Melon Aphid Control

effectiveness of insecticides influenced by weather, predator populations, and infestations in adjacent fields

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The melon aphid, *Aphis gossypii* Glov. was extremely abundant and widespread in California during the 1949 season. In some areas very large and destructive populations were encountered, and large quantities of aphicides were used to combat the pest. The seriousness of the infestation afforded ample opportunity to evaluate the effectiveness of several insecticides in controlling the pest on many varieties of melons including cantaloupe, honeydew, Persian, crenshaw, casaba and watermelon.

Most of the insecticide investigations were conducted at Patterson, Stanislaus County. The principal materials tested were 2% parathion dust, 1% tetraethyl pyrophosphate dust and nicotine dusts of several concentrations. All insecticide applications were made with a ground power duster and at a rate of from 30 to 35 pounds per acre. Of the insecticides tested 2% parathion dust usually resulted in the highest initial kill and best control under the conditions of severe infestation as they existed at Patterson. Next in effectiveness was a 1% tetraethyl pyrophosphate dust followed by a 4% nicotine dust. However, the best treatments rarely remained effective for more than three weeks. In many cases control was secured for a period of only a week or two.

When applied under satisfactory conditions, tetraethyl pyrophosphate and parathion resulted in almost a complete kill of the aphid, but the excellent initial control was frequently nullified due to a heavy influx of winged aphids from adjacent severely infested melon fields.

The destruction of natural enemies of the aphid created a rather serious situation. Where the predator population was reduced to an extremely low level, even the best treatments were unable to hold for any considerable period of time due to the constant influx of migrating female aphids. With the environmental resistance greatly reduced, the winged migrants established new colonies with ease, and in many cases the population increased at an extremely rapid rate.

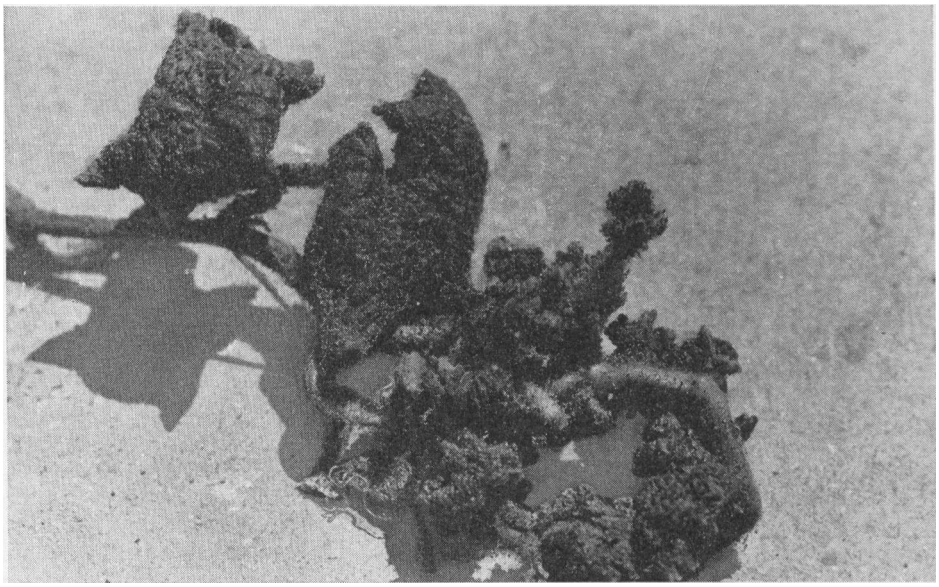
In practically every case where tetraethyl pyrophosphate was compared with parathion the population increase was more rapid where the former was applied. It is possible that parathion may have exerted some slight residual action, although the more probable explanation is that it usually resulted in the highest initial kill.

Hundreds of acres of melons were grown in the Patterson area and all of these were treated one or more times with tetraethyl pyrophosphate or parathion. It is felt that the mass use of these insecticides made it almost impossible to obtain satisfactory control of the melon aphid with nicotine dusts. In 1948 exceptionally good control of the aphid was obtained on several occasions where a 4% nicotine dust was applied under favorable conditions. It appears that satisfactory control of the melon aphid with nicotine can not be expected where the aphid infestation is severe and there are few natural enemies. The results indicate that nicotine performs best where natural enemies of the aphid are not destroyed.

The problem created by migrating aphids is very serious, and in most cases it can not be effectively combatted by the individual farmer. However, some evidence was obtained which indicated that considerable benefit might be derived through community action. The present experiments were conducted with a producer who grew more than 1,000 acres of melons. It was found that the control secured in a particular field could be greatly improved if it was possible to delay treatment until an adjacent field in which harvest was just completed could be disked under. If this procedure was followed, an important source of migrating aphids was eliminated. In cases where an adjacent, heavily infested field was left or not destroyed until after treatment, the influx of winged aphids was usually so great as to largely nullify the effect of the application.

In cases where it was impossible to destroy heavily infested fields, it was found that considerable benefit could be derived by first treating the fields to the windward side. Where this precaution was taken the problem created by migrating aphids was reduced considerably. With all insecticides best control resulted where treatments were made on calm, still days. Parathion could be applied over a wider range of weather conditions than could tetraethyl pyrophosphate. For example, the latter insecticide was not nearly as effective when applied to plants wet with dew. Why dew should reduce the effectiveness of the dust is not known for a certainty, but it is probable that in the presence of moisture the tetraethyl pyrophosphate hydrolyzes before it has had an opportunity to produce a satisfactory kill of the aphid.

