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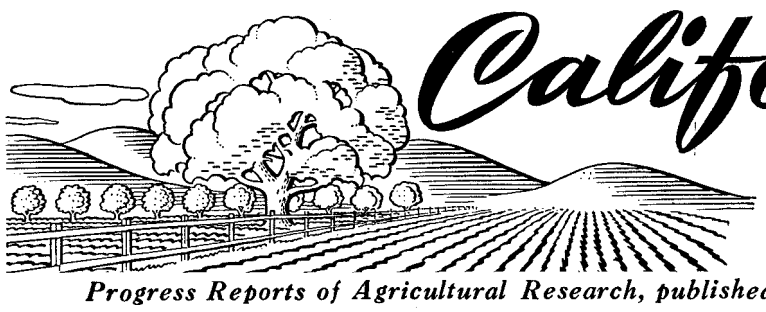

California AGRICULTURE

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Insecticides May Cause Unseen Internal Injuries To Plants Resulting In Losses To Growers

E. T. Bartholomew

An insecticide may be efficient and not cause visible injury to a plant—but that is not a guarantee it does not, or will not, cause internal plant injury.

Water escapes in the form of vapor from green leafy plants almost entirely through the leaves.

Plant leaf surfaces are covered with a waxy layer that is almost impermeable to water. This layer, on one side or on both sides of the leaf, has many minute pores. Each pore is surrounded by two guard cells which regulate the size of the openings during the day and close them at night.

Excessive Loss of Water

Dust and certain sprays contain finely divided particles which may become wedged between the guard cells and keep them from closing the pores. If the spray or dust contains an alkali such as lime, it may combine with the waxy layer and make it more permeable to water.

Either of these conditions may permit excessive loss of water.

Excessive losses of water may cause internal injuries which later may produce visible injuries, such as leaf and fruit scorch and drop. Such injuries are most likely to occur when high temperature, low relative humidity, and rapid wind movement prevail during or soon after the application of the insecticide.

Excessive Retention of Water

The same insecticides that prop the pores open may cover and stop them and thus, excessively reduce the loss of water.

Oil sprays also reduce the loss of water by making the waxy layer itself more impermeable to water vapor, or the oil may enter the pores and form a covering over the walls of some of the cells below each pore. These effects of the oil are especially noticeable in the portions of the plant that are shaded, because the oil remains on or in the tissues longer. Some insecticides or their products may penetrate into the tissues of the plant and have a direct injurious chemical effect.

An excessive decrease, as well as an excessive increase, in water loss from the plant appears to be another one of the factors ultimately responsible for leaf and fruit drop.

Plant Manufacture of Foods

Carbon dioxide is one of the foundation substances used by green plants in manufacturing foods.

If an insecticide prevents the plant from receiving an adequate supply of carbon dioxide—by effecting the leaf pores—the amount of food that it can manufacture will be reduced.

Food manufacture begins in the plant when the little bodies containing the green coloring matter bring about, with the aid of sunlight, the combination of carbon dioxide and water to form sugars. The more complex foods are formed later, with sugars as the starting point.

Some insecticides tend to destroy or retard the formation of the green coloring matter in the leaf.

Equally important, an adequate supply of oxygen is just as necessary for the life of the green plant as it is for the life of human beings or other animals.

If the plant does not have access to adequate supplies of any one or more of these necessities, it can not form the sugars, starches, proteins, and the other substances which are indispensable for its growth and for food storage in seeds, roots, and tubers.

Insecticides may slow down or prevent the action of certain enzymes which change the complex food into simpler forms so they can be used for further growth of the plant, or stored. This condition brings about excessive accumulations of foods in the places where they are formed and stops further food manufacture.

Effects on Growth

Decrease in water loss appears to be responsible also for abnormal growth activity. It may cause an increase in the prevalence and severity of granulation in citrus fruits. Many of the juice sacs enlarge, become hard and lose at least most of their color.

