

# California

# AGRICULTURE

Progress Reports of Agricultural Research, published by the University of California College of Agriculture, Agricultural Experiment Station

Vol. 1

NOVEMBER, 1947

No. 12

## California's Farm Products Affected By Foreign Trade

M. R. Benedict

A condensation of an address delivered before the Western Farm Economic Association Meeting in Berkeley, October 3, 1947.

There is no one simple and easy solution to the international trade problem.

Under present conditions of world-wide conflicts in ideologies, it would be foolish to base international trade policies mainly upon the possibilities of temporary gain or loss to this or that group within agriculture, labor, or business.

Whether we can maintain peace and reasonable opportunity for private business activity will depend very much on what happens economically and politically in the whole group of nations interested in maintaining democratic institutions.

If peaceful solutions fail, the ultimate cost in dollars, to say nothing of moral values and human lives, will be so vast as to make any temporary gains or losses seem microscopic.

This is not to say that dollar gains or losses can or should be ignored, but merely to point out that we need to be on guard against overlooking things of major importance as we concern ourselves over local problems and those of our own particular groups.

We here in the United States have such a great diversity of resources that we can satisfy from within our own borders a very large part of our needs. Many, perhaps most, of the other nations have economies that are built upon special kinds of products.

(Continued on page 3)

## Liquid Manure—Pumps, Tanks and Application Method

John B. Dobie

The three inch centrifugal pump, designed to handle up to 40 per cent solids without clogging, is widely used in handling liquid manure.

In one type of installation the pump body is located near the edge of the storage tank and a suction pipe with a foot valve is extended into the sump. A discharge pipe is provided from the pump to the delivery point.

Another type of installation has the pump runner housing submerged in the bottom of the pit and driven by a long drive shaft which projects upward through a casing. The shaft runs in bearings in the shaft housing and is lubricated by a drip cup oiler. There is no suction pipe or foot valve on this type pump and the unit is self-priming. The discharge pipe is extended from the pump up over the side of the pit to the desired point of delivery.

### Power

The electric motor is a most satisfactory source of pumping power. It is available in a range of power and speed for all sizes of manure pumps.

A three-inch pump requires a two to three-horsepower electric motor which can be handled by any rural electric power line. The motor should be equipped with a good magnetic switch as a protection against overloading.

### The Storage Tank

The size of the storage tank varies according to the ideas of the individual owner.

Installations for the use of liquid manure

(Continued on page 2)

## Low Cost Control Measure For Wireworms Made Possible By New Chemicals For Soil Application

W. Harry Lange, Jr.

Some of the newer types of chemicals make possible the economical control of wireworms.

These yellowish, wirelike worms are the active, larval stages of click-beetles and live for several years. They are especially hungry in the spring of the year when they feed on germinating seeds, or bore into the underground portions of plants. Several years of experimental work

Ethylene dibromide is best applied before a crop is planted and a period of seven to 15 days should elapse before planting.

Beans, corn and lettuce are particularly tolerant of the chemical, but tomatoes or certain other solanaceous plants—the plant family to which the potato belongs—may be injured if planted too soon following application.

The material can also be used in hand applicators applying 3.5 milliliters per shot at 12 inch intervals.

The dosage necessary for wireworms is 400 pounds to the acre which is more than is ordinarily recommended for nematode control.

As with ethylene dibromide this material should be applied prior to planting a crop, and because of its



(Left) Applicator for applying soil fumigants. A series of drills are mounted on the front tool bar.



(Right) Results of soil treatment. Foreground, the check; background, soil treated at the rate of approximately 400 pounds of D-D per acre; far background area is another check strip.

and observations have been accomplished with the new chemicals for soil application but their full effects on all types of plants—their lasting qualities and their possible penetration within the plants and movement in the soil—are not fully known at this time.

Growers contemplating the use of such chemicals should contact their local agricultural authorities for recommendations.

### Ethylene Dibromide

Ethylene dibromide dissolved in naphtha thinner has proved outstanding for the control of wireworms.

In 1947, approximately 25,000 acres of wireworm and nematode infested soil, to be planted to large limas, were treated in southern California.

Ethylene dibromide is a colorless liquid, usually of 10% or 20% strength—on a volume basis—in thinners. It is best applied by an applicator which drills the liquid into the soil six to eight inches deep, at 12 inch spacings.

The dosage using the 10% material is two milliliters—one fluid ounce is 29.6 milliliters—injected into the soil at 12 inch spacings. The dosage of pure ethylene dibromide used for wireworm control is 2.5 gallons per acre but may be varied occasionally to suit particular soil conditions.

