cheaply, and to understand their hazards so fully that the losses from plant diseases can be largely foretold in order that planting a crop may be to that degree less a "leap in the dark."

Future development should greatly increase the importance of plant-disease information to land utilization. When it is possible by careful surveys to determine those areas in which diseases are likely to be particularly troublesome, it will then be possible to prevent many disastrous experiments in growing new crops as well as ill-advised attempts at settlement.

NEIL E. STEVENS, *Bureau of Plant Industry.*

PLANT Shipments Freed From Diseases and Pests by New Methods

Sterilizing and disinfecting treatments are applied to plants and plant products under quarantine regulation in order that they may move from areas or countries where particular fungus or insect pests are known to be present to other regions without danger of spreading such pests. This eliminates the risk of pest dispersal and at the same time provides for the natural commercial movement of the commodity. The necessity for such treatments was early recognized in the administration of Federal plant quarantines and numerous methods of treatment for various pests have been authorized and applied to plant products. With the progress of research work on pest control, it is possible to modify these treatments and develop new processes which are more economical or more efficient or interfere less with the commercial movement of the regulated products.

An infestation of the Mediterranean fruit fly in Florida discovered in the spring of 1929 and found to be rather widespread over the citrus region of the State made necessary the application of some treatment to the 1929–30 crop if it were to move without danger of dispersing this pest. Tests by the Bureau of Entomology indicated that the larvae and eggs of the Mediterranean fruit fly could be destroyed within the fruit by heating it to a temperature of 110° F. and holding it at that temperature for 8 hours. It was also shown that such treatment could be applied to citrus fruit grown in Florida without injury. A treatment was then developed which consisted in heating the fruit contained in field boxes in a specially designed room by means of hot, moist air applied in large volume. By this method, the fruit could be heated uniformly throughout the room without danger of overheating. The treatment could be applied to 40,000 pounds of fruit in a single room in a period of 14 to 16 hours, allowing 6 to 8 hours to heat the fruit to 110°, and a holding period of 8 hours at that temperature. About 5,000 carloads of citrus fruit which were from within the regulated area but were not known to be infested by this insect were sterilized by this process, the fruit moving to its normal markets without danger of dispersing the pest.

This method of treatment was also applied with success to avocados in Florida. A similar method has since been developed by the Bureau of Entomology for the treatment of narcissus bulbs infested with bulb flies. The treatment might be applied to a number of other perishable commodities where the thermal death point of the pest is lower than the temperature at which the commodity will be injured.

Sterilization By Refrigeration

Refrigeration was also employed in the sterilization of citrus fruit to eliminate the possibility of disseminating the Mediterranean fruit fly. It was determined by the Bureau of Entomology that holding fruit at a temperature of 30°–31° F. for 15 days seemed to insure the death of eggs and larvae of this pest. As this temperature was only slightly lower than the cold-storage temperature at which the fruit will keep best for the longest period, it was found to be well adapted to this work. The treatment was applied commercially to some 500 carloads of citrus fruit from Florida at the end of the shipping season, thus combining sterilization with the storage of the fruit for later markets.

The method has since been applied to citrus fruit from the lower Rio Grande Valley of Texas following an infestation of Mexican fruit fly to insure freedom of the fruit from this insect. Two hundred and fourteen carloads were treated in this case. The treatment is applicable to many other types of fruit and vegetables, as well as nonliving plant products which are not injured by temperatures below that necessary to destroy the insect pest which may be infesting them. These two methods of treatment for fruit flies have been employed only as additional safeguards for the treatment of fruit exposed to infestation and were not used for treatment of fruit known to have been subject to fruit-fly attack.

