Ag and Food Interprets . . .

- **Hydrocarbons and phosphates fight it out in Cotton Belt**
- **Twin surfactant approach eases formulators' headaches**
- **Fertilizer dealers get attention as farmer studies multiply**
- **Entomologists work hard at raising as well as killing insects**
- **Animal tranquilizers may produce "the contented cow"**

Cotton Insecticides

Competition intensifies as organophosphates, chlorinated hydrocarbons battle for market supremacy

DURING THE PAST few years, entomologists have been busy erasing and adding names to their lists of insecticides recommended for cotton pest control. Most of the changes have resulted from evidence that some insects have developed resistance to previously effective insecticides. But this year, barring new outbreaks of resistant insects, cotton pest control recommendations will be about the same as last year.

Discussing resistance almost always leads to an argument. Some label it as a very serious problem. Others say that talk about resistance is more widespread than resistance itself, and that the problem has been greatly overemphasized. Be that as it may, as a result of changes in cotton insect problems, and in various states' recommendations for their solution, insecticides have become noticeably more competitive within the past year. If anything, they should become even more competitive this year.

The most serious resistance problems concern the boll weevil. In 1955, boll weevil resistance to some chlorinated hydrocarbons was observed or suspected in parts of Louisiana, Arkansas, and Mississippi. By 1957, afflicted areas included over half the cotton acreage in Louisiana plus parts of Arkansas, Mississippi, North Carolina, South Carolina, and Texas.

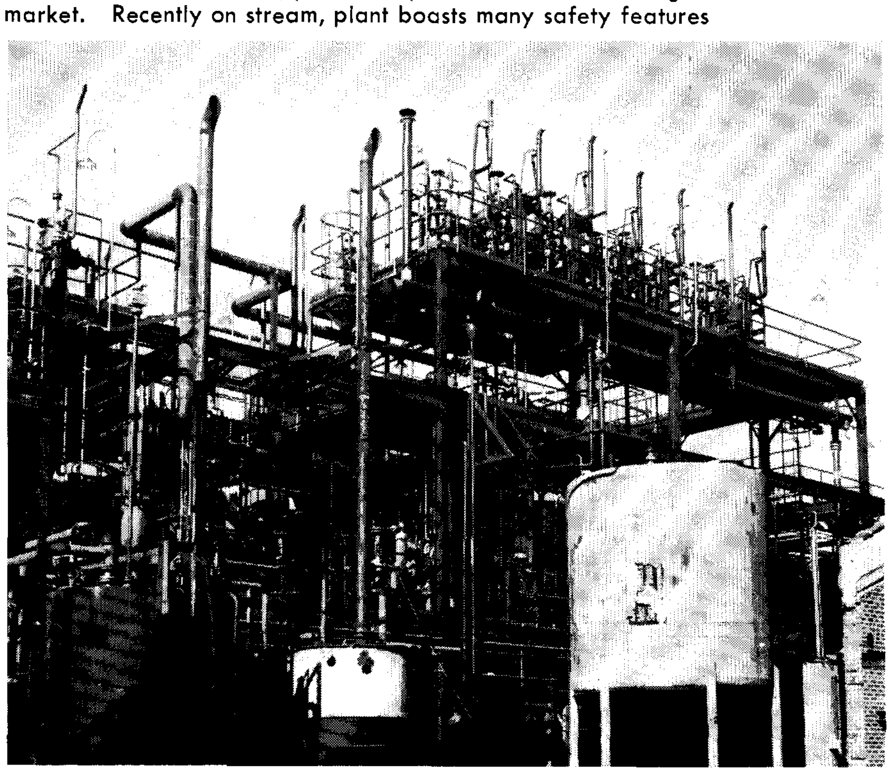
In addition to the boll weevil problem, there are indications that:

- The cabbage looper is resistant in some measure to all chlorinated hydrocarbons. Even the phosphates have not been fully effective against the looper.
- Aphids have become resistant to benzene hexachloride. Entomologists now generally prefer phosphate compounds to combat this pest.
- The general use of chlorinated hydrocarbons has actually stimulated increases in spider mite populations in many areas of the Cotton Belt. Since sulfur no longer prevents damaging infestations of the two-spotted mite, entomologists have again turned to phosphates.

