# Calcium Hunger in Carnation

by Ralph Peterson [1]

Calcium is one of the elements which is immobilized by plants. Once the plant has taken in and utilized calcium ions, that calcium is usually not available for translocation and reuse. Potash and some of the other nutrient ions can be moved from the older leaves to the growing points when the supply becomes limiting, but not so with calcium. This is the reason that calcium deficiency symptoms appear on the tips of the young leaves, in the flowers, and on the root tips.

[1] C.F.G.A. Research Assistant at Colorado State University.

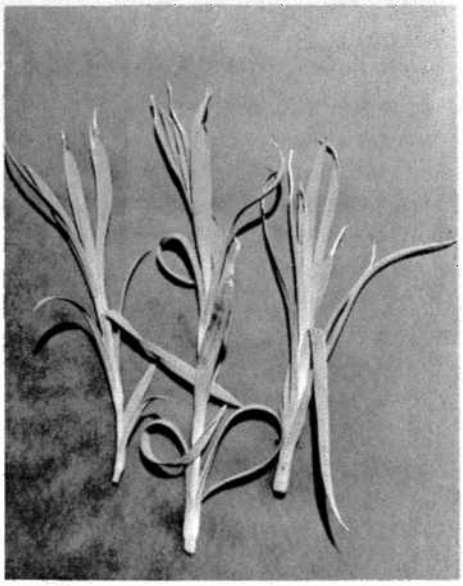

Fig. 1. The first signs of calcium hunger are scorching of youngest leaves.

The first visible symptom of calcium hunger is a characteristic tip burn which begins on the youngest leaves. The affected area may involve up to one-third of the leaf, the tip becoming constricted and turning up at an angle to the rest of the leaf. As calcium hunger increases the growing points of the stems start to die causing prolific side branching, with each new growth showing the same burning and dieing back. Lower leaves remain a darker green, not showing the tip scorch of the younger foliage. The flowers show a marked tendency toward sleepiness with the pistils becoming larger and protruding from the flowers. Many flowers do not open fully before these symptoms are evident. Some flowers do not open at all.

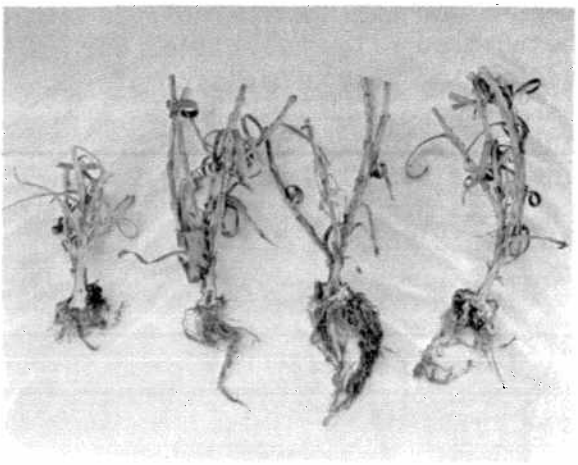

Fig. 2. Calcium hunger causes overgrowth at the stem base. Plant on left received adequate calcium, while those to the right were grown with successively smaller amounts of calcium.

Probably the last symptom to be noticed is the death of root tips and a gall-like overgrowth of the crown of the plant. Fig. 2 shows sections of four plants grown with different levels of calcium nutrition. As the deficiency becomes more severe the overgrowth at the stem base increases. This gall-like growth should be helpful in diagnosing calcium deficiency. It is not unlike club-root of cabbage, a disease which is corrected by liming the soil.

Various technical studies have indicated that calcium plays an important role in nitrogen metabolism. This is the process of converting the sugars formed by the leaves into tissue building protein material and into energy for growth. When calcium is lacking there is also a rapid breakdown of the apical tissue. These two factors tend to account for the excessive sleepiness and protruding pistils, which are in reality premature ageing. Earlier work at CSU (CFGA bulletin 60) indicated that low available calcium decreased cut flower life of carnations.

A large part of the calcium which is taken up by the plant is used to form calcium pectate, an important constituent in cell walls. When calcium is lacking it is not possible for cells to develop normally and growth is reduced, accounting for the typical necrosis which appears at the growing points -- stem and root tips.

In order to develop calcium hunger symptoms, rooted cuttings of White Sim carnation were planted in 4-gallon crocks of volcanic scoria and supplied 3 levels of calcium from June 1958 to November 1959. There were 3 crocks of 3 plants in each calcium treatment. The treatments were: no calcium, 5 lbs. of calcium carbonate per 100 sq. ft. per year, and 10 lbs. per 100 sq. ft. per year. All plants were fed the following nutrients per 50 gal. of water at each irrigation:

| | |
|---|---|
| ammonium nitrate | 78 grams |
| sodium nitrate | 6 " |
| potassium sulfate | 48 " |
| magnesium sulfate | 10 " |
| phosphoric acid(52%) | 28 ml |
| boric acid | .32 grams |
| zinc sulfate | .03 " |
| copper sulfate | .03 " |
| iron sulfate | .56 " |
| manganese sulfate | .13 " |

Except for the last four trace elements, this is the rate of water treatment used on producing plants at Colorado State University.

The weight in grams and the length of stem in inches were recorded for all flowers. All abnormal flowers were noted. Yield, mean weight, mean length and a weight/length ratio of the flowers are shown in Table 1. A carnation of good grade should have a minimum weight/length ratio of 1.00. The treatment which received no calcium produced 13 per cent less flowers with a 12 per cent reduction in weight/length ratio. Calcium did not affect stem length, however lack of calcium caused many extremely sleepy flowers and consistent foliage scorch.

One of the interesting facts brought out by this study was that carnations growing in scoria (or other inert media) require higher dry application rates of calcium than do those growing in soil. A rate of 5 lbs. per 100 sq. ft. per year seems to be adequate for most soils, but some deficiency symptoms appeared at this rate in scoria. When the equivalent of calcium is fed as soluble calcium compounds in nutrient solution, there is no calcium deficiency. The most likely explanation for this is that scoria being inert is unable to retain the calcium which is slowly leached out of the medium. To introduce calcium into the nutrient solution, 90 grams of calcium nitrate can be used to replace 45 grams of the ammonium nitrate.

Calcium hunger is not common in commercial greenhouses, but it could be expected to occur under one of the following situations:

1. When the soil pH is low.
2. When excess phosphorus is present in the soil.
3. When soil has been used for many years without sufficient calcium additions.
4. When inert media are used without adequate liming.

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Table 1. The effects of three calcium levels on yield, weight, length, and opening characteristics of White Sim carnation flowers.

| Limestone applied per 100 sq. ft. per year | Yield | Mean weight in grams | Mean length in inches | Weight per length ratio | Number of sleepy flowers |
|---|---|---|---|---|---|
| None | 248 | 24.05 | 27.97 | 0.896 | 60 |
| 5 lbs. | 272 | 27.26 | 27.90 | 0.977 | 8 |
| 10 lbs. | 284 | 28.76 | 28.22 | 1.019 | 3 |