

Control Of Vapors In Storage Essential For Prolonging Life Of Avocados And Citrus Fruits

(Continued from page 1)

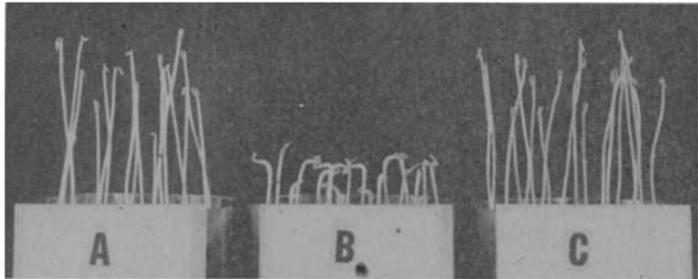
One of the factors which plays an important role in avocado storage is the accumulation of an active emanation recently identified in this laboratory as ethylene gas.

The production of this gas is closely associated with the trend in respiration. By exposing several samples of avocados to temperatures vary-

jected to mold emanations.

These active vapors can be readily absorbed from the atmosphere by passing the air through a solution of bromine. As a demonstration of this, pea seedlings were used as indicators for air purity.

If a stream of air, free of active volatiles, is passed through a con-



The absorption of active vapors by bromine illustrated by pea plants. (A) The effect of air first passed through a container of moldy fruit, then through a bromine absorber to continue on over the peas. (B) The effect of air passed through a container of moldy fruit directly to the peas. (C) Normal growth resulted when air, free of active volatiles, passed through a container of pea seedlings.

ing from 41°F to 77°F, it was found that the rise in respiration started at different dates.

No evolution of active emanation was observed prior to these dates, as evidenced from the use of pea seedlings, which are very sensitive to ethylene gas. The maximum suppression in growth of these seedlings coincided with the peak in carbon dioxide production.

Citrus

The behavior of citrus fruits in storage was found to be markedly different from that of avocados.

With lemons, no measurable quantities of active vapors were noticed as long as the fruit was sound. The occurrence of a slight amount of mold altered the picture decidedly. The effects of the common green mold are most pronounced. The gaseous products of this rot increase the rate of respiration and accelerate color development of sound green lemons.

Carbon Dioxide Production

Air was passed over four samples of fifty lemons each, at a constant rate, with the exception of the treated fruit, which was exposed to the vapors of the infected fruit. The moldy lemons were kept in containers separated by means of tubes packed with cotton from the jars filled with sound lemons.

At the storage temperature of 59°F, the maximum carbon dioxide evolution is commonly 100% higher than in fruit subjected to air free of these active vapors.

Shedding of stem ends—buttons—and rind deterioration known as pitting and spotting often take place along with the above mentioned symptoms.

Emanations of a single moldy lemon can produce these effects in 500 sound fruit. This action is not limited to fruit immediately after picking. At any time during a seven months storage period of lemons the mold emanations bring about greatly increased respiration, which is doubtlessly responsible for the lowered vitality and very much decreased storage life of lemons sub-

Fertilized Legumes Aid Following Crop Of Non-legumes

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studies will be required in each area.

Non-legumes

The increases of non-legumes such as grasses, cereal hay, and threshed grain following the fertilized legumes have varied from 38% to 107%. In addition, many of the fertilized plots continue to give increased growth of legumes, as for example, bur clover mixed with the grasses on range lands.

Though a good start has been obtained much remains to be done to find the most efficient combination of legumes and of fertilizer practice to secure the maximum benefits for the various areas of the state.

John P. Conrad is Professor of Agronomy and Agronomist in the Experiment Station, Davis.

Poultry Nutrition Research Proves Helpful To Humans

A brief report concerning the search for a successful formula for a synthetic diet for chickens, and some of the unforeseen benefits to humans and animals disclosed by investigation of vitamins discovered in the search for the diet.

Nutritional research made possible the formula for a synthetic diet which would promote growth and reproduction in chickens. It discovered Vitamin K which has proved of value in human medicine, especially surgery. And it led to the process for making synthetic folic acid that gives relief to humans afflicted with certain types of anemia.