The stability of the dust is another matter that must be taken into consideration in selecting a tetraethyl pyrophosphate dust. Unless the proper carrier is used tetraethyl pyrophosphate rapidly hydro-



Melon leaves heavily infested with melon aphid.

lyzes. There are, however, commercial dust mixtures available in which little deterioration of the tetraethyl pyrophosphate occurs within a period of several weeks after they are prepared. Only such products should be used, because to approach satisfactory control practically all the aphids in a treated field must be killed.

Effect of DDT

It has been generally recognized that applications of DDT to melons on many occasions have resulted in an increase in the aphid population. However, it is desirable that a program be developed in which DDT can be used because it is so effective against *Diabrotica* beetles and the melon leafhopper, *Empoasca abrupta* De Long. Both of these insects are very destructive to melons and if not controlled may greatly injure the crop. During 1948 and 1949 extensive investigations were conducted and it was found that under some conditions DDT can be applied without resulting in a severe loss from aphids. On numerous occasions the environmental balance was not adversely affected. It is certain, however, that the amount of DDT used should be held to a minimum and treatments should be properly and thoroughly applied so that both the *Diabrotica* beetles and the leafhopper are nearly eliminated from the field. However, in order to guard against complications frequent applications of DDT to control these insects should be avoided. During the early stages of growth a material such as cryolite should be used to control *Diabrotica* beetles. Later when the leafhopper population develops to a level to justify control, an application of DDT can be made. It was found that 30 pounds of a 3% dust or a spray containing approximately two pounds of 50% wettable powder per acre will adequately control the leafhopper as well as any *Diabrotica* beetles present. Such a practice need not result in a serious dislocation of the environmental balance. During the 1949 season insect population trends were followed in a number of fields that received a DDT treatment. Subsequent to treatment in fields at Brentwood, Contra Costa County, and at Woodland, Yolo County, there was an increase in the aphid population, followed rather closely by an increase in the predator population. Although the aphid population showed evidence of becoming destructive the threat failed to develop because of the rapid rise in the predator population. The end result was almost perfect biological control. Of the predators present ladybird beetles appeared to be the most important. They were able to establish themselves in the fields rather shortly after the DDT was applied. For example, at Brentwood a 3% DDT dust was applied on July 25th and yet four weeks later the predator population had risen to a sufficiently high level to clearly indicate that it was going to suppress the aphid population. Another example was encountered at Woodland where a melon field was treated with a DDT spray on July 27th. No aphids were observed in a survey conducted on August 5th, but a survey one week later revealed the beginning of an infestation, which gradually increased until September 2d. At this time there were localized areas of severe infestation, but these spots were heavily populated with predators and the aphid population was practically destroyed within the next 10 days. The above illustrations clearly demonstrate that predators are able to establish themselves in a field within a relatively short time after it has been treated with DDT.

The rapid rate at which the predator population increases under favorable conditions is truly remarkable, and if the host population has reached a fairly high level just before it is suppressed the predators are present in great abundance. However, once the aphid is controlled there is a tendency for a rapid dispersal of the predators, and they largely leave the field. Where it is evident that natural enemies are in a position to control the aphid, applications of insecticides that are likely to destroy the environmental balance should be avoided, if this is at all possible.

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JUICE

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Potassium in juice was increased by the fertilization with potassium.

At Riverside, the application of potassium in the fertilizer caused a significant decrease in the calcium content of the juice. The application of phosphorus also reduced the calcium. When phosphorus and potassium were applied together, the decrease in calcium content of the juice was highly significant. The application of manure likewise reduced the calcium content, and high nitrogen from calcium nitrate failed to increase the calcium content. At Claremont, these treatments caused no significant differences in the calcium concentration in the juice.

Correlations

It was found in the Riverside and Claremont experiments: *1*, that a negative correlation existed between the phosphorus content and the acid content of the juice; *2*, that a positive correlation existed between the potassium content and the total acid content of the juice; *3*, that a positive correlation existed between the phosphorus content of the juice and the percentage of juice of the whole fruit; and *4*, that the ascorbic acid content of the juice was negatively correlated with the concentration of phosphorus in the juice.

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tively large percentage of the freeze injured fruits. The weather conditions were also such that the concentration of soluble solids in the juice did not become so high and the acids did not get so low as in most years.

Young, immature, freeze-injured citrus fruits make a more nearly complete recovery than mature or nearly mature fruits. Under southern California conditions therefore, Valencia oranges, immature lemons and Marsh grapefruit have a better chance to recover than Navel oranges which are usually mature at the time of the low temperatures.

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The detailed results of this investigation will appear in the near future in the form of a University of California Bulletin.

SUGAR BEET

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night temperatures, as well as day temperatures, must be considered in growing a crop of sugar beets successfully at a high nutrient level.

At harvest the beets in this experiment will be analyzed for their sugar content and perhaps the results of the sugar analyses will be as startling as the differences observed in the growth of the beet plants themselves.

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The Earhart Plant Research Laboratory where this project is being conducted is under the direction of Professor F. W. Went at the California Institute of Technology in Pasadena.