

Chemists, entomologists, agronomists, and other technically trained people are working together toward more efficient use of agricultural chemicals. Here two specialists test experimental equipment for the application of modern pesticides to cotton

Developments in Agricultural Chemicals

A survey of economic status and technical progress

NOW NEAR THE END OF THE 1954 SEASON for agricultural chemicals, the industry takes a sounding and finds that this year has been the best of the past three. Although far from ideal, this season has, at least, approached normal. There were some bad breaks, such as the weather, which took its toll in considerably reduced sales of cotton insecticides. But there were many more bright spots in the total picture: sales in the west were high, pre-emergence herbicides were popular, increased attention to the nematode problem caused wider use of soil fumigants, the industry met the

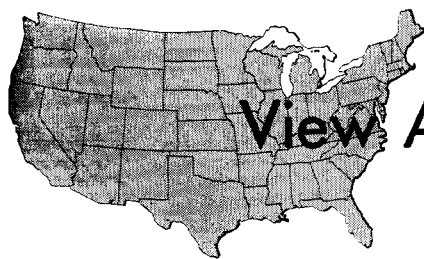
armyworm infestation smoothly, and some of the newer pesticides moved into commercial use for the first time and came out with flying colors.

From an economic standpoint, the situation was somewhat improved also. Price cutting, rampant in the previous year, leveled off, with most prices remaining comparatively firm during the season. The inventory situation, plaguing the industry last year this time, has also improved greatly.

Some of the nagging problems, such as dealer education, liability claims, and consignment selling, are still plaguing

the industry, as they have for many years. But, these are problems that no one expects to solve in the space of one year. One of the industry's long-range problems, however, was given a big boost on the way to solution this year with the passage and signing into law of the Miller bill.

As industry members gather at their trade association meeting in Spring Lake again this year, there will probably be more optimism than was evident at the New Jersey resort during last year's fall meeting. Although the situation is far from ideal, it is at least better than last summer's doldrums.



View Across the Nation

A direct-contact gathering of significant information by
AG AND FOOD's editors

Industry Fought High Insect Infestation in the West

A DEFINITE CHANGE for the better in most instances is the outlook for agricultural chemicals in the West, refreshingly different from the pervading gloom at the end of 1953. Estimates for sales thus far in 1954 vary considerably, but most are at least as optimistic as the representative of one large company: "This season is an average year—which means a definite improvement over 1952 and 1953."

Prime reason for better sales, cited by more than one industry and university man: There have simply been more insects to kill this year than last in the West. In addition, applications per acre are slightly higher (exception is alfalfa, where use is not as high as in the past; other applications more than offset this reduction, however). Inventories are much lower than last year, indicating greater over-all use.

In marked contrast is the opinion of one of the largest pesticide producers. His view: For the first half of 1954, sales were better than the 1953 average; since then, sales have been considerably worse. He goes further, says the pesticide industry is no better off than last year, with possible even a little less business. Causes: drought in the Southeast and certain other areas, reducing national pesticide needs, and freezes in the Pacific Northwest. He also notes farmer income is down, reflecting in purchases.

As the end of the 1954 crop year approaches and with harvest beginning on many crops, sales are expected to decline, although there might be some increase in the next few weeks because of greater infestations on cotton in California's San Joaquin Valley. Cotton defoliation remains as one major outlet for the industry in the coming weeks.

Prices Firmer "Across the Board"

Despite generally rising sales, as contrasted with 1953, prices have remained about the same. Generalizations are hard to arrive at, but the consensus seems to be "definitely a little firmer."

Singled out as exceptions are DDT, up from the "demoralized low" of 1953, and toxaphene.

Standing out against this consensus is the pessimistic view of one large producer who observes that the situation has deteriorated in recent months, with prices now "spotted." To his company, the price outlook is gloomy for the next few months because of less volume of business and because of the farmer's poor economic condition.

While prices thus seem to be holding fairly steady for the producing industry, trouble seems to be brewing for agricultural chemical applicators. Feeling is rising among aircraft applicators in California that chemical salesmen are tending to favor one applicator over another. Furthermore, and looked at as much more serious by the applicators, salesmen are tending to talk low application figures in order to sell more chemicals.

On the West Coast there is little effort to educate dealers, one producer points out. Manufacturers and mixers are going directly to the farmer with their products; if a dealer is used at all, it is primarily as a warehousing and collection agency.

Acresage, 2,4-D Restrictions Haven't Harmed Western Sales

The severe cotton acresage cutback in California (one of the largest reductions in the nation) this year has had little effect on agricultural chemicals sales. As one big producer says, the pesticide business is helped rather than hurt during periods of depression or acresage control. Farmers feel they must get the maximum production from each acre, and use per acre goes up.

California, Oregon, and Washington each have set aside certain areas where application of 2,4-D and related chemicals is restricted during the growing season. While this has tended to reduce sales in some of the local areas, the loss has not been large. In Washington, for

instance, industry has shifted to low-volatile formulations which can be used, thus maintaining over-all sales. Any slowness there is attributed to weather conditions. In some instances, too, the expected weed growth did not develop.

Nevertheless, one large manufacturer says these regulations have materially slowed the use of 2,4-D and that corresponding regulations on other hazardous chemicals equally retard use. On the positive side, however, come reports from California that complaints from spray drift damage are definitely down.

Industry Bestirs Itself To Reduce Liability

Liability for alleged damage is undoubtedly the most serious economic question facing the industry. Says one university man, "There is too much indiscriminate use of newer chemicals without proper evaluation. Sales pressure and large, untrained staffs have resulted in many recommendations being made regardless of consequences. Much injury could have been avoided with a less forceful sales program, with greater knowledge of material action, and with trained and more scrupulous personnel in the field."

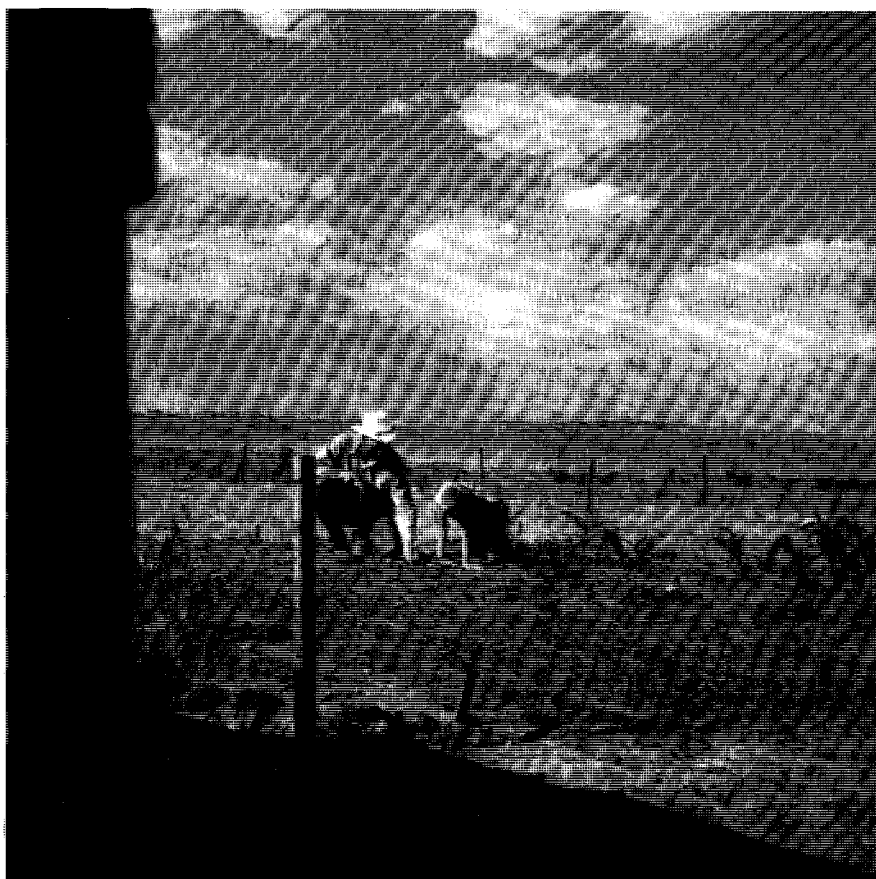
More time is being spent on improving labels, advertising, and pamphlets. Disclaimer notices are getting critical evaluation. Field men are being cautioned to make only those recommendations backed by research results.

