Irrigation Engineering Applied To Winery Waste Disposal, Stops Odor Nuisance, Mosquito Menace

(Continued from page 1)

of not more than six inches and preferably not over four inches.

Use of Disposal Basins

A sufficient number of basins should be provided so that cycling or rotated use of each check occurs at not less than seven day intervals. If plenty of land is available, ten day intervals are recommended. Pomace stillage requires a somewhat longer cycling period because of its higher suspended solid content.

period which produces the curled pieces of dried residue.

Dried Layer Rich in Protein

The pieces of curled residue will float when the next application of stillage is made. In the pilot scale testing, better than twenty applications were made to a basin without a serious reduction in the rate of percolation of the liquid into the soil but the dried cake accumulated to a considerable thickness.

The waste solids remain as a thin layer on the floor of the disposal basin after the liquid disappears. As the layer dries, it cracks and curls exposing the surface openings of the soil to the air.

Four to six inches of stillage placed upon a basin usually will be absorbed within 48 hours by soils classed as sands and loams. This is an important feature of the method as it enables aerobic bacterial decompositions to reduce the organic content to a very considerable degree.

Shallow Basins Important

An important feature of the intermittent irrigation method of disposal and the one which accounts in a large measure for its success, is the change occurring at the soil surface.

The solids and the colloidal material which the stillage contains will seal the pores of the soil surface under continued application and reduce percolation to the minimum.

In the ponds or lagoons of the older method of land disposal the soil surface becomes so tightly sealed that percolation almost ceases and the odor nuisance develops.

In the shallow basins with not more than four to six inches of liquid at any time the rate of percolation is not reduced to any great extent. The liquid disappears in 48 hours and the surface of the basin begins to dry.

Odors and Mosquitoes Avoided

A thin layer of waste solids remains on the floor of the basin after the liquid disappears. Because of the nature of the solids the upper surface of the layer dries faster than the under surface. The layer cracks and breaks into pieces which curl upward. The combined action of the breaking and curling re-exposes the surface openings of the soil to the air, allowing it to dry before the next application of stillage.

Odors and mosquito breeding waters are eliminated by the drying

At periodic intervals the dried layer should be scraped and collected. Most, if not all, of it should be removed before the rainy season begins.

Because the dried cake is approximately 35 per cent protein, it has a potential value as a concentrated fertilizer.

Operational Recommendations

The intermittent irrigation system of disposal has important features intended, primarily, to reduce the amount of liquid waste going to the stillage basins.

Separation of the clean, uncontaminated waters, from condensers and cooling coils, will reduce materially the volume of liquid from as much as a conservative 25 per cent to as high as 75 per cent in some cases.

Increasing the strength—the alcohol concentration—of the distilling material will decrease the volume in direct proportion as the strength is increased. Certain changes in distilling material production may be necessitated but should be undertaken by the wineries.

A competent and trained man should be placed in charge of the operation of the disposal system. Careless handling of the basins can quickly result in standing pools of putrid waste waters. Intelligent handling can keep the basins operating at capacity during the entire vintage —including the cloudy, wet weather at the tail-end of the season.

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sate for the extra irrigations involved.

On the other hand treatment **C** obviously suffered from insufficient irrigation. The total crop was smaller than either **A** or **B** and the average percentage of large sizes was also smaller.

The results indicate that refilling the soil reservoir when empty or nearly so is the most economical irrigation practice. In commercial operation irrigation must be started somewhat before the lower limit is reached in order to cover the entire acreage before the last trees are allowed to suffer very long.

The results of these experiments show that soil moisture is readily available throughout the range between the field capacity and the permanent wilting percentage.

The results also indicate that trees in soil at the permanent wilting percentages for comparatively short periods are apparently not injured, but that reduction in growth and crops results when they are allowed to suffer for water for long periods.

Except for a small increase in cross-section area, there is nothing in these results to indicate a marked benefit from using more water than necessary. Conversely, there was no harm to the trees.

A. H. Hendrickson is Pomologist in the Experiment Station, Davis.

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Rootstocks For Marsh Grapefruit Investigated

L. D. Batchelor and W. P. Bitters

Two experimental plantings of Marsh grapefruit on several different rootstocks were made in 1928.

One parent tree of the Marsh grapefruit supplied the buds used on seedling rootstocks from a selected parent tree of each variety of rootstock.

One orchard, at Brawley, is on Holtville silty loam. The other orchard, at Riverside, is on Ramona loam.

The average annual yields were recorded in pounds of fruit per tree and the size of each tree indicated by the square centimeters of a trunk cross section.

Effect of Rootstocks on Tree Size

One of the most noticeable effects of the rootstocks on the orchard trees is their influence upon the sizes of the trees.