As a result of these developments, organic phosphate compounds have fast become large-volume movers. Monsanto introduced methyl parathion in the United States. Then Shell Chemical started making methyl parathion at its Denver, Colo., plant, while Chemagro pushed its organophosphate, Guthion.

More recently, producers of phosphate compounds have stepped up their promotion of these materials. Monsanto has just put on stream at Anniston, Ala., the "world's largest" plant for the production of parathion and methyl parathion (AG AND FOOD, February, page 79). Victor Chemical, in the methyl parathion market for about a year, has started making the product at its new plant in Mt. Pleasant, Tenn. Velsicol also recently announced methyl parathion production

Monsanto's Anniston, Ala., parathion plant is close to the large cotton insecticide market. Recently on stream, plant boasts many safety features



at Memphis, Tenn., and added facilities for parathion as well. Other phosphates which have had a fair share of the cotton insecticide business are malathion, Trithion (Stauffer), and demeton.

Organophosphate makers obviously are riding the crest of a wave. Their markets increased considerably last year at the expense of producers of chlorinated hydrocarbons, and they see more widespread use of their products in 1958.

Chlorinated Hydrocarbons Fight Back

Producers of chlorinated hydrocarbons have not taken all of this lying down, however. They point out that entomologists still urge growers to use hydrocarbons in areas where resistance is not a problem. They add that in those areas chlorinated hydrocarbons are just as effective as phosphates for boll weevil control, yet cheaper and less toxic to man. In the wake of much talk about new products, the fact that benzene hexachloride is still the work horse in many areas has often been overlooked.

Even in areas where boll weevils are supposedly resistant to hydrocarbons, some experts think that the hydrocarbons can be effective if proper methods and timing of applications are observed. Perhaps the most dramatic proof of this thesis was supplied by Hercules Powder. Last summer, Hercules launched, in Louisiana, a major field study of its principal cotton insecticide, toxaphene. Results of the program satisfied Hercules, and many others, that good boll weevil control—even in so-called weevil-resistant areas—is possible with a toxaphene-DDT mixture. Hercules' program included early applications to control over-wintering weevils and other early season insects, followed by routine late season spraying starting at or before the time infestation from the first generation of emerging weevils reached 10%.

Other producers of chlorinated hydrocarbons viewed the Hercules tests with considerable interest. They feel that with proper application, other hydrocarbons (endrin, dieldrin, BHC, heptachlor) mixed with DDT could effectively combat resistant weevils as well as toxaphene-DDT did in the 1957 tests. In addition, DDT is still the most used insecticide for boll worm control. Aside from the boll weevil, the boll worm perhaps causes more cotton damage than any other pest. This leads to still another possibility—phosphate-hydrocarbon mixtures.

Most chlorinated hydrocarbon producers admit that they have lost ground to the organophosphates. But a few have attributed the losses to adverse publicity rather than to any lack of efficiency in their products. To counteract the unfavorable publicity, they are considering launching an intensive joint publicity campaign of their own. The object—to show how the hydrocarbons can still be used to good advantage.

Thus the battle lines are drawn for 1958. But looking a few years beyond, several new products appear promising. One is Cyanamid's Thimet. Thimet, used as a seed treatment, has proved effective against thrips, mites, and aphids for a period of 4 to 7 weeks after planting. Although it is not a cure-all, Thimet is a good beginning on systemic insecticides.

Another promising material is Carbide's Sevin, which brings a new mode of action into the cotton insecticides field. It may well come into its own if weevils ever develop resistance to phosphates as well as chlorinated hydrocarbons. And some entomologists think this could happen.

Pesticide Emulsifiers

Sales vary with the weather; shift to twin surfactant approach eases formulating headaches