Universities, experiment stations, and industrial laboratories have contributed to the scientific advances made in the general field of fundamental nutrition.

Project 677-D-2

The progress made in nutritional research is reflected in the records of Project 677-D-2, a research program conducted by the Division of Poultry Husbandry.

Organized in 1935, the project had the expressed purpose of seeking to construct a diet of purified feedstuffs that would supply completely, the nutritional requirements of the chicken for growth and reproduction.

Vitamin K

The same year that Project 677-D-2 was started, and within a few weeks of each other, a scientist in Denmark and scientists working in the Division of Poultry Husbandry in California, announced the discovery of an unknown vitamin.

The new vitamin was named Vitamin K, and is known as the coagulation vitamin because of its ability to cause the clotting of blood.

Absence of Vitamin K in the diet of the chick leads to hemorrhages, but there is no problem in supplying an adequate amount of the vitamin in the normal poultry diet.

Studies of Vitamin K by research laboratories in other fields extended into investigation of its value in human medicine. There it proved of

tainer of peas grown by a standardized procedure, the growth of the seedlings is normal as shown in (C) of the accompanying illustration.

When the air is first passed through a container with green mold, the result is a depression in growth as shown in (B).

Finally, (A) refers to the effect on peas of an air stream which passed through a container with a moldy lemon, then through a bromine absorber, and finally over the peas. Clearly the bromine took out the active emanation.

In subsequent experiments it was found that activated charcoal treated with bromine was highly effective in purifying the air stream. These tests can be cited as strong suggestion that the vapor under consideration is an unsaturated hydrocarbon, presumably ethylene.

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Vertical Cabinet Type Electric Sterilizer Tested For Lethal Effect On Bacteria In Milk Cans

J. R. Tavernetti

Tests were made on a vertical cabinet sterilizer heated by five strip heaters and using no moisture except that on the equipment after washing.

The cabinet has outside dimensions of 50" depth, 38" width and 66" height, is insulated with three inches of mineral wool all around

For the tests seven standard 10 gallon milk cans—6 sterilized, 1 control—were used. Milk was allowed to stand in the cans at room temperature for 4 hours after which they were rinsed with cold water and placed in the sterilizer and heated. The cans were then removed and bacteria counts made and compared

TABLE I

Temperatures at Various Points in Sterilizer When Loaded with Six 10 Gallon Milk Cans (150 lbs. metal)

Time Mins.	Thermocouples				Can*		Thermometer Air T
	Air #1	Air #2	Air #3	Air #4	#5	#6	
0	79	80	80	80	86	82	—
6	82	86	97	97	84	80	95
15	106	115	135	135	99	90	118
25	129	142	167	167	122	108	145
35	154	169	194	192	153	129	172
45	178	192	217	217	180	156	192
50	187	201	226	225	190	167	200 Heat Off
55	192	205	223	221	199	178	200
65	189	198	205	199	201	185	180
75	180	189	192	189	198	187	165
95	171	180	181	176	189	181	155 Cans removed

*Thermocouple soldered in junction of bottom and side on outside of can.

TABLE II

Results of Tests for Lethal Effect on Bacteria in Sterilizer

Can Number	Condition of can	Bacteria Colony Count
216—sterilized	old fair condition no rust.....	215
77—sterilized	old dented fair condition.....	68
617—sterilized	old sl. etched good condition.....	900
391—sterilized	old dented rust spots bottom.....	840
693—sterilized	good condition.....	225
336—sterilized	old dented sl. etched no rust.....	69
584—not sterilized	control can not washed old sl. rusty.....	228,000

and has a net storage space of 30 cubic feet.

The heaters which have a total connected load of 2500 watts are located under a false bottom and the heat is circulated through a flue located on the back wall. It is equipped with a thermostat which cuts off the heat at the temperature at which it is set and the heat does not go on again until the thermostat is reset.

with the control.

Temperatures of the air and the cans were taken at various points in the cabinet by thermocouples and an ordinary thermometer with which the cabinet was equipped.

In tables 1 and 2 are shown the results of the tests.