Trees on Sampson tangelo rootstocks are larger than those on sweet orange rootstocks. Trees on Rough lemon, sour orange, and Cleopatra mandarin stocks are about the same size and all are smaller than trees on sweet orange stock. Trees on Trifoliate rootstock are the smallest.

In general, the yields are in proportion to the size of the trees.

Trees on sweet orange rootstock have produced somewhat more than those on sour orange, primarily because they are slightly larger trees.

Rootstocks and Fruit Quality

Certain citrange rootstocks have improved the fruit quality.

The Rough lemon and the Palestine sweet lime rootstocks have invariably lowered the quality. Total sugars, soluble solids and total acids in fruit produced by trees on these rootstocks are lower than those on other rootstocks.

These two rootstocks are the exceptions to the general absence of any striking effect upon the quality of the fruit by either sweet orange or sour orange rootstocks.

Tree Hardiness

Rootstocks affect the hardiness of the trees. Trees on sour orange rootstock in an experimental orchard in Imperial Valley were only about one quarter defoliated by a minimum temperature of 17° F., in 1937. At the same time, trees on Rough lemon were more severely injured, and lost nearly three quarters of their foliage.

The experimental plots were duplicated several times in the orchard and these differences in defoliation were consistent throughout.

The orange tree quick decline prevalent among Washington Navel and Valencia orange trees on sour orange rootstock has not yet been found among grapefruit trees.

The Cleopatra Mandarin Rootstock

Among the uncommonly used rootstocks the Cleopatra mandarin has produced as good as the sweet orange rootstock in the Riverside orchard, and nearly as good as the sour orange rootstock in Brawley.

It is more resistant to gummosis than sweet orange rootstock.

The quality of fruit from the Cleopatra mandarin has been almost exactly the same as the average quality for all the rootstocks studied.

The Cleopatra mandarin and the Savage citrange are clearly superior to other tested varieties in their respective groups.

The Savage Citrange

The Savage citrange, another uncommonly used stock, has made a good showing in both orchards.

It has produced fruit of outstandingly good quality and more of it, in proportion to the size of the trees, than other rootstocks.

The seed for this rootstock is not generally available now but could soon be produced by topworking mature trees for seed production purposes.

The Sampson Tangelo

The production from trees growing on Sampson tangelo rootstock has been somewhat lower than would be expected from the size of the trees. Both of these orchards have had only a moderate amount of fertilizer, and possibly it has been insufficient for such large trees.

(Continued on page 4)

Successful Precision Planting Of Small Seed Row Crops Now Possible With Improved Planter

(Continued from page 1)

Graded whole seed and pelleted seed give little trouble with over-filling or multiple-filling, when sized within a 3/64-inch limit, because of the spherical or ball shape of the seed.

Plate-type Planters

Planters employing vertical, horizontal, or inclined plates are capable of uniform metering of seed.

Certain problems are common to all plate-type planters. It is essential that the cells in the plates fit the seed. There must be sufficient opportunity for the seeds to enter the cells of the plate. Positive unloading of the cell is necessary for regularity of drop. The tube carrying the seed from the plate to the furrow must be smooth to offer only the least restriction to the seed.

Laboratory Tests

Special laboratory equipment was set up for testing the metering units before making field tests with them.

The equipment consisted of a stand, adjustable in height, for mounting the units under test. A power driven endless conveyor was provided for carrying grease-coated boards under the planting device. The grease caught and held the seeds in place as they fell from the planter.

This method of studying the seed distribution of each planter was useful in determining the effect of modifications in design on the performance.

Field Tests

Following pilot field tests, a commercial planting of sugar beets was made on 80 acres near Davis, last season.

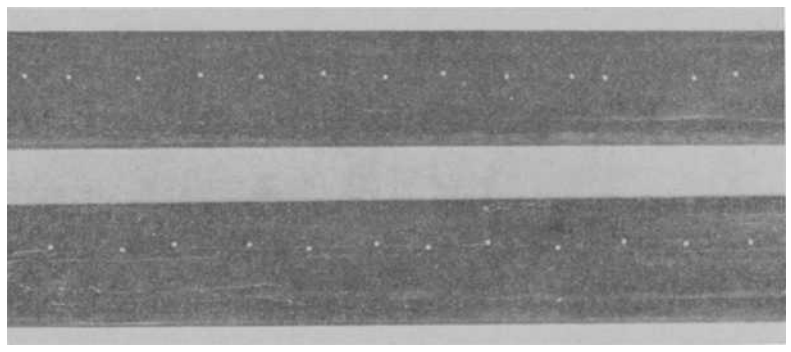
Thinning of the field was combined with the first hoeing for weeds.