In California the agricultural code has been changed to set definite time limits within which a claim for alleged damage can be filed (within 60 days of damage or before half of the crop is harvested, whichever is earliest).

However, some companies think the industry is "actually not doing much" about improving its liability risk. One producer says a large segment of the industry still invites damage claims by distributing hazardous chemicals without properly warning users of difficulties which might result.

Minor Outbreak of Old Pests, Appearance of New Pests

Along the West Coast there have been no serious major outbreaks of specific pests during the past few months. In California, expanding corn acresage in



Rancher surveys a garden which has been virtually destroyed by hoppers moving in from the heavily damaged range in the background. Severest hopper infestations occur in the Great Plains and along the eastern slopes of the Rockies

the San Joaquin Valley has created favorable conditions for infestations of corn earworms which may migrate later to cotton fields. Cotton bollworm appears to involve the largest acreage in California at present.

Grasshoppers caused somewhat more than normal trouble along the Sierra foothills from about mid-state northward, particularly in olives in Butte County. But they did not reach the epidemic proportions of a year ago in the southern San Joaquin Valley where crops were severely threatened.

Along the eastern slopes of the Rockies, some 4 million acres of western range lands were estimated early this year to require an active grasshopper control program, but extent of control is not so great as it might have been. To date, some 825,000 acres have been treated, with the 1954 control program just about ended.

During 1954, known infestations of Mormon crickets requiring control amounted to only 121,500 acres in six states. Effective, timely work in previous years made the difference.

Two insects new to California are appearing in the Imperial Valley. Yellow clover aphid has developed for the first time in damaging numbers, denuding lower halves of plants and interfering

with cutting and baling because of copious amounts of honeydew. Another insect, ground pearls, has been found attacking grape and Bermuda grass roots over widespread Imperial Valley areas.

More or Less New Chemicals?

Some 80 to 90% of the agricultural chemicals industry's 1953 business was based on new chemicals not a pound of which was available in 1945. Will this rate continue? Some say yes, some no. Says the sales manager for one large western manufacturer, "It is inconceivable that new pesticides can be developed and introduced at anywhere near that rate. However, at present there are many new products in the mill, and for the next few years we can expect quite a number of additional products. After that, there should be a tapering off."

Most agree with this position—with predictions ranging up to a 50% reduction in rate—reasoning that high costs of bringing out new products and restrictions imposed by FDA and USDA (which from 1949 to 1953 jumped from "stringent" to "rigid") will put on the brakes. Research will be directed toward new fields of use, not toward new products, says one company. Unless a

new product is definitely and measurably superior to an old one, it will not be commercialized.

Those hoping the tide is indeed ebbing might well shudder at the prediction made not too long ago by the director of an industrial experimental farm. In his view, industry must be prepared to meet greater variety and concentrations of insects as well as to cope with resistant insects. He also believes the development of resistance is apt to be more specific than is susceptibility, concludes that effective control will only continue with an endless development of new insecticides of greater variety and specificity.

Expecting a continued stream of new products is an entomology department chairman of one of the West's more prominent universities. Predictions to the contrary, he states there has been no decrease in new experimental compounds. And, he adds, a great many have definite possibility of becoming commercial successes. Industry, he observes, seems to be adjusting itself very well to strictures imposed by regulatory agencies and is making every effort to conduct thorough and basic research to provide necessary information on residues and toxicity.

A possible straw in the wind is a comment by the western sales manager for a basic manufacturer: The new tax law, with its exemption approval for "expensing" money spent on research, could mean intensified research effort resulting in "any number" of new products. A straw in the opposite wind: "Experimentations cannot continue indefinitely to pass on to new chemicals without really learning the merits and shortcomings of those already available. There is a widespread feeling that too much superficial work is done." This from another university entomologist.

"Natural" Products Continue to Lose Ground to "Synthetics"

More potent compounds is the trend in the West in an effort to obtain pest control in spite of less-than-perfect applications. However, the limit has just about been reached, according to one producer. He notes that despite high potency there is a physical limit to how far one can stretch a few ounces of material. He also predicts we will see resistance develop more quickly with highly potent materials than with products which must be used in gross amounts.

Sulfur use continues to decrease, a trend beginning with the development of Systox. Sulfur is practically out of the market for use alone, but it continues to enjoy demand as a carrier for chlorinated hydrocarbons. Arsenicals and botanicals can be removed from the list of major insecticides. Use of petroleum oils declined drastically with the intro-

duction of DDT, parathion, and others, but many fruit growers are now finding it important to return to dormant oil sprays in order to maintain an effective and economical program.

Systox Gets First Food-Crop Registration in California

Systemics, looming on the pesticide horizon for the past several seasons, are at last moving into food crop protection in the West. First to crack the barrier has been Systox. Previously limited to use on nonfood crops, such as cotton, legume seed crops, and nonbearing fruit trees, systox received registration in mid-May in California (first state to give such registration) for some fruit-bearing trees. Similar registration will probably come in other states as industry supplies supporting data for registration decisions.

Meanwhile, cost and toxicity stand as deterrents to more widespread use of Systox. In Washington, feeling is that Systox is far too expensive to use on fruit trees, although it has replaced such materials as parathion and other chemicals which are strictly acaricides (such as Aramite) on nonbearing fruit trees and legume seed crops.

In California, systemics are gaining a major place in cotton, alfalfa, walnuts, and some other pest control programs. The tendency is away from highly toxic phosphates and toward materials such as malathion, Diazinon, and others. Further spread could be delayed by improper use and attempts to get registration with insufficient data.

A most important factor in the trend to systemics will be any announcement of federal tolerance for spray residues, as presumably will result from administering the Miller Bill. Some in the West think as soon as the residue hazard is settled on systemics and as long as resistance does not develop, systemics will be used eventually on every fruit, vegetable, and ornamental crop where aphids and mites are a problem—which means practically every crop.

Nematode Control Leading Problem

The future for soil fumigation for nematode control is very bright, but it can be realized fully only as cheaper chemicals become available. Magnitude of damage to many crops is only now being recognized, due in part to the fact that nematodes seldom give rise to disastrous outbreaks; on the contrary usually increase steadily after infestation is established and decrease in production has been attributed to other factors. Inasmuch as nearly all vegetable areas are affected in time and as the field is relatively untouched, the nematode problem is said to be one of the leading ones in the industry.

Meanwhile, control is currently in-

creasing, much more in the Southeast than West. This is partially due to soil fumigants having been used over a greater period of time in the West than they have in the Southeast.

The Department of Agriculture of British Columbia tells us that nematode infestation has been bad this year, particularly in strawberries and bulbs. Growers there are increasing the use of temporary soil sterilants, such as D-D and ethylene dibromide. Growers would like to have a chemical with a longer residual effect for more efficient control.

Forest Management Is Outlet of the Future

Pests are the most serious problem confronting Western forests today. While many in the agricultural chemicals industry are eyeing that market, much research still needs to be done before forest pest control reaches its full potential. Raids by tree killing insects are killing upward of 5 billion board feet in western forests each year. Add losses from diseases and rots and an additional several billion feet are also lost.