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Proper Temperatures Important In The Storage, Precooling And The Shipping Of Stone Fruits

(Continued from page 1)

and at 32°. It is questionable if apricots should be held longer than three weeks.

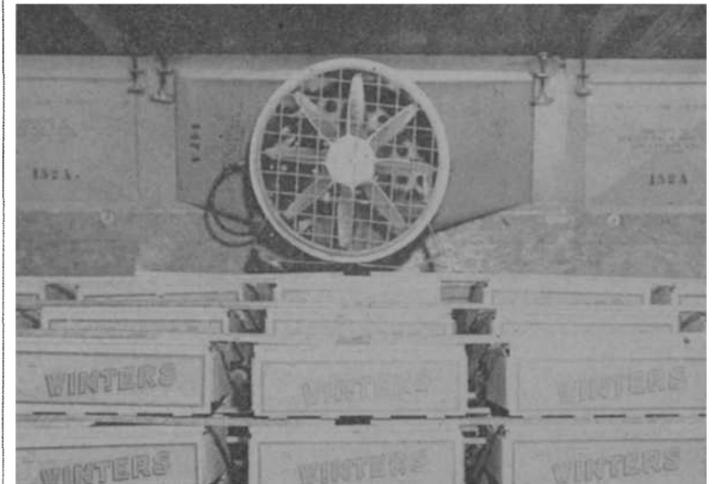
Plums

Plums, of which we have numerous varieties, hold their dessert quality in storage rather well, most of them being quite acceptable for a month to six weeks. Tragedy has, in some instances, kept well and has maintained its quality for two

months. After four to six weeks, Santa Rosa sometimes failed to ripen. The flesh of the greener fruits was often woodlike in texture, and bitter. Browning also developed around the pit.

Precooling

Except at the beginning of the



Loading of apricots in a refrigerator car. Precooling fan in place at top of ice bunker opening. The fruit is precooled for 12 to 18 hours.

months. After four to six weeks, Santa Rosa sometimes failed to ripen. The flesh of the greener fruits was often woodlike in texture, and bitter. Browning also developed around the pit.

Cherries

Except during precooling and while in transit, cherries are usually not held under refrigeration. Limited storage trials with Tartarian, Black Republican, Bing and Lam-

shipping season when some ripening of plums and apricots in transit is more beneficial than detrimental, precooling of stone fruits in California is general.

In the absence of definite precooling standards, the term "precooled" has sometimes been applied to fruit where only the top heat is removed and where at the time of shipping the temperature in the center of the packages was between 50° and 60° F. When fruit in the center of packages is cooled to 40° it can be transported for ten days in well iced cars with maximum temperatures of between 40° and 48°.

Riboflavin

In the course of work on Project 677-D-2 studies were made of the vitamin factor, riboflavin. Investigations proved that a deficiency of this vitamin in the diet of chickens caused the production of eggs with low hatchability.

Dead embryos had characteristics defects, such as dwarf size, degeneration of the kidneys, deformed down, and evidences of edema and anemia.

In 1937 California poultrymen reported an epidemic-like prevalence of eggs with low hatchability. They were advised to increase the riboflavin content of the diet they gave their chickens. They did so and the egg hatchability jumped to normal.

Pyridoxine

Pyridoxine is another vitamin factor to be discovered in the progress of Project 677-D-2.

A scientist working on the project conducted parallel investigations with rats. He made certain findings which he applied to the experiments in progress with the poultry diet. His observations in his rat studies were confirmed. Thus pyridoxine was first isolated and the first description made of the neurological manifestations of its deficiency.

Lack of sufficient pyridoxine in the diet of the chick is indicated by such symptoms as weakness, nervousness, and convulsions.

Pantothenic Acid

Pantothenic acid was investigated to determine the possible place of this vitamin in the sought-for synthetic diet.

It was found that the presence, or a deficiency, of pantothenic acid in the diet of the parent hen affected the embryos in her eggs. A sufficiency of this vitamin is needed to prevent a certain type of dermatitis—an inflammation of the skin—in the chicks and is necessary for reproduction by the adults.

