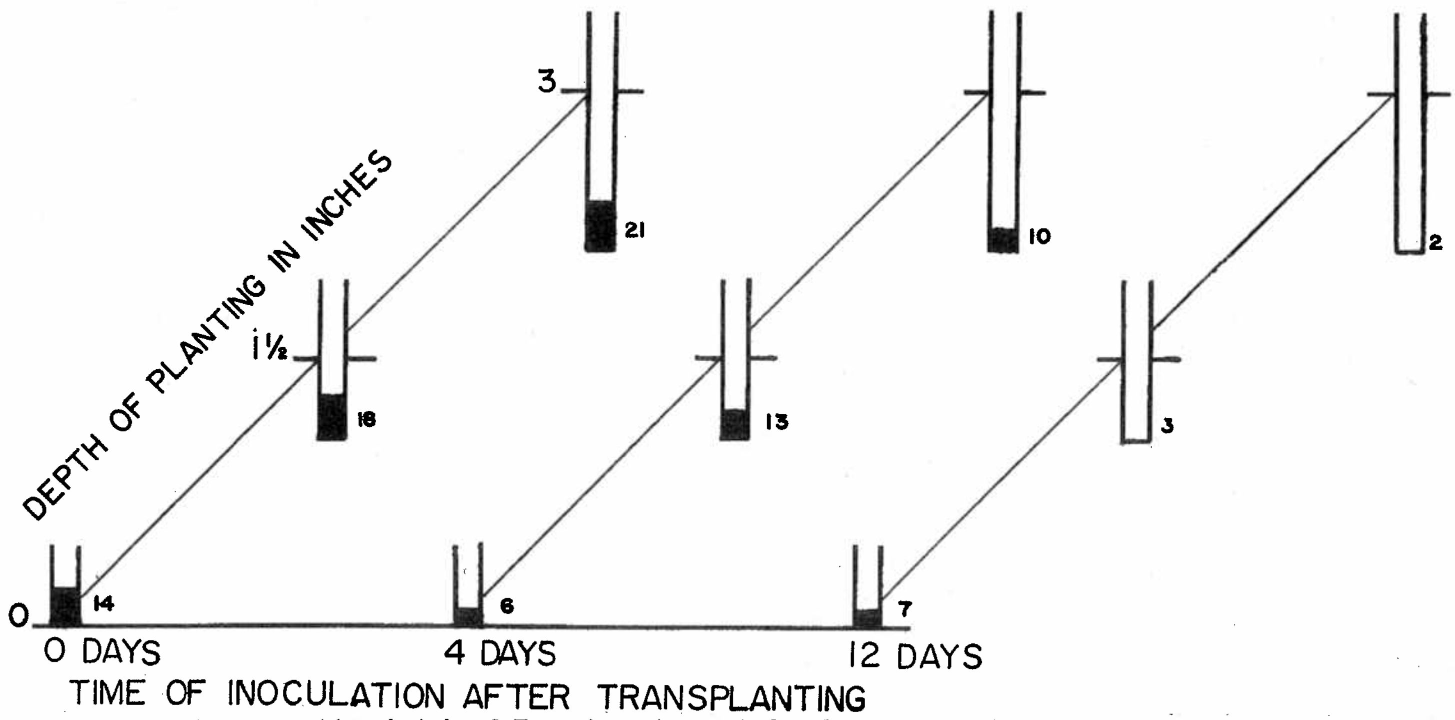
The Influence of Depth of Planting on Fusarium Stem Rot

by Ralph Baker

Many growers both here and abroad transplant carnation cuttings with the base of the cutting as close as possible to the surface of the soil. Such a practice, presumably, would lift much of the stem tissue away from pathogens which may be in the soil and allow better aeration around the root head. Further, wounds on the stem might be expected to heal more rapidly.

An experiment was set up to investigate the influence of depth of planting on the development of Fusarium stem rot. Rooted cuttings (variety Red Sim) were planted in flats. Three planting depths were used: bases of cuttings were set 3 inches below the surface of the soil, others were planted at a conventional depth of 1 to 1½ inches under the surface of the soil, and a third lot was planted so that the base of the cutting was no deeper than ½ inch below the surface. The last named transplants were tied to pot labels stuck alongside for support.