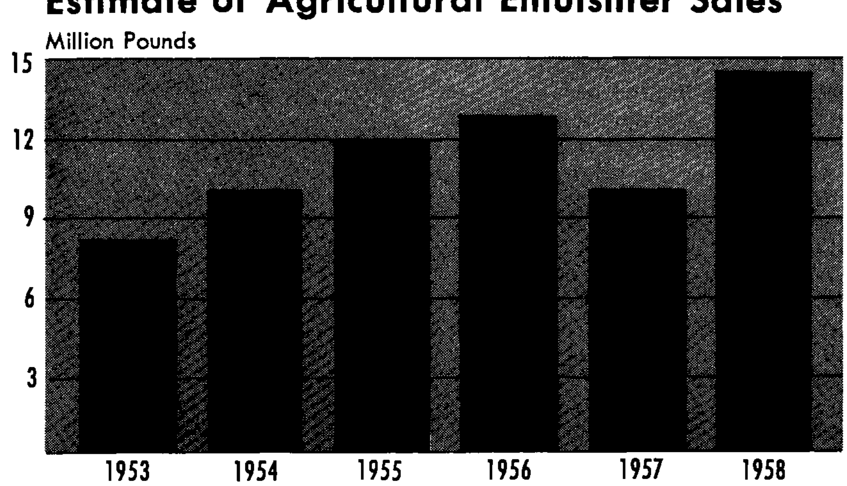
SALES OF EMULSIFIERS for agricultural chemicals were off somewhat in 1957. But manufacturers remain calm. This is typical in a business governed by such unpredictable factors as the weather and insect infestations.

A wet season in the South and Southwest sliced into expected sales to the cotton market, while dry conditions in New England dropped emulsifier sales there considerably. And cold weather on the West Coast, especially in the Imperial Valley of California, caused late crops and lost sales. Even the insects were uncooperative, as the corn borer took pity on midwestern farmers.

Market researchers are hard-pressed to learn the total ag-emulsifier market. A rough estimate is 10 to 12 million pounds per year, although some manufacturers are looking for sales to total as much as 14 to 15 million pounds in 1958. These figures do not include the output of captive producers such as Dow, Reasor-Hill, Thompson-Hayward, Chapman Chemical (Memphis), and others. These companies put out finished insecticides and fungicides, already containing the emulsifier, which they make. Figures on this tremendous outlet are not readily available. Also, most emulsifiers as sold contain something less than 100% active material.

The South—more specifically, the area within a 175-mile radius of Memphis, Tenn.—appears as the greatest single growth area. Four new formulating plants went up in this section in 1957, and another is slated for 1958. General Chemical Division (Cleveland, Miss.), Helena Chemical (Helena, Ark.), Hayes-Sammons Chemical (Indianola, Miss.), and Champion Chemical (Canton, Miss.) all opened shop in 1957. And Niagara Chemical Division has a unit

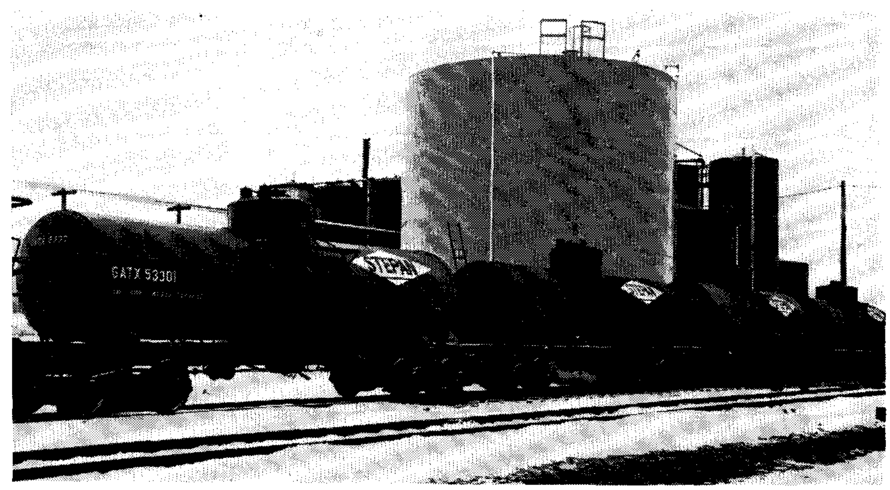
Estimate of Agricultural Emulsifier Sales



scheduled for 1958 completion at Greenville, Miss.

The major factor accounting for increased use of emulsifiable concentrates over dusts was the advent of the low-gallonage sprayer. Farmers found that this equipment was within their financial reach, and that with it they could apply pesticides in amounts comparable to those applied from the air (less than 10 gallons of total spray per acre). The low-gallonage sprayer is attached to a tractor and the pump is driven from the tractor power take-off—total financial outlay in the neighborhood of $300. Its efficiency comes from high precision nozzles.