Choline

Tests of choline proved this vitamin factor to be necessary for good growth and normal bone formation in chickens and turkeys.

Biotin

Investigations of biotin established

(Continued on page 4)

Fruit cooled to 32° to 34° will carry under a lower temperature during the first few days in transit and, in a well constructed car in good repair and kept well iced, may even arrive at destination slightly colder than if precooled only to 40°. Since, however, the temperature of refrigerator cars at the time of loading is not generally below 45° to 50°, and the ice in the car frequently does not maintain an average air temperature lower than between 40° to 50°, the advantages gained by precooling fruit to 32° to 34° are not always so great as anticipated. Cooling to these temperatures is most effective when the car itself is precooled to a temperature approximating that of the fruit loaded.

Hydrocooling

Hydrocooling is infinitely more rapid than cooling in air and this is now employed commercially with a number of vegetables.

In experimental tests conducted by Federal investigators in the state of Washington, the temperature of individual cherries was reduced from 65° to 34° in seven minutes, or about 145 times as fast as packed fruit held in still air at 32°. No cracking or other injury was noted from water cooling for seven minutes.

Dry Ice

Since trials in using dry ice to retard mold growth on fruit in transit and since its retarding effects upon coloring and softening have been established, interest has been taken in using it as a supplement to refrigeration.

In a test shipment of Bing and Tartarian cherries conducted in 1941, five pairs of test cars, one of each pair containing dry ice, were shipped to the New York market. The fruit from each was sold in the auction and size for size the price paid for the fruit in the dry ice cars ranged from 10c to 49c per box more than the fruit from the untreated cars.

Possibly the commercial use of dry ice in conjunction with good precooling, may make possible the shipment of a better quality product.

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Poultry Nutrition Research Proves Helpful To Humans

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the fact that a sufficient amount of this vitamin in the diet is required to prevent a dermatitis of a different type from that caused by a deficiency of pantothenic acid. Biotin — like choline — is necessary for proper bone growth.

Folic Acid

Believed to be the only vitamin discovered by industrial research, folic acid was isolated, identified and later, in 1946, first produced synthetically in a commercial laboratory. One of the scientists participating in the synthesis of folic acid was a former member of the staff of the Division of Poultry Husbandry.

The same laboratory was conducting experiments with a synthetic diet for poultry, similar to those in progress in Project 677-D-2.

A new formula for the synthetic diet, which included folic acid, was constructed by the scientists in the commercial laboratory. Day old chicks were placed on the new formula. They grew, matured and produced eggs. In turn, those eggs hatched and the resulting chicks are growing.

Experiments with folic acid conducted as part of Project 677-D-2 indicated that the requirement of the vitamin by Single Comb White Leghorn yearling hens for egg production is low. Breeding hens require higher levels of folic acid for sustained high hatchability of their eggs than for egg production. The best level for hatchability has not been determined.

Folic acid is especially remarkable for the swiftness with which it increases the red corpuscles in the blood. This ability suggested extensive investigations which were made by many research laboratories.

Successful attempts to cure cases of diarrhea in laboratory animals, notably in monkeys, indicate the need for folic acid in the intestinal tract to prevent diarrhea.

Investigations have produced the conclusion that the natural manufacture or synthesis of folic acid by the human system is impaired, if not halted, by the presence of a sulfa compound in the intestines. Treatments with synthetic folic acid have counteracted the deficiency.

The addition of folic acid to the human blood stream results in a rapid increase in the red corpuscles with the attendant expansion of the oxygen-carrying ability of the blood. Patients suffering from certain types of anemia have made quick and complete recovery following treatment with folic acid.

Nutritional Research Continues

In universities, experiment stations, and in commercial laboratories, nutritional research continues with the emphasis of interest being extended to the specific requirements of animals and humans for amino acids.

