A NEW PAGE IN INSECTICIDAL PRODUCTION FOR THE PROTECTION OF VEGETABLE CROPS

E. G. KELSHEIMER, Entomologist
Vegetable Crops Laboratory
Florida Agricultural Experiment Station
Bradenton, Florida

World War II was the impetus that started economic entomology on its way to a broader and more efficient insect control. In this country, DDT was the organic insecticide responsible for all of this enthusiastic and fact finding research. DDT has been the guinea pig and standard for all of our organic insecticides, and practically every insecticide manufacturer has initiaited a program to produce a material superior to DDT. As a result, we have many promising organics in the chlorinated series, such as chlordane (chlordan to the chemists), dichloro-diphenyl dichlorothane (DDD), methoxychlor, chlorinated camphene, and benzene hexachloride (low gamma and essentially pure gamma isomer base material). Of more recent introduction are the members of the phosphatic group—hexaethyl tetraphosphate, tetraethyl pyrophosphate and parathion. There still is a large and promising array of insecticides known only by their laboratory code numbers. Another group includes the botanicals such as pyrethrum, rotenone, Rynia, Sabadilla, nicotine, and others, all of which play an important part in agriculture.

It has become a common expression among research workers and representatives of manufacturers to remark “Am I confused?” It is obvious why we have this confusion, but fortunately this picture is being cleared as quickly as time and funds permit. As Garner said, “Every man after a certain age is entitled to his conclusions and confusions.”

1 Presidential address, 1948 meetings.

Mailing Date: July 19, 1949
There isn’t one of us present that can’t remember back when
the standard reply to an inquiry was, “If it is a chewing insect,
use arsenicals or cryolite, if a sucking insect, use nicotine.” If
properly applied, a grower managed to produce a crop. Our
new organics and inorganics have not entirely replaced our old
insecticides because there still is a big demand for arsenicals,
cryolite, nicotine, pyrethrum and rotenone where their past
records have proven their value.

Enough time has now elapsed so that intelligent growers
and the public realize that DDT did not end their insect prob-
lems. Such is true with our other organics. Too many of these
are specific for a limited number of insects, some even to species
within a genus. The growers’ as well as the workers’ ideal is
one compound that is general for all chewing and sucking in-
sects. We don’t have any such material, so therefore, the doors
have not been closed to research seeking for new and more
powerful chemicals.

I dare say that more emphasis has been placed upon the
importance of toxicity to man, toxicity to plants and harmful
residues in the past five-years than in all of the time previous.
Is it due to the fact that we have become more conscious of
these factors or is it because our older materials did not present
these problems? Every one understands the tolerance placed
upon certain fruits and vegetables and this was used as a
criterion for our research. We know that all insecticides should
be treated as poisons and applied with care. We also know
that many of our old insecticides were phytotoxic and were
just not applied to plants. Harmful residues were explained
under the heading of tolerance. Residues in the soil are an
important factor. My own classic example is the application
of lead arsenate in my garden to kill the grubs. I thought that
the application would not last long in a sandy soil but would
leach out. Such was not the case. I couldn’t grow anything
on it for three years. I have since learned that perhaps I could
have corrected the problem but it was my garden and I didn’t.

You see, we had our same problems before with the older
materials, but perhaps did not place too much importance
thereon. In many parts of Florida, the custom has been to clear
off and prepare new land each year for a crop. It is true this
did hold down certain insect populations, plant diseases, and
prevented any soil residue problems. With new land each year
becoming more scarce, growers are using the same fields over again.

Perhaps more alarm has been shown over the harmful residues left in the soil after heavy applications of organics for both soil inhabiting and aerial types of insects than ever before. Some very disquieting reports have been issued from the northern states on harmful effects of DDT in the soil to certain crops.

