Ag and Food Interprets . . .

- **Granular insecticides may find big market in corn belt**
- **Cost bars wider use of pyrethrins to protect food packages from insects**
- **Special properties and synergists pushing up pyrethrum demand**
- **Shortage of trained agricultural specialists may soon affect chemical industry**
- **Livestock production shifting the geography of meat packing industry**
- **Unenviable safety record is thorn in side of fertilizer industry**
- **Solar energy use not just around the corner but research is progressing**

Granular Insecticides

Promise of big use on corn borer next year may carry relatively new form to commercial level

ONE OF THE MOST IMPORTANT advances in the history of chemical control of the corn borer appears ready for widespread use next year. It isn't a new insecticide, but a relatively new type of formulation—granular. Granular insecticides have made several forward steps in the past three years over the bridge from research and field trials to commercial development. Corn borer control, if as effective as it looks now, may be one of the biggest yet. There are more than 10 million acres of corn in Iowa alone, and at least 55 million acres in the North Central States.

DDT and other chlorinated insecticides are the active ingredients of the granules tested against the corn borer. Granular formulations are showing promise in a number of other insect control problems. Already they are commercial in mosquito control on coastal lowlands, turf insects on residential lawns, some pasture pests, and on corn root worm in some areas.

Pesticide-fertilizer combination application is another area where granular insecticides are finding use. They give better control in mixing as well as less dust. In some instances, the answer in this controversial area may be separate application of granular insecticide simultaneously with fertilizer.

Granular insecticides roll down into leaf whorls and axils, main attacking point of first brood corn borer larvae

Corn Borer Recommendations Ready

T. A. Brindley, H. C. Cox, and W. G. Lovely, who have been leading various aspects of the USDA corn borer control work at Ankeny, Iowa, in cooperation with the Iowa Agricultural Experiment Station, have concluded that borer control with granular insecticides is not only possible, but practical. They are supported by other entomologists in the North Central States and the group last week released recommendations. Estimated yield increases of 7 to 15 bushels of corn per acre on the Ankeny test plots give some of the most concrete support. From 15 to 20 pounds of a 5% DDT formulation appears to be the most practical and economic level for corn borer control. That is only a little more than half the amount of DDT recommended for emulsion spray application.

Advantages of Granules

While granular DDT hasn't usually given statistically better control than the same insecticide in emulsion form, it has a number of advantages:

- application equipment is simpler in operation, calibration, cleaning, and upkeep.
- granules do not involve hauling, mixing, or measuring of water and emulsion.
- with proper equipment, a given payload of granules will cover about four times the comparable load of emulsion.
- material may be applied in windier weather than sprays.
- less residue is left on plants at harvest time.

DDT is not the only insecticide effective in granular form against corn borer, but it has been used as the model. Heptachlor and EPN (ethyl *p*-nitrophenyl thionobenzenephosphonate) also have given good first-brood borer control and endrin, aldrin, dieldrin, isodrin, parathion, toxaphene, and Strobane show promise.

The structure of the corn plant and habits of corn borer larvae make the borer an exceptionally good target for granular insecticides. The granules fall on the leaves and adhere temporarily, but soon roll down into the moist whorls and leaf axils where the larvae feed. There is an added advantage that residues are concentrated in a relatively small area. Granules leave only about a tenth of the total residue on corn plants as do emulsions at the same application rate

per acre. In the Ankeny tests, DDT emulsion applied at 1.5 pounds per acre gave a residue of about 150 p.p.m. at harvest time. Comparable granular application gave a residue of 15 p.p.m.

Equipment and Carrier Important

A seeder type applicator, mounted high enough to drop granules on rows, has proved more satisfactory in the Ankeny tests than has the power-type duster. Particles packed in the duster and agitators caused some breakdown of granules. Also, air-blown granules bounced off leaves. Fluted-shaft agitation-type seeders, redesigned for granule application became available on a semi-commercial scale during 1955.

Granules are made by putting the active ingredient on a carrier, usually with the aid of a solvent.

Attapulgite, bentonite, Celite, perlite, tobacco stems, and vermiculite were used at Ankeny, with attapulgite, tobacco base, and bentonite giving best results. RVM-AA type attapulgite was superior to the LVM-A. Particle size is important. Larger size particles are less affected by air turbulence than the smaller, but on a weight basis, they decrease the number of particles distributed over a unit area. The best corn borer control was obtained with 30–60 mesh particles, followed by 30/40 and 15/30.