Forest management men feel there is little chance of getting on top of the forest pest problem in the immediate future. Losses will continue heavy as long as there are extensive areas of overripe decadent virgin stands.

Cotton Defoliation Leads In "Important" Future Growth

Of 14 applications of agricultural chemicals which have been highlighted in the press over the past few months, cotton defoliation is picked by many as being of potentially greatest importance to the agricultural chemicals industry (California now defoliates over 50% of its total crop). And many predict that

Forest entomologists now advocate the use of agricultural chemicals for the protection of the tree forest crop. Here a ranger surveys damage by the spruce budworm



this use, which is essential for clean picking of top quality cotton, will see considerable additional increase. Also, new defoliants for cotton should appear, as nothing has done a really satisfactory job in the arid West.

A very active company picked six of the applications as being of top significance. Cotton defoliation was included along with prevention of premature fall of apples and oranges, defoliation of potatoes and other tuber crops, seed treatments, and hormones to produce superior, seedless tomatoes.

While all of these, and others, offer great potentialities to the agricultural chemicals industry, comments pro and con were made on several heralded applications. For example, many growers have taken serious losses because they used a hormone and then left the fruit on the tree long past maturity. As a result, hormone treatments have received some unfavorable publicity, but improper usage was to blame.

Use of hormone sprays to delay flowering appears to have some very practical uses on deciduous fruits in the West Coast states. A week or 10-day later blooming could reduce frost hazards and orchard heating costs. Also, it could reduce fungicide demands on such crops as apricots, prunes, and plums, which are subject to disease attack during the blooming stage.

The new antibiotics will have a definite but limited place in disease control programs. Currently, they offer an improvement on occasional diseases such as fire blight on pears and apples, but they are not thought by many to be "miracles." Proper application and timing are necessary in order to obtain any benefits.

The basic problem in insecticides is decreasing effectiveness against various pests. Every year, new instances are found in California. This has caused the chlorinated hydrocarbons to be largely abandoned for fly and mosquito control. Phosphates bring out resistance to a much lower degree, but for practical use the situation is similar. Only a minute fraction of the total money and effort being put into work on insecticides is being devoted to this problem which merits much more attention, say Westerners.

Some of the problems facing the industry, however, are peculiar to the West. These include breakdown of DDT in hot interior valleys, the short residual effect of most insecticides, complications of insecticides application and irrigation. Farmers in the West must produce superior quality to offset the cost of transporting these products to eastern markets. In many instances this superior product is achieved by highly efficient pest control, and the West is looking forward to continued progress along these lines.

Drought Seen as Cause of Disappointing Season in the South

SHARP REDUCTIONS in late season pesticide sales, resulting from the drought, lowered 1954 sales volume somewhat in the South and Southwest. Some seasonal sales estimates set volume at from one half to two thirds of that in 1953. There was a bright spot in the pesticides business—the profit margin was more stable than in either 1952 or 1953. Consignment selling is still practiced here generally for insecticides; herbicides are sold on 30-day terms or a cash basis.

The sagging trend in pesticide market has tightened slightly, over-all, and improved somewhat on certain products. The comparatively new products have gained in popularity. Endrin, dieldrin, and heptachlor have been applied increasingly for boll weevil control in cotton. In sections where bollworm infestation was high, DDT sales also continued high. Several suppliers commented that the factor bringing on the sagging trend in 1953, oversupply, was anticipated in planning for 1954 season. However, the late 1954 season slump is due to the drought conditions occurring throughout the area with the exception of some sections of the Gulf Coast. Ordinarily late August sales are near peak for the season, but activity is now down to a virtual standstill.

Herbicides Sales Ahead

Herbicides sales have been good this season. Early sales were brisk, particularly in the Mississippi Delta. CIPC sales in the Delta were about equal to those in 1953; dinitro compounds sales were down. Blamed for this decrease: Delta farmer's suspicion that these materials might do injury to cotton, observed a USDA official.

The anticipated large scale usage of herbicides on cotton did not materialize in 1954; herbicidal oils were not used as extensively as they might have been because dry weather has minimized post-emergence weed problems.

Sales of 2,4-D dropped in some Gulf Coast areas as a result of Texas' ban on aerial application on rice fields adjacent to cotton in seven counties. In these areas 2,4,5-T and MCP sales have gained. MCP is meeting with increased acceptance in rice weed control because of its comparative safety from burning of the rice plant, claim suppliers. Some new products appear promising and are beginning to draw real market interest. Silvex has looked good in Texas experiment station tests and is stirring interest of dealers serving rice growers. Texas herbicide regulations are apparently

effective; by mid-August there had been no 1954 damage claims filed by cotton farmers against rice growers' weed control applications.

Sales of herbicides have been active for control of brush and hardwoods on Texas range land. Studies by the Range and Forestry researchers at the Texas Agricultural Experiment Station have led to application of hormone herbicides and other materials to improve grass lands. This has helped to offset some of the drop in sales resulting from the drought.

Acreage Reductions Not Blamed

There is little feeling that the USDA acreage reductions were to blame for any sales losses. Comments range from "little effect" to "it hurt some." Most manufacturers anticipated the reductions and, had rainfall for the season been normal, sales volume would probably have been as high as 1953 or perhaps higher. A tendency for farmers to take better care of a smaller acreage, which would lead to a greater use of pesticides, was offset in at least one area, the Mississippi Delta, by the availability of surplus labor for weeding. There was some increase in consumption of herbicides on acreage shifted from cotton to rice—some 120,000 acres in the Delta alone.

Prices Firmer

Prices on pesticides were generally more stable throughout the South and Southwest than in either 1952 or 1953, but were considered by some as somewhat weak in Texas.

Price cutting was not nearly so widespread as in previous years. There were really only two major cuts. Effects of the drought led to an almost general cut in late June. Prices then held virtually steady for three or four weeks. Another general cut in late July was aimed at unloading stocks held in consignment during August. Central Texas exhibited a fluctuating price situation during the latter part of the season. Louisiana was comparatively steady. As seasonal movement of stocks proceeded into Mississippi and Arkansas, a more or less general price cut followed. Prices on liquids were more stable than on dust materials. Dealers mention that there was more profit in the liquid materials, too. Tennessee suppliers report some offering of off-season discounts to stimulate late season sales. Price cuts were reported on herbicides in the Mississippi Delta in the spring and on insecticides later in the season.

Dealer Education Lacking

One large gap in the educational program in the South is failure to train dealers adequately in the recommended procedure for using certain of the new pesticides, such as those used in weed control. They are an extremely important group in a position to render valuable service to farmers in the various communities. In Mississippi some members of the USDA have attempted to encourage holding of pesticide schools for dealers, without too much success. Dealers frequently do not stock such common items as nozzles, spray tips, and pumps that farmers need in constructing spray equipment for common herbicides, and common herbicides are not always readily available.

Some manufacturers are making real progress in dealer education. Hercules and Shell have circulated motion pictures describing proper use of pesticides. Several manufacturers have sponsored meetings to educate dealers and others in the use of agricultural chemicals. Generally speaking in the South and Southwest, county agents and state extension officials are making real efforts to inform the farmers directly, as their time permits. Aggressive dealers are seeking information to enable them to answer questions and stay one jump ahead of the farmer—the customer.

300,000 Cotton Acres Treated with CIPC

Very little pre-emergence weed control is practiced in the Southwest, but it is used extensively on cotton in the Mississippi Delta area (about 10%). Weed control on cotton is a large item of expense in the Southeastern states. Hoeing costs can run as high as \$20 an acre; chemical control costs about half that much. A constantly shrinking labor supply is forcing more and more growers into using chemicals, although they do not like the idea of such a large investment unless a crop is insured.

