

IN COOPERATION WITH COLORADO STATE UNIVERSITY  
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## Carnation Tissue Analyses

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The start of regular carnation tissue analyses in 1968 inaugurated a new era in carnation nutrition. Soil analyses can be misleading. For example, they are of no value for plants grown in inert media and, under the best of conditions, indicate plant nutritional status indirectly. In the last five years, nearly 200 carnation and rose tissue analyses have passed through the CSU laboratory, and one can ask: "How good a job has been done, and is being done, in maintaining the recommended nutrient levels in carnations?" In the light of recent fertilizer price increases, are we using too much; or, are there elements that deserve more attention?

The recommended tissue levels of major elements are:

Phosphorous .....	0.20 to 0.35%
Potassium .....	2.9 to 3.3%
Calcium .....	1.0 to 1.5%
Magnesium .....	0.20 to 0.40%
Total nitrogen .....	3.2 to 3.6%

The summarization of about 173 tissue analyses is presented in Figures 1 through 3. With the exception of potassium in Fig. 2 and total nitrogen in Fig. 3, the black parts of each graph represent the levels given above. From these graphs one can determine how many tissue analyses were within the desired ranges, what percent were above or below the recommended levels, and what variation existed. Thus, in Fig. 1, the majority of analyses for calcium and magnesium bracketed the limits fairly well, with the average value for all analyses within the proper limits. However, Fig. 2 shows a wide variation for potassium and phosphorous levels, with the average for all exceeding the upper limits. Total nitrogen (Fig. 3) indicates nearly half of all analyses were slightly below the lower recommended level, with a few extreme variations.

The large variations for potassium and total nitrogen suggest difficulty in controlling these tissue levels in carnations, and either the recommendations should

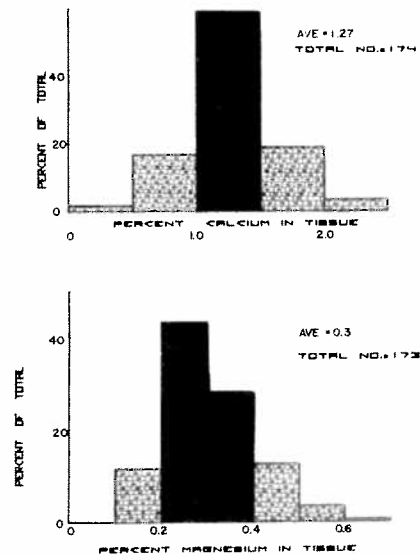


Figure 1. Distribution of calcium (upper) and magnesium (lower) analyses in carnations. The black portions show the recommended ranges.

be looked into for a possible change, or we should be more precise in applying these fertilizers. The results for phosphorous indicate that growers may be over-supplying this element a large part of the time (Fig. 2), and the fact that only 8% of all growers represented by these tissue analyses (Table 1) ever experienced low phosphorous levels substantiates this conclusion.

Even though 20% of all analyses, and 38% of all grower establishments, have at some time shown low potassium, Fig. 2 suggests that a few are applying much more than needed. Considering the high cost of potassium nitrate, application rate might be reduced. Perhaps most important, more than 18% of all calcium analyses, and nearly half of all growers (Table 1), show calcium deficiencies. When the importance of calcium in keeping life of carnations is considered,

Table 1. Carnation tissue analyses, 1968 to 1974.

Out of 173 samples	Percent Desired lower level	Percent Desired upper level
Calcium	18.4 below 1.0 %	22.4 above 1.5 %
Magnesium	11.6 below 0.20	16.8 above 0.40
Phosphorous	1.7 below 0.20	56.7 above 0.35
Potassium	19.8 below 3.00*	54.1 above 3.40*
Total nitrogen**	46.2 below 3.20	10.6 above 3.80*

Out of 39 greenhouses:

- 49% have experienced calcium deficiencies
- 30% have experienced magnesium deficiencies
- 8% have experienced phosphorous deficiencies
- 38% have experienced potassium deficiencies
- 67% have experienced total nitrogen deficiencies

\*Recommended levels for potassium have been 2.9 to 3.3 (values changed here to fit the statistical program). Maximum recommended level for total nitrogen = 3.0.  
 \*\*Total number of samples = 135.

calcium applications should perhaps be adjusted upward, particularly during the winter.

As long as carnations are growing well, total nitrogen levels down to 3.0 can probably be tolerated. But, the large number below the recommended 3.2% suggests a borderline condition to which more attention should be given.

There are two important items to consider: 1) with increasing costs and fertilizer shortages, these results show that we could do better in fertilizer manipula-

tion, and 2) EPA will eventually ask what the greenhouse industry is contributing to water pollution. Excessively high tissue levels may indicate luxury consumption, and that perhaps a large amount of what is applied is going out with the drainage water. Another point to keep in mind is that each grower is an individual case, and the results here are not applicable to all individuals.

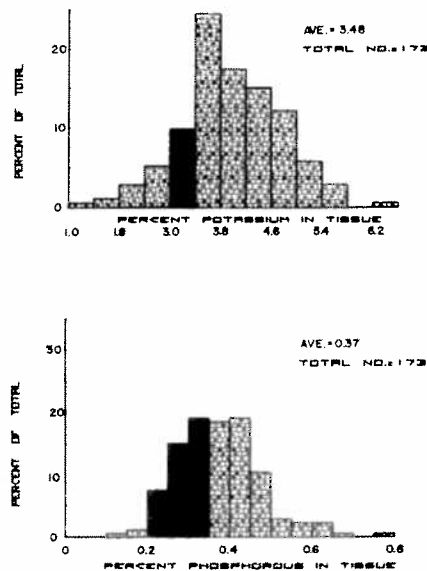


Figure 2. Distribution of potassium (upper) and phosphorous (lower) analyses in carnations. The black portions show the recommended levels, except that potassium is 2.9 to 3.3% rather than 3.0 to 3.4% as shown.

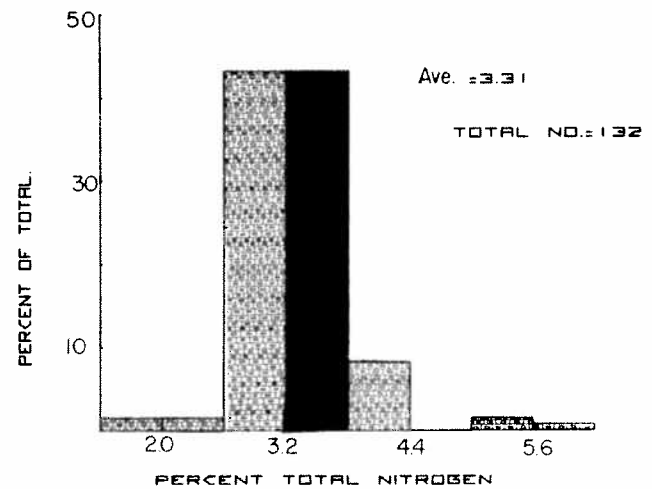


Figure 3. Distribution of total nitrogen analyses in carnations. The black portion shows the number of samples between 3.2 and 3.8%. The recommended upper level is 3.6%.