Staff members who have worked on Project 677-D-2, under the direction of L. W. Taylor, Professor of Poultry Husbandry and Poultry Husbandman in the Experiment Station and Head of the Division of Poultry Husbandry, include: S. Lepkovsky, Professor of Poultry Husbandry and Poultry Husbandman in the Experiment Station; V. S. Asmundson, Professor of Poultry Husbandry and Poultry Husbandman in the Experiment Station; F. H. Bird, Senior Laboratory Technician; and E. L. Robert Stokstad, graduate student, 1934-1937.

Dr. H. J. Almquist and Dr. E. L. Robert Stokstad are considered contemporary discoverers of Vitamin K with Dr. Henrik Dam, Denmark.

The use of phosphate in synthesis of sugars and starch by plants is under extensive biochemical study by the Division of Plant Nutrition.

Differences In Fertilization Needs Of Citrus In Florida And In California Explained

Condensation of an article by H. D. Chapman, published in full in the June issue of Citrus Leaves and in the July issue of Citrograph.

The fertilization of citrus, or of any other crop, is far from an exact science.

Often in contemplating the purchase of some fertilizer or soil conditioner, it is forgotten that present poor tree condition or low yield may be the result of circumstances in which the soil has played no part at all. Past wind or frost damage, hot spells, scale, aphid, or spider infestations, spray injury or combinations of these often prove to be the source of the trouble.

Differences In Soils

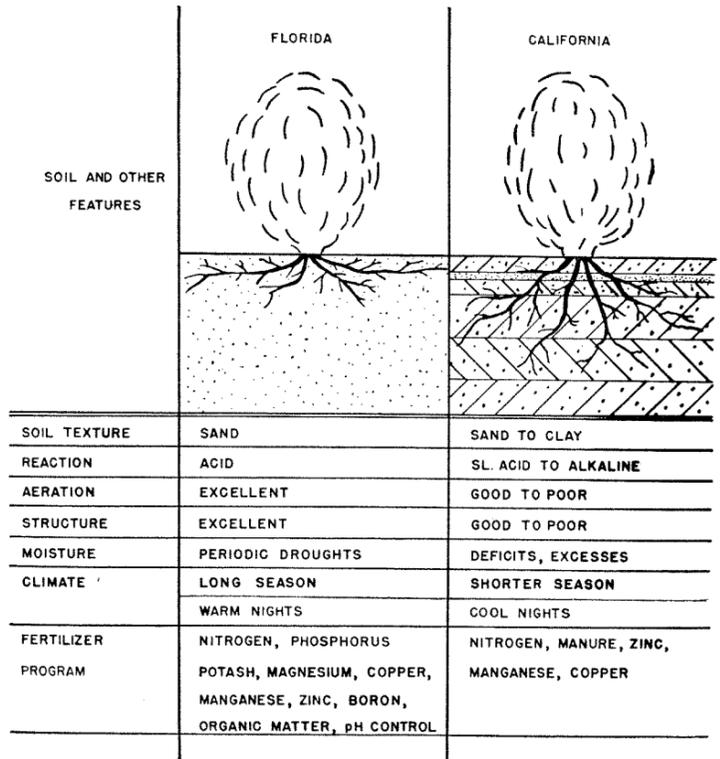
The root system of citrus trees growing in the sandy soils of Florida

very favorable physical media for root development but the needed plant foods for the most part are supplied by fertilizers and nutritional sprays.

In contrast, California soils are much richer in calcium, magnesium, phosphorus, potash, and other elements. Also, they are much more variable in texture.

The Florida fertilizer program involves the use of nitrogen, phosphorus, potassium, magnesium, zinc, manganese, copper, boron, and organic matter, with control of pH.

The hydrogen ion concentration control program is to reduce the rate



Comparative soil, climatic characteristics, and fertilizer program of Florida versus California.

is shallow and aeration is excellent. No serious difficulty therefore is encountered in getting fertilizer salts into the root zone and soil structure deterioration is not a problem in general.

California citrus soils are predominantly heavier in texture. They vary all the way from loamy sands to clays.

Aeration is, in general, poorer in California citrus soils than in the sandy soils of Florida.

The increased amount of clay in California soils, and other textural characteristics, make them susceptible to structural breakdown, to the development of poor tilth, to puddling, and to physical deterioration in general.

