Plant Analysis As A Guide In The Fertilization Of Sugar Beets For Improved Production

Albert Ulrich

The need for better methods of determining the fertilizer requirements of sugar beets is emphasized whenever a fertilizer program is proposed for a field of beets.

Soil analyses conducted either through chemical or biological means are helpful in estimating the concentrations of nutrients in the soil that are available to plants, but they do not indicate what the crop is actually getting from the soil under the prevailing climatic conditions.

Value of Plant Analysis

In contrast to soil analysis, analyses of plant samples properly collected from the field will indicate what the plant is getting from the soil in relation to its environment.

When the analytical values from the plant samples are compared with the critical levels for each nutrient, conclusions may be drawn with respect to the adequacy or inadequacy of the nutrients at the time of taking the sample.

From the analyses of plant samples properly collected the relative importance of the deficiency can be estimated from its duration and from the time of its occurrence during the growing season.

The earlier in the growing season a nutrient deficiency is discovered, the greater the chance of getting an increase in yield from adding the required but deficient nutrient to the soil.

Demonstration Experiments

During 1944 and 1945 six demonstration trials were conducted. In all cases the results were in accord with the leaf analyses that were made in the course of the experiment.

When beets from unfertilized plots have nitrogen concentrations well below the critical level, the addition of nitrogen increases the nitrate concentration of the beets considerably during part of the growing season.

In plots near King City, the addition of nitrogen increased the yields from 12 tons per acre for the untreated plots to 20 tons per acre by application of 400-500 pounds of ammonium sulfate per acre. Plots treated with 800-1000 pounds of ammonium sulfate increased their yield to 21 tons per acre.

At Grimes, the yields were increased from 14.4 tons per acre to 16.7 tons per acre by the addition of 335 pounds of ammonium nitrate per acre.

Field History

The importance of keeping a record of the nutrient levels of crops grown on the same field is shown by the case history of a field of sugar beets on Egbert muck located near Rio Vista.

In 1939 and for many years before, the field was in asparagus; in 1940 it was in oats; in 1941, in barley; in 1942 and 1943 it was in sugar beets; 1944, carrots; and 1945, sugar beets again.

Plant analyses of properly collected beet leaf samples were made in 1943 and in 1945.

No fertilizer had been used on the field until 1942 when 400 pounds of 30-20-0—nitrogen, phosphoric acid (P_2O_5)—per acre were applied.

17.1 Tons Per Acre, 1943

In 1943 when plant samples were first collected, the beets were fertilized with 400 pounds of nitrate of soda per acre. The results of analyses indicated that the beets were primarily deficient in nitrogen, although at times they were somewhat low in phosphorus throughout the field.

On October 9, 1943, the field produced 17.1 tons of beets per acre with an average sugar concentration of 19.1 per cent.

In 1944 the field was planted to carrots, which were grown for seed, and during this period no fertilizer was applied.

20.3 Tons Per Acre, 1945

In 1945, when the field was again in sugar beets, it received 480 pounds of nitrate of soda per acre on April 15, as a side dressing. On June 24, 150 pounds of ammonium nitrate per acre were applied through the sprinkling system.

Sugar beets in a test field near King City. The larger, thrifty plants are on soil treated with 170 pounds of nitrogen per acre, applied as ammonium sulfate.

The chemical analyses of leaf samples indicated that the beets were well supplied with nitrogen throughout the growing season and that phosphorus in the meantime had become low in mid-July, through August, and at the time of harvest.

On September 11, 1945, the field was harvested and produced 20.3 tons of beets per acre with an average sugar concentration of 15.5 per cent.

The use of phosphorus in addition to nitrogen now should be considered for this field, particularly when it is planted to sugar beets. Potassium was apparently adequate, as shown by the potassium analyses for the two years.

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Methods of Fruit Plant Propagation Explained

The following extracts are from Circular No. 96, Propagation of Fruit Plants, written by C. J. Hansen, associate in Pomology, and E. R. Eggers, associate in Subtropical Horticulture.