If food and water supplies are deficient, the cells can not normally increase in size, even though they do divide.

Such conditions cause a dwarfing or stunting of the plant. It is possible that dwarfing effects may go entirely unnoticed where whole fields are

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A 19-year-old orange tree injured by spraying with kerosene. Emulsions of the lighter fractions of kerosene sometimes prove disastrous because they are apt to run down the trunks of the trees and kill the bark, just below the surface of the soil.

Sulfaguanidine As Control Against Cecal Coccidiosis

R. A. Bankowski

Sulfaguanidine is a preventive rather than a curative drug in the control of cecal coccidiosis in chickens.

Sulfaguanidine acts by destroying coccidial forms which are found in the ceca. It does not aid in repairing damage to the tissues caused by the parasite.

Because it acts on coccidia already in the intestine of the chicken sulfaguanidine may be looked upon as an adjunct but not a substitute for sanitation in coccidiosis control.

The most effective means of controlling coccidiosis is to have the chickens resistant or immune to the disease.

A certain number of coccidia must be present in the intestine in order to produce such a resistance. Experimentally, it has been shown that the effectiveness of sulfaguanidine upon the coccidial forms in the intestine is proportional to the amount of the drug present in the ceca.

When the drug is given in too large amounts the action on the coccidia present is so great that nearly all of the parasites may be destroyed. This leaves no opportunity for the chick-

(Continued on page 2)

Spinach Harvest Increased By The Use Of Nitrogen

O. A. Lorenz

Yield and quality of the California spinach crop can be improved by nitrogen fertilization.

A series of eight fertilizer experiments, centered around nitrogen, were conducted in the important canning spinach areas of California during the early spring of 1946.

Treatments Tested

The experiments involved studies on both the rate and source of nitrogen fertilization and particularly, their effects on yield, quality, and nutrient absorption.

Each test included the following treatment: 1) No nitrogen. 2) 60 pounds of nitrogen per acre from sulphate of ammonia. 3) 60 pounds of nitrate of soda. 4) 120 pounds from sulphate of ammonia.

Results

In every test, the quality of the spinach was greatly improved by nitrogen fertilization. The plants were darker green in color, more succulent, sweeter, and less astringent in flavor.

In some of the experiments, spinach grown without nitrogen was unmarketable and the crop was a total failure.

Examples

With but one possible exception, the yield was increased by applying nitrogen, often by as much as two tons and in some cases, by five tons per acre.

In a test located at Davis, the unfertilized plots yielded 3.9 tons per acre while those fertilized with 300 pounds per acre of sulphate of ammonia yielded 8.5 tons.

In another test located in southern California, the increases due to nitrogen application ranged from 4.4 tons to 9.5 tons per acre.

In most cases, 300 pounds of sulphate of ammonia per acre produced top yields but on some of the poorer

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Dryness Protects Farm Stored Grain From Insect Attack

A. E. Michelbacher

Many insects that infest grain in farm storage are small. Some are smaller than a grain of wheat. In fact, with some species, a single kernel of grain furnishes sufficient food for the development of from one to several individuals.

Among the more important pests are the granary weevil, rice weevil, lesser grain borer, Angoumois grain moth, confused flour beetle and the saw-toothed grain beetle. The first four mentioned are capable of attacking and destroying sound grain. The others generally feed upon broken grains, particularly the finer particles.

Where the environment is favorable, these insects cause serious damage and under extreme conditions the grain may be completely destroyed. Most of the important grain pests are wide-spread throughout California and if grain is not properly protected it is subject to heavy infestation.

Development of Stored Grain Pests

The development of stored grain pests is largely regulated by temperature and the moisture content of the food on which they feed. The

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Control Measures For Armillaria Root Rot In Citrus

Donald E. Bliss

In citrus, armillaria root rot becomes well established in the roots before any visible effect appears in the top.

There may be a gradual deterioration in vigor, with the foliage yellowing and dropping over part or all of the tree; or there may be a sudden wilting and collapse. In either case, death eventually follows.