The soil should be adequately tilled to allow for the penetration of the gas to a depth below the drill points and should be in a condition ready for planting—not too wet or too dry. Under certain conditions a rail or roller should be pulled behind the applicator to fill up the furrows. The treatment should be made at temperatures of from 45° F. to 70° F.

The cost of material and application will run from \$20 to \$30 an acre depending upon the amount of material used, the type of applicator used, and the number of acres to be treated.

One treatment usually continues to give a partial control the second year and occasionally into the third year.

The lasting effect of one treatment is based on a rather complex set of factors and for the reason a carry-over effect to a second year cannot be predicted definitely.

### D-D

The fumigant, commonly known as D-D, Dichloropropane-dichloropropane mixture—has been used successfully for wireworm control, and in cases where both wireworms and nematodes are a problem in the same field.

It is a dark colored liquid applied in the same manner as ethylene di-

lasting ability in the soil a period of 14 to 25 days should elapse before planting.

In certain cases where it is applied during low soil temperatures or high moisture conditions, a longer waiting period may be necessary.

This chemical has been most successfully used for wireworms affecting lettuce in the Salinas Valley, particularly as a fall treatment. The addition of 35 pounds anhydrous ammonia applied with the fumigant in the fall has given outstanding results by increasing the yield.

D-D has been used very successfully where sugar beets are to be planted.

The necessary soil preparation is similar to fumigating with ethylene dibromide. A temperature above 50° F. is desirable.

### Benzene Hexachloride

Benzene hexachloride is one of the most promising of the newer materials for wireworm and garden centipede control.

It kills the worms chiefly by contact action over a period of several months. Unfortunately it is of little value for the successful control of nematodes.

The chemical is a white to brown powder with a very pungent, earthy

(Continued on page 3)

## Small Size Citrus Fruits May Be A Genetics Problem

Robert W. Hodgson

The production of undesirably small sizes of citrus fruits is a problem currently of great importance in California and occasionally so in Florida.

The average size of fruit attained by the crop of any given citrus tree appears to be the result of a number of factors, of which the following are known to limit or affect fruit size: (1) variety, (2) rootstock, (3) nutrition, (4) weather.

### Variety

Among commercial orange varieties considerable inherent variation exists as to average fruit size. In Florida the small fruit size problem is concerned only with the Hamlin variety and in California primarily with the Valencia variety.

### Rootstocks

Certain rootstocks tend to reduce fruit size, others to increase it, and still others apparently have no effect.

Sour orange, at least under certain conditions, seems to exhibit the tendency to reduce the average fruit size but to a lesser degree than does the trifoliolate orange.

The small fruit size problem in Florida is confined to Hamlin trees on sour orange rootstock. While information as to the rootstock situation is not available, it is certain that a large part of the Valencia orange trees in the California districts where this problem is most acute are on sour orange rootstock.

### Mineral Nutrition

The mineral nutrients most commonly deficient in Florida are magnesium and the so-called trace elements.

(Continued on page 4)

## Shot-hole Borer Control Problem One of Management

Leslie M. Smith

Late in the fall, in dry years, trees injured by the shot-hole borer are bedecked with large masses of gum which have been accumulating throughout the summer. The gum masses reach their greatest total just at the start of the fall rains.

As long as the trees hold their leaves the gum is not conspicuous; but as soon as the leaves fall, growers are suddenly and forcefully aware that something is wrong.

Heavily gummed trees are especially conspicuous when viewed against a setting sun. Each mass of gum acts as a lens to focus the light to a bright point.

With the advent of the fall rains, the gum masses soften, dissolve, and drop from the tree, and to the casual observer, the trees again appear to be in good health.

### Recognition of the Shot-hole Borer

The pest can be recognized as small, dark brown beetles, about one-tenth inch in length. Their cylindrical bodies resemble a small segment of pencil lead. The adult beetles crawl rapidly over the bark of affected trees, with a nervous, jerky gait.

In the fall, the female, often accompanied by a male, is found chewing a hole into the twig at the base of a bud.

### Egg-laying Habits

It seems probable that the adults feed on the wood as they bore into the twigs, and it is also probable that they would lay eggs in the tunnel so constructed but the tree begins

(Continued on page 3)

## Relationship Of California's Agricultural Products To The Nation's International Trade

(Continued from page 1)

duction. Their dependence on foreign sources of supply is far greater than our own.

### California Problems Similar To Those of the United States

The agricultural output of California is unquestionably more diverse than that of any other state in the Union. We have almost all the types of foreign trade problem that are to be found in the nation as a whole. The state's products, with respect to international trade, fall into some four major groups.

