Ag and Food Interprets . . .

- With new plant growth regulators comes knowledge of plant physiology
- Despite anticoagulants, there is no effective field control for rodents
- Salesman is key to inventory control in pesticides
- Grain fumigant use growing; sales up 25% this year
- Chemical industry approves food additives law—with reservations

Chemicals and Plant Processes

New compounds boost plant growth, retard it, prevent sprouting

On many fronts, researchers are finding new chemicals that can dramatically change the basic life processes of plants. They are discovering new materials capable of making plants grow to unusually large size, others of producing dwarfed plants. They are developing new materials that selectively destroy plants, prevent them from pollinating, or retard sprouting during storage. And with both new and old materials, they are studying the basic chemistry and pathways of action.

One of the most striking developments in recent years has been the discovery of the gibberellins. These compounds can have a powerful effect in increasing the growth rate and size of plants. The gibberellins, such as gibberellic acid and gibberellins A_1 and A_2, were originally isolated from a fungus that attacks rice. Recently, gibberellin A_1 has also been recovered from bean seed.

While research is continuing on gibberellins and other compounds that produce abnormally large plants, other chemicals are being studied for their ability to do just the opposite. Compounds are being tested for their effectiveness in producing plants with very short stems. When suitably treated, the plant develops a dwarfed appearance, although in many cases its leaves and blossoms remain approximately their normal size.

Among the most potent of these growth-retarding compounds is Amo-1618 or 2-isopropyl-4-dimethylamino-5-methylphenyl-1-piperidinecarboxylate methyl chloride. Although the growth effect of this compound was discovered several years ago, USDA researchers only recently described its detailed synthesis. They have also reported the synthesis of other quaternary ammonium compounds that likewise suppress plant growth. Seven of these structurally related compounds have proved highly active biologically. They are under test for possible use on chrysanthemums, beans, and other plants. When applied experimentally, Amo-1618 has been found to prolong the life of bean plants.

W. C. Hall, Texas A&M, checks results of cotton cotyledon explant test used in screening chemicals for ability to defoliate cotton

Plants Made Male-Sterile

Researchers at Rohm & Haas are developing an unusual compound that can make certain plants male-sterile. This chemical, sodium α,β-dichloroisobutyrate or FW-450, appears especially promising for use in producing hybrid cotton seed.

When it is applied to the flowers of cotton plants, the plants become male-sterile and are therefore no longer self-pollinating. However, the plant remains female-fertile, so it can be pollinated by untreated plants. If these untreated plants are of a different variety, the treated plant can, in this way, be cross-pollinated to produce hybrid seed.

This hybrid seed may be useful in developing cotton that excels in quality and yield. It may also produce cotton less sensitive to poor growing conditions, Rohm & Haas researchers believe.

So far, most of the work on FW-450 has been on cotton. Preliminary tests, however, have been carried out on a number of vegetable crops. The new material is also under study as a possible weed killer.

In another project, a potentially important group of herbicides called double-phenoxy compounds is being studied by USDA researchers. These are made by esterifying a halogenated phenoxyalkyl carboxylic acid with a halogenated phenoxyalkyl alcohol. Both units of the compound contribute to its herbicidal action.

Fourteen of these compounds have been tested on mesquite seedlings. Some have shown high activity and compare favorably with such standard herbicides as 2,4,5-T and 2-(2,4,5-TP). Several of them have the advantages of low volatility and high persistence.

Especially promising have been results obtained in aerial spraying of mesquite with the 2-(2,4-dichlorophenoxy) ethyl alcohol ester of 2,4,5-trichlorophenoxyacetic acid. Further field testing of this compound is planned for this autumn and next.

Preventing Sprouting

In another area, work is going ahead on chemicals that inhibit the sprouting of stored vegetables. Among the materials currently finding greatest acceptance are the methyl ester of α-naphthalene acetic acid, tetrachloronitrobenzene, and maleic hydrazide. Other materials in the research stage have actually shown greater ability to inhibit sprouting than the chemicals now being used commercially.