Florida being an insecticide manufacturers paradise has used great quantities of organic materials for the control of certain soil inhabiting insects. DDT was the first material used in the soil in any great quantities. Some greenhouse tests with peppers showed no significant difference up to 5,000 pounds actual material per acre. Tomatoes were more sensitive, significant reduction beginning with 800 pounds actual per acre. In a laboratory test, lettuce was grown in soil containing varying amounts of DDT up to 500,000 lbs. actual DDT per acre. There was no difference in the growth and appearance of the plants up to 50,000 pounds. The soil with the high amount was like putty, being half sand and half 50W DDT. This amount failed to kill the plants and after a month's time when the experiment was discarded, one dwarfed lettuce plant was removed to good soil, and it grew and produced a normal head of lettuce. These are all tremendous amounts of material, but we were attempting to reach a toxic range. Under our Florida conditions, it is doubtful if we will have to contend with a residual effect in the soil. We have not tested all of the new materials by any means and perhaps never will as it is a long process. You grow a crop under these conditions and follow up with the same or a different one to see how long these effects may be noted. Chlordane has been used up to 50 pounds per acre with no effect on the germination of seedlings of vegetables in seedbeds. The tobacco men have a different story as injury occurs there.

Phytotoxicity is of primary concern to every one. The new materials have a specificity toward plants. Some plants may be treated with safety at any time. Others have to be perfectly dry or burn will result to the new growth. This factor is one of the reasons why we like to apply our insecticides in the afternoon and evening. Phytotoxicity does not have to appear as damaged plants but may show only as decrease in yield. A field of cucurbits may look green and healthy and the grower is real proud of his insect control. Because he has not run any
check he does not realize how many hampers are missing at the end of the harvest.

We briefly mentioned tolerance limits but now we think of our materials in terms of toxicity to man. All insecticides are poisons, but some are many times more toxic than others. It is this toxicity to man that is of the utmost concern to all. New materials appear so fast that they are not fully tested so, with many, there is still a question of doubt as to their safeness. Many of the new insecticides break down fairly rapidly under our sunlight conditions, thus enabling us to give the grower a little wider range of latitude of safety between the last application and harvest.

All growers want to combine their insecticides and fungicides and frequently include secondary nutritional elements. Think of the fungicides which include the carbamates and copper and then the insecticides of the chlorinated and phosphate group—not to mention cryolite and the arsenicals. To this may be added the nutritionals such as iron, manganese, zinc, boron and copper, if no copper spray has been used. One time a grower called up and inquired about the advisability of mixing a carbamate and copper plus a chlorinated insecticide, some iron, manganese, zinc and then some ammonia. I told him I never tried such a combination and certainly would not advise it. He then said “I put her on”. I am no longer confused, just numb.

Compatibility of material is of utmost importance. We think of compatibility in chemical, physical and biological terms. The manufacturers have screened their materials and stated on their labels that such a material can be used in safe combination with some and not with others, generally those of an alkaline nature. We are interested in all three phases because a material cannot settle out, curdle or in other ways mess up a spray machine. Particularly are we interested in the biological compatibility as it affects the control of our insects and fungi. Some very interesting phenomena have shown up in some of our carbamate and chlorinated combinations. Very definite chlorosis is visible, sometimes within 24 hours after application. This occurs on new growth of fast growing plants. It is not evident on older and slow growing plants. Its effect upon yield has not been evaluated.

Recently, I was asked by a group of interested citizens what was my opinion of the value of mosquito control and its effect
upon wild life. My answer was in favor of it because it has been found that DDT, used with care, is not harmful to wild life. In this same connection, the bee keepers were quite alarmed about the insecticides used on cucurbitis. They need not be, if the growers will cooperate and apply their insecticides on cucurbits in the afternoon and evening. Bees do not remain in cucurbit fields long after noontime. Applications that are made will be on old flowers. The new ones that open the next day are the ones that will be visited by the bees and there is less likelihood of the bees picking up the poison.

THE COMMERCIAL ANGLE

As previously stated, Florida uses a tremendous amount of insecticides. Thus the economic stake is considerable for every company is interested in placing its material before the public eye. Florida offers a year around growing program, something we often forget. Little if anything of commercial vegetable importance is grown in central and south Florida from June to August. But in northern Florida, crops are in full swing at that time. I mention this to show how complicated the picture is for the insecticide representative. At times the research man in particular sections is ‘talking to himself’—how about this representative I have mentioned? At times I become quite critical of some of the methods used to put across a material, but when I calm down, I realize they are in it for the money. Sometimes a product is put on the market prematurely. We all realize the lack of wisdom in doing this. We research men are likely to forget the amount of capital invested in a new product. We don’t like the high prices demanded just because the company wants its returns from the pilot plant venture. This isn’t the entire picture by any means. When a product is considered ready for the trade, a substantial inventory of the material must be in each district or area. Suppose a change in formulation is necessary before the present inventory is moved, then considerable readjustment must be made. This means then a re-education of that particular representative’s clients, and may cause considerable grumbling.

