nomically using the residual nutrients, as where grain sorghums are double cropped with potatoes. Carry-over effects are important also in areas where heavily fertilized annual crops—berries and vegetables, for example—are intercropped in new orchards or vineyards.

Product Quality

When high levels of fertilization are used on certain high value crops, a change in product quality may result, which is of such importance that additional considerations are required to determine the most profitable rates of fertilizer application.

Recent trials with potatoes have indicated that the percentage of U. S. No. 1-size A grade potatoes may decrease and the percentage of U. S. No. 2 may increase when high rates of nitrogen are applied. While larger tubers are produced, more are growth cracked and misshapen, which drop them from the U. S. No. 1 grade.

When the quality of additional potato yield diminishes, the product price per hundredweight is no longer a constant amount. The average price per hundredweight decreases as the proportion of U. S. No. 2 potatoes increases and the proportion of U. S. No. 1 potatoes decreases.

Another case of quality-fertilizer interaction can be illustrated with experimental data on fertilizing sugar beets in California. In several experiments, the increased per acre yields of beets were usually accompanied by a decreased sugar content. Grower prices are based on tonnage and on sugar content. Therefore, the most profitable rate of nitrogen application involves consideration of quality—percent sugar—of the additional yield as well as the amount. The exact nature of the relationship between yield level and sugar content has not been established.

The general principles involved in application of nitrogen fertilizer to potatoes and sugar beets are widely applicable to any of the high value crops.

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Soil properties and Citrus Production affected by management practices

Decline in production and in size of fruit is an increasing problem in southern California's citrus groves. Package plot experiments, under way for some time, have not solved that problem, but they have provided promising leads. This report is concerned with one phase of the project—the effect of various treatments on production, fruit size, and the physical properties of the soil within the plots. Treatments were made in: navel orange groves at Redlands, Highlands, and Riverside; Valencia orange groves at Olive and Santa Paula; and a lemon grove at Ventura. Two replications of four tree plots were used in the groves at Redlands, Highlands, and Olive; four replications of four tree plots were used at Ventura and Santa Paula; and five replications of two tree plots were used at Riverside.

Yield and Fruit Size

Only furrow irrigated groves were selected for the package plot experiments because the decline was most apparent under this environment. The most striking characteristic was the destruction of the feeder root systems in the irrigated middles, commencing at the furrow nearest the tree. Consequently, a portion of the research project involved the use of mulches, sprinkler irrigation, furrow irrigation, and soil fumigation with the nematocide D-D—all aimed at providing a more favorable environment for root development in the irrigated middles.

A sprinkling system—portable except at Riverside—was installed in a portion of each grove to provide even distribution of moisture over a greater percentage of the root system and avoid, as much as possible, the accumulation of moisture in any one location. It was hoped that this would provide a more favorable soil moisture condition for root health and perhaps prevent a localized environment favorable to root-rot organisms.

The change from furrows to sprinklers stimulated vegetative growth and fruit size during the first season, but the effect did not persist beyond that time. In the Valencia orange grove at Olive there was an indication that sprinkler irrigation may have improved production and fruit size in 1957. The method of irrigation, so long as the rate and interval of water application remained the same, generally had no effect on production or fruit size.

A rather heavy accumulation of salts developed on the leaves in the Riverside plot, where a permanent, overhead type of sprinkler system was used. The force of water droplets from the high sprinklers tended also to compact the soil surface and reduce the rate of water infiltration; this condition was reflected by a decline in production and fruit size. The wood shaving mulch in the sprinkled plots at Riverside improved water infiltration and tree condition in the sprinkled area. However, with the exception of this grove—where water infiltration was a problem—there was no evidence of benefit from the application of 4″ of wood shaving mulch. The mulches encouraged a very shallow root growth—extending into the mulching material—but this was not sufficient to cause a noticeable improvement in tree condition or production.

Decomposition of wood mulching material is often reported to cause nitrogen deficiency. However, in the mature citrus groves used in these experiments there was no visual evidence of deficiency or any reduced growth to suggest nitrogen starvation. This was confirmed by leaf analyses, which showed nitrogen to be as high in mulched trees—2.21% on a dry-weight basis—as in nonmulched trees—2.15%. Perhaps deficiency was prevented by the accumulation of nitrogen in the soil from ample applications in preceding years and continuous applications during the experiments.

The attempt to reduce the nematode population in a portion of the root area, by fumigation with D-D, resulted in a noticeable reduction in yield and fruit

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sexual and asexual cycles between poplar trees and annual plants—and certain species select agricultural crops in fulfilling portions of their life histories.