The various fruits, including nuts, grown in California may be divided into two general groups: temperate-zone fruits, chiefly deciduous, produced in both northern and southern California; and subtropical fruits which, though not all limited to the southern part of the state, are in the main best suited to the warmer climate there. The first section of this publication is devoted to temperate-zone fruits and discusses principally methods of plant propagation. The second section is concerned with subtropical fruits. Methods of propagation are not discussed fully in this section because many of the methods are similar to those discussed under temperate-zone fruits, and reference should be made to the descriptions in the first section. Many of the subtropical fruits require special treatment; it therefore has been considered advisable to discuss each of these fruits under a separate heading.

Vegetative Methods of Propagation

The chief vegetative methods of propagation utilized for deciduous fruits are budding, grafting, layering, and the use of cuttings, suckers, and runners. Often a plant may be propagated by more than one of these methods. The nurseryman knows, from experience, how to secure the most plants for the least outlay in cost and materials. A fruit grower may, however, sometimes use a method that would not be practical on a large scale.

Budding

Budding is the placing of a single detached bud upon a plant called the stock. This method is used by the nurseryman to propagate his plants and sometimes by the grower to change trees over to another variety. Some of the names given to methods of budding are based on the time of year the work is accomplished; spring budding is usually done in March or April, June budding in May or the first half of June, and late-summer or fall budding in July and August or a little later. Other names used are based on the method of cutting and inserting the bud: there are shield budding, patch budding, I budding, chip budding, and some other methods of less importance. In all these processes, success depends upon joining the cambiums of the stock and the bud. The cambium, or growing layer, is found at the junction of the wood and the bark. The various methods of budding listed will be considered separately.

Grafting

Grafting differs from budding (which is itself a type of grafting) only in that the scion, a short section of a shoot, instead of a single bud, is placed upon the stock. The different kinds of grafting are classified according to the part of the plant upon which the scion is placed and the actual method of putting the scion on the stock. Based on the position of the graft, there are the following five classes: root grafting, crown grafting, top grafting, bridge grafting, and inarching. The actual methods used will be discussed under these five headings.

As a rule, closely related plants may be grafted one upon the other. Since, however, there are many exceptions, table 1, has been included to show the combinations possible among the common deciduous fruit-tree species.

Selection of Scion Wood

The selection of suitable scion wood is important. Shoots that are soft, with a large pith (the central soft portion of the stem, surrounded by the wood), should be discarded in favor of a more solid type of growth. Often one must discard the apical third, or even more, of each shoot in order to eliminate undesirable scion. The precautions just discussed apply particularly to the English, or Persian, walnut. The danger of using flower buds . . . is much less in grafting than in budding. Since two or three buds should be present on a scion used in grafting, the likelihood of having at least one leaf bud is greater than in budding, where only one bud (or cluster of buds) is present. Besides, flower buds can be distinguished from leaf buds more easily at grafting time than at budding. Some care should be exercised, however, to avoid having too many flower buds on scion wood, especially in the cherry.

Most scion wood consists of shoots that have grown for one season. Usually, such one-year-old branches are of a size suitable for grafting and have enough strong leaf buds. Older wood is sometimes employed if satisfactory buds are present; in the fig, two-year-old scion wood is preferable.

Circular No. 96, **Propagation of Fruit Plants**, is available at no cost by addressing the University of California College of Agriculture, Berkeley 4.

Rootstocks For Marsh Grapefruit Investigated In Plantings At Two Experimental Orchards

(Continued from page 3)

Sweet Orange Rootstocks

The small difference between Seedling 362 and the Homosassa rootstocks would not seem to be important. However, the tendency for the Homosassa to be inferior to the Seedling 362 noted in these plantings is consistent and has been observed in other experimental orchards.