Pre-emergence weed control in cotton was generally satisfactory in the Mid-south area during 1954. Some sources have estimated approximately 300,000 acres of cotton were treated with CIPC, the principal compound marketed during the last two growing seasons in Tennessee, Arkansas, Mississippi, and Louisiana. Farmers who have used pre-emergence herbicides were well pleased with the results. Cold weather damage caused much of the cotton in the Mid-south to be replanted and many farmers were reluctant to retreat the replanted cotton because of the additional expense.

CIPC has found the greatest success as a pre-emergence herbicide for cotton in the Delta area, but the volume was not so great as anticipated. Herbicidal oils are being used extensively as post



Typical dust formulation plant—at Pine Bluff, Ark. Mixing plants of this kind supply local growers with dusts scientifically formulated to meet local needs

emergence materials. Use of either varies greatly within and between seasons depending upon weather conditions during and following planting time. 2,4-D is still being used on small grains and rice.

The USDA says potential consumption of pre-emergence herbicides is great in the Delta area.

Weed killers finding greatest interest are CIPC, 2,4-D, and 2,4,5-T. There is considerable interest in the ureas as both soil sterilants and pre-emergence herbicides. Only limited acreages of cotton were treated with ureas in 1954. TCA and the chlorates were used on a limited basis for Johnson grass.

A small amount of acreage was treated this year with Karmex DL (the only new herbicide introduced in the South this year), which gave surprisingly good results and little injury to crops. Most farmers, however, are concerned with the residual aspects of this material, and will probably go slow in their use of it until more information has been obtained on residual build-up, particularly as it affects winter grazing crops and others which may follow cotton. The importance of soil and weather factors from one soil type to another has not been clearly defined, making difficult the formulation of recommendations for safe usage. Midsouth authorities say Karmex DL will bear watching next year for use on cotton.

Dalapon has shown excellent promise for controlling Johnson grass in sugar cane but techniques of employing it to kill the weeds selectively in this and other crops have not been worked out.

Acreage reductions in cotton have been an important factor in limiting the use of pre-emergence herbicides for this crop. Many farmers had sufficient labor on their farms to handle the weed problem following acreage restrictions. No doubt restricted acreage control will

play an important role during 1955 in determining the market potential. Land taken out of cotton and planted in lower crops will mean restricted use of pesticides.

Problems needing more attention in the Midsouth are control of perennial vines in cotton fields and Johnson grass in cultivated fields and adjacent areas. There is an acute need for a cheap herbicide that will control the same weeds in rice, corn, and pastures; something like 2,4-D, but which causes no severe drift damage to cotton. Grassy weeds in rice are becoming more important and materials for controlling them effectively have not been found as yet.

Directional spraying of both contact and systemic herbicides holds great promise for use in cotton and other crops and will find a definite place in the event satisfactory selective herbicides are developed. Use of herbicides such as Dalapon on Johnson grass prior to planting is a technique that will be investigated extensively next year. Combinations of herbicides with cross-plowing and other cultural procedures will likely receive major attention with a view toward reducing the amount of herbicide applied, thereby placing weed control on a more economical basis. There is a definite need to demonstrate to the farmer that use of herbicides can not only reduce labor requirements but also increase his net income. This may be brought about by cheaper herbicides or devising techniques to use smaller amounts per acre to do the job.

Brush Control

Perhaps one of the most significant developments in application of agricultural chemicals in the Southwest this year has been the extensive use of herbicides for brush control on Central and

West Texas ranges. Researchers at the Texas Agricultural Experiment Station have conducted studies with 2,4-D, 2,4,5-T, and the nonselective materials such as Ammate, kerosene, and diesel oil. Areas so treated yield up to twice the grass of those ranges sapped by heavy brush growth. Although definite figures are not now available, reliable estimates predict that the added weight of beef produced should pay for the chemical treatment in two or three years. Targets of the organized attack are heavy growths of several kinds of oak and mesquite. Early rains in the spring of 1954 produced heavy growth that led to increased application of brush control practices, both chemical and mechanical.

The severity of nematode infestations with cotton in the South is becoming more noticeable; soil fumigants are showing good promise of reducing this threat. Infestations are mostly spotted as to locality and severity. As more growers are becoming acquainted with their use, especially in the last two years, sales have increased appreciably. Thousands of acres of soil for tobacco, vegetables, and other crops have been fumigated for the first time.

Control of nematodes sometimes has considerable effect in preventing infection of plants by fungi and bacteria, although the exact relationship between nematodes and these diseases is still obscure. Results in the control of Fusarium wilt of cotton and black shank of tobacco have been particularly striking.

Effect of fumigating the soil is largely lost if nematode-infected transplants are used; demand for seedbed fumigants is increasing among farmers who grow their own plants.

Home gardening markets have yet to be tapped by manufacturers of soil fumigants, although some attempts are now being made to develop this business through small package sales and the use of improvised equipment.

Nematodes seriously damage thousands of acres of orchards, citrus groves, and vineyards, but the control problem is far from being solved. Soil fumigants now on the market can and are being used prior to planting, although serious damage results if applied around the roots of growing trees or shrubs. More work is needed to develop new nematocides with reduced plant toxicity.

The use of liquid fumigants adsorbed on vermiculite materials has been suggested, which permits application in granular form. Adsorption apparently does not affect volatility too much; and good results have been obtained by placing the granules in bands one foot apart and eight inches deep.

Endrin for Cotton Pests

No new recommendations have been made in Texas for control of the boll

weevil and bollworm, but entomologists in Mississippi are suggesting endrin. Tennessee reports very little change in recommendations of last year.

Some chlorinated hydrocarbons are losing their effectiveness against household pests; some resistance to miticides by spider mites has been noted.

The possibility of soil contamination from chlorinated insecticides is being recognized, although the problem has not been thoroughly studied to determine how serious the accumulation of residues might be. Opinions in the South to data range from "information lacking, but it is a possibility" to that of "I don't think so."

In the Southwest, use of pesticide-fertilizer combinations has failed to create a great deal of interest; Mid-south reports show consumption only on a limited basis—primarily experimental. By far the largest interest lies in the Southwest. People in Texas say combinations have not been used enough to determine the degree of success, whereas good results have been reported in some cases in Tennessee.

With the exception of Systox, which looks good, systemics are still being used only on an experimental basis. Systox use is increasing in Tennessee and more widespread tests are under way in the Delta area.

Antibiotics in the plant field have been used only on an extremely limited basis in the Midsouth. They are now being investigated as controls for fire blight in pears and apples.

Defoliant usage is increasing throughout the South for cotton and legume seeds, and increases have been reported on soybeans, some on crimson clover.

Defoliant or desiccants were not used to any appreciable extent in this area on clovers in 1954 because of the extremely dry weather. These materials appear to have a place in the clover seed production and in favorable years more will be used than in the past. It is too early yet to know the extent of defoliant usage on cotton. The extreme drought in many areas has promoted natural leaf drop, and defoliant are not likely to be used to as large extent as in the past, except where mechanical harvesters are used or where cotton has been irrigated.

Very little use of chemicals to retard or advance ripening, improve "set," and the like, has been reported in the South.

The most recent changes in application techniques have occurred, in airplane spraying. Larger droplets are being used for better coverage and drift control. Some new types of dusts are being formulated and tested in Mississippi on a large scale with conventional airplanes; other tests with helicopters are being solicited.

Season in Midwest Satisfying To Most Manufacturers

MIDWEST PESTICIDE manufacturers seem to be fairly well satisfied with business so far this year. One or two report that business has been slow, but the majority say that it is about as good as could be expected. DDT business is reported "mediocre" by one major company, but parathion and herbicides moved nicely. CIPC did not sell too well. The remainder of the year will be off season for widespread insecticide usage, but on a somewhat longer-term outlook most of the insecticide people are cheerful.

