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A Modern Concept of

Feeding Greenhouse Plants

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We have come a long way since the first publications on fertilization of plants. The gamut has been run from crude fertilizer materials applied once or twice a year to refined chemicals applied with clock-like regularity. Regular soil testing has been adopted as an aid, and sometimes relied upon too much. Next, fertilizers were mixed and applied in solution instead of in the dry state. Our most recent step is the elimination of most of the labor involved in nutrition control by mixing the nutrients with the irrigation water and feeding every time we water.

Every step in this evolution of supplying nutrients to plants has had its dissenters. Problems have often arisen that should have been avoided. There are many who say that plants should have only "organic" fertilizers, yet the same people are using mixtures of straight chemicals from a bag on which is printed an "organic" sounding name (and on which is usually an "organic" price tag).

One reason for this article is that there are greenhouse growers today using practices in every stage of this evolution of feeding plants. Our production costs today are too high to allow us to use labor that we can do without. Neither can we afford to let plants get hungry, for with most greenhouse crops, we lose a lot in reduced yield or quality every time this happens.

Feeding by soil test

Soil testing has been one of the most useful tools advanced for nutrition control, but it is relied upon too much by many growers. The grower who waits to fertilize until a soil test shows a need for one or more elements will invariably have some crops hungry each year. Once carnations, chrysanthemums and most other crops show hunger signs, a lot of damage in reduced yield and quality is done. On permanent or semipermanent crops several months may be required for these hunger signs to disappear.

Soil testing is best used as a check on luxury feeding. Rather than test for low levels of nutrients, we fertilize freely according to a schedule and use our regular soil tests to avoid nutrient levels above the optimum range, toxic soluble salts, and adverse trends in the soil pH.

Dry applications of fertilizer

A feeding schedule can be used on actively growing crops. If the yearly amount of nitrogen and potassium needed by any crop is known, these amounts may be apportioned out during the year on a schedule that is established in advance. Applications can be started 2 to 3 weeks after planting and continued on a regular basis until 6 weeks before the crop is replanted.

We have made an exception of phosphorus and trace element mixtures, preferring to make one yearly application of these. A feeding schedule of supplying nitrogen and potash that has been used successfully in Colorado for a number of years is as follows: Nitrogen -- ½ pound of ammonium nitrate per 100 sq. ft. from 2-3 weeks after planting until Nov.1; ½ pound each 3 weeks to Feb. 1; ½ pound each 2 weeks until 6 weeks before replanting. Twice as much calcium nitrate is often substituted during mid-winter. Potash--1 pound of muriate of potash per 100 square feet each month for the first 7 or 8 months of the cropping year; crops that are to be grown several years would require continuous use of potash, 1 pound every 5-6 weeks. Variations in watering practices and soil types between growers may require some modification of this schedule. Regular soil tests will indicate the needed modifications, if any.

This is quite a lot of fertilizer -- it might be called luxury feeding. Records have shown that it pays, however. The principal drawback to dry feeding, on a schedule or not, is that it is wasteful of labor.

Liquid Feeding

Reliable equipment which will eliminate the labor of dry feeding is now available to all growers. All irrigation water is treated at a constant rate. This system is an ideal method of feeding plants for many reasons. Plants require water according to their size and their rate of growth. It is logical that they would use nutrients in this same relationship. Plants grow and require nutrients and water in relation to the light which they receive. When irrigated with water treated at a constant rate, a plant of a given size would require about half the water and nutrients in winter that the same plant would need in the summer. The correlation between growth and the water and nutrient needs of a plant is a very close one. Many different plants from carnations and roses to cymbidiums and pot plants have thrived with this feeding system.

For the past six years we have been treating the irrigation water at Colorado State University. At present we are using the following amounts of fertilizer grade chemicals per 1000 gallons of water:

3 lbs. ammonium nitrate or 25 lbs. of calcium nitrate
0.25 lb. sodium nitrate (for the sodium)
1.75 lbs. muriate of potash
0.5 lb. epsom salts
1/2 ounce borax

The concentration of nitrogen and potash approximates that used in gravel culture solutions. We have not used soluble phosphorus because of the cost and the sludge formed in concentrate tanks. Phosphorus is applied once yearly as treble superphosphate. Epsom salts is added because magnesium and sulphates are low in our water supply. Well water usually contains ample of both of these.

This rate of treatment has evolved from gravel culture solutions and may be stronger than is actually necessary. Of the many Colorado growers using this method of feeding, some apply slightly more and some slightly less fertilizers. There have been no accumulations of fertilizers after prolonged use of this rate of feeding.

This year for the first time facilities and space are available for testing several different feeding rates. Replicated plots of carnations are being watered with solutions containing the basic rate as listed above, and 1/2, 3/4 and 1 1/4 times the basic rate. After six months observations the 1/2 basic rate is inadequate. Yield and grade records will be required to separate the other three feeding rates.

Checks on this system

Someone must check on all greenhouse operations as well as all equipment. There are three useful checks for proportioner machines which inject concentrated fertilizer solution into the water supply. The first and simplest is constant observation of the solution line in the concentrate tank. This line should drop regularly according to the amount of water used.

A second check is accomplished by weekly solubridge (total salts) readings of the treated water. The base reading for comparison should be obtained when the machine is known to be working properly. Unless the injection rate or the concentrate solution is changed, any later sample should give approximately the same specific conductance reading. Repairs are simple on most machines so an immediate correction can be made as soon as a large decrease in the conductance of the irrigation water is noted.

A final long term check on the feeding rate and the system is that of soil tests. Any trend upward or downward in levels of specific nutrients can be corrected by altering the amount of fertilizers injected into the water.

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