One species—the lettuce root aphid—alternates between Lombardy poplar and lettuce. In the spring of the year stem mothers, hatching from overwintering eggs on poplar, start forming typical pear-shaped galls on the petioles and leaves. Winged forms later migrate to lettuce and other weed hosts. Continuous asexual cycles can occur on lettuce and certain weeds irrespective of the poplar cycle. In the fall certain winged migrants move to poplar bark and give birth to beakless sexual males and females. The females lay one egg each.

A second species—the sugar beet root aphid—is believed to be the asexual form of one of the native species forming galls on cottonwoods. The relationships of six or nine species remain to be investigated in California.

The aphids in the galls are entirely distinct structurally from aphids of the same species occurring on the roots of annual plants and the forms on annual plants tend to exhibit very similar structural characteristics.

Control investigations have shown the value of pre-plant parathion applications in the control of the lettuce root aphid, but no adequate chemical control has been developed for the beet aphid.

Further investigations of this group of gall and soil infesting aphids may lead to developing adequate chemical or other control measures.—*W. H. Lange, Dept. of Entomology, Davis.*

Weed control in

SWEET PEA SEED CROP

at Lompoc

Two chemicals—neburon and CDEC—successfully controlled weeds in sweet pea seed fields when properly applied at the right time. Both chemicals are low in toxicity to man and animals.

Neburon is effective against more species of germinating weed seed—including grass and broad-leaf—than CDEC, but may not control seed germinating from depths of 1″ or more. CDEC is particularly effective against most germinating grass seed.

Immediately after planting, neburon and CDEC were sprayed on the soil surface of test plots. Weeds were controlled in the treated plots and seed yield increased. At regular handweeding time, weeds removed from the untreated check plot included prostrate pigweed, lamb's-quarters, shepherd's-purse, nightshade, small nettle, common knotweed, yellow mustard, wild radish, bull mallow, red brome, and foxtail. Neburon at the rate of two pounds active per acre in 100 gallons of water gave good broad-leaf weed control early in the season, but it was not so effective against grass species.—*Jack L. Bivins, Agricultural Extension.*

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size, especially in groves which were in a state of decline. Recovery of these trees, indicated by yield, required from 4–5 years. By contrast, experimental plots with Valencia oranges in Santa Paula and lemons in Ventura—which were not in a state of decline—showed but little decrease in production and fruit quality as a result of soil fumigation, and made total, rapid recovery. The D-D used for soil fumigation is quite toxic, and it destroyed much of the root system in the area treated. However, the vigor of the trees was apparently sufficient to prevent serious decline and encourage rapid recovery.

Soil Physical Properties

In order to evaluate the effects of soil treatments in each grove, soil samples were taken from various depths at the start of the study. Soils studied included three sandy soils, with quite different percentages of sand, silt, and clay, and three loams with about the same percentage of silt, but varying widely in their clay content.

Comparisons were made between soils under the tree and soils under the furrow-irrigated areas. One factor was consistent in all the orchards—the less favorable physical properties of the soils in the furrowed row middle as compared with soils under the trees. This indicates that the poor soil structure is probably the result of orchard traffic and more mechanical tillage in the middles.

In the orchard at Redlands there was a marked difference in bulk density—weight of soil per unit volume—between the top soil in the areas under the trees and that in the furrow or middle area. This appeared to have little effect on how much water the soil held or the hydraulic conductivity—rate of flow divided by hydraulic gradient in saturated soil. The soil under the furrows had a smaller volume of large pores than did soil under the trees. The larger pores control the rate at which water infiltrates into and moves through the soil. The Ramona loam from Riverside also showed a much more compacted condition in the furrow area. Soil in this orchard is a good example of one that can be abused easily when subjected to the cumulative effects of normal cultivation, sprinkler irrigation, and other cultural practices which can cause a deterioration in soil tilth. The hydraulic conductivity in the furrows was at a minimum and therefore required a long period of irrigation to rewet the soil. With this type of soil, traffic and mechanical tillage contribute to a compacted soil layer and a reduction in water penetration.

The Ventura orchard was also a problem soil in so far as water infiltration was concerned. The high silt-clay ratio resulted in a poorly aggregated soil. However, this orchard seemed to be less affected by cultural practices than did any of the other five. The soils in the orchards at Santa Paula and Highlands were similar to that in Riverside. Certain cultural practices may have more of a detrimental influence on their structure than was the case with either the Redlands or Ventura soils. The surface soil in the orchard at Olive was very coarse-textured but had areas of fine material below. These caused sharp changes in suction-moisture content relationships in the soil profile.

Physical conditions of soils are related to many factors. On some soils a certain management practice may be beneficial while on others it will show no effects. Some management practices, such as mulching and less orchard traffic, could encourage the development of larger soil pores in irrigated middles. A higher percentage of these pores would increase the infiltration rate of the soil as well as its hydraulic conductivity.

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