Soil Moisture

In Florida the average rainfall is around 50 inches annually. The general moisture situation, from the standpoint of tree growth and health, is perhaps somewhat better than under California conditions.

In California, during the summer months, moisture deficits between irrigation often occur; these tend to promote fruit dropping and in some instances may decrease the growth rate of fruit. In wet winters the root zone often remains in an overmoist condition for long enough periods to promote root rot or root deterioration.

Effect of Climate

The climate of Florida is characterized by greater humidity, warmer nights and a longer growing season than in California. These promote more rapid growth, more rapid recovery from adverse factors and perhaps better yields.

It is probably the particular complex of climatic conditions which prevail in California that makes for superior fruit quality.

Fertilization Needs

The sandy soils of Florida have become depleted of many of the essential plant foods by the leaching action of the rainfall.

It has been necessary to add some eight or nine elements to meet citrus tree requirements. The natural soil provides a moisture reservoir and a

of leaching losses of magnesium and other bases. There may be some favorable influence on plant food availability.

Organic matter is important as it tends to decrease the rate of plant food losses by leaching.

The items used in Florida which seem unnecessary in California are phosphorus, potassium, magnesium, and boron. The results of future research may bring to light data and facts which will modify present recommendations.

Phosphorus and Potash

The possible need of California citrus soils for these elements has been under investigation for many years. The weight of the evidence to date is negative as to the need for additions of potash and phosphorus.

Magnesium

Comparative soil analyses show that California citrus soils are much better supplied with magnesium than are Florida soils. In addition, all irrigation waters in California carry dissolved magnesium.

Boron

To date, no evidence of a need for boron has developed in California citrus soils. As in the case of magnesium, most irrigation waters add boron to the soil. Some waters, as is well known, supply excess boron to the point of being harmful to citrus trees.

Iron

In a number of areas in California iron chlorosis or deficiency is a perennial problem.

The most helpful practice which has come to light is better control of soil moisture. In many instances the use of less irrigation water or cutting down on irrigation frequency or holding off on the spring irrigation until the subsoil shows a real need for moisture, have done wonders toward clearing up iron deficiency.

Factors Important To Soil Conditions

Because California Citrus soils are heavier, in general, than Florida soils they are subject to structural deterioration and plow sole development. These conditions are considered to be of as much importance to the nutrition and well-being of citrus

Sugar Beet Seed-Bed Preparation On Unplowed Soil

(Continued from page 1)

There were no essential differences in weight per cubic foot of soil. The pore space was in an inverse relation to the weight of a cubic foot of soil. At the time when the fleshy part of the root was enlarging, the volume weight of the soil was about the same whether the land was plowed or not plowed.

Water Infiltration

The rate of water infiltration for the first irrigation showed a higher rate for the plowed plots. For the other two irrigations, the rate was about the same for the two seed-bed treatments.

Judging from the data, plowing will not increase the rate of water infiltration except, possibly, during the first irrigation.

Shape of Beet Roots

The shape of the beet roots from the two seed-bed treatments was studied for the first three years of the experiment.

From the results, it is clear that the shape of the beet is not measurably affected by whether or not the soil is plowed.

Depth of Rooting

Sugar beets root deeply. They extract all the readily available moisture and nitrate nitrogen in the soil to a depth of at least six feet.

Cultivation or even plowing can not be expected to influence greatly the growth and yield of beets which draw their nutrients and water requirements from six feet of soil.

Cultivation Trials

The effect of spring cultivation on the yield and sugar content of the sugar beet was studied.

The results indicated that cultivation is necessary only for weed control.

Weedy land with much spring rain may require three to four cultivations, whereas land relatively free from weeds may require, in the absence of rain, one or, at the most, two cultivations for control of weed growth.

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tees as is the chemical makeup of the soil.

Cultivation

It is now well-established that cultivation acts to break down soil structure and is the principal cause of plow sole development.

While the practice of noncultivation is still too recent to permit of proper evaluation, there are reasons to believe that plow sole may gradually disappear or become less serious under this system and soil structure improve.