A follow-up to this is the "Hi Boy" sprayer, which is also low-gallonage but is selfpropelled. It gets its name from its design, which allows it to straddle crop rows. Behind all this development, of course, has been the rapid market introduction of a succession of organic toxicants that could be made into emulsifiable concentrates.



Twelve tankcars of pesticide emulsifier, believed to be largest single shipment ever made, recently left Stepan Chemical Co.'s Chicago plants. They were bound for Stauffer's Tampa, Fla., plant for formulation into 20 million pounds of toxaphene spray for insect control on Egyptian cotton

Peak in '51

Pesticide emulsifier sales reached their previous peak in 1951. The reason: heavy insect infestation plus good weather. As a result, formulators overstocked. Then 1952 hit them hard when the cotton insecticide market failed because insects did not show up. That year found many local manufacturers bankrupt. The larger, nationwide companies managed to counterbalance their losses in some areas through sales in other sections. From 1953 through 1956, total sales climbed steadily but not spectacularly each year, although never hitting 1951's peak.

Through about 1951, non-ionics had been used almost exclusively. They did a fair job, too, especially in hard water areas. But in many cases it took a great deal of non-ionic—sometimes up to 10 or 12%—to do the job. Then competition made formulating costs a major factor. So surfactant producers brought in anionics (sulfonates) to cut down the required emulsifier content to 5% or less through blending with non-ionics.

Anionics alone are used very little in toxicant systems, except in preparation of dormant oil sprays. But when blended with non-ionics they generally make better formulations than those obtained using non-ionics alone. They seem to be most effective in giving emulsions of fine particle size and in speeding up emulsion formation.

So successful was the blending approach that blended emulsifiers flooded the market, with manufacturers often emphasizing a particular product for only one or two special uses. Formulators' stockrooms were soon piled high with different emulsifiers—each effective for a few specific toxicant-solvent combinations. And new toxicants and solvents appeared frequently, adding to inventory and emulsifier evaluation problems. Formulators got suggestions from local agricultural extension services, emulsifier producers, and solvent producers, concerning what emulsifier-toxicant-solvent combination to use for what pest. These suggestions all had to be tried, for pests often strike with little or no warning, and formulators must have everything on hand to cope with any situation.

Today, emulsifier manufacturers are easing this pressure. Their answer: just two products that can handle most solvent-toxicant combinations. Each is a blend of anionic and non-ionic, one having a high percentage of anionic, the other of non-ionic. Blending these two products gives excellent across-the-board performance in water of all degrees of hardness, and with most chlorinated hydrocarbon toxicant-solvent combinations.

Advantages for Formulators

Thus, formulators can now stock just two emulsifiers, and these two in large quantities. And they can take advantage of large quantity price breaks and shipping costs, since they can buy all their emulsifier needs from just one manufacturer. Atlas Powder, Rohm & Haas, Emulsol Chemical, and Ninol Laboratories, all major producers in this field, are pushing the twin products approach. One notable exception to this approach is in organophosphate toxicants. For these, most companies still have specific emulsifier recommendations.

Testing Never Ends

But simplification of some of the formulators' problems has by no means eliminated all the costly headaches of the basic producers. Much time and money still goes into developing satisfactory new products, or improving old ones. Chemists test and retest these products in water of all hardnesses, and with all solvent-toxicant combinations and concentrations. Bloom or spontaneity tests are run on the concentrates (toxicant, solvent, emulsifier combined) as a quick measure of emulsion stability. Shelf aging and phytotoxicity tests also are time-consuming and expensive, as are tests for possible interactions among emulsifier, toxicant, and/or solvent upon standing or heating. All this and at a low price, too.

And there's more work in store for emulsifier producers. Purchasers are acquiring more and more knowledge of emulsifiable concentrates, emulsifiers, and solvents. As a result they are more selective regarding the quality of emulsions, and the amount of emulsifier required. This means that manufacturers will need to produce very stable emulsions of proved superiority and at lower emulsifier concentration in order to compete in the market.

In addition, new toxicants keep pouring out into the market, adding to the emulsifier manufacturer's struggle to keep emulsions simple and effective. Thus, more research time and technical service—and more pressure on profits.

Farmer and Dealer Attitudes

Fertilizer dealers come under scrutiny as studies of farmer attitudes multiply

MUCH HAS BEEN LEARNED in the past decade about farmers' feelings toward fertilizer use. More is being learned daily as new studies progress and as statisticians analyze data from already completed surveys.