Pricewise, the insecticide business is stable. DDT and BHC seem to be a little higher than last year but will probably drop back somewhat in the months to come. 2,4-D pricing has remained fairly stable for the season, although at a level lower than preceding years. One experiment station reports that with our increased use of insecticides, it would seem that prices have been too high. Here and there, there have been some price declines for certain chemicals, but price cutting by dealers has been largely local. It is possible that some unexpected demands for export materials might cause some increase in price.

Manufacturers are pretty consistent in their belief that new pesticides will continue to be introduced at a rapid rate, although this rate may be somewhat lower than that of preceding years. New products will not find as ready an acceptance as did DDT, parathion, and other "pioneers." Active research programs are being continued by most of the large chemical companies in the field. One factor which may slow up the introduction of new compounds is the difficulty and cost of getting materials on the market, and especially the cost of research necessary to get label approval. Experiment station people doubt that the output of new agricultural chemicals can continue at its present high rate, not that there is not plenty of room for new products in many situations where present pesticides are not completely satisfactory.

Crop acreage controls do not seem to have hurt the pesticide business yet. With smaller acreages the farmer will want to take better care of his crop and use more pesticides. However, if there are further reductions in corn acreage, they would possibly be felt by the pesticide makers. Weather is a more important factor than the controls.

Insect Outbreaks

Insect outbreaks seem to be under control. This year there was quite a serious outbreak of armyworms in

Minnesota, Missouri, Illinois, Indiana, and the Dakotas. These infestations are difficult to anticipate more than a week or 10 days in advance. In the Minnesota outbreak which, T. L. Amond, state entomologist, says is the largest ever to occur in Minnesota, over a million acres were treated in a very short time. Much of the credit for effective control measures is given to the airplane spraying industry which was mobilized within a few hours to rush chemical and technical aids to the infested areas. He estimates the saving to be \$40 million.

Heaviest infestations of European cornborers in the past five years are reported in northern Illinois. Corn earworm infestation is also heavy this year; control for earworms in field corn is not practical. Grasshoppers have been reported serious in several locations throughout the Midwest, especially in the drought areas. There have been outbreaks of cutworms, flea beetles, and chinch bugs. The recent armyworm outbreak in Minnesota affords a good example of the problem caused by the great fluctuations in insect abundance which make it very difficult to anticipate the amount of materials to be used in a given season.

Sales Programs

There is a national trend toward more and more cooperation among dealers, manufacturers, and experiment stations. One of the problems in the past has been availability of materials in event of insect outbreaks. In Indiana this problem seems to have been solved, largely through the educational efforts of Purdue Experiment Station. The program consists of short courses, regional meetings with dealers in insecticides, and other activities.

One insecticide manufacturer complains that there is still no industry-wide concerted effort to promote sales. Herbicides are getting better effort. The NACA has a special herbicide department with a full-time technical man who is devoting full energy to expanding the use of herbicides by farmers.

Damage Claims

One of the serious headaches of the agricultural chemical industry is that of claims due to damage. Insecticides are inherently poisonous because they must kill animal life and, therefore, are likely to cause a hazard for humans. Herbicides are not so specific that they will not

affect some types of other valuable vegetation.

The industry recognizes that reasonable restrictive legislation is necessary and the industry is trying to help state legislatures to provide reasonably protective legislation which is not at the same time prohibitory and overly restrictive. The industry also is doing more and more to educate not only the dealer and jobber but also the actual user in the proper handling of dangerous materials.

In South Dakota, which has no restrictions on pesticide application, there is a law calling for a commercial sprayer operator to have a permit and post bond. This seems to have reduced the number of commercial operators.

Kansas has passed laws licensing airplane pesticide operators and ground-rig operators. An extension specialist from Kansas says that his department gets most complaints about county-owned weed spraying outfits causing 2,4-D drift from spraying roadsides. Injuries have also resulted from diesel fuel carriers from airplane application of toxaphene to sorghums to kill grasshoppers.

Combinations Appeal to Midwestern Growers

Fertilizer-pesticide combinations have a certain appeal to the farmer, but the general feeling at the experiment stations in the Midwest is that they will not involve large segments of the agricultural chemicals industry. Opposition to combinations comes from the fertilizer manufacturers because of mixing problems and from labor unions because of possible health hazards. Most of the combinations are put out by the smaller companies (output less than 50,000 tons per year). The small companies have been quicker to adopt combinations because they need to be more aggressive in their sales efforts than the large producers.

The large pesticide manufacturers on the other hand, are in favor of combinations because it makes their marketing simpler. By selling to fertilizer mixing plants, a pesticide maker can cut his sales force and distribution expense. Combinations will continue to have some attraction as long as the farmer is willing to pay extra to avoid going over his fields more than once. Biggest application of combinations is for control of corn root worms, wire worms, and possibly white grubs.

There has been an increasing interest in combinations of liquid fertilizers and liquid insecticides. Some systemics are being tested with soluble fertilizers. An interesting possibility is that combinations prepared on the farm might become popular. Legislative difficulties would thus be avoided.

There hasn't been too much worry so far about contaminating the soil with



A corn field showing difference between aldrin-treated and untreated corn. Villain is the corn rootworm

insecticides. There is not enough information available to predict the severity of accumulated effect of continued application of chlorinated hydrocarbons to the soil. However, it is agreed that more work is needed on this subject as it could become a serious problem.

Pre-Emergence Herbicides Get Big Play on Corn

Pre-emergence weed control chemicals are getting a mixed reception. Some investigators report poor results while others are more optimistic. 2,4-D and 2,4,5-T are getting the biggest play on corn. Soybeans are also being treated. Results are difficult to evaluate because of the many variables, such as weather at application and time of application. Use has been known to set corn back a little under certain conditions. There has been some severe damage to vegetable crops also.

Nematicides

According to Marshall M. Manns of Michigan Chemical Corp., nematodes have been increasing in economic im-

portance as cultivated fields have become more intensively cropped. With exception of imported infestation such as the golden nematode there has not, until recently, been very much publicity or active interest in controlling these pests. Because nematodes build up rather slowly in the soils, the general farmer, not knowing the cause, has been increasingly contributing an annual crop loss to this pest.

Until a few years ago the control of nematodes in the field was not practical on an economic basis. The comparatively recent introduction of ethylene dibromide and dichloro propene-dichloro propane for field use has provided reasonably low cost chemicals for field control and has provided the farmer a means of control by which he can evaluate his losses. While the nematode problem is more severe in the South it is also becoming more of a problem in northern areas.

Soil Fumigant Future Looks Good

Soil fumigation is attaining another large-volume use in fumigation of plant seed beds. While the greatest increase is in the tobacco areas there is still a

smaller, but definite, increase in vegetable seed bed areas, and in greenhouse and nursery soils. The future of soil fumigants looks very good.

In the Midwest the systemics are not finding many uses for which they are capable of replacing other insecticides. Studies are not far beyond the experimental stage and available systemics are too costly to compete. They may possibly be used on peas and potatoes, for aphid control, and they may also find use on greenhouse plants. Most important developments in systemics insecticides during 1954 has been the improved method of assay and evaluation. It is only a matter of time before systemics will be granted registration throughout most states; the only factors which might delay such registration are insect resistance, accidents, or adverse publicity. Big use will be for vegetables and fruit trees and possibly wheat.

Important trends in the changing popularity of various types of insecticides are becoming evident. Petroleum oils, arsenicals, sulfurs, and botanicals, are definitely declining. Hydrocarbons seem to be rising in popularity although certain of these have declined. The phosphate types of insecticides are looking up, but some of them like parathion and TEPP may decline to be replaced by safer materials such as malathion.