### Domestic Demand About Equal to Domestic Supply

The largest percentage of the state's agricultural income rises from products not importantly affected either by exports or imports. For example, the income from dairy products, poultry and eggs, beef cattle, truck crops and field crops accounts for some 60% or more of the total. By 1940, imports of eggs to the United States—never in amounts sufficient to have an important influence on prices—had shrunk to practically nothing. Imports of beef cattle and dairy products were likewise inconsequential when compared to the production within this country. Here, as in many other lines, the major factor affecting prices is the general level of prosperity in the United States.

### Domestic Demand Exceeded

Next in importance as an income source is the group that includes cotton, raisins, pears, prunes, apricots, citrus, canned peaches, canned asparagus and barley which accounted for around 20% of California's agricultural income in 1939.

These are the products of which we produce a substantial excess over the amounts needed to supply the domestic demand.

Of the dried fruits, which fall in this group, California produces more than 90% of the nation's total.

For such products—of which from 10% to 40% or 50% is normally sold abroad—the domestic market can not possibly maintain a satisfactory price if foreign markets are extremely weak.

Agriculture tends to continue production regardless of prices. When demand is weak, marketings remain high, and the quantities moving into either domestic or foreign markets are not sharply curtailed.

The amounts going into the markets abroad do so at whatever price the buying countries are able or willing to pay.

It is of great importance to the growers of these products that foreign buyers be in a position to buy freely of American products, and that such buying powers be widely distributed among foreign nations so the competition for them may be keen and active.

Even for these products however the buying abilities and inclinations of American consumers are the most significant factor in the price situation.

The importance of strong foreign buying power is especially great for those products which are of a semi-luxury type. While keenly desired by foreign consumers, these products will not be purchasable by them so long as inability to buy adequate quantities of basic necessities forces the maintenance of exchange controls; or where foreign exchange regulations are used as economic and military weapons.

### Demand Exceeds Domestic Supply

Third in income producing importance is that class of crops which benefit directly from tariff protection. They are the products which we normally produce in quantities that are not sufficient to supply the needs of the United States market.

These crops—such as almonds, walnuts, figs, flax, olives, and wool—account for roughly some 3% to 5% of California's agricultural income. Contrary to the beliefs of many pro-

ducers, our past experience does not indicate that high imports of these products have usually been associated with low prices. The usual situation is that high United States prices result in heavy imports. There are occasional exceptions to this where growers have had to make distress sales in this country regardless of price.

In this group the world wool situation is one of particular interest, and importance. There is at present a huge carry-over of wool in the world. This will have to be liquidated in one way or another before the industry can be on a sound free-enterprise basis. For some years governmental action will undoubtedly be more important than private action. The solution to this problem is not simple. The American sheep man has long had a predilection for the tariff as a means of escaping the adverse effects of a condition of this kind. Yet we have seen within the last thirty years 57c wool with wool on the free list and 9c wool when it carried a tariff of 34c a pound. This problem has recently been before the Congress. The industry has accepted, probably wisely, a compromise that assures some stability until the problem can be given more study. Some people object to the current program because it requires subsidies. It should be remembered, however, that the tariff on wool is also a subsidy. The increased income to the wool grower comes out of the same pocket and goes into the same hands; it is merely the channel that is different.

In the last two years almond imports have been heavy and prices moderately high. During the war the almond industry of the United States had a virtual monopoly of the domestic market because foreign almonds could not be shipped. With a high national income the industry was in an exceedingly favorable situation, one which could scarcely be expected to continue indefinitely with any control short of an outright embargo. The industry undoubtedly has difficult problems to solve. A look at the past record indicates, however, that, in general, high imports and relatively high prices have gone together. Low domestic prices have usually depressed imports. Heavy imports at times may depress domestic prices, but the record seems to indicate that usually the other relationship has been the more important one.

### Farm Supplies

The fourth category, not so well recognized, but in which California farmers have reason for a lively concern is that consisting of farm supplies, particularly feed grains and fertilizers.

California is a heavily deficit area for such products, particularly corn. Huge quantities must be imported either from the middle West or from abroad.

This is one of our expenses of production, and tends to place our livestock growers, especially the beef, poultry, and dairy interests, at a disadvantage with respect to their mid-west competitors.

It would seem logical, that both east and west-coast livestock producers would favor minimum rates of tariff on their more important types of purchased feed, seeking feed supplies from whatever source they can be obtained most economically and with a minimum of artificial pricing through tariffs.