Almost the only crop being treated with sprout inhibitors these days is potatoes. And only a small percentage of this crop is treated.

Several factors have militated against the use of these chemicals. One of the biggest is that sprout inhibitors tend to retard the formation of new skin over cuts and bruises that potatoes may receive during harvesting. Since the potatoes don't heal properly, they are much more prone to attack by rot organisms during storage.

Another factor is cost. The inhibitor used during a storage season costs about 5 cents per bushel of potatoes. For many growers, this expense may be too high, particularly at a time when the market value of the potatoes is uncertain.

Research is progressing on improved inhibitors that give better performance at lower cost. Sprout inhibition of onions, carrots, turnips, radishes, and other vegetables is being explored. As one university researcher points out: "Since sprout growth normally determines the maximum storage for tuber crops, it seems likely that eventually a large portion of the stored crop will be treated with chemical inhibitors."

Fundamental Research

While scientists are investigating new chemicals for regulating plant growth, they are also carrying out fundamental studies to determine the path of action of these and older materials. For example, workers at Naugatuck Chemical have been studying the factors that influence the performance of maleic hydrazide. Using radioactive tracers, as well as spectrophotometric and chromatographic techniques, they have demonstrated that maleic hydrazide is a stable, nonvolatile compound that can be readily translocated through a plant. They also find, however, that the absorption rate has proved to be the most important single factor limiting its effectiveness.

Other variables, particularly humidity, also influence the effectiveness of maleic hydrazide. All formulations are poorly absorbed at low relative humidity. Other factors, such as temperature, light intensity, and method of chemical application, also play a part, but to a much lesser extent.

Chemists at Texas A&M are doing basic work on the chemistry and action of various defoliants. They find little relationship between the chemical structure and defoliant activity of these compounds. However, two types of reactive groups—the sulfhydryl and amine groups—do seem to promote defoliation.

Defoliant activity, they believe, depends on the ability of a compound or its metabolites to cause mild physical or physiological injury to plants. In some cases, the activity depends on the ability of the plant to degrade the parent compound to a defoliation-inducing metabolite. This has been found true, for example, with the thiophosphate defoliants.

Some years ago, researchers showed that preventing abscission (the breaking off of plant parts such as leaves) was one of the many functions of the master plant hormone, 3-indoleacetic acid or auxin. By 1950, most workers in the field had agreed that indoleacetic acid, if not the only auxin, was at least the only important one in higher plants.

Today, however, chromatographic and radiochemical techniques, as well as biological response studies, have cast serious doubt on whether indoleacetic acid is actually the only auxin of importance. In fact, there is now considerable confusion over what really constitutes an auxin compound. At the same time, workers are recognizing that the entire defoliation process, whether natural or chemically induced, is not nearly so simple as was once assumed.

These views are echoed by researchers at Boyce Thompson Institute. "Probably no field in plant physiology," they say, "is at present in as much confusion as the one concerning the auxins." Plant growth was formerly considered to be primarily regulated by these hormones. This concept, they believe, needs to be thoroughly overhauled. Recent work has shown that plant growth is also regulated by a variety of other compounds, such as the gibberellins, which are quite different from indoleacetic acid.

Investigators at Boyce Thompson have recently isolated a new plant-growth promoter from Maryland Mammoth tobacco. The processing of 3 tons of tobacco led to the recovery of a few milligrams of this growth promoter. Although its complete structure is as yet unknown, it is believed to be a long-chain fatty alcohol in the range of C_{18} to C_{27}.

Boyce Thompson chemists also report that they find no indolic plant-growth substance in Maryland Mammoth tobacco. "This indicates," they say, "that 3-indoleacetic acid is not, as was once assumed, a ubiquitous naturally occurring plant-growth hormone."

Based on Symposium on Control of Physiological Processes in Plants by Chemicals, presented at the ACS National Meeting in Chicago, Sept. 10.