Separate blocks of rooted cuttings planted at the 3 depths were inoculated (5000 macroconidia/cc of soil) on the day of transplanting and at 4 and 12 days thereafter respectively. In all, 36 plants in 3 replications were inoculated at each of these times per planting depth.



Diagrammatic sketch of Fusarium stem rot development as it is affected by depth of planting. Height of lesions is shown in black. Top row of figures represents cuttings planted at a depth of 3 inches, second row planted 1-1½ inches, and third row planted 0-½ inches below the surface of the soil.

A study of the results as listed in Table I and the illustration indicated that when inoculation occurs immediately after transplanting the deeper the planting the longer the lesions. However, the plants with their bases nearest the surface of the soil were susceptible for a longer period after transplanting.

The full significance of these result must await other tests now in progress. Certainly, cuttings may be planted at excessive depths which could increase disease severity as measured by length of lesions. Conversely, if the stem is barely touching the surface soil, the length of lesions is reduced significantly. This is only true, however, when inoculation occurs on the day of transplanting or soon thereafter.

Table 1. Effect of depth of planting on Fusarium stem rot development.

Depth of planting in inches	Mean height of lesions in millimeters: Inoculated Day of trans-planting	Inoculated 4 days after trans-planting	Inoculated 12 days after trans-planting	Unin-oculated Control
0-1/2	14	6	7	--
1-1 1/2	18	13	3	1
3	21	10	2	--

Minimum difference for significance with odds of 19-1 = 5

15-30-15?? or *Soluble Phosphorus Fertilizers*

Use of 15-30-15 liquid fertilizer has been recommended in our columns and elsewhere for general florist crops. A 15-30-15 feed means of course, 15% nitrogen, 30% phosphate, and 15% potash.

Ray Moore of Moore Laboratories, Buffalo, New York raises an interesting point of caution here in a recent letter. We quote:

"During the last year a considerable number of ranges have experimented with 1-2-1 (or 15-30-15) completely soluble fertilizers applied with their watering operation.

"The Laboratory has been much interested in these trials for the reason that soluble phosphates form insoluble compounds with calcium, magnesium, iron, manganese, and other elements essential to growth.

"In a Rose range with a sixteen year monthly average of 170 parts per million of calcium (Spurway) in a heavy soil the level of calcium dropped to 90 to 110 parts per million within three months, with constant use of a 1-2-1 soluble fertilizer. Iron and manganese deficiencies developed. After discontinuing its use, three months time was required to readjust the soil to its previous levels.

"In a Carnation range with a nine year monthly average of 120 parts per million of calcium in a light sandy soil, the calcium level dropped to 60 to 70 parts per million in two months. Slowing down of growth, poor leaf color and an indication of boron deficiency was present. Two months time was required to adjust the soil to its previous levels after discontinuing the soluble phosphate.

"Both calcium and magnesium deficiencies developed in a Mum range. Similar results were found in seven different ranges experimenting with a 1-2-1 soluble fertilizer.

"In each case, no increase in available phosphate was found indicating that the soluble phosphate combined with other elements in the soil and was rendered unavailable to the plants.

"Since the absorption of available elements by the plant is a rapid process, it is quite possible that the plants had ample time to absorb some phosphate before it was rendered unavailable. As a matter of fact, no identifiable phosphate deficiencies were noted in the time involved. Only a normal reduction in available phosphates occurred.

"These experiments do not necessarily mean that any use of soluble phosphate fertilizer materials will cause trouble. We know they are beneficial as starting solutions and that soluble 1-1-1 fertilizers have been used for pot plants and short time crops without visible damage occurring.

"We believe, however, that complications will arise from too frequent or continuous use of soluble phosphate fertilizers on greenhouse crops. This is especially true where the soil is sterilized for re-use.

"Soluble phosphate salts are expensive."

----Reprinted from Geo. J. Ball., Inc., "Growers Talks" May 1956.

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