Use of antibiotic sprays is increasing although their high cost makes them susceptible to replacement by new chemicals. Upjohn manufactures Actidione which has been used successfully for cherry leaf spot. Acidione has recently been found to have interesting rodent repellent qualities as well.

Terramycin-streptomycin mixtures are also being used. In Kansas an unspecified antibiotic spray has been found useful against fireblight in Jonathan apples.

Some of the partially unsolved insecticide problems in the Midwest are corn earworm, house flies, stable flies, the microscopic mite carrying wheat mosaic. Angoumois grain moth, especially damaging to popcorn, cannot be economically controlled at present. A good combination insecticide-fungicide for seed treatment is also needed. Generally, there is a need for more compounds with broad spectra of activity and low toxicity to animals. Insecticide accumulation in soil should be thoroughly studied.

In the herbicide field there is a need for compounds having a greater selectivity among both broadleaves and grasses. In the Midwest a means of weeding soybeans would find wide acceptance.

A good general purpose fungicide would be welcomed by everyone. A good fungicide-insecticide combination would find a large market.

This Season Rated Better Than Last in the East

IN THE EAST, where most of the large producers maintain their home offices, there is more of a tendency to see the year in agricultural chemicals from a national point of view. Talking to company officials in Wilmington and New York, one gets the impression that the present season is being rated as better than last year. Although the situation is far from their ideal, most firms were a little happier with the outcome than they were this time last year. Some said business was "as good as last year," several thought it was substantially better, and none of those contacted rate business below that of the 1953 season. This year is being considered the best of the past three—it approaches normal.

The inventory situation, at least, is much improved—carryovers are not nearly so high. This inventory situation is thought to extend right down to distributors and dealers.

On the price situation, consensus seems to be that prices are firm. Some organizations claim to have seen no evidence of domestic price cutting and, on the opposite side of the fence, other firms say that there have been only minor improvements in this problem. Volume, some say, is not going to be high.

The export picture looks good, with big government bids for insecticides for foreign use now being filled. India and Pakistan are the big consumers; Formosa, Iran, and Indochina are also taking substantial shipments. Prospects are that more insecticides will be exported this year than ever before.

Acreage restrictions generally have affected sales of pesticides but little. Most firms report, as expected, that acreage restrictions have helped, if anything, because growers are inclined to farm more intensively in years of lower acreage.

Weather, also as expected, has been a bigger factor than acreage restrictions. BHC and DDT consumption for cotton has been disappointing, because of a cold spring, which necessitated replanting, and the hot, dry summer, which reduced insect infestations. However, the percentage of DDT and BHC in dusts for cotton is rising, from a level of 5 to 10%, and that is encouraging. DDT is also finding increased usage for controlling the corn borer, a large potential market.

Those who find business better this year say that insecticides with lower toxicities and broader spectra are stimulating increased sales.

One producer remarked that specialty products, such as some of the pre-emer-

gence herbicides, have increased their proportionate share of the market this year, because these products have an economic value to the user which justifies considerable expense and effort in development, research, and merchandising. Such products, of course, require considerable dealer education and assistance. This increases the job of communication at the local level—a job that television may be able to take on. (Along this line, one company's spokesman remarked that county agents, state and federal specialists, and even the experiment stations themselves are acquiring a good deal of experience in the use of television to reach farmers.)

Quiet Insectwise

In the eastern part of the U. S., another drought area, this has been a relatively quiet season insectwise, according to one extension entomologist in that region.

Maine potato growers have been fighting a range of pests—Colorado potato beetles, aphids, leaf hoppers, and flea beetles—and DDT use there is on the rise.

In New Jersey, several insects are more in evidence this year than ever before, but there have been no uncontrollable problems. The red spider mite is abundant on the vegetable crop, and is being fought with phosphate insecticides. Flea beetles are more numerous on vegetables than ever before. They are the vector of bacterial wilt on sweet corn, one of Jersey's most valuable crops. Flea beetles are being controlled very successfully with DDT. The codling moth is also responding well to DDT treatment, now being tried for the first time in this area. There has been no evidence of resistance as yet, in spite of reports from the Midwest.

Because of the high intensity of agriculture in the Jersey area, nematode infestations are becoming more severe, and are affecting a large portion of the more than \$50 million vegetable crop. More nematodes than ever are in evidence, especially the root knot nematode. Other free-living forms of nematodes (not confined to a gall) are being found to be responsible for conditions formerly ascribed to poor soil. Crop rotation and soil fumigation are the two weapons in the antinematode arsenal. Crop rotation is not always effective, and often requires the farmer to abandon a high-value crop in favor of one of lesser value.

Fumigants now in use are ethylene dibromide and dichloropropene-dichloro-



Asparagus bed on left seven weeks after applying Karmex W, a CMU herbicide. On the right is an untreated bed. These were results of tests on chemical weed control of various truck garden crops at the University of Delaware agricultural experiment station by E. M. Rahn

propane (D-D). They are both liquids. Stauffer and Shell are both experimenting with solid soil fumigants, which could be applied in fertilizer spreaders. Work looks encouraging.

Poison Baits

A major new development in the insecticide field this year has been the fast-growing use of poison baits. These are being employed mainly in dairy barns against flies that have developed a high order of resistance to the conventional chlorinated insecticides, such as DDT and BHC. In the new baits, use is being made of such phosphorus compounds as American Cyanamid's Malathion, Geigy's Diazinon, and Chemagro's Dipterex.

When used as poison baits, these insecticides are mixed to about 1 to 2% by weight with granular sugar, which is usually sprinkled on the floor. They can also be sprayed on barn walls. The dairy man now has an effective means of fly control against resistant insects and can achieve such control with compounds that are relatively nontoxic to mammals.

Geigy reports that the use of Diazinon in poison baits has gone over much better than the company had originally anticipated. The compound also looks quite good for use against codling moth on apples and other pests on apples. Promising results have also been re-

ported on the use of Diazinon against cherry fruit fly. The company is awaiting the compilation of this year's field trial results, which probably won't be ready until October.

Reports from Carbide's research group at Boyce-Thompson Institute indicate the considerable promise of the new pyrethrin-type insecticide, Cyclethrin. This compound is the cyclopentenyl homolog of Cinerin I, as distinguished from the related compound, allethrin, which is the allyl homolog of Cinerin I.

Cyclethrin, still in the experimental stage, is being carefully investigated by researchers of USDA, the armed forces, and industry. Like allethrin and natural pyrethrum, the new product is nontoxic to man and animals, although it is lethal to houseflies. Because of their safety advantages, these various pyrethrin-type compounds are widely used in aerosol sprays for fly control in the home.

A big disadvantage of allethrin is that its insect-killing power cannot be greatly increased by such conventional pyrethrum synergists as sulfoxide and piperonyl butoxide. On the other hand, Cyclethrin can be markedly synergized by these compounds. This factor is of considerable importance to the economic future of these costly pyrethrin-type insecticides. Although the commercial selling price of Cyclethrin has yet to be determined, it is likely to be in the vicinity of the \$32-a-pound figure for allethrin.

This year, Carbide completed its \$6 million plant at Institute, W. Va., which is capable of producing about a half million pounds of allethrin a year. If Cyclethrin lives up to Carbide's expectations, the company might very well convert a portion of these facilities to the manufacture of the newer compound.

Cyanamid is investigating an aminotriazole growth retardant, which has promise as a defoliant or herbicide. Geigy is experimenting with chlorobenzolate, a new miticide.

This year, there have been scattered reports of the resistance of codling moth to DDT. In some cases, already it has been proved that the ineffectiveness of the DDT was caused by the improper application of the insecticide to the farm crop.