A white, felty, fan-shaped growth of fungus mycelium under the root bark constitutes the most reliable sign of armillaria root rot.

Other signs, helpful in diagnosis, are cordlike, purplish-brown rhizomorphs on the surface of diseased roots and light-brown toadstools appearing occasionally above ground in late fall.

The rhizomorphs resemble small, dark roots except that they are smooth and shiny when fresh and are differently branched. The rhizomorph consists of an outer brittle shell, and a light-colored, towlike center composed of fungus threads.

Infection and Spread

Armillaria infection is accomplished by direct penetration of a rhizomorph into the bark of a nearby root.

The fungus kills the tissues as it spreads from the point of infection. It also invades the underlying wood.

The disease is confined at first to a very small, localized lesion, but it may spread throughout the root, thence to other roots, and finally girdle and kill the trunk at the root crown.

Armillaria root rot spreads from tree to tree in citrus orchards at the rate of about one tree row every two years.

Survey

A grower can best make a survey for the existence of the disease in his orchard by looking at each tree for symptoms.

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Hand Pollination Of Cherimoya Practical Method For Improving Fruit Set For Better Yields

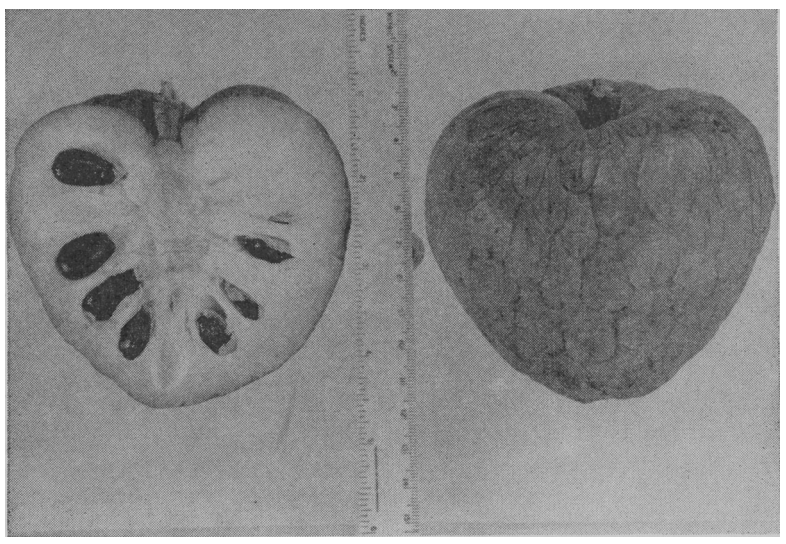
C. A. Schroeder

The cherimoya, said to be among the world's finest fruits is well adapted to many sections of southern California.

One of the limiting factors of commercial production of the cherimoya in California has been irregular and light yields together with the formation of poorly shaped fruits.

Investigations carried on by the Division of Horticulture at Los Angeles have shown the cause of poor quality fruit and irregular production to be the result of inadequate pollination.

It is evident from experiments and many observations that the cherimoya is not extensively pollinated by insects in California. Hand pollination has been clearly shown to be a very practical method of performing this necessary process in order to assure fruit set.



The Chaffey variety of the Cherimoya. Note the distinctive shape of the fruit and the marking of the skin. The seeds are brown-black and about the size of coffee beans.

The Cherimoya Tree

The cherimoya is a tender semi-deciduous, subtropical plant restricted to those areas which are relatively frostfree and where strong winds and very dry atmosphere are not prevalent.

The tree attains considerable size —up to fifteen feet high—when grown in good soil. The lush, dark green, elliptical and pointed leaves make the plant very desirable, not only as a fruiting specimen but as an ornamental as well. The leaves are shed and the plant is bare for a short period in early spring just before the flowers and new leaves appear.

The Fruit

The delicious and interesting fruits —sometimes erroneously referred to as custard-apples, as are a half dozen other fruits—mature from November to June, depending upon the locality and the variety grown.