Now coming in for closer observation is a group whose tremendous potential for influence among farmers remains largely undeveloped—the fertilizer dealers. Iowa State's Joseph M. Bohlen and George M. Beal, widely known for their extensive studies of factors that influence farmers, now have under way an analysis of dealer attitudes toward fertilizer. At the 10th annual joint meeting of college agronomists with the fertilizer industry, sponsored by the Midwest office of the National Plant Food Institute (formerly Middle West Soil Improvement Committee), Bohlen and Beal offered some clues as to why the dealer's influence is not much stronger.

Perhaps the greatest single limitation is the small fraction of the dealer's total business that fertilizers represent. The 12 dealers covered in Bohlen and Beal's "preliminary pilot study" derive, on the average, only 6.6% of their gross revenue from fertilizers. The managers interviewed spent an average of 5.6% of their work time in management of fertilizer business, and only 0.6% of it actually working in the fertilizer department. Their employees spent an average of 0.5% of their time in administration of the fertilizer department, and 1.3% of their labor time in its operation.

If the state-wide study now in progress in Iowa bears out the preliminary findings, which obviously are based on too small a sample to permit trustworthy generalization, it may well show that the dealer's apparent lack of enthusiasm for fertilizer promotion is tied closely to fertilizers' relatively minor contribution to his business. About 43% of the total business volume of the 12 dealers covered was in feeds, another 30% in grain handling, storage, and sales.

The dealer's limited financial interest may thus explain why he does not give fertilizers more of his time, and seek to extend among his farmer-customers his influence in fertilizer matters. While 11 of the 12 dealers surveyed thought that dealers should try to influence farmers' decisions about fertilizer use, 75% of them regarded their own fertilizer operations as merely another customer service, important (to 50% of the dealers) for its capacity to bring in business to other departments.

The pilot study also indicated that the average dealer feels he is offering more customer services—such as soil sampling, credit, custom application, and fertilizer program planning—than he should be offering. Nearly half, however, said they would offer more fertilizer services if they could receive help from outside sources such as the wholesaler or jobber.

When asked what sources of information they considered most important to their fertilizer business—and most reliable—dealers ranked government agencies first, commercial sources a close second, and mass media and farmers a poor third and fourth.

The high respect for government agencies among dealers is akin to that among farmers, who were found in earlier Bohlen-Beal studies to depend heavily on county agents, agricultural colleges, and extension services for information and advice in the adoption of new practices, including fertilizer use.

Other recent surveys have pointed in the same direction. The most extensive study of farmers' attitudes toward fertilizer, that recently completed for the NPFI by National Analysts, Inc., showed that Cornbelt farmers rate county agents and agricultural college publications very high as sources of practical fertilizer information. This is true especially when the desired information is of a technical nature, such as what analysis and amount the farmer should use for specific soil-crop combinations, or when and how to apply commercial fertilizer.

When Cornbelt farmers are ready to fill their fertilizer needs, however, they are more likely to go to dealers to discuss analyses, amounts, and prices. Their choice of contacts thus appears to be somewhat different when they are buying fertilizers, as opposed to obtaining information about new or improved fertilizer practices.

A similar conclusion—that the dealer is the main source of information about form, analysis, and amount of fertilizer to be used—was reached in a four-state fertilizer buying study last spring. In the survey of 400 farmers in Michigan, Illinois, Indiana, and Ohio, conducted by National Analysts for Allied's Nitrogen Division, fertilizer dealers or salesmen were named most often as the source to whom farmers first turned if they wanted to know more about a particular type, analysis, or brand of fertilizer.

This finding may be taken as another indication of the dealer's high potential for influence among farmers. The alert and informed dealer who can satisfactorily answer farmers' fertilizer inquiries—including those requiring technical background—stands to grow in respect and influence among his customers, actual and potential. If he can build farmer confidence on a par with that enjoyed by government agents and institutions, he will have placed himself in the desirable position of serving as a "one-stop" supplier of fertilizer needs—whether the need is for technical information, practical advice, or actual materials, equipment, or services.