The commercial representative can help the research work by discouraging the too frequent and sometimes promiscuous use of high priced insecticides. Many of these are sold on credit. A loss to one is a loss to all.
In summing up the manufacturer's side of the picture, they can help the research worker by adequately screening out their materials, giving generous samples for investigational work, and allowing the material to be tested a normal gestation period (a term used by my good friend, George Decker). Curious as it may seem, some concerns still are hesitant to supply adequate samples. One very well known firm just sent tiny exhibition samples and then expected full field reports back on the material. Those samples went in the waste basket. We generally ask for enough material to run two seasons; in that way we can test a batch lot in the fall and in the spring.

**THE ROLE OF THE RESEARCH WORKER**

The state research worker and the manufacturers work hand in hand. It is our duty to adequately and carefully evaluate material sent to us for experimental investigation. By that we mean a product ready for use if not already on the market. We cannot serve as screening depots and test a number of experimental materials. Florida is a wonderful testing ground by reason of the fact that crop production is a year around proposition somewhere in the state.

New materials appear so fast that we are able only to hit the high spots and are happy to report in a preliminary way on the toxicity to insect, phytotoxicity, toxicity to man, residual effects in the soil and then hope that we can come back later and do a more thorough job of evaluating the materials.

Everyone present knows how complex the situation is. It is no longer a job for the entomologist. He runs into problems that require the assistance of chemists, plant pathologists, plant and insect physiologists, toxicologists, ecologists, etc. Just to touch lightly on the last subject, the ecological relationship, a material may be specific for an insect in one section of the country and fail miserably elsewhere. This same condition may be true within a state.

In our rush, we have not had the time to evaluate these new materials under various weather conditions. Some materials respond well during dry weather, others in wet weather. Apparently, from recent tests conducted, a material needs only to be on the plant an hour's time to prove effective. We know of one material, very effective for subterranean insects, whose efficacy is increased following artificial watering or a light shower. This same material applied to a plant for aerial types
of insects is again apparently activated by frequent rains and goes so far as to reduce the yield of the fruit. I mention these illustrations, as perhaps some of the reasons why a material may fail after apparently proving itself a good insecticide.

In conclusion, we have presented some of the facts as we see them. Yes, we are still confused. New products continue to be called to our attention. A new product is a new problem and limited time does not permit us to break down this confusion. We all do the best we can. We supply the manufacturers and growers with the best answers that only limited data provide. The challenge of the "new" is very demanding. We have turned a new page in insecticidal production and with plenty of energy and a dash of luck, we can keep pace and supply the information they are asking us to give.

OBSERVATIONS ON THE INCREASE OF APHIDS ON CELERY FOLLOWING THE APPLICATION OF COPPER A COMPOUND AS A FUNGICIDE

By J. W. Wilson
Central Florida Experiment Station

For a considerable period of time the fact that application of certain materials to various crops tends to be followed by an increase of one or more insects, has been generally recognized by Entomologist and Plant Pathologist. For example, Folsom in 1927 attributed the initial infestations of aphids on cotton following the application of calcium arsenate to the positive phototrophic reaction of the winged females. Bonde and Snyder (1946 and 1947) reported a significant increase of aphid populations in potato plots sprayed with Bordeaux Basic Copper Sulfate, Karbam Z, Karbam Z and soap and Dithane. They also observed that aphid populations are often greater in fields sprayed with Bordeaux than in those receiving applications of neutral copper fungicide. Wylie (1948) reporting on his work on the control of aphids on celery with insecticides combined with fungicides stated that the aphid populations on the plots treated with Bordeaux were significantly greater than on the untreated plots. Thompson (1936, 1937 and 1940) observed the buildup of purple scale on citrus following the applications of Bordeaux. He found that the scale populations increased with the amount of residue deposited on the citrus leaf, and