

California

AGRICULTURE

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

Vol. I

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

(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—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-dichloropropene 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-

lasted 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 trifoliate 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)

Rind Spot And Drop Of Valencia Oranges Investigated In Effort To Determine Cause And Cure

L. J. Klotz, W. S. Stewart and R. J. Bumgardner

A breakdown of the rind and the accompanying drop of Valencia orange fruit caused severe loss in some groves in Orange County again this summer.

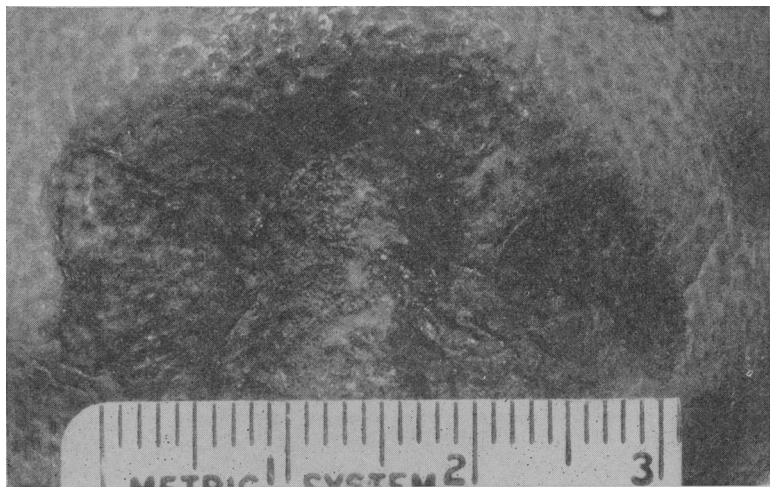
The spots were sunken and of various sizes ranging from a mere speck to an inch or more across. They were most abundant on the shoulder portion of the stem half.

Similar losses were experienced during the summers of 1926, 1931, and

rind oil escapes internally and injures the cells adjacent to the oil glands.

Where the surface is noticeably broken by some external agency, the typical rind oil spot—oleocellosis—may precede the breakdown. As the lesions age they darken through the various shades of brown until they are a deep chestnut brown.

The anthracnose fungus—*Colletotrichum gloeosporioides*—and *Alternaria* fungus—*A. citri*—may become



Rind spot of Valencia orange showing fruiting bodies of fungus.

1934. A slight amount of the breakdown may occur in late pickings almost every season.

An extensive orchard survey of the trouble was made this summer during the last half of July, all of August and the first half of September. Seven hundred and ninety-five trees and 45,000 fruit were examined.

In classifying the types of injury on the dropped fruit, it was found that 15% was caused by the pink scavenger worm and other worms. The injury from this cause may be very slight but supplies excellent paths of infection by the tear-staining and fruit-rotting fungus, *Colletotrichum gloeosporioides*.

Injury from the Tortrix worm, while it occurs in early July or before, which is previous to the time of greatest drop, very probably plays a part in the drop later in the season.

Thirty per cent of the fallen fruit had rind spots which include the typical Valencia rind spot, shoulder spot, and breakdown around stem.

Twenty-four per cent showed splits and soft decays; 7% had mechanical injuries or were pulled from the tree in various orchard operations.

There were 24% from all other causes, but mainly from the trouble called "dry stem."

The heaviest period of dropping was the week beginning August 11 when an average of 48 dropped fruits was found per tree.

The week beginning July 28 averaged 24.6 fruits per tree; the week of August 18, 27.35 fruits per tree; the week of August 25, 22.36 fruits per tree; and the week of September 2, 14.7 per tree.

The periods of greatest drop corresponded to those of the highest temperature which reached 103° F. There were two weeks when the temperature was 90° F., or above. In Orange County from July 24 to August 12, 1947, the temperature reached 90° F or above every day.

Causes Considered

In a consideration of the causes of Valencia rind spot, it is assumed that some weakness of the rind in the absence of visible injury apparently precedes the actual breakdown and spotting.

Similar effects sometimes follow mechanical injury such as those from insects, wind, thorn pricks, etc. The lesions in the advanced stage resemble one form of water spot on the stem half of navel oranges.

In the absence of mechanical injury, the first noticeable symptoms are the collapse and sinking of small areas in the rind without a discoloration. Sometimes it appears to start by the collapse of one oil gland. These are closely followed by a darkening of the individual oil glands to various shades of brown; then occurs a collapse of the adjoining tissues until larger areas are affected. As in one type of water spotting apparently the

established in these areas causing them to darken and enlarge further, and even develop into a decay of the fruit. Such lesions may also be vantage points for the entrance of blue and green molds.

The spots are usually confined to the button half of the fruit, being most abundant on the shoulder and around the button. This region is apparently the more permeable, weaker portion of the rind although an abrasion any place on the rind may result in a typical spotting.

Weather Factors

Hot weather, rains, and high humidity may be important factors in the development of rind spot of the stem-end half.

The severe breakdown in 1934, the first year in which we made accurate observations, followed the period of high temperature in July and August. The most seriously affected groves in Orange County were those that experienced the high temperature of 103° F and high humidity of 70% on July 27, and a light rain in the early morning of July 28.