It is not safe, however, to assume too readily that tariffs result in a United States price higher by the full amount of the tariff than the price would be without the tariff.

This demands on the other outlets available to foreign producers of the import product. If the producers must sell in the United States, in order to sell at all, one effect of a tariff of that kind is to depress prices in the foreign producing area.

If producers' products have ready sales outlets elsewhere, the probable effect of a tariff will be to maintain United States prices at something approximating the amount of the

## New Chemicals For Low Cost Control Of The Wireworm

(Continued from page 1)

odor. It can be applied as a dust, a spray, or dissolved in a solvent and drilled into the soil in the same manner as soil fumigants. Approximately one-half to one pound of gamma isomer—the active ingredient—is needed per acre for wireworm control. As a dust this would be a dosage of 50 to 100 pounds of 1% dust per acre. As a spray it takes 8.25 to 16.5 pounds of wettable powder containing 6% gamma isomer.

The use of benzene hexachloride in solvents or in combination with "D-D" or ethylene dibromide requires special equipment.

After dusting or spraying the chemical on the surface of the soil, it should be thoroughly mixed with the soil by discing two ways to a depth of six to eight inches or by rototilling into the soil.

It is better to use the material in the spring of the year, although it can be applied at any time when wireworms are active near the surface of the ground. An interval of from three to four weeks or longer should be allowed between treatment and planting in order to give sufficient time for the chemical to kill the insects and to avoid a possible injury to the crop.

There is danger of certain crops taking up the odor of the chemical, and for this reason growers are warned to use only the recommended dosages of the chemical and to be particularly careful in leaving an adequate interval of time between treating and planting.

Certain root vegetables, melons, and tomatoes, have been shown to take up the odor of the chemical. With sugar beets tests have shown no effect on growth or sugar production if used at the specified dosages.

As a seed treatment benzene hexachloride shows promise for the treatment of sugar beet seed used at the rate of 1% of the weight of seed of a micronized 10% gamma isomer material.

Experiments indicate that this chemical as a seed treatment delays the germination of lima beans, peas, and other legumes, but ordinarily does not affect sweet corn or melons.

Another use of the chemical is its incorporation in tomato planting

tariff above what they would be otherwise.

Usually a tariff of this kind has both effects, some lowering of prices in the principal foreign producing areas and some rising of prices in the United States.

### The Outlook

Many foreign countries, especially those of western Europe and eastern Asia, can not for some years to come, make exports comparable to their needs for imports.

They will seek dollar exchange in various ways; through loans and through desperate efforts to sell in the United States.

In our interest and in that of the borrowing countries their productivity and buying power should be revived as soon as possible.

On the other hand we do not want to see an established American industry wrecked through desperation selling by a foreign competitor.

In considering ways to facilitate imports that will give other nations dollar exchange it is unfortunate that public thinking centers so largely on agricultural products.

The major opportunities at present do not lie in agriculture. We are not going to import in the near future any large quantities of wheat, cotton, corn, tobacco, or pork—the items that might run into big money. We shall undoubtedly import a good deal of wool, and some minor crops, but not in quantities and values to meet the foreign need for dollars.

There are a number of things we ought to import in our own long-term interest. As a matter of reasonable foresight we should conserve our supplies of such things as minerals, petroleum, lumber and pulpwood.

Some other things such as rubber, we may find it advisable to import

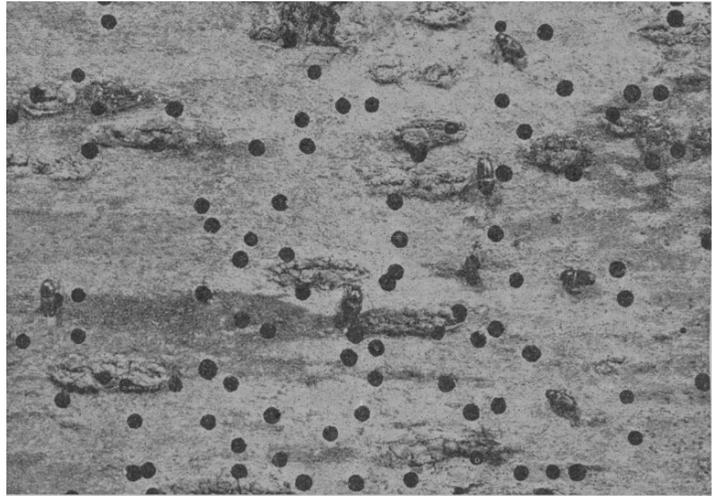
## Orchard Management Practices Recommended For The Control Of The Shot-hole Borer Problem

(Continued from page 1)

to secrete gum so rapidly that the beetles must withdraw or they will be entrapped and drowned in the gum. A sick or devitalized tree can not produce enough gum to do this. Sometimes eggs are actually laid in weak twigs which can not produce gum but such twigs die and dry out before the young shot-hole borers—the larvae—are able to complete their development.

panied by a male, finds a suitable sick tree, they burrow directly into the cambium—the soft, formative tissue of the wood—then turn up or down the limb, constructing a clean tunnel about one inch long. Eggs, laid in niches on either side of the tunnel, hatch and the larvae develop as white, legless grubs feeding on the cambium.