Antibiotics on Ornamentals

In the field of antibiotics, the New Jersey Agricultural Experiment Station reports that bacterial wilt of chrysanthemums can be controlled by dipping the chrysanthemum cuttings in a solution of 50 parts per million of streptomycin. Since chrysanthemum cuttings are supplied by a relatively few growers in the U. S., their adoption of antibiotic treatment could be a significant factor in the eradication of chrysanthemum bacterial wilt. This method of antibiotic treatment also shows promise in the control of bacterial wilt on carnations.

● Views from Abroad

AG AND FOOD presents reports from specialists in other parts of the world

Biological Control Used For Cotton Insects in Peru

Oscar Biengolea, Agricultural Experiment Station, Molina, Peru

ONE IMPORTANT CONSIDERATION regarding chemical control of cotton insects in Peru is that organic insecticides will destroy biological enemies of *H. virescens* causing an outbreak of this insect which will need as many as 10 DDT treatments to be checked, without having any certainty about the quality of the yield. This can be avoided if we consider that leaf-worm can be satisfactorily controlled with arsenicals, and, when used in mixture with nicotine sulfate, outbreaks of Aphis are also controlled. Square weevil outbreaks generally cease by change of climatic conditions as full summer arrives. The red-stainer can be avoided by selecting proper dates for planting.

In many experimental and industrial field comparisons the yield is better when

use of insecticides is restricted to inorganic or vegetable ones, and expenses of organic insecticides, when used, are four times as much as that of the former. This is because organic insecticide treatments cannot be stopped once started.

Beside these insects others who deserve mention are Platynota spec. and *Pseudoplusia rogationis*. The first is well known in our country as a cotton insect but was restricted to particular areas characterized by a high soil humidity; however, in the last season (1953/1954) it increased greatly in the central coast despite normal conditions of the fields. The second was not formerly known as a cotton insect; so it is a new pest for this crop. Both insects are suspected to have increased because of numerous treat-

ments with organic insecticides for they were always present in fields treated many times with those chemicals.

Sugar cane insects. The problem of the virus transmitting aphid *Aphis maidis* has been solved through use of resistant varieties. The sugar cane borer, *Diatraea saccharalis* is well checked by the egg parasite, *Trichogramma minutum* and the larvae parasites *Paratheresia claripalpis*, Tachinidae, Ipobracon rimac, Braconidae. The tachinid fly *Lixophaga diatraeae* has been recently introduced; it has adapted to local conditions but it is most probable that because of biological saturation and competition by the native parasite it will not afford any noticeable improvement in the biological control of this pest.

Fruitculture. Most important are the scale-insects and the fruit-flies *Anastrepha*. Some scales are controlled biologically as *Icerya purchasi* by Novius (*Rodolia*) *cardinalis* and *Lecanium oleae* by *Aphycus lounsbury* and other introduced parasites. Others can be controlled with miscible oils. *Anastrepha spp.* are controlled with 0.5% DDT sprays.

Some Entomological Problems of Peru^a

Insect	Distribution	Efficient Insecticide Treatment	More Important Biological Enemies	
			Predators	Parasites
<i>Heliothis virescens</i> bollworm	Central coast	DDT 5 and 10%	<i>Rhinacloa carmelitana</i> Carvalho (Miridae) <i>Paratriphleps laeviusculus</i> (Anthocoridae)	<i>Trichogramma minutum</i> Tachinid flies (2 species) <i>Ophion sp.</i> Ichneumonidae
<i>Anthonomus vestitus</i> (square-weevil)	All the coast	Aldrin or Dieldrin 2.5%	Spiders (10 species) Carabidae, Vespidae, etc. None	<i>Triaspis vestitica</i> Braconidae <i>Microbracon vestitica</i> Braconidae
<i>Dysdercus peruvianus</i> (red-stainer bug)	Northern and central valleys	BHC 3%	None	<i>Acaulona peruviana</i> <i>Paraphoranta peruviana</i> Tachinidae
<i>Mescinia peruella</i> Schauss (boll-borer)	All the coast (lives only in Peru)		Same as for <i>Heliothis</i>	<i>Idechtya peruviana</i> Ichneumonidae
<i>Aphis gossypii</i> (cotton-aphid)	Cosmopolite	Nicotine sulfate 0.2% liquid—3% powder BHC-Phosphoric compounds	Coccinelids (6 species) Chrysopids (2 species) Syrphidae (<i>Bacha spp.</i>)	<i>Aphidius phorodontis</i> Braconidae
<i>Anomis texana</i> (lesser leaf-worm)	All the coast	Lead or calcium arsenate Toxaphene. Endrin phosphoric compounds	Same as for <i>Heliothis</i>	<i>Eucelatoria australis</i> <i>Rogas sp.</i> Braconidae <i>Meteorus sp.</i> Braconidae
<i>Alabama argillacea</i> (major leaf-worm)	Northern coast			
<i>Bucculatrix thurberiella</i> <i>Bucculatrix gossypiella</i>		Phosphoric compounds	Same Mirid and Anthocorid bugs as for <i>heliothis</i>	

^a Jefe de la Brigada N° 3 de Defensa Agrícola.

32 Insecticide Plants in Mexico Supplying Rapidly Developing Demand

Alonso Blackaller Valdes, Banco Nacional de Credito Agricola y Ganader, S. A., Mexico City, Mexico

THE MEXICAN FRUIT FLY (*Anastrepha*), is responsible for the establishment of quarantines in the U. S., against the Mexican citrus fruit they attack. Nowadays, those fruits must be sterilized with vapor-heat, before they are permitted to enter the U. S.

Citrus black fly (*Aleurcanthus woglumi*), was first reported in our country during 1938 and in 1949 a strong campaign was started against it. Actually this pest is being widely reported, but its damages are less in the commercial plantings, on account of the intense biological control work done during the last years.

Cotton boll weevil (*Anthonomus grandis*). This cotton pest was responsible for so much damage that the farmers of some areas no longer grow cotton. Where cotton planting is permitted, the boll weevil was controlled almost exclusively with calcium arsenate for many years. Now we use dust or sprays with BHC, Toxaphene, Aldrin, Dieldrin, and Methyl-Parathion.

Pink bollworm (*Pectinophora gossypiella*), was formerly a problem of the northern cotton growing areas; now we occasionally have trouble with it, and control heavy infestations with DDT dusts at 10 or 15%, or its equivalent in sprays.

Banana fungus (*Cercospora musae*) disease was responsible in 1938 for banana production being reduced to the minimum in the State of Tabasco, but fungicide treatments with copper compounds, mainly, have rendered an acceptable control these last years.

"Tizon temprano de la Papa y el Tomate" (*phytophthora infestans*), another fungus disease that spreads rapidly during the years when there is a damp growing season and rapidly ruins the plants, is controlled with copper fungicides, dithiocarbamates, and others.

Locusts (*Schistocerca spp.*) are a major problem in Mexico. Crops may be invaded by this pest, sedentary or migratory, especially in the southeastern part. Sedentary locust is fought principally by the Federal Government in connection with State authorities and the farmers. Migratory locusts, which some years come to the same area from Central America, are being combated efficiently in cooperation with other Central American countries. Recently, during the second week of August, the Second Extraordinary Meeting of Agricultural Ministers of Mexico and Central America was held here in Mexico, with the objective of studying the locust problem and cooperative controls.

Bean beetle (*Epilachna varivestis*). In every bean growing area, this insect causes heavy damages if control measures are not used, but fortunately the farmers have learned to apply insecticides effectively to reduce its damage, such as BHC, Metoxichlor, Ethyl Parathion and Methyl Parathion.

Sugar cane borer (*Diatraea spp.*). Great areas are planted with sugar cane, and one of the main problems in addition to mosaic is the cane borers. A control of these borers is the biological control with parasites.