The fruit is short conical to spherical in shape and attains a weight of tree fourths to one and one half pounds. The surface is marked by spirally arranged tubercles or depressed segments. The skin is moderately delicate, light to yellow-green in color and sometimes has a faint peachlike down.

Enclosed within the skin is a mass of creamy white flesh of custard-like consistency, in which are embedded numerous brown-black seeds the size of coffee beans. The flavor of the fruit suggests to most people, a blend of pineapple and banana. It is primarily a dessert fruit of high quality when grown under the proper conditions.

Hand Pollination

The cherimoya flower contains both male (stamens) and female (pistils) parts, but under ordinary conditions these two parts frequently do not mature at the same time in any given flower. Therefore cross-pollination of flowers on the same tree or of flowers on different trees is necessary to induce fruit set. This pollination can be done easily by hand.

The process of hand pollination is accomplished as follows: When the rather large, inconspicuous, fleshy flower first opens, the central pistil mass which eventually gives rise to the fruit is receptive, sticky and cream colored. The pollen of the flower is not shed at this time.

After a period of eight to twenty-four or more hours, depending on weather conditions, the petals open wider, while the pistil mass becomes brown and dry and is no longer receptive; hence here is illustrated a lack of overlapping of the maturity of the sex parts, a condition which the botanists refer to as dichogamy.

If the pollen is taken by means of a soft brush from a flower which is in the pollen-shedding stage and placed on the pistil mass of a flower which has just opened and is receptive, pollination will result in fruit set.

When hand pollination is done on a large scale, the pollen of many pollen-shedding flowers is first gathered into a small glass vial and is used to pollinate other freshly opened flowers.

Pollination can be done at any time during the day, except when the air is extremely hot and dry.

Hand pollination has been practiced by several growers on a commercial basis and has been found to be feasible and economical. There appear to be no varietal pollination problems such as self-sterility or cross-sterility in the varieties now growing in California.

Timing of Pollination

The cherimoya sheds its old leaves in spring just before the new leaves and flowers appear. Hand pollination is done during the months of June, July and August when the flowers are fully developed and after the new leaves have expanded and have attained good size. On many occasions flowers may appear before the leaves have developed and poor fruit sets results from these early blooms, even if hand pollination is practiced.

C. A. Schroeder is Assistant Professor of Subtropical Horticulture, and Assistant Plant Morphologist in the Experiment Station, Los Angeles.

New Wax-Wrap For Frozen Pack Meat Now Under Study

Recently a wax coating procedure for preparation of frozen pack meat has come into use. The meat is frozen in the unwrapped condition, and is then dipped in a melted special wax.

A continuous coating of the hardened wax completely covers the meat, and is said to be air and moisture proof and to retain freshness of color and flavor remarkably well. On thawing the wax is easily removed.

Wax dipped samples are in storage at this University, but the storage period has not been long enough for conclusions to be made at this time.

The wax coating procedure is being tested as part of the investigation of pretreatment and wrapping of frozen pack meats studied for effects on storage conducted under the direction of W. V. Cruess, Professor of Food Technology and Biochemist in the Experiment Station, Berkeley.

Sulfaguanidine As Control Against Cecal Coccidiosis

(Continued from page 1)

ens to develop resistance to the disease. Although the disease may be arrested promptly by a larger dose of sulfaguanidine, a second outbreak may occur a short time later.

When the amount of the drug used is too small, the quantity which finds its way into the ceca is insufficient to destroy the large numbers of coccidial forms. These parasites will continue to multiply with consequent severe damage to the cecal wall, causing hemorrhage and possibly death to the chicken.

Effectiveness of Sulfaguanidine

In a controlled laboratory experiment, groups of chickens were given large doses of coccidia and fed mashes containing sulfaguanidine.