Chemical Rodent Control

Anticoagulants check commensal pests, but effective chemicals for field control are lacking

Rodents are both a nuisance and a danger, to farmers as well as to city dwellers. They damage trees, crops, landscaping; they pollute stored corn and grain; they reduce forage yields. Indicating their cost to the farmer, one agricultural official in California estimates that field mice alone caused over $500,000 in damage to potatoes in one 7800-acre area in his state last summer. Although this is unusually high for mouse damage, rodents in the country as a whole can do as much as $2 billion in damage a year, according to one scientist in the Department of the Interior. And if that in itself were not enough incentive to control them, they carry disease, or carry the vectors that carry disease—tularemia and Bubonic plague are examples.

Thus it is not surprising that a long list of chemicals has been used to fight rodents (gophers, squirrels, jackrabbits, and others in addition to the usually thought-of rats and mice). Against commensal rodents (rats and mice which live near people), chemical control is effective, thanks mainly to a relatively new weapon, the anticoagulants. And because there are effective chemicals, most rodent control effort is directed against those commensal pests, with field control done on a smaller dollar scale.

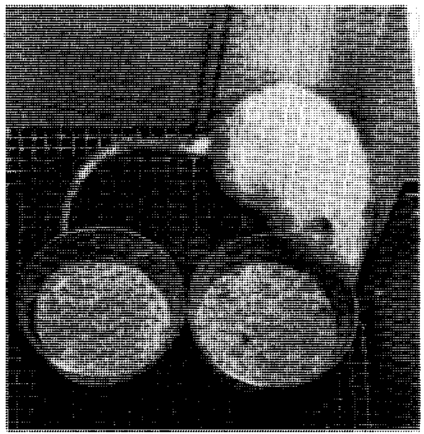
Wisconsin Alumni Research Foundation developed the first successful anticoagulant, Warfarin, which came on the market in about 1950. Since then, several similar chemicals have also been introduced—Fumarin, Pival, Diphacin (diphacinone), and PMP. These have been effective enough, according to the Wisconsin group, to increase the total rodenticide market from between $3 and $4 million a year in 1948 to an estimated $15 to $20 million in 1957. In fact, declares WARF, "the anticoagulants were the first really effective rodenticides ever made available to the general public."

But the anticoagulants, effective as they are against commensal rodents, still have many drawbacks. First, they are slow-acting. This means that for several days, baits must be checked and replenished almost daily. And second, they are in general not effective against field (or sylvatic) rodents such as the field mouse or ground squirrel. As a result, field control is fitful, expensive, and none too effective.

In the field, rodenticides are usually put out on a grain bait, although some fumigation (with methyl bromide, carbon disulfide, and occasionally hydrogen cyanide or carbon monoxide) is done in those places where field burrows can be sealed off. With bait, any of a number of chemicals can be and are used—strychnine alkaloid, zinc phosphide, thallium sulfate, sodium fluoroacetate (1080), and Red Squill. Where rats are to be controlled in the field, the anticoagulants can be used.

Compared to amounts of anticoagulants used in commensal control, the total amount of these other chemicals used in field control is small. The reasons:

- They are not as effective as can be desired.
- They present great hazards to other wildlife if not handled with great care (1080 and thallium sulfate can be used only by licensed operators in some states).
- The rodents become bait-shy (except with anticoagulants).
- It is hard to find the right bait for the specific rodent to be controlled. The bait should appeal to that rodent but not to other animals.
- Protecting the bait from the weather and from other animals, and supplying the labor involved in spreading the bait, raise the cost considerably.



Laboratory rat shuns feed treated with a repellent (right). This is one screening test for rodent control chemicals

But if chemicals more effective for field control could be found, potential markets would be large. Users would be working against damage adding up to that $2-billion figure. And even low levels of application (1080 goes into grain bait at 1 oz./100 lb., and is applied at 1 to 10 lb./acre for heavy meadow mouse infestations) add up to large quantities of chemicals.