The field mouse (*Sigmodon spp.*) causes heavy losses in the corn fields of some areas. It has been controlled efficiently with strychnine poisoned baits, and lately with warfarin.

During the year of 1946 near Zitácuaro, Michoacan, in the State of Puebla was reported the existence of "Carbón de Bandera" (*Urocystis tritici*) in some wheat fields planted with wheat brought from Australia. It has practically been eliminated. Although this fungus disease is still being found in limited areas, it is not a serious problem and till now has not been reported elsewhere.

Pesticides

The development of the use of pesticides has grown rapidly since the

years following the second World War, with the widespread use of DDT, BHC, and other synthetic organics, most of which are imported. Some of these pesticides are manufactured in Mexico on a small scale.

So that the reader can have an idea of the growth of the use of pesticides in Mexico; we have 32 insecticide plants with distribution in the Federal District, and eight states of Mexico. Two of these plants are equipped with machinery for impregnation of concentrates starting with technical products. We also have four sulfur mills for grinding and a few companies are grinding and conditioning inert dust for the formulation of insecticides. It can also be mentioned that several formulators have the necessary equipment to produce liquid insecticides, which are gaining customers in our country. This year many dusting-planes were converted for aerial spraying in the cotton growing areas, for the application of liquid insecticides. During the past year there was a great problem with the spider mites in some cotton areas, due to the drought of the last few years, the heavy infestation was controlled by spraying Systox from planes.

The growth of the use of pesticides in Mexico is increasing with the farmers' education, through the campaigns conducted by the "Secretaría de Agricultura y Ganadería" and every day the results of this educational campaign are seen in the growth of the pesticide volume used and the greater and better crops obtained.

Coccids Giving Trouble to Colombian Coffee Growers

Nelson Delgado, School of Agriculture, National University, Medellin, Colombia

AT LEAST 35 INSECTS have been recorded as pests of coffee, the principal crop of Colombia. Fortunately these insects are of relatively little economic importance. However, there are some problems caused by Coccids attacking the roots of the coffee plant. These insects also attack the banana, sugar cane, and maize, but coffee is the preferred host plant. Experiments are being conducted by the Coffee Agricultural Experiment Station at Chinchiná which seem to indicate that they can be controlled with aldrin, dieldrin, and chlordan.

Insects of major importance on corn include various species of cutworms which damage the seedlings and young stalks. The corn borer and corn ear worm also cause considerable injury. Dusting with toxaphene at the rate of 2 to 4 pounds per acre gives good control of these pests.

Beans are severely attacked by the leaf

hopper, *Empoasca fabae*. DDT at the rate of 1 pound per acre has been effective for control of commercial crops, however.

The boll weevil first reported in 1951 has proved very destructive to the Colombian cotton crop. In addition to this pest, which is now restricted to the Sinu Valley and the Atlantic coast, the cotton crop is also attacked by the cotton leaf worm, the pink bollworm, aphids, and red mites. Airplane dusting of toxaphene, chlordan, aldrin, and dieldrin has been effectively used for control of these cotton insects.

Fruit trees are heavily infested by coccid insects as *Chionaspis citri*, *Aspiditus*, and *Pseudococcus*.

The oil emulsions recommended for control of orchard insects have proved difficult to use because of our peculiar climatic conditions and growing practices.



Modern equipment and modern insecticides go together in protecting crops in Colombia

Scientific and Practical Agricultural Workers in Close Liaison in Denmark

Hans Wichmand, Director, Government Pest Infestation Laboratory, Springforbi, Denmark

IN DENMARK the investigation of plant diseases and pests is centered in two research laboratories: The Government Pest Infestation Laboratory in Springforbi, for stored products and household pests; The State Experimental Station for Plant Diseases and Pests in Lyngby, for growing crops. Research on some special lines is conducted in departments of the Royal Agricultural College, Copenhagen.

There is very close cooperation between science and practical agricultural workers. About 300 scientific advisers are active in local farmers' organizations. These advisers demonstrate pest control techniques and do other extension work. Laboratory staff members visit these scientific advisers regularly and provide demonstration material for their exhibitions and lectures. Press and radio are used a good deal. Special problems in connection with cultural practice have been studied by joint committees of leading advisers, soil and disease specialists.

Standing problems in cereals are "take-all" and "eyespot," essentially rotation questions. Oat nematodes are also a rotation problem, although resistant barley varieties promise some release.

In beet fields black aphids are a serious pest on their own account while peach aphid is an important agent for virus yellows; seed-carriers as a source of yellows have been sprayed with phosphorus esters with great success. Peach aphid is a problem also as an agent of leaf-roll and other viruses in the seed potato production which preferably is placed in regions of minimal aphid infestation.

Cabbage root worms may be devastating in Swede fields; the pest is studied

by means of hatching boxes and numerous yellow trays. Aldrin has showed some promise.

Deficiencies of copper, boron, and manganese are relieved extensively by mixing the micronutrients in fertilizers or by spraying. Control of weeds and

Most Insects Under Control with Modern Insecticides in The Netherlands

C. J. Breijer, Director, Plant Protection Service, Wageningen, The Netherlands

THERE HAS BEEN a great increase in the use of insecticides in The Netherlands since the war. This has solved many agricultural problems. The Colorado potato beetle, for example, is no longer a problem as a result of the widespread use of DDT emulsions.

However, problems have arisen with the advent of the new organic insecticides which are dangerous to men and domestic animals. There is a great need for insecticides which are less toxic to man and domestic animals, and also do not kill natural predators of insect pests. Research to develop good repellants should be pushed. The use of baits to lure insects might prove valuable in other instances. Repellants could perhaps be developed which would keep insects off crop plants.

Apart from the problems outlined, present knowledge and techniques permit control of most insect pests and fungus diseases. This is not the case, however, with bacterial diseases and viruses. Some bacterial diseases which are not yet under control are *Pseudomonas phaseolicola* in beans, *Pseudomonas mors-*

potato late-blight is in the hands of private or cooperative contractors.

Black stem rust was successfully controlled by the prohibition of barberries by an act of 1903—but surprise attacks have twice taught us that subdued enemies should not be forgotten. After about 30 years of total absence yellow glume rust has appeared in wheat varieties imported recently.

Colorado beetle, which is common in the countries south of Denmark, has in 1949 and some of the following years tried some invasions which have all been exterminated at once by means of intensive spraying and soil fumigation.

Stored grain pests are a problem in the farmers' grain stores, 40,000–80,000 tons yearly are mixed with DDT powder for control of *Calandra granaria*. *Aleowobius farinae* causes trouble during moist periods.

Biological control affords the best of all methods of control of bollworm. Economically it is not possible to perform weekly applications of DDT to a plant for ten months to maturity as the case of Tangüis varieties sown in the central coast. Regarding the other insects it is necessary in some cases to resort to chemical control. Exceptions are early attacks by *Aphis gossypii* which are well controlled by its biological enemies and *Bucculatrix* which are also well controlled by cultural practices and biological enemies.

pronorum in plums, and *Agrobacterium tumefaciens* in several crops. Antibiotics might be the answer to these and other bacterial diseases. Virus diseases are widespread, occurring on almost every type of crop plant and rouging is the only means of control.

Much work is still to be done on soil borne diseases and pests. Eelworms are a widespread problem here. They are not only found on field crops but are also a problem in orchards and pastures. Nematocides are of growing importance and in use of these chemicals is expected to increase as prices are reduced.

Control of mites on bulbs and tubers after harvest is still an unsolved problem. New experiments with DNOC as a herbicide in grains indicate a stimulating effect on the crop even when compared with weed free controls. If these results can be confirmed a large increase in the use of DNOC can be expected.

Control of pests in The Netherlands is enforced by the Lam law. Trade and handling of pesticides are also under government supervision.