California Avocado Society 1959 Yearbook 43: 94-95

LEAF ANALYSIS AS A GUIDE TO NITROGEN FERTILIZATION OF AVOCADO

T. W. Embleton, W. W. Jones, and M. J. Garber
T. W. Embleton, Assoc. Horticulturist; W. W. Jones, Horticulturist; and and M. J. Garber, Asst. Biometrician, University of California Citrus Experiment Station, Riverside.

Grower practice for nitrogen fertilization of the avocado varies widely. Very little critical information has been available to assist in formulating a nitrogen program. Recent reports (1, 2, 3) indicated that applications of too little or too much nitrogen resulted in a reduced yield. This report summarizes 8 years' research on nitrogen fertilization of the avocado.

In the course of many experiments it was observed that a heavy cover crop in an orchard, either planted or volunteer, competes very strongly with the tree for nitrogen. Thus, one must supply not only enough nitrogen to take care of the tree but also an additional amount to meet the needs of the cover crop.

It was observed that a change from cultivation to nontillage resulted in a marked change in the nitrogen nutrition in the tree, even though the nitrogen program was not changed.

Experiments and observations indicate that the MacArthur variety requires a higher rate of nitrogen to maintain an adequate nitrogen level in the tree than do the Fuerte or Hass varieties.

Undoubtedly, soil types, rootstock, climate, soil salinity, variations in irrigation water and other less obvious factors influence the efficiency of a given rate of nitrogen as related to the nitrogen nutrition in the tree.

A more precise method than generalizing on rates is needed as a guide for nitrogen fertilization practice. Leaf analysis shows promise of being such a method. The curve shown in Fig. 1 was developed from experimental data from 95 Fuerte trees in an 8-year study in northern San Diego County. The trees were 11 years old at the beginning of the experiment. Statistical analyses of the data show that the curvature in Fig. 1 is highly significant (1% level). Nitrogen values are from leaf samples obtained in the August-October period. The leaves were the youngest fully expanded and mature leaves from shoots, from all sides of the trees, that were not fruiting nor flushing. Care was taken to obtain, as nearly as possible, leaves that were free of tipburn, sunburn, or other visible symptoms or blemishes.

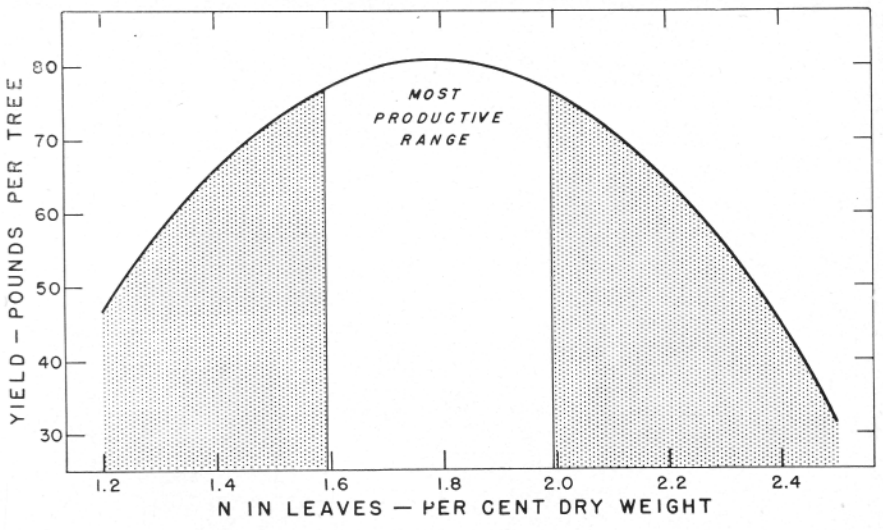

Figure 1. Fuerte avocado yield as related to the percentage of nitrogen in the youngest, fully expanded and mature leaves sampled in the August-October period.

The trees that had nitrogen leaf values that were below the "most productive range" were deficient in nitrogen and were weakly vegetative. The foliage was sparse and light green to yellow in color. Leaves were small and new shoot growth was less than on trees with nitrogen leaf values in the "most productive range." The trees with nitrogen leaf values that were higher than the "most productive range" were highly vegetative with a dense, deep green foliage. These trees had large leaves and an abundance of long new shoot growth. Trees with nitrogen leaf values in the "most productive range" were intermediate between the above two groups of trees for vegetativeness, foliage density, leaf size, leaf color, and amount of new shoot growth.

The curve in Fig. 1 shows clearly that too little or too much nitrogen results in a reduction in yield of Fuerte avocado. Although experiments on other varieties have not been under way long enough to draw conclusions, indications are that the curve in Fig. 1 also applies to the MacArthur variety. Results with the Hass variety suggest that the "most productive range" of leaf nitrogen values is somewhat higher than for the Fuerte.

If leaf analyses are used as a guide for nitrogen fertilizer practice, results from samples taken in the August-September period could be used to estimate the amount of nitrogen to apply the following spring. If the leaf nitrogen level is found to be above the "most productive range" apply less nitrogen than was applied the previous year. If the level in the leaves is below the "most productive range" apply more nitrogen than was applied the previous year. Levels of nitrogen within the "most productive range" would suggest little or no change in the nitrogen program.

The "most productive range" for nitrogen is wide and includes values from 1.6 to 2.0 per cent of dry weight of leaves. As additional experimental results become available, it is anticipated that this range will be defined more clearly for the major varieties and will possibly be narrowed. It is expected that there will be specific examples that will probably not be in close agreement with the curve. However, there is no infallible method for determining the best nitrogen program because of the influence of seasonal

factors which cannot be predicted in advance. Use of leaf analyses, appears to be the best method available to date.

Indications from the studies here reported are that from 100 to 150 pounds of actual nitrogen per acre annually will generally be adequate. If a volunteer or planted cover crop exists in an orchard, additional nitrogen will be needed to overcome the competition by the cover crop. The MacArthur variety appears to require a higher nitrogen rate than other varieties to maintain leaf nitrogen in the "most productive range" and maximum production.

LITERATURE CITED

1. Embleton, T. W., W. W. Jones, and M. J. Garber. A curvilinear relationship between leaf nitrogen and yield of Fuerte avocados. Proc. Amer. Soc. Hort. Sci. (In press.)
2. Embleton, T. W., W. W. Jones, and J. D. Kirkpatrick. 1955. Avocado fertilizer experiments. Calif. Avocado Soc. Yearbook 39:62-66.
3. Embleton et al. 1958. A progress report on cooperative avocado nitrogen fertilizer experiments. Calif. Avocado Soc. Yearbook 42:111-113.