When treatment with a regular mash containing 1 per cent sulfaguanidine was started one day before, on the same day or one day after the birds were inoculated, the sulfaguanidine mash was very effective in combatting the heavy infection.

The effectiveness of the drug was demonstrated by the decreased severity of symptoms, by the lowered mortality and by the increased weight gains.

Some protection was evident when the treatment was delayed until the second and third days after the birds were inoculated, but the drug became much less effective as the time between inoculation and treatment was increased from four to six days after inoculation.

All treated groups fared better than the non-treated inoculated birds.

The results of this experiment show the importance of starting treatment at the first sign of the disease, to protect the majority of the flock before the parasites develop beyond the time when the sulfaguanidine may be most effective.

Timing Treatment

In an outbreak of coccidiosis in the field it can be assumed that all chickens in the flock do not become infected at the same time with the same number of coccidia.

A schedule of treatment which is to be used should benefit the mildly-infected chickens already showing symptoms; it should stop the further development of the parasites in those chickens which are infected but do not yet show symptoms; and it should not be harmful to the sick birds or to the susceptible chickens which have not picked up the coccidia.

Treatment, to be of greatest benefit, must be 1) started in the initial stages of an outbreak, 2) discontinued long enough to enable the still non-infected chicks to pick up enough parasites and 3) repeated for the benefit of those not infected when the first treatment was given.

Theory and experience indicate that at least two and possibly three treatments with the medicated mash at three or four day intervals should be given.

A moderate to severe form of the disease should be treated with a mash containing 1 per cent of the drug.

Mild outbreaks of coccidiosis can be treated successfully with mashes containing ½ per cent of the drug.

At the first sign of the disease the medicated mash should be substituted for the regular feed. The initial period of medication will depend on the severity of the outbreak. Twenty-four to forty-eight hours of feeding is usually sufficient.

If the disease is unusually severe and little benefit from treatment is noted on the second day, a third day of medication should be applied. After the first medication period, the sulfaguanidine mash is removed and the birds are placed on the regular mash for four days.

In some cases a marked improvement will be noted. However, the medicated mash is set before them again for a twenty-four or forty-eight hour period, the decision being based on how well the flock responds to treatment. This second period of treatment is followed by a four day period on the regular mash.

In milder forms of the disease a third period of medication is not always necessary but if the disease was severe a final twenty-four hour feeding of the medicated mash should be given.

If the factors discussed above are observed, a reasonable degree of success can be expected.

Other Sulfa Drugs for Coccidiosis

Recently, several new drugs have been introduced, including sulfamerazine and sulfamethazine.

Some workers claim that these two drugs are superior to sulfaguanidine for the treatment of cecal coccidiosis. Since the toxicity of these drugs is still being studied and adequate field trials demonstrating their effectiveness are lacking, it probably would not be advisable to substitute them for sulfaguanidine at this time.

The newest sulfa drug to show promise in the control of coccidiosis is sulfapyrazine but this too, is still in the experimental stage.

Whereas sanitation limits the number of parasites that the chicken can pick up from its environment, sulfaguanidine limits the number of parasites which can multiply in the ceca.

Sulfaguanidine is not a substitute for sanitation but it can be advantageously used as an additional control measure.

Before sulfaguanidine is used, it is important to know that the disease being treated is cecal coccidiosis and that the course of treatment is appropriate for this outbreak.