The uniformity of the seedling stand was emphasized by the fact that an average final stand of 119 beets—85 per cent singles—per 100 feet of row was obtained.

The final yield amounted to slightly less than 20 tons per acre.

For Seeds Other Than Beets

The precision planter was developed for sugar beets but has been adapted to handle peas, beans, grain sorghums, spinach, pelleted tomato, onion and lettuce seeds.



In the above illustration the white spots are seeds on boards coated with heavy grease to hold the seeds in place. In the laboratory tests these greased boards were used to catch the seed as it was dropped by the planter and to hold them where they fell so the accuracy of the mechanism could be studied.

In a field test near Davis, pelleted onion seed was planted at the rate of nine pellets per foot and produced a final stand of six plants per foot.

Last year, 20 acres near Davis were planted to tomatoes, using commercially pelleted seed. Two rows, six feet apart, were planted at one time. Seed was dropped every three inches and thinned, by hand, to one plant every 24 to 30 inches.

No transplanting was necessary and for that reason tobacco mosaic was reduced to a minimum.

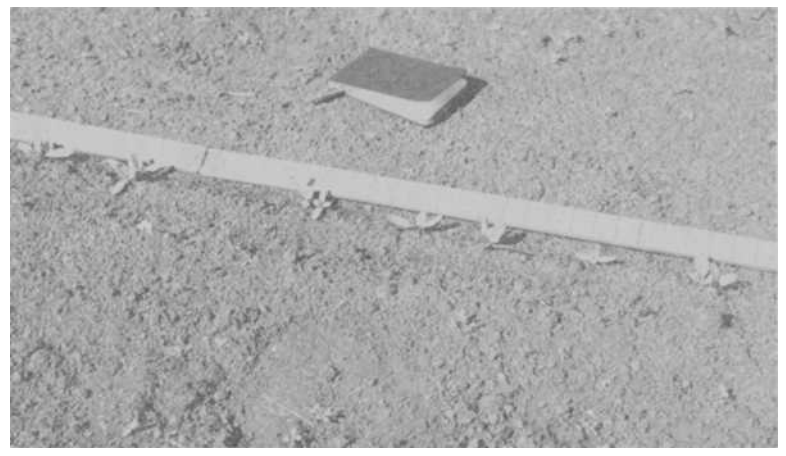
This year, 300 acres were planted to tomatoes as a result of last season's test planting of 20 acres.

Precision Planting—Precision Practices

Precision planting requires precision seed and precision farming practices if the greatest gains are to be realized.

Planters available today are capable of better performance than the seed and farming practices used justify.

New developments in seed process-



Field test followed laboratory experiments to prove the practicability of precision planting. Note the pencil and pocket notebook for comparative sizes in judging the regularity and spacing of the plants seeded by precision planting, rate of less than three pounds of seed per acre.

Decorticated seed having a laboratory germination of 95.6 per cent, with 1.75 seedlings per each seed unit capable of growing, was used at the rate of 3.03 pounds per acre—3.82 seeds per foot.

Planting was done on beds to a depth of 1½-inches with the planter operating at three miles per hour. The field was irrigated following planting to insure germination.

Stand counts showed 17.85 uniformly spaced inches per 100 inches, with a total of 24.75 plants. Of the 17.85 inches with plants, 64 per cent contained singles. Under the field germination—49.6 per cent—of this trial, seed showing approximately 25 per cent singles in the laboratory, produced a stand in which 64 per cent of the inches with plants contained singles.

ing indicate the possibility of producing seed with a higher germination, a greater factor of safety and improved shape for use in a precision planting program.

Roy Bainer is Professor of Agricultural Engineering and Agricultural Engineer in the Experiment Station, Davis.

Many soils cannot be used in adobe construction unless they are improved by adding other materials to the building mixture. In fact, some soils, such as the clay known commonly as "adobe," are not at all desirable building material.

The use of oils as general contact herbicides for pre-emergence spraying in row crops is being investigated.

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.

Albert Ulrich is Assistant Plant Physiologist in the Experiment Station.

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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W. P. Bitters is Assistant Horticulturist in the Experiment Station, Riverside.

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).

DONATIONS FOR AGRICULTURE RESEARCH

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Braun-Knecht Heiman Co. ..... Two pounds of pure DDT
For the Division of Plant Pathology.
Corn Industries Research Foundation $6,000
For the Division of Plant Nutrition.
Dehydrating Company ..... 500 pounds of liquid fish
For the Division of Poultry Husbandry.
Hercules Powder Co. ..... Two 50 pound fibre drums of Toxaphene
For the Division of Entomology and Parasitology.
Sherwin-Williams Co. $5,000
For Agricultural Research.
Sherwin-Williams Co. ..... 24 pounds of dry Solcopper
For the Division of Plant Pathology.