Orange Yield and Fruit Size

long-term experiments test the effects of organic matter in covercrops and manure on trees in southern California

E. R. Parker and W. W. Jones

Organic matter from winter covercrops or other sources increased orange yields in an experimental orchard at Riverside.

The size of the fruit was increased by applications of manure and by the use of covercrops.

This evidence of the importance of organic matter was obtained in a complex long-term fertilizer experiment. The trees are Washington navel on sweet orange roots. The soil is Ramona loam, of granitic origin and easily compacted. Ordinary cultural practices, including cultivation, were practiced. The experimental treatments were first applied in 1927.

Organic Matter and Yields

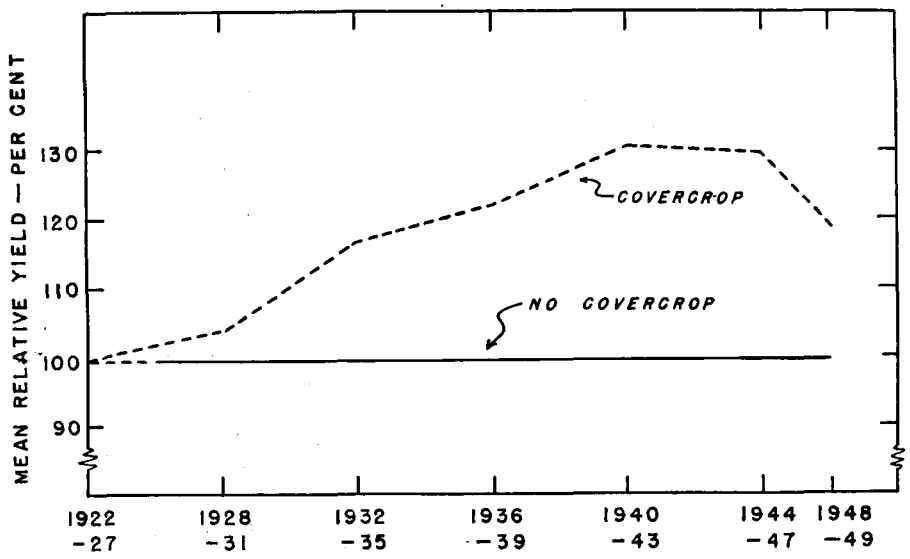
In one group of treatments organic matter was supplied solely by winter covercrops, and yields were compared with those which occurred under a practice of continuous clean cultivation. In the past 22 years the average yields of the covercropped plots increased gradually until they were 20% to 30% greater than those of the clean cultivated plots. The increase in yield due to growing of covercrops is apparently due to improved soil structure, resulting in increased porosity and better water infiltration.

Several experimental treatments also tested the effects on yields of organic matter supplied in cattle manure. In most cases the manure was applied in the fall. The total amount of nitrogen applied was kept the same in all treatments by supplements of a chemical fertilizer which was applied in early spring.

For the first 12 years of the fertilizer experiment—1928–39—the total quantity of nitrogen applied was one pound per tree each year from all sources. The trees were slightly deficient in nitrogen. During this period the growing of winter covercrops appeared to supply all of the organic matter needed to maintain maximum yields. Further additions in the form of manure failed to increase yields.

Spring applications of manure alone—with no covercrops—and fall applications of manure alone with winter covercrops actually decreased the yields. This yield decrease was the result of temporary reductions in the nitrate-nitrogen supply at time of fruit setting in the spring. This reduction results from microbial activity which decomposes organic matter, and depends upon the ratio of decomposable organic matter and of available nitrogen in the soil. During this 12-year period the supply of nitrogen with these particular treatments was not sufficient to supply both the microbes and the trees with sufficient available nitrogen in the fruit-setting period.

Relative average increase in orange yields resulting from the use of winter covercrops with various sources of nitrogen.



The situation differed in the 1940–49 period when a total of three pounds of nitrogen was applied per tree each year. The data show that the relative yields gradually increased in the treatments which received manure in addition to covercrops. The largest yields occurred when half of the nitrogen was supplied in manure, and at present the yields of this treatment are about 20% higher than in treatments where covercrops with commercial fertilizers were used. While the yields of the manure-alone treatments were not depressed in the later years of this period—as compared to those of the covercrop treatments—they were less than those of the treatment which received only half its nitrogen from manure.

During the later years of the 1940–49 period, no combination of chemical fertilizers produced as high yields as the use of manure supplying one half of the applied nitrogen. In these comparisons the total nitrogen applied was three pounds per tree annually, and covercrops were grown.

Supplementing this manure-nitrogen program with phosphates, potash, or sulfur did not increase the yields or sizes or improve the grade of the fruit.

The yield responses in recent years to moderate applications of manure seem to be due to the effect of the organic matter on soil structure. The soil in the experimental orchard became more permeable as increasing quantities of organic matter were applied. As the trees grew larger, the growth of covercrops decreased due to shading, and annual winter covercrops appear no longer to supply sufficient organic matter to maintain satisfactory soil structure. The decrease in yield of the manure-alone treatments—as compared to the treatment which received only half of its nitrogen from manure—is attributed to a smaller supply of nitrogen which was available to the trees during the fruit-setting period. The depression in yield was not so severe in the 1940–49 period when a total of three pounds of nitrogen was applied per tree annually as in the earlier 12-year period when only one pound was used per tree.