Beyond this, the dealer needs a progressive attitude, and a positive program for fertilizer promotion. One such program is the "production potentials" concept outlined at the agronomists' meeting by Charles E. Trunkey of U. S. Industrial Chemicals, until recently a member of the MWSIC staff. The production potentials program is based on the premise that before a farmer can be interested in securing specific information about a particular practice, he must be convinced that better yields or lower production costs are practical on his own farm. Production potentials reflect yields that a farmer could easily average over a period of years—including both good and poor years—provided that he used the best available management practices, such as fertilizing according to soil test, planting adequate stands, and controlling weeds, insects, and disease.

Production potentials have already been worked out on an area-by-area basis for Illinois and Wisconsin, and are in preparation for other midwestern states. NPFI believes that dealers could make profitable use of production potentials data by pinpointing for individual farmers realistic goals that are within their reach, and offering assistance in planning for and attaining those goals.

Through this and other techniques, the progressive dealer can establish closer contact between himself and his farmer customers. He can build prestige with relatively little outlay of effort or cash, and in many cases convert what is now "just another customer service" to a profitable business. There is no essential reason why fertilizers should not be as important and profitable a part of the average dealer's business as are feeds, grains, or farm implements.

Care and Feeding of Insects

Raising insects in the laboratory, an important part of entomologists' work, makes possible experiments that couldn't be done in the field

Entomologists work just as hard keeping insects alive as they do trying to eradicate them. These large milkweed bugs, being watched by Monsanto's George Ludvik, are about to enter their 265th generation in the laboratory

Just about all research work on insect control has one prerequisite in common: insects. Availability of insects for research work would appear to be no problem, since nature provides a seemingly never-ending supply. But as entomologists delve deeper into insect control problems, depending only on nature's supply becomes less and less desirable. As a result, science turns increasingly to raising its own insects in the laboratory.

Breeding insects in the lab is not a new idea. A survey made several years ago showed that there were 85 laboratories across the country with full time insect raising programs. Altogether, these labs were breeding about 175 different species of pests. House flies and cockroaches are the most popular. However, there are relatively few economic pests that have not been raised in a laboratory at one time or another.

Laboratory raised insects are essential to insect control. They provide a continuous, abundant supply of laboratory "guinea pigs" of known age and environmental background. Lab insect colonies, as summed up by A. W. Lindquist of USDA, ensure essentially uniform insects through use of which comparable data can be obtained from day to day with a minimum number of tests. Lab colonies are a means of speeding up all aspects of research on insect biology and control.

At Monsanto, says entomologist George Ludvik, the objective of the insect raising program is to reduce to constants all variables except the particular chemicals under test. And J. J. Menn of Stauffer feels that lab raised insects might very well be the real key in helping solve insect control problems.

Still, the laboratory will never be able to replace the outdoors. For regardless of how effective they may be on laboratory raised insects, insecticides must still be tested in the field. Perhaps the biggest drawback of lab insects is the inbreeding which occurs after several generations. Inbreeding can produce an insect strain with characteristics far different from what is found in the field.

A major forward step in insect raising was accomplished recently at the Illinois Natural History Survey. There the European corn borer now thrives in the laboratory just as well as it does in a corn field. Until the work at Illinois, the corn borer had been a difficult pest to raise in the lab.

As in most insect raising programs,

Probably one of the biggest insect-rearing projects is in connection with USDA's battle against the screw worm. Larvae are reared in shallow vats, in a medium of finely ground lean meat, citrated blood, water, and small amount of formaldehyde. Full-grown larvae crawl to edge of vat and drop into sand trays below

one of the main problems in growing the corn borer is its food supply. Corn, the obvious food, usually can't be used since a year-around supply is not available, and small pieces of the plant, such as would be used, tend to wilt and mold quickly. A corn substitute was found in ordinary string beans, to which the borers took like humans to steak. Small cages were made from sections of plastic tubing, each enclosed at the bottom with wire screen, and covered by a petri dish. High humidity, needed for proper growth, is maintained by placing each cage over a dish of water. In this set-up, adult corn borers develop from laboratory laid eggs in two weeks to a month.

Raising corn borers in the laboratory provides a basis for some special experiments that would be difficult or impossible to conduct in the field. One such, for instance, is applying insecticide to food or substrate and observing the reactions of larvae. It becomes possible also to estimate the amount of insecticide ingested. And systemic insecticides may be evaluated by applying the systemic to bean plants grown in the green house.