In the development of granular insecticides there have been problems of formulation. Some solvents were taken up by the granules, then slowly released on storage, changing the product analysis. Others had phytotoxic effects. The use of hot solutions gave crystallization on cold granules, resulting in a sticky mass. These problems have been recognized and mostly solved, as has that of catalytic activity of some carriers which caused decomposition of some toxicants. In the latter case, addition of a little urea introduced enough basicity to neutralize the acid sites on the carrier and stabilized the granular product.

The use of rubber blenders, traditional mixing equipment in the insecticide industry, for mixing granules gave excessive fines. But slowing the blender and removing the scraper bar has overcome that problem. Fertilizer mixers have proved particularly good. The favored method now is to impregnate in a slow moving tumbler, not blend as is done with dusts. For some insecticides, techniques have been worked out for formulation with specifications, sampling systems, and analytical methods. Shell Chemical, for example, publishes a handbook for aldrin, dieldrin, and endrin, giving such methods.

Control of Other Insects

The fact that granular insecticides fall through most foliage to reach the ground or water below, has made these materials especially valuable. It was this property that led to their use for mosquito larvae. It also makes them effective for the soil-born stages of a number of pests.

United Fruit Co. reports excellent success in controlling the red rust thrip and partial success in controlling banana borers on banana plants on more than 40,000 acres treated aerially with dieldrin granules.

More than 3000 acres in Iriquois County, Ill., were treated with dieldrin granules to give good control of Japanese beetles and less drift than with sprays or dusts.

In southern U. S., the white-fringed beetle is being controlled with granular insecticides. Good results are reported on wireworm in sweet potatoes and Southern corn rootworm in peanuts. Excellent control of fall armyworm is reported from Georgia.

In California, the Argentine ant has been a troublesome pest in citrus orchards, but granular insecticide application shows promise of control without residues. In Ohio some interesting success has been achieved with aerial application of BHC granules against spittle bug.

The use of DDT and other chlorinated insecticides to control corn borer promises to be the most striking development with granular insecticides next year. But in most of the major crop growing areas of the country, successful experimental work is being reported. Use of

Use of Granular Insecticides for Corn Borer Control

(Summary of Recommendations Approved by North Central Regional Technical Committee on Entomology)

Insecticide:	DDT is only material tested sufficiently to warrant recommendation.
Carriers:	Granular Attaclay RVM-AA type; tobacco base; sodium bentonite appear best. More effective control with particles in 30/60 mesh range than with larger size.
Application Rate:	Granules with 5% DDT at 15–20 lb./acre applied with ground equipment; 20 to 25 lb./acre by airplane.
Timing:	One application usually suffices; should be applied to field corn as soon as 75% of plants show evidence of recent feeding in whorl, providing corn is not more than 7 to 10 days from tassel emergence. If second application is desirable, apply 7 to 10 days later. For treatment of late corn, to prevent stalk breakage and ear damage, on occurrence of heavy second brood moth flights—treat at first egg hatch if there are 100 egg masses per 100 plants.
Application Equipment:	Individual metering hoppers over each row or conventional seeder hoppers with only three open outlets over corn row have been satisfactory. Conventional crop row dusters less satisfactory. Granules should be released in 12 to 14 in. band, 8 to 10 in. above whorl of corn plant. Airplane equipment designed for seeding of rice has been most satisfactory for air application to date. Should fly 35–40 feet above ground. Effectiveness of air equipment variable and should be checked for rate and pattern.
Precautions:	As practically no DDT reaches kernels, roasting ears or mature grain may be fed or eaten without danger. Light residues may remain on leaves, stalks, and husks. Evidence now available indicates any such residues left by application in strict accordance with directions will not produce ill effects on livestock eating such plants. Some DDT may be excreted in milk or deposited in fat. Until more information is available, DDT contaminated plants should not be fed to dairy animals. Animals should not be fed DDT-contaminated plants for at least 90 days before slaughter.

granules in pesticide-fertilizer mixtures is growing. The reduced load factor and drift factor offer advantages to airplane applications. For many reasons the immediate future looks interesting for granulated insecticides.

Insect Control in Food Packages

Synergized pyrethrum is effective but costs bar wider use in food industry

INSECT DAMAGE is a problem in food production that begins on the farm and in the orchard and extends right through to the final stage of packaging. Prevention of damage and infestation in this last phase is probably the most difficult because of toxicity hazards and limitations placed upon the chemicals and quantities that can be utilized.

