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BORON DEFICIENCY IN CARNATIONS

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Extent of Problem—

Boron deficiency was very severe in Massachusetts and Pennsylvania, 1955-56. Crops of saleable flowers reduced as much as 50% in some ranges.

It has also been reported in Colorado, North Carolina, Connecticut, Maryland, and can be expected to occur along much of the Eastern Seaboard, because many soils in this area naturally low in boron.

Symptoms—

The symptoms may not appear as an overall decrease in growth or vigor in early stages. Some of the best deficiency symptoms in the flowers have come from very vigorous plants.

Unfortunately, symptoms may not be evident until flower buds begin to develop. Therefore, the grower must check his plants closely for any abnormal flower development.

1. Calyx ring — partial or complete ring affecting presence of Waxy bloom on calyx. Flower usually normal, may be split.
   One of the first symptoms to appear — does not always occur. Probably too late to correct deficiency in order to save flower buds.
2. Reduced number of petals — range from slight reduction to very few. When only one or two petals develop, pistil parts very prominent.
3. Curved — crippled buds — lack of boron in cells during development responsible for this abnormal flower formation.
4. Aborted buds — buds form but do not develop — turn brown in color — usually axillary shoots develop immediately below.
5. Excessive development of axillary shoots — Shortening of internodes — when deficiency is severe, buds abort, and axillary shoots develop vigorously. Plant behaves in same manner as if pinched.
   These side shoots will develop into normal flowers if boron is applied before their flower buds are formed.
   Most plants behave in this manner when boron is deficient. Illustrations of boron deficient Snapdragons confirm this observation.
6. Young axillary shoots growing through and below leaves — Messing, working in England with sand culture experiments, reported this as a symptom of boron deficiency. Our experience in Massachusetts and Pennsylvania has indicated that this symptom is not a reliabe indicator of a boron deficiency. It does occur in normal plantings.
7. Leaf symptoms — unless the deficiency is severe, no definite foliar symptoms occur. A browning of the tips with a purple colored band immediately adjacent to the green of the leaf does occur. In sand culture, this symptom develops very well, and the plants are stunted. Chlorosis and a redding of the main leaf vein may also occur. At this stage, the plants are severely deficient.
   Leaf symptoms for boron and calcium should not be confused. Deficiencies of both elements usually affect the growing tip of the plants first. They are distinctly different in carnations.
   In the leaves, — calcium deficiency causes a necrotic area to develop in the leaf approximately ¼ to ½ inch back from the tip. The tip remains green until the entire tip of leaf turns straw brown in color. There may not be a colored band on the leaf.
   On the flowers — flowers develop normally with a full number of petals, and no curved abnormal buds. The petals do fall asleep on the plants before becoming fully developed. At this stage they do not develop normally. The tips of the sepals also turn brown, and this browning may develop down some distance on the calyx.
   A boron deficiency will affect the overall height of the plants sooner than a calcium deficiency.

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Boron Deficiency in Carnations

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What are some possible reasons for the development of a boron deficiency?

1. Florists are working with a limited soil volume — and if this soil is used over and over again for the same crop, the boron supply can be depleted.
2. Technical and Economic changes have recently occurred in the industry.
   Cost of labor — has made is necessary to reduce labor costs as much as possible. Therefore: soil changing has been eliminated, and liquid fertilizers have become most popular as a means of supplying the nutri ent requirements of plants.
3. Steam sterilization — essential for disease control — has also made it possible to use the same soil over and over again. Steam sterilization in itself plays no role in contributing to the boron deficiency problem; it is mentioned only in the light of making it possible to reuse soils.
4. Completely soluble fertilizers for liquid applications; introduced as a method of saving labor and for better, quicker application of nutrients. To be completely soluble, the fertilizers must be highly purified in contrast to the dry materials previously used. Boron supplied accidentaly as an impurity in the dry feeds is not present in the highly soluble ingredients now in use.
5. Better soil preparation — use of peat moss — Growers are doing a better job of preparing their carnation soils; they are better drained, plants grow faster and take up more boron. Boron can be leached from greenhouse soils; Peat moss not only has done a better job of conditioning soils, but in itself, may not carry as much boron as manure. Manure, one should remember may result in ammonia toxicity following steam sterilization of the soil mixture. Peat moss will not.
   Growers should remember that these improvements in cultural practices, while possibly contributing factors to a boron deficiency, cannot be abandoned just to avoid a boron deficiency. They are an essential part of modern cultural programs and greenhouse management. The best bet is to correct the boron deficiency problem by adding boron.

Correcting The Deficiency, How Much—When?

When symptoms occur and have been diagnosed as a boron deficiency by your Experiment Station or Extension Specialist, add 1 ounce Borax (household grade) per 100 sq. ft. or use 4 ounces per 100 gallons in your regular liquid feeding program.
We suggest 1/3 to 1/2 oz. of borax be applied 3 times a year.

(1) when new shoots following last pinch are 4-6 inches long.

(2) immediately after first big crop is removed in fall — October or November.

(3) another in Feb. or March to maintain the Easter — Mother's Day Crop.

This does the job in Pennsylvaina.

We believe there is a better way of doing the job in one application — Use fritted trace elements. —

A single application uniformly spread and thoroughly mixed into the soil can maintain plants free from boron deficiency for a period as long as 2 years. This is in a known boron deficient soil. They are also so safe that they can be applied as an insurance measure in soils not known to be deficient, but that may be suspected to become deficient, during the growth of the crop. (A word of caution — particular soils high in some of the trace elements may reach a toxic level with this method.)

Experiment conducted in Massachusetts on Red and White Sim.

		% of Splits 1955-56	56-57
Check		23.1	47.9
FRIT FN501	50 lbs. acre-2%B	8.7	21.1
FRIT FN501	100 lbs. acre-2%B	4.7	5.9
FRIT FN502	50 lbs. acre-2%B	6.2	18.4
FRIT FN502	100 lbs. acre-2.8%B	7.4	14.9
Esminel	100 lbs. acre	13.9	52.1
XL-36	12-12-12 (0.04% B)	4.9	4.1

Experiment in Pennsylvania —	% of Splits 1957-58
Check	33.7%
1 oz Borax	10.6%
3 oz. Borax	13.0%
FN 505 3% B 12% Mn.	8.1%
FN 176-C 4-7% B 65 lbs. acre	9.2%
Colemanite 10.1% B 30lbs. acre	9.5%

Suggest — 4 ounces of FN501 per 100 sq. ft. to maintain plant free from Boron
Cost — 10c per 100 sq. ft.
Mix uniformly and thoroughly with soil.