A Cooler for Beetles

Another advance in homegrown pests is under way at Oregon State College. OSC has just completed a forest insect lab to study such costly forest pests as bark beetles, the spruce budworm, and the balsam woolly aphid. A constant supply of insects for testing will come not from the green forests surrounding the laboratory, but from modern, temperature-controlled rearing rooms built right into the lab. In the case of bark beetles, Oregon State will secure infested logs, seal the ends with wax to prevent drying out, and place them in laboratory rearing cages. The pest's natural environment will be duplicated even to providing a winter season in an 8-×-9-foot walk-in cooler. Chief advantages will be speedier research, since two or three generations of insects can be raised per year, compared to just one in the field.

At Beltsville, one section of the USDA laboratory is devoted to raising cockroaches—a dozen different species that range in size from less than half an inch to over two inches. The roaches are used primarily to evaluate new insecticides. But roaches also provide a tool for studying resistance to insecticides, since some species are resistant and others are not.

The USDA is now building a huge insectary at Sebring, Fla., that might properly be called a screw-worm factory. This installation is designed to produce 50 million sterile screw-worm flies each week for use in the screw-worm eradication campaign recently initiated in Florida.

The latest insect to be reared in the laboratory is the boll weevil. Texas Agricultural Experiment Station has just wrapped up a seven-year research program on a synthetic boll weevil diet. The diet, a mixture of crude protein and other nutrients, will permit laboratory raising of plant-feeding weevils for the first time, according to the USDA.

As in the case of boll weevils, raising insects is not always an easy job. Before an insect can be grown in the laboratory all aspects of its environment must be known and then duplicated. The California Department of Agriculture has tried to raise the Jerusalem cricket, since its large size and slow movement make it an ideal lab "animal" for certain uses. However, all attempts to raise this insect have failed because of some missing environmental factor. Other insects, for instance the cabbage worm, are very susceptible to disease and thus are not usually raised in the laboratory. Mold is a problem, too.

Bioassay Neglected

Screening insecticides is not the only use for laboratory raised insects. Bioassay is another big field. For determining insecticide residues, bioassay methods are simple, quick, and usually inexpensive. A single bioassay can determine if any of a large number of toxic materials is present, while chemical methods require specific tests for each possible toxicant. Though bioassay cannot replace chemical analysis, some feel that it is a neglected tool which should be used more often by industry and regulatory groups.

For the future there are many yet untried applications for laboratory rearing of insects. For instance, insects like aphids or leafhoppers could be used to study how plant diseases are transmitted. Similarly, mosquitoes could be used to study animal disease transmission. And just as fungi are used to produce antibiotics, insects could conceivably be used to make insect repellents. One farsighted entomologist suggests that laboratory raised insects might some day be used for food. Possibly to an unprejudiced gourmand, a wax moth larva would be just as wholesome as an oyster or shrimp.

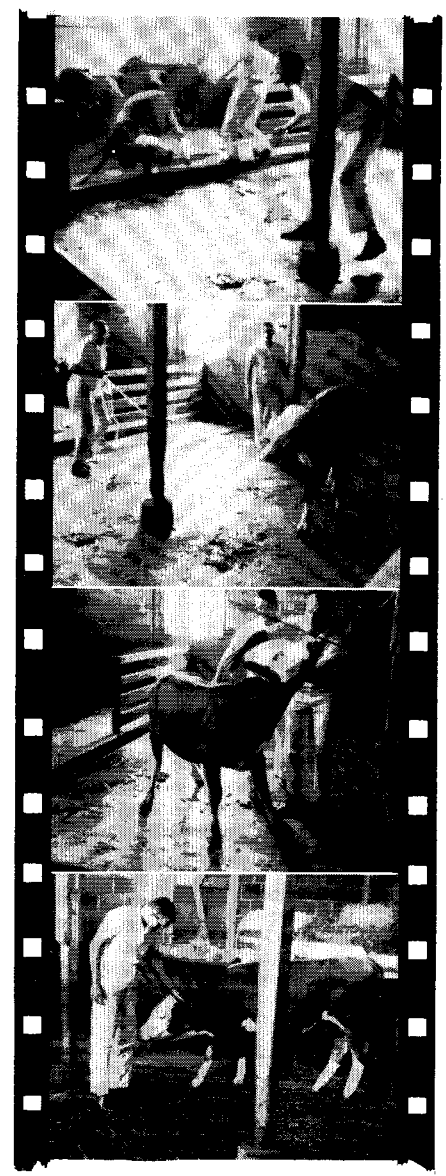
Animal Tranquilizers

Tranquilizers carve a growing niche in veterinary field, but role in feeds is still in doubt

THE phrase "contented cows" that appeared in an advertising slogan some years ago may become timely again. The spectacular success of tranquilizers in human therapy is prompting drug makers to look toward using the drugs in the animal field—as therapeutics to treat nervous conditions, and as feed supplements.