Grove Traffic

Pest control operations, cultivation, furrowing out, picking, pruning, fertilizing, and orchard heating, together with other miscellaneous operations, amount to a considerable total of traffic in orchards.

These operations are particularly detrimental on certain soils when they are too wet. It is often not possible to time orchard operations so that moisture conditions are most favorable but every effort should be made to cut down on the amount of traffic, especially that involving trucks, tractors, and heavy machinery. It is especially important to keep off the soil while it is wet.

Structural Breakdown

To some extent the addition of manures or the growth of covercrops will help prevent or overcome structural deterioration. In many soils

ABSTRACTS OF NEW PUBLICATIONS

TOMATOES

CANNING TOMATOES: SITUATION IN CALIFORNIA, 1947, by Walter D. Fisher. Ext. Cir. 369, July, 1947. (16 pages).

California now produces over one third of the United States' canning tomatoes, and puts up a large percentage of the country's pack of tomato paste and sauces. The state's main producing areas are the counties surrounding the Delta and San Francisco Bay. Its 1946 crop was the largest in history.

Some, but not all, of the expanded production will continue. The overall picture depends on national consumer income, a factor which cannot be accurately predicted. Since the 1946 crop was so large, canners' demands for 1947 will be below those of the previous year. Both growers and canners should keep informed on economic trends in the nation as well as conditions in their own locality.

ROOTSTOCKS

APPLE, QUINCE, & PEAR ROOTSTOCKS IN CALIFORNIA.

Even favorable varieties of apple, quince, and pear differ in suitability as rootstocks. Observations and experiments with various roots and intermediate stocks have been recorded for these fruits.

Apple is the only rootstock on which apple varieties have been grown commercially in California. A well-tested, good rootstock resistant to woolly apple aphid is desirable, but no completely satisfactory one has yet been found.

Quince varieties are grown only on roots of their own species. The greatest use of rooted quince cuttings in California is for rootstocks for pear trees. The Angers type is used for this purpose.

Pear is grown in California on the so-called French pear roots, with or without blight-resistant Old Home as an intermediate stock.

Quince roots with Hardy as an intermediate stock are also used.

Insect pests and disease which attack rootstocks of each species are discussed in the following bulletin, which also covers the relation between rootstock and climate, soil, planting, irrigation, and pruning.

As a part of a long-time dairy cattle breeding project, the Division of Animal Husbandry is outcrossing inbred lines of Holsteins to determine the extent of hybrid vigor that may be developed.

where cultivation is practiced, the frequent use of some sort of organic matter is indispensable.

Water Penetration

In orchards where water penetration is poor, favorable results have been obtained in many instances from the use of gypsum or organic matter.

Many soil acidifying agents such as sulfur, sulfur dioxide, sulfuric acid, lime sulfur, etc., are being offered for sale as soil conditioners. While many of these agents will, like gypsum increase water penetration—largely through reactions which form gypsum in the soil—they also exert an acidifying influence on the soil.

No clear answer is yet available as to whether soil acidification in citrus groves is beneficial. A number of field experiments are under way on a variety of soil types, but insufficient time has elapsed for clear-cut answers to emerge.

H. D. Chapman is Professor of Agricultural Chemistry and Chemist in the Experiment Station, Riverside.

DONATIONS FOR AGRICULTURE RESEARCH

Gifts to the University of California for research by the College of Agriculture, accepted in July, 1947

BERKELEY

California Farm Bureau Federation and Canners League of California.....\$2,298.00
Research on tomato insects and disease control methods and procedures, by Division of Entomology

Merck & Company.....25 milligrams biotin
Division of Poultry Husbandry

DAVIS

California Committee on Relation of Electricity to Agriculture.....\$2,500.00
Electrical applications to agriculture, Division of Agricultural Engineering
Central California Berry Growers Association.....\$ 800.00
Strawberry investigations by Division of Pomology
Producers Cotton Oil Company.....One Sizz-Weeder, complete with butane equipment
Division of Agricultural Engineering

LOS ANGELES

Jerry Martin.....Two packets of valuable orchid seed from Venezuela
Division of Ornamental Horticulture