FLORIDA AGRICULTURAL EXTENSION SERVICE
UNIVERSITY OF FLORIDA
INSTITUTE OF FOOD AND AGRICULTURAL SCIENCES

*Vegetable Crops Department*

# VEGETARIAN

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Gentlemen:

Considerable interest has developed in the work of Dr. C. M. Geraldson in adopting the principle of INTENSITY AND BALANCE of plant nutrients in the soil as guides for the fertilization of vegetable crops. Dr. Geraldson's work, although quite advanced and very promising, is not yet being recommended for general use. County Agents, who have cooperated in this work, are encouraged to continue to do so. Other agents are advised to keep informed on this approach to fertilization, but not to attempt to use it until more information becomes available.

## DEFINITIONS

Balance refers to the percentages or ratio of the nutrient elements (Ca, K, Mg, Na, $NH_4$, $NO_3$, Cl, $SO_4$) in the soil solution. Balance, in other words, is a measure of the relative proportions of the various fertilizer elements desirable for satisfactory crop response and not a measure of total amounts of those elements. As an example, in soil solution, calcium should be over 20 percent of the total soluble salts for the production of good quality tomatoes.

Intensity is a measure of concentration (amount) of the total soluble salts in a soil solution. An intensity determination gives a reading of amount of fertilizer as against balance which gives a reading of ratio of the various fertilizer elements.

One, two or more balance determinations during the growing season may be needed to properly estimate nutrient fertilizer needs of a given crop. Caution: All details necessary for proper interpretation of a balance determination have not been worked out as yet. Until more data becomes available, a balance determination should be used as only one of many tools in helping to carry out a satisfactory vegetable fertilizer program. Intensity determination may be needed weekly, biweekly or after leaching rains to keep a check on the total fertilizer status of a soil.

## EQUIPMENT

The analysis to determine balance of nutrients is complicated and must be run in a well-equipped laboratory. On the other hand, intensity determinations are quite simple and can be made in the County Agent's Office. The equipment needed is simple and not too expensive.

(1) A Solu-Bridge* (Model RD-15, with short cell) Approx. Cost $80.00.

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* Listing of a specific trade name does not constitute an indorsement of this equipment over others capable of performing the same operations.

(2) 50 ml. beakers )
(3) 200 ml. beakers ) or equiv. glasses

(4) Glass stirring rods

## METHODS OF ANALYSIS

Steps in making the determination are:

A. Soil Moisture determinations:

(1) Obtain a moisture holding capacity determination of the soil from the Extension Soils Laboratory. Make all necessary arrangements with the Extension Soils Specialist before sending samples to this laboratory for analysis. For the determination, take the soil sample when soil moisture is optimum for plant growth. One determination will suffice for all soils with the same physical characteristics.

B. Taking Solu-Bridge Readings:

(1) Get a representative composite soil sample (the depth and area of sampling should be representative of the effective root zone).

(2) Air-dry the soil and screen to remove large clods.

(3) Measure 50 mls. of soil by pouring air-dry soil into a 50 ml. beaker and scraping off excess with thin-edged ruler.

(4) Pour the measured 50 mls. of soil into a 200 ml. beaker.

(5) Pour 100 ml. of distilled or de-ionized water (substitute clean rain water) over the soil.

(6) Stir vigorously for 1 minute.

(7) Allow to stand for 30 minutes.

(8) Stir vigorously again for 10 to 15 seconds.

(9) Take and record reading from Solu-Bridge directly in soil-water mixture. (Be sure to read carefully instructions on use of Solu-Bridge).

## INTERPRETION OF ANALYSIS

After a soil moisture determination for a specific soil is made and a good Solu-Bridge Reading is taken, the results can be interpreted from Table I or from Figure I. The tabular interpretation is simplest but it does not present the complete picture as shown in Figure I. Both methods of interpretation will be explained.

A. From Table I:

(1) Compare the Solu-Bridge reading taken with those given opposite the appropriate soil moisture percentage. Low, optimum and excessive ranges are explained in the legend at the bottom of the table.

(2) For soil moisture levels not listed in the table, interpolate by proportioning the difference between the two nearest soil moisture levels.

B. From Figure I:

(1) Find the point on the Solu-Bridge line (Vertical line on left side) corresponding to the reading taken on the sample from the Solu-Bridge. Follow this line across until it intersects the line corresponding to the soil moisture percentage of the soil being tested.

Example - Assume a soil with 25% moisture and a Solu-Bridge reading of 50. The two points intersect on the chart at a point marked (X). The intensity of the nutrients in the soil used in this example falls in the optimum range for most crops.

(2) The chart, also, illustrates the relative sensitivity of some of the vegetable crops to soluble salt injury.

a. The range below the 1000 PPM line on the chart corresponds to the low intensity level of Table I. This range is generally inadequate in nutrient intensity for best growth of most vegetable crops.

b. The range between 1000 PPM and the 4000 PPM lines corresponds to the optimum level of Table I. Intensity levels in this range are generally optimum for most vegetable crops.

c. The range between the 4000 PPM and 15,000 PPM lines corresponds to the excessive level of Table I. Most vegetable crops may be injured from these excessively high salt concentrations. The vegetables are placed in the chart to illustrate relative sensitivity of the various crops to salt injury. Beans are relatively more sensitive than celery and celery more than radish, etc.

Each vegetable crop is placed on chart to indicate the level of nutrient intensity which may reduce yield of that crop by 50%. Squash growing in a soil solution containing slightly over 6000 PPM salts in the soil solution may yield 50% less than expected as a result of salt injury. Similarly, cauliflower yields may be reduced by 50% when salt concentration of the soil solution is about 10,000 PPM.

NOTE: To calculate PPM soluble salts obtain factor from Factor Line on chart which corresponds to the soil moisture percentage used.

Example: Assume a soil with 12.5% soil moisture taken at level optimum for plant growth. Assume a Solu-Bridge Reading of 120.
(a) Factor at 12.5% moisture = 50
(b) Factor x Solu-Bridge Reading = PPM Soluble Salts.
50 x 120 = 6,000 PPM Soluble Salts.

This is complicated and hard to simplify. If you need further explanation, write us!!!

Remember - these interpretations are made at optimum field moisture. As the soil becomes drier in the field, concentration of soluble salts goes up!!!

TABLE I

| Soil Moisture | INTENSITY LEVELS (SOLU-BRIDGE READING) Low (a) | Optimum (b) | Excessive (c) |
|---|---|---|---|
| 5.0% | below 13 | 13-54 | 54 - above |
| 6.0 | " 14 | 14-60 | 60 " |
| 7.0 | " 15 | 15-63 | 63 " |
| 8.0 | " 16 | 16-67 | 67 " |
| 9.0 | " 17 | 17-70 | 70 " |
| 10.0 | " 18 | 18-74 | 74 " |
| 11.0 | " 19 | 19-77 | 77 " |
| 12.0 | " 20 | 20-80 | 80 " |
| 16.0 | " 22 | 22-86 | 86 " |
| 20.0 | " 23 | 23-92 | 92 " |
| 25.0 | " 25 | 25-100 | 100 " |
| 50.0 | " 33 | 33-130 | 130 " |
| 100.0 | " 43 | 43-170 | 170 " |
| 150.0 | " 50 | 50-200 | 200 " |

(a) Low-Concentration is too low for most plants and fertilizer is generally needed.
(b) Optimum - Best range for growth of most plants.
(c) Excessive - Most sensitive plants (beans, celery, radish) may be injured.

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FIGURE I--FACTORS (for conversion to PPM Soluble Salts)