Early in the tranquilizer game, or shortly after chlorpromazine's debut in 1953, pharmaceutical makers and animal research scientists started studying tranquilizers as possible feed

Tranquilizer calms hyperexcitable calf



supplements. Together with antibiotics and diethylstilbestrol, tranquilizers sometimes seem to act as effective weight gain promoters and consequent food savers.

But now veterinary scientists have turned their tranquilizer guns on animal stress. Animal stress stems from many causes. For example, a very pronounced stress occurs in cattle during shipping. Many veterinarians think that stress promotes the condition called shipping fever, which is an acute respiratory disease.

Animal weaning brings on anxiety, too, as do many animal management practices. Estimates of shipping fever losses range from $25 to $100 million within a year. This amount includes the large costs of attempts at prevention and of treating affected animals.

Shipping fever losses can be reduced by better shipping and handling methods to minimize stress—by proper stock chutes, correct loading and shipping of animals, and more careful handling in the stockyards. But stock fresh from the range and herded into lots, into cattle cars, and into pens undergo stress which lowers vitality, puts them off their feed, and causes excitement which results in bruises.

And cattle held under such stress conditions are more likely to be dark cutters (a condition in which slaughtered beef develops a dark cast due to preslaughter over-excitement and agitation). No matter how carefully cattle are handled, the trip from farm to market and through marketing channels causes added stress.

Tranquilizer treatment of stress is done by administering the tranquilizer directly—usually orally, intramuscularly or intravenously—rather than by supplementing feed with tranquilizers.

Almost all of today's tranquilizer producers have made some kind of animal studies—either in their own facilities or through agricultural colleges. Several veterinary preparations are now on the market. With one exception, the tranquilizers used in this field are the same ones that are used in human therapy. All are derivatives of phenothiazine, reserpine, diphenylmethane, or substituted propanediols. Drug companies involved include Smith, Kline & French, Pfizer, Schering, CIBA, Wyeth, and others. The one drug that is used solely for animals is Jensen-Salsbery's Diquel (AG AND FOOD, January, page 7), a phenothiazine derivative.

Tranquilizers in Feeds

As weight gain promoters for addition to feeds, tranquilizers have not yet arrived. Reports on their value are, at best, conflicting.

But if the tranquilizer is used together with antibiotic and/or hormone supplements, there appears to be a synergistic action. Although weight gain is slight when tranquilizers are used by themselves, there is a significant increase when they are used with the other growth promoters—a gain that apparently cannot be accounted for by the other agents alone.

Most schools around the country feel that this research on tranquilizers is not yet far enough along to justify even a guess as to whether or not the drugs are actual weight gain promoters. At one school, though, where animal tests have gone on for some time, lamb feeding data give encouragement. And from several experimenters comes advice that although not proved conclusively, the value of tranquilizers in feeds should not be sold short. It was only a few years ago that diethylstilbestrol was at the same development stage, they point out.

If these agents ever prove their fettle as feed supplements, their sales spiral could parallel that of antibiotics (which regularly go into feeds). But there is little agreement on the potential size of the market. Estimates range from $20 to $200 million dollars a year at the manufacturer's level. Between these extremes, a figure of about $50 million seems plausible, many think.

Depending on the cost of the tranquilizer in terms of the amount needed per ton of feed (which in turn depends on the drug's feed efficiency and growth promoting potency), the estimated annual market breaks down this way:

- Poultry, broilers—$5 million
  layers—$15 to $20 million
- Swine—$5 to $10 million
- Steers—$5 to $10 million
- Others—up to $5 million

Unanimous agreement can be obtained on only one point: much more testing still needs to be done on tranquilizers' role in feeds. And if all other aspects work out successfully, there is still another formidable "if": FDA approval is still to come.