It is also possible that coastal fogs may be an important factor.

Laboratory Experiment

Susceptible Valencia oranges collected in Orange County were atomized with a fine spray of distilled water and placed in a moist chamber at 98° F. After 48 hours, the typical breakdown was noticeable on areas of the rind that were previously apparently unaffected, and old lesions were enlarged by this treatment.

This laboratory experiment was repeated this summer using temperatures of 100° F to 105° F., and a relative humidity of 95%.

Typical spots were developed after a period of one week. Spraying with eight parts per million—.0008%—of 2,4-D to check the drop had no influence on the development of spotting under these conditions.

Whether this plant growth regulator will have any effect on the incidence of spotting of susceptible fruit under field conditions has not been determined. It does have a pronounced affect in decreasing the tendency to dropping. Preliminary experiments also indicate that trees sprayed with the chemical have fewer dry fruit stems.

Fruits that had some slight evidences of incipient spotting developed definite spots after the washing operations of the packing house, suggesting a relationship to water spot and water rot.

Fumigation and ethylening also seemed to aggravate the condition.

L. J. Klotz is professor of Plant Pathology and Plant Pathologist in the Experiment Station, Riverside.

W. S. Stewart is Assistant Plant Physiologist in the Experiment Station, Riverside.

R. J. Bumgardner is Deputy Agricultural Commissioner, Orange County.

Liquid Manure—Pumps, Tanks And Application Method

(Continued from page 1)

manure usually are made on dairy farms and most authorities recommend not less than 100 cubic feet of tank capacity per cow and prefer 150 cubic feet.

Proponents of smaller storage tanks prefer to empty them often and pump the liquid manure into the irrigation system or directly onto the land. These systems may be automatic, with the pump controlled by a float valve.

Storage tanks are six to eight feet deep and have no recommended lateral dimensions. The bottom of the tank should slope towards the outlet. In a tank in which all solids are collected, the slope should be as much as one foot per 10 feet in length. Larger tanks, collecting liquids mainly, may have a slope of only one foot in fifty feet, but will likely require agitation before pumping to facilitate complete removal of solids. All tanks should be covered for sanitation and for safety.

A sump should be provided at the outlet of the tank to facilitate complete cleaning. The sidewalls and floors of a concrete tank should be not less than six inches thick. They should be reinforced with wire or metal rods, especially at the corners.

Application Method

One method of spreading liquid manure is by tank wagon. From the storage tank the material is transferred to a water tight wooden box tank wagon, either by pump or by gravity.

A controlled outlet at the rear of the sloping wagon tank permits the liquid manure to flow onto a splash plate which spreads it about the width of the wagon as the wagon is driven through the field.

Throughout the irrigated area of California the method commonly used is to pump the liquid manure into the irrigation system for distribution.

Carotene Recommended As The Coloring Agent For Production Of Standardized Butter Yellow

G. A. Richardson and M. Louisa Long

The natural color in butter is mainly carotene which has great nutritional significance and from which Vitamin A is derived.

The concentration of carotene in milk and cream, apart from breed characteristics, depends upon the amount of carotene in the feed of the cow. The seasonal variations in the carotene content of feed causes butter to range in natural color from a pale yellow to a deep "summer yellow."

Usually the manure is admitted into a stand pipe and the flow directed through the pipelines or ditches from there, using the irrigation water as a carrying agent.

Liquid manure may be pumped directly to the land without extra water but the solids are likely to settle out in the pipeline, requiring subsequent flushing. Also, it is difficult to get even distribution of the manure over the soil without plenty of water.

A sprinkler system should never be used to distribute liquid manure with the sprinkler heads in place. By removing the sprinkler heads the system may be used, provided the pipes are flushed thoroughly immediately after use.

Liquid manure is highly corrosive on wrought iron pipe, necessitating thorough flushing immediately after use. Low spots in pipe lines clog easily as will pipe with an irregular interior.

John B. Dobie is Associate in Agricultural Engineering, Experiment Station, Davis.

Further suggestions for the installation and operation of the liquid-manure system are given in the California Agricultural Extension Service illustrated Circular No. 140, now available without cost by request addressed to the College of Agriculture, University of California, Berkeley 4, California.

The buttermaker usually attempts to standardize his product to a shade with good eye appeal by adding harmless vegetable or synthetic dyes. These attempts have been only partially successful due to inefficiency, negligence, not recognizing the importance of color, or which is more likely, to the use of unsatisfactory methods of standardizing.

Butter never has been regulated as to Vitamin A content but nutritionists and food technologists have long advocated the use of the nutritionally significant carotene instead of the usual butter colors. The suggestion went unheeded because of the lack of a supply of suitable carotene and of the high cost. Today, refined carotene concentrates are available at prices that compare favorably with those of the commonly used butter colors.

In some sections of the country, improvement of winter feed has produced less seasonal variation in the carotene contents of the milk resulting in a more uniform year round butter color.

Carotene For Color

The introduction of carotene as a butter color presents problems.