Shipments of green beans from the area heavily infested with the Japanese beetle when the adult beetle is numerous are very liable to be infested with these insects and inasmuch as long-distance shipments are made they may carry the beetle well outside the infested area and result in establishing new infestations. A machine for freeing the beans from these insects was developed which consisted of two drums of wire mesh, one within the other, the inner drum being about 20 inches in diameter and 10 feet long, supported in an inclined position by a shaft through the axis and suitable braces. The drums are open at both ends, the beans are fed into the upper end through a suitable hopper, and as the drums are rotated they progress to the lower end, where they are caught in hampers. The beetles are shaken out of the beans and fall through the wire mesh to the ground. The machine is much more effective than hand-inspection and cheaper, costing only about 1 cent per bushel for operation, and having a capacity of about 1 bushel per minute.

Pressure Method for Killing Pink Bollworm

The elimination of the pink bollworm from cotton lint and linters is a problem of first importance in the prevention of spread of the pink bollworm. These commodities when produced in infested areas were formerly fumigated under vacuum with hydrocyanic acid at the cost of about $1.50 per bale. It was found, however, that a pressure of 2,000 pounds per square inch in a mass of cotton would crush all seed contained therein sufficiently to kill any pink-bollworm larvae that might be present. It was determined also that such pressure was developed in a commercial compress and that cotton from the lightly infested area could be shipped after such treatment with little or no danger of transporting a live insect. This method was therefore authorized for all cotton except that grown in areas where the infestation was heaviest.

Further work showed that by passing the cotton in the form of a bat between heavy steel rollers held together by heavy springs just before it entered the press box and as part of the ginning operations, the same results could be accomplished. That is, sufficient pressure was applied to the cotton to crush any seed which might be therein and destroy any pink bollworm. This process had the advantage of being applied at little added cost, the operating cost being estimated at about 1 cent per bale. By this method, all the cotton was subjected to a uniformly high pressure, and the entire bale was free from possible infestation when it left the gin press. It was thus possible without decreasing the effectiveness of the treatment to substitute in certain areas a process which cost 1 cent per bale for application for one which had cost $1.50 per bale.

A method of sterilizing cottonseed for planting, in which the seed, preheated by steam, was held for 1 hour at 145° F. in a steam-jacketed container, was developed. The apparatus was designed to operate continuously with a capacity of about 8 tons of seed per day. Careful tests showed that this treatment would sterilize seed without injuring the viability. This made possible the shipment of special varieties of cottonseed from the lightly infested area for planting, and made this seed available over a wider area, thereby benefiting the producer in that he received a higher price for his seed.

The object in this work is to make the treatments as simple and economical as possible, reduce interference with the commercial movement of the commodity to a minimum, and, at the same time, prevent the spread of the pest against which the regulations are directed.

LON A. HAWKINS, *Bureau of Plant Quarantine.*

PORK of Good Quality Grown Efficiently on Corn-Soybean Ration

Rapid expansion in the production of soybeans during the last decade has led to increased utilization of the crop in feeding livestock. Because of its high protein content, the soybean has become popular as a supplement to corn and other starchy feeds in the production of hogs. This often makes unnecessary the purchase of concentrated protein feeds. Soybeans contain about 36 percent of protein and vary in oil content from 12.7 to 20.5 percent depending upon the variety, the more common varieties used in hog feed averaging approximately 18 percent. Because of their high oil content, soybeans fed in large quantities produce soft or oily carcasses of unsatisfactory market quality. Another consideration in feeding soybeans is their deficiency in certain mineral elements; hence hog rations containing soybeans should include a good mineral mixture.

Rations of Corn and Soybeans

In cooperation with the Purdue (Ind.) University Agricultural Experiment Station, the Department has conducted a series of tests to determine the maximum proportion of soybeans that may be fed to hogs with corn without serious detriment to the quality of carcass. The plan of this series of experiments provided for a study of the effect of mixtures of ground corn and ground soybeans when fed to fattening hogs in the proportions 3:1, 6:1, 9:1, and 12:1, as compared with the effect, on a control lot, of a mixture of corn and tankage in the proportion of 12:1. The Purdue investigators also used another lot in which