The larvae transform to adult



Adult beetles crawling among exit holes in the bark of French Prune tree.

The beetles lay their eggs mostly in the larger limbs and trunk of trees which are too devitalized to produce gum. In trees which are suitable to the larvae the tops are usually dead; or a single scaffold limb may be suitable and it will be found to be dead several feet beyond the area attacked by the beetles.

When the adult female, accom-

water. It was found that two ounces of 6% wettable powder material will repel and kill wireworms Good agitation in the water tanks is needed, however, and excessive dosages may injure plants. Until the full effect of this chemical on tomatoes is determined it should be used only on an experimental basis.

Newer forms of benzene hexachloride are now being developed which have most of the odors removed, and it is possible that these preparations can be used with greater safety on vegetables which tend to take up the odors.

The cost of treatment exclusive of application costs, will run from \$7.50 to \$20.00 per acre depending upon the amount of active ingredient used.

### Other New Chemicals

DDT and chlordane are showing promise for wireworm control, but until the full possibilities of their absorption into plant tissues are known it is best to use them on an experimental scale for wireworm control.

DDT is slow in killing wireworms and has been used commercially during 1947 at the rate of 10 pounds of technical grade per acre with one-half pounds of gamma isomer benzene hexachloride, and at 10 to 20 pounds of technical grade material alone.

Chordane is effective at the rate of 10 pounds per acre. It is dissolved in a solvent such as benzene and drilled into the soil in the same manner as the soil fumigants "D-D" and ethylene dibromide.

W. Harry Lange, Jr. is Lecturer in Entomology and Assistant Entomologist in the Experiment Station, Davis.

unless national defense policies call for production here. We are not likely to produce wool and sugar in sufficient quantities to supply our home market.

Our trade policies must, in some way, be on a live-and-let-live basis, particularly with respect to those nations that are heavily dependent upon us or who look to us for leadership in achieving a reasonably peaceful free world.

M. R. Benedict is Professor of Agricultural Economics, Agricultural Economist in the Experiment Station, and Agricultural Economist on the Giannini Foundation, Berkeley.

beetles, while still under the bark. The new adults chew their way out through the bark and fly away in search of food and other trees in which to lay their eggs.

In the late fall, the larvae do not transform to adults, but remain in their burrow all winter, transform to adults, and emerge during April of the following year.

Their life cycle is rather short, and they complete at least three generations each year.

### Control

Control of the shot-hole borer is largely a matter of prevention.

The larvae feed on the larger limbs and the adults feed on small, normal, healthy twigs. A brood can be established only in very sick limbs and trees.

If a large population of adult beetles is present in an orchard, their attack on the twigs will weaken the trees in a year or two so that the brood can become established in the main limbs.

When the larvae are generally established in a main limb, it can not be saved and should be sawed out and burned. Dead and nearly dead trees should be removed and burned during the winter. The overwintered beetles emerge from the wood in April so all infested wood should be destroyed by the middle of March.

### Treat Cut Wood

The first principle in shot-hole borer control is sanitation. Burn or dip all infested wood in the winter to minimize the attack of adult beetles on healthy twigs the following year.

If there is a quantity of wood which is valuable as stove wood it should be dipped for a moment in stove distillate, as this treatment will kill the overwintering shot-hole borers.

Dead and dying wood removed from the orchard during the winter is not suitable for rearing the summer generations of the following year. It is dangerous only because of the overwintering borers it may contain, since these will emerge readily in the spring.

The second principle in shot-hole borer control is to keep the trees as vigorous as possible. This can be done by reducing twig injury, by burning infested wood, by irrigation, by fertilizing, and by pruning to reduce the top.

Irrigation is the most important of these cultural practices. A tree suffering from drought can not produce much gum. The beetles are much better at picking out dry trees than we are, and beetle attack in many cases is one of the first indications that the trees are suffering from a shortage of water.

Leslie M. Smith is Associate Professor of Entomology and Associate Entomologist in the Experiment Station, Davis.