Sour Orange Rootstocks

Of the four sour orange rootstocks represented in the investigations — African, Brazilian, Rubidoux, and Standard—the African is inferior to the other varieties. The consistency of this in other orchards justifies the conviction that the African variety of sour orange rootstock is not a desirable one to use.

Consideration for Future Orchardists

Soil considerations are important in choosing rootstocks. Rough lemon is not so well adapted to clay loam soils as is either sour orange or sweet orange. Sour orange is not so well adapted to soils with a high water table as is sweet orange, which develops a more shallow type of root system.

From the data collected at the Riverside and the Brawley plantings and additional information from other orchards, it is evident that the orchardist of the future should choose not only the species of rootstock best adapted to his needs, but should also designate the variety which may be expected to give the best results.

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ABSTRACTS OF NEW PUBLICATIONS

BARTLETT PEARS

Bartletts are the most important variety of pear grown on the Pacific Coast, where nearly all of the United States commercial Bartlett crop is produced. California produces about 56 per cent of the Pacific Coast Bartlett crop, Washington, 33 per cent, and Oregon 11 per cent.

It is not likely that there will be much increase in California's production of the fruit. Conditions in recent years were favorable to high yields, but the production level can continue only if net returns make it worth while to maintain current acreage and good wartime cultural care, and if weather and pest conditions remain favorable. Extensive new plantings do not now appear justified.

Expanding Northwest production of Bartletts will increase competition with California crops, but more for canning pears than for fresh shipments. Northwest fresh shipments compete directly only with late shipments of California Bartletts.

Aside from the size of Bartlett pear crops and production of important competing fruits, the chief factors affecting prices and use of Bartletts during the next few years will be domestic consumer purchasing power and export demand. While national income remains near the high average of 1943-1946, Bartlett prices and the quantity and proportion canned will probably be nearer the high level of those very prosperous years than the lower level of the less prosperous prewar years. During the next few years, foreign demand for luxury food products like pears will probably be less than during 1934-1938, when 30 per cent of California Bartlett production was exported, chiefly to foreign countries.

All facts considered, it seems probable that growers' net returns for Bartlett pears during the next few years may fall considerably below the highly profitable average of the past five years.

The economic status of the industry is graphically described in the following publication, the second in a series of papers prepared by the Giannini Foundation of Agricultural Economics dealing with the situation and outlook of California agriculture and agricultural industries.

CALIFORNIA BARTLETT PEARS: ECONOMIC STATUS, 1946-47, by Sidney Hoos and S. W. Shear. Cir. 368, April, 1947. It is now available at the College of Agriculture.

AVOCADOS

California is fortunate in having had among her early settlers persons who took a keen interest in horticulture, especially in subtropical plants. The early history of the avocado in this state is particularly marked by such interest. Since 1910, the emphasis has been on the commercial aspects of avocado culture.

The five main varieties (Fuerte, Nabal, Anaheim, Hass, and MacArthur) have been grown in most parts of the state, although the relatively high per-acre cost of production limits its planting of commercial importance to the subtropical zones of southern California. The avocado is extremely sensitive to climatic changes, effects of poor soil drainage, and frost. It is advisable for prospective growers to consult Farm Advisors before selecting sites for orchards. Not until all the information available has been obtained should a definite choice be made.

The avocado may be expected to assume increasing importance, since it has unusually high food value. It has an average protein content three times that of most fresh fruits, and is high in oils, minerals, and Vitamin B.

Although the avocado industry is still in the experimental stage, there is every reason to believe that it is settling down to a commercial basis, where the profits will not differ materially from those of other California specialty subtropical fruits.

The culture of the avocado is described in the revised edition of the following publication, which is both a manual of directions on how to grow, harvest, and market the fruit and a survey of the soil and climatic requirements essential to the successful establishment and operation of the orchard. It is now available, without cost, at the College of Agriculture. THE CALIFORNIA AVOCADO INDUSTRY, by Robert W. Hodgson. Ext. Cir. 43, April, 1947 (94 pages).

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