Carotene concentrates must be protected from heat and light or the carotene will be destroyed and acquire an unpleasant odor and flavor.

In trade channels and in household refrigerators, provision should be made against over-long storage or unnecessary exposure to light.

Experiments show that commercial concentrates differ among manufacturers' brands as to concentration and stability of the carotene.

Storage trials with laboratory and commercial butters showed that at low temperature the added carotene was not definitely detrimental to the keeping quality of the butter.

When carotene is used as a butter color very attractive shades are obtainable.

The use of carotene, in amounts at least sufficient to minimize the seasonal fluctuation in the natural color of butter, should be considered by the buttermaker.

How To Obtain Desired Color

Here is a simple method whereby the creamery technician or the cream tester can determine the natural color of the cream to be churned and calculate quite accurately, the amount of added color needed to give a predetermined shade to the butter. Carotene concentrate or artificial coloring may be used.

The method requires only a few minutes and consists of churning about nine grams of cream in a Babcock test bottle at a temperature of 30°C—87°F—extracting the fat with definite volume of benzene and determining the color with a colorimeter or by comparing it with a set of permanent inorganic color standards using a simple comparator.

Color standards may be prepared at low cost in most any chemical laboratory, including that of the local high school.

By making use of this method it should be possible to effect economies in the use of color and supply the consumer with butter of a uniform shade to meet the market demands.

G. A. Richardson is Associate Professor of Dairy Industry and Associate Dairy Chemist in the Experiment Station, Davis.

M. Louisa Long, formerly Associate in the Experiment Station, Division of Dairy Industry, Davis has resigned.

CALIFORNIA AGRICULTURE

Established December 1946

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

HAROLD ELLIS, Director, Agricultural Information
W. G. WILDE, Editor

California Agriculture, progress reports of agricultural research, will be sent free to any resident of the State in response to a request to the University of California College of Agriculture, 331 Hilgard Hall, Berkeley 4, California.

Any part or all of this material may be used with or without credit

Supplemental Feeds For Range Sheep Compared As To Protein, Digestible Nutrients And Price

R. F. Miller

Sheepmen are faced with the problem of feeding high priced supplements this winter.

Ewes that are bred to lamb in November and December should be on good feed at this time of year. Formerly lambs were not dropped until December and January but now it is common to find sheepmen in the Sacramento and San Joaquin valleys lambing during November. These early lambs get a good start in life before the colder weather arrives and in general are more profitable than the later lambs.

In many sections of the San Joaquin Valley ewes are lambed on alfalfa pasture and this, of course, is ideal. If green alfalfa is not available a good substitute would be irrigated pasture, preferably a mixture of ladino clover, birds-foot trefoil, and some of the grasses, preferably ryegrass. The sheepman, however, cannot be too "choosy," he will be glad to get any kind of green pasture.

ton and most sheepmen, no doubt, have laid in a good supply for the winter. Volunteer grain hay with considerable bur clover is also satisfactory. The most common concentrate feeds are shelled corn, cottonseed cake, whole oats, whole barley and bean screenings. Dried figs, and possibly some other inferior dried fruits, may be available. Cull potatoes were available last year at a low price through the Government surplus program.

Composition and Relative Value of Common Feeds

The comparative price is based on the total digestible nutrients for 100 pounds of feed and assuming an average price of \$30.00 per ton for alfalfa hay.

With shelled corn quoted at the present time at \$95.00 per ton, barley at \$80.00 per ton and cottonseed cake at \$90.00 per ton it is easy to see from the above table that alfalfa hay is by far the cheapest supplement and fortunately it is one of the best feeds

Name of Feed	Total Crude Protein, Per Cent	Total Digestible Nutrients in 100 lbs.	Comparative Price when alfalfa hay is \$30.00 per ton
Alfalfa hay leafy No. 2.....	16.0	51.0	\$30.00
Wild oat hay.....	6.6	48.7	28.65
Corn Eastern No. 2.....	9.4	80.0	47.06
Whole barley.....	8.7	78.0	45.88
Cottonseed cake 43% protein.....	43.2	75.5	44.61*
Bean screenings (10% dirt).....	20.4	60.7	36.10*
Cane molasses.....	2.8	56.6	33.30
Irish potatoes.....	1.1	17.3	10.18
Dried figs.....	1.7	65.8	38.70

*The figures for cottonseed cake and bean screenings do not give a fair expression of relative values since these feeds are very high in protein and protein is the most valuable nutrient in feeds as a whole.

Later in the season it becomes necessary to feed some of the supplements in addition to whatever natural range feed is available. It is true the sheepman always hopes for early rains to start the green feed.

Alfalfa Hay at Top of List

Of the supplements alfalfa hay stands at the top of the list. Due to a large production this summer the price has been \$25.00 to \$27.00 per

for bred ewes and ewes with lambs. Shelled corn or cottonseed cake may be more convenient to feed as troughs are not necessary. With hay at one-third the price sheepmen should construct suitable hay racks and make other necessary provisions to feed mainly alfalfa hay this winter.

R. F. Miller is Professor of Animal Husbandry and Animal Husbandman in the Experiment Station, Davis.