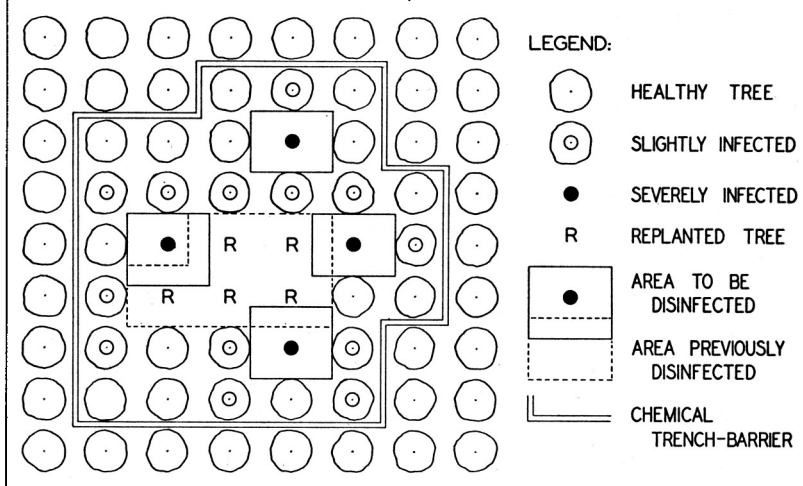
R. A. Bankowski is Assistant Professor of Veterinary Science and Assistant Veterinarian in the Experiment Station, Berkeley.

Chemical Trench Barrier And Soil Fumigation For Control Of Armillaria Rot In Citrus

(Continued from page 1)

The toadstools of armillaria appear on the most severely affected trees in late fall after the first storms of the rainy season.

If the disease is suspected, examination of the root crown should be made by removing the topsoil. A tree showing distress from armillaria will usually have one or more dead roots.



Map of surveyed citrus orchard, illustrating a method of controlling armillaria root rot. A chemical trench barrier encloses the infested area. Severely infected trees removed and the soil fumigated. Treated areas replanted with healthy trees.

Prevention

Where citrus orchards are being planted, the use of healthy nursery stock in noninfested soil is perhaps the most important and most practical way to control armillaria.

Nursery stock is usually free from the disease, but even a single infected tree can form a center of infestation.

The problem of obtaining clean soil is more serious. An infestation may have developed from previous orchards or native trees.

No citrus rootstocks are known to be immune or very desistant to the strains of armillaria root in southern California.

To keep armillaria away from the healthy trees of an infected citrus orchard usually is more important than to treat the diseased trees.

Chemical Trench Barrier

Spread from an infested area may be prevented by a chemical trench barrier designed to maintain a root-free zone about the infested area by means of charges of carbon disulfide.

The rhizomorphs of armillaria remain closely associated with the diseased roots from which they grow and the carbon disulfide will prevent roots from crossing the trench barrier. It will prevent also the development of rhizomorphs and the infection of healthy roots beyond the barrier.

Physical barriers made of concrete, galvanized iron, roofing paper and the like, are not recommended.

Treatment

Since armillaria is very sensitive to drying, a pit may be dug about the root crown and left open indefinitely. The growth of the fungus is arrested by exposure to the air, especially where it is moving inward along the roots toward the trunk.

Surgery is most effective in the early stages of the disease because then only a small part of the root system is involved, and the loss of a few roots is not serious.

Eradication in Infested Soil

The destruction of armillaria in infested soil may be accomplished by removing the diseased citrus tree and fumigating the soil with carbon disulfide. All trace of the chemical disappears from the soil within 4 to 8 weeks, and another tree can be planted.

Carbon disulfide has been used effectively against armillaria root rot in southern California for nearly 30 years. This soil fumigant is a readily volatile inflammable liquid, but it may be used safely if one takes the same precautions as with gasoline.

Questions concerning identification and control of armillaria will be answered by local Farm Advisors.

Donald E. Bliss is Associate Plant Pathologist in the Experiment Station, Riverside.

Clarification

To clarify the meaning of a sentence which appeared in the June issue of **California Agriculture,** it is reprinted in the original and in a re-written form.

On page 4 of **California Agriculture** for June 1947, was printed the article, "Family Selection and Progeny Testing of Poultry Worthwhile for Higher Egg Production."

In the body of the article, under the subhead of "The Progeny Test" was this sentence:

"The progeny test increases by a considerable amount, the ability of the offspring to inherit the characteristics of the selected parents."

The idea which that sentence was intended to express may be stated more clearly, perhaps, as:

"The progeny test increases the accuracy with which the hereditary constitution of a breeding bird can be identified."

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