Manure has been particularly beneficial for soil structure when used with nitrate of soda or ammonium sulfate. The sole use of either of these nitrogen sources

Continued on page 14

REVOLVING

Continued from page 2

of certificates are lost and that frequently the wrong certificates are returned for payment. To avoid delay, confusion and unnecessary expense, book credits are being used. A statement is mailed to each member showing changes in his account during the year, and its status at the year's end adequately serves the purpose of a certificate.

Intermember Adjustments

There are several plans by which western associations transfer investments from members in need of money to those with money to invest. One such plan has been in operation for over 20 years. These plans are a step in the direction of making revolving finance more popular among farmers, particularly those who are getting started in the business of farming and are short of capital.

Giving revolving fund credits negotiability touches two other problems. One concerns the extent to which an association considers revolving finance funds as security when it extends credit to members. Obviously, an association which extends credit to its members must protect itself in any plan to transfer revolving fund credits. For example, the bylaws may give the association a prior lien on all revolving funds to cover any indebtedness of the members.

A second point concerns the matter of paying interest. Revolving fund credits bearing approximately current interest rates are likely to be salable at something like par. In cases where no plan has been worked out to facilitate such transfers, needy members must sometimes assign accounts at heavy discounts.

Risk Aspects

Co-operatives face many of the same risks as other types of business. Associations which derive their revolving capital from stated percentage deductions from proceeds may find themselves short of funds in years of low prices. On the other hand, a flat deduction—say 1¢ per dozen eggs—may seem burdensome to producers with eggs at 20¢ a dozen, equivalent to 5%, but be negligible with prices at 75¢, equivalent to ⅔ of 1%. Associations which revolve capital out of savings will find that savings vary from year to year. Decreased savings may require such lengthening of revolving periods as to cause trouble under fixed maturity plans.

Another sort of risk concerns equities after violent price level changes, particularly in case of dissolution and liquidation when articles and bylaws have not been carefully drawn. In times of significant inflation some well-established co-operatives could pay off all revolving funds and have a large amount of money left. Bylaws could allot such a residual to the stockholders in case of liquidation and not to those who contributed most of it.

Co-operatives, like other businesses, set up reserves for numerous purposes. Recently there has been a tendency to set these up as revolving funds. Some of these so-called reserves are more in the nature of risk capital and should perhaps be so treated. In that case they might be revolved, perhaps on a book value basis.

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ORANGE

Continued from page 4

over the 22 years of the experiment was detrimental to the structure of the soil, causing a marked deterioration of tree condition and yields. However, when these fertilizers were used with manure in such a manner that the manure supplied one half of the nitrogen, harmful effects did not occur and the yields were not depressed. When soil conditions are such that the continuous use of these fertilizers is harmful, organic matter supplements appear to be particularly desirable.

In these treatments dairy or steer manure from fattening yards was used. Other treatments with manure, alfalfa hay, cereal straw or lima bean straw indicate that these have equally good effects on yields if equal quantities of organic matter are applied and their use is supplemented with nitrogen fertilizers to reach the same total quantity of nitrogen. The most important consideration in the use of different bulky sources of organic matter appears to be the ratio of the amount of organic matter to the amount of nitrogen—from all sources—applied annually. In the most productive treatments this ratio has been close to 20 to one. This is equivalent to a carbon-nitrogen ratio of about 10 to one.

Fruit Size and Grade

The use of covercrops—with chemical sources of nitrogen—caused a small increase in the size of the fruit. Larger increases resulted from the use of manure.

The effects of organic matter from covercrops and manure on fruit size appear to be due to two factors. One is their beneficial effect on soil structure and the infiltration of water; the other is the effect of applied organic matter upon the supply of potassium which affects fruit size.

The grade of the fruit was not appreciably affected by the growing of covercrops or the use of manure. However, these factors slightly affected the internal quality of the fruit. In general, manure appeared to act very much like a potash fertilizer and made the juice slightly more acid.

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The above progress report is a summary of part of the results of a long-term experiment at the Citrus Experiment Station at Riverside. The full report is available as Bulletin 722 of the California Agricultural Experiment Station.

POTATO

Continued from page 13

about 6° F, the average 4° F. This was true in early April when the foliage gave only partial cover to the bed, as well as in late May when the foliage almost completely shaded the ground.

Records were obtained from irrigated and nonirrigated fallow beds. Water was first applied to the irrigated beds on April 17, after which they received daily irrigations in alternate furrows. Temperatures obtained at the 6″ depth show that, during late April, soil of the irrigated bed was on the average approximately 2° F cooler than that of the nonirrigated beds. During May, the difference was approximately 3° F, and near the end of the test, in June, the irrigated beds were approximately 4° F cooler. It appeared that the higher the air temperature the greater was the degree of cooling of the soil by irrigation. It would seem that growers planting potatoes in this soil at the 6″ depth during periods of high temperature might expect a cooling of approximately 4° F, or possibly slightly more, in irrigated as contrasted with a dry soil.

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The above progress report is based on Research Project No. 1175.

CARTONS

Continued from page 11

April 2, a premium has been paid for the new box over the old, often amounting to 25¢ per standard box.

Retail markets gain from the one-half box carton. Many stores find the old box uneconomical because of its size. Decay and shrinkage become serious before all the fruit is sold. The new boxes are lighter to handle and, when empty, can be used as consumer tote box.

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