Only one compound, Pyrenone, has found acceptance in coating paper bags and cartons against the inroads of boring beetles and other pests. It is a synergized form of pyrethrum, and may consist of one part pyrethrum combined with 10 parts of piperonyl butoxide, the latter acting as both stabilizer and activator.

Knockdown and kill with pyrenone-treated bags is quite high for the first few months. The repellency of the compound, however, has been shown in storage tests to continue for as much as nine months or more, indicating the line of research taken recently. In this work allethrin, lindane, and methoxychlor have shown encouraging results but these materials also have their drawbacks. They are among the insecticides which "migrate" into the inner plies of multiwall paper bags.

Results of this research were described earlier this year before a meeting of the Technical Association of the Pulp and Paper Industry in New York by Hamilton Laudani and Dean F. Davis, Marketing Research Division, USDA. The work has been conducted jointly by the Stored-Product Insects Laboratory and the Quartermaster Corps.

Extended Protection Obtained

An important finding was that treatment of the just outer ply of multiwall paper bags with synergized pyrethrum would give protection for up to 12 months. Bags made of textile materials will require more effective treatment, and a suitable compound has yet to be found for rendering paper shipping boxes insect-repellent.

On the other hand, investigation conducted by Robert Gair Co. researchers has indicated that infestation of stored products is reduced through the use of a pyrenone-treated, clay-coated folding carton. Richard I. Rice, technical director of its American Coating Mills at Elkhart, Ind., contends that most folding cartons are entered through their closures and not through the boxboard.

From the West Coast comes the objection that pyrenone treatment for food containers is costly, and the same criticism is voiced elsewhere in the industry. Production of flour bags involves a manufacturing cost of from 9 to 12 cents per bag, depending on size and type according to a container interest in California. Treatment of these bags with pyrenone will cost an additional 2 to 4 cents per bag. At the TAPPI meeting, Rice declared that cost has been a deterrent to widespread use of the insect-resistant carton. Synergized pyrethrins, he said, cost 0.7 mill per sq. foot of boxboard. Others make it one tenth of a cent.

This brings the outlay for treatment of cartons close to $2.00 per 1000 cartons, and for a company employing up to 20 million cartons a year the added cost would be in the neighborhood of $40,000. The point made is that the cost of infestation would be less in this instance. In most branches of the food industry, certainly in production, processing, and packaging, manufacturers are dealing with very small profit margins necessitating large volume for profitable business.

The use of insecticides therefore in insect-repellent packages will have to be confined to specialized uses. The procedure is being followed on packages intended for export, and some use of it is being made also in drugs and pharmaceuticals, where the profits per package justify the added expenditure. The treated area in this case amounts to only a few square inches.

Pyrenone is a product developed by the Fairfield Division, Food Machinery & Chemical Corp., which recently has located its activities in Baltimore. The company designates the product as an insecticide, although its outstanding characteristics are its repellency to insects and its lack of toxicity to humans in packaging applications. It is used by the Quartermaster Corps, and as a contact insecticide government specifications call for its surface application.

Toughies of the Insect World

The insects which attack food packages are mostly bettles and borers although moths and caterpillars can also ruin food supplies. The confused flour beetle thrives on cereal products. The cadelle is a very tough boring insect who prefers flour, and the saw-tooth grain beetle is only less menacing than the cadelle.

The particular problem in the West appears to be the Khapra bettle against which nothing has been effective in the past except methyl bromide fumigation. More recently paper manufacturers there have been running tests against the Khapra with Pyrenone-treated bags.

Some package experts contend that there is no defense against these pests other than a well designed and constructed package. But this view is not fully shared in the paper and container industries. Besides, some beetles have shown that they can bore through almost any type of paper carton regardless of its construction.

Pyrethrum Progress

Special characteristics and improvement by synergists are pushing up use and encouraging production

PYRETHRUM demand is steadily increasing. This year, U. S. usage of pyrethrins (the general name for the active ingredients in pyrethrum) is expected to reach about 100,000 pounds, as compared to about 80,000 pounds in 1950. U. S. consumption estimates are about 120,000 pounds in 1956 and 200,000 by 1960.

There are a number of reasons, in addition to the general increase in pesticide use for pyrethrum's rise. New government regulations and increasing sensitivity to safety are focussing attention on

Demand for pyrethrum flowers rising