Governmental research looking toward more effective rodent control agents is centered in the U. S. Fish and Wildlife Service. This group's policy is to look for means of controlling rodents, not exterminating them. Thus, it tries to develop repellents as well as poisons for rodents and other wildlife. It is working on chemicals for seed treatments, to reduce the number of seeds eaten by rodents without affecting germination. It is seeking ways of making foliage less palatable to rodents. And, for killing rodents, it is working on tracking compounds—irritants which the rodent will pick up on its feet; when the rodent licks its irritated feet, it will ingest a lethal dose of the chemical.

None of these programs has yet produced a satisfactory route to field control of rodents. Nor has the chemical industry bettered the anticoagulant approach. With the large and ready market for effective chemicals, both government and industry have plenty of incentive to continue their research. But, as one industry source puts it: "The present cost of research to demonstrate true value of a rodenticide, plus the cost necessary to meet official or governmental requirements for safety, make the development of a new rodenticide by a commercial organization a rather hazardous investment."

Pesticide Inventory Control

Estimates by sales staffs deemed vital—industry deplores lack of statistical data

INVENTORY CONTROL is a difficult and continuing problem for manufacturers and distributors of pesticides. Unable to chart consumer demand very far ahead, because of the vagaries of weather and the uncertainties of insect and plant disease infestation, companies in this industry must use every trick available to keep stocks reasonably adjusted (AG AND FOOD, June 1958).

Some have a two- or even a three-point attack on the problem, based on field men's estimates of customers' requirements, as in the instance of Prentiss Drug & Chemical of New York. All sales personnel must estimate as of Sept. 30 each year the average production and the amount each will sell during the following year. Each salesman is allowed, on a quarterly basis, to revise his estimates.

This method calls for careful deliberation on the part of the sales staff; to make these estimates, according to Prentiss' John R. Stoddard, the salesman must make an intelligent appraisal of customer inventory and requirements. Second weapon in the company's battle for inventory control is to maintain most stocks in the form of technical material. With the plant geared to high capacity, inventory of finished materials is held to a minimum.

Selling Terms

A third weapon which probably would not be considered as inventory control—although it works as such—is the policy of selling on terms of 1% in 10 days, net 30 days. This practice allows very close contact with customers, and helps the company avoid losing control of its inventories through consignment stocks.

In Pennsalt Chemicals' Washington Division, Tacoma, regional managers must make monthly reviews and comparisons of inventories. Since inventories have a direct influence on working capital, according to J. D. Watson, administrative assistant, they are compared each month with those of the previous month and the previous year.

If any significant dollar increases are evident, the products involved are identified and reasons for the increases must be explained.

This company's salesmen are authorized to recommend products to be stocked in local warehouses; consequently it is their responsibility to eliminate any slow moving or dead items, and see to it that inventories are held to a minimum consistent with optimum sales. At the same time the general purchasing agent screens all purchase orders issued by outlying offices, and maintains a close check on all acquisitions of raw materials. Production of finished materials prior to the busy season is predicated on having available only the necessary volume of the popular items which can be sold during the season regardless of infestation. Based on plant capacity, this preseason production is delayed as much as possible in order to keep inventories at a minimum.

Sales Estimates

A New York State manufacturer also indicates that he leans heavily on the sales force to keep inventories in check. Sales estimates are utilized, he says, to provide adequate supplies of branded merchandise, and to avoid overproduction. These estimates are revised regularly as the season progresses. Finished stock is occasionally shifted from one warehouse point to another to meet unusual conditions. Inventory control is centered at the top divisional level.

The idea of maintaining materials at the plant in technical or concentrate form evidently is widely practiced. Florida Agricultural Supply, Jacksonville, generally operates very closely on most items, keeping as much as possible of the material on hand in technical form. This leaves the firm in an adaptable, free position, and assists in holding down inventories.

In other words, says the company's M. C. Van Horn, Fasco operates one of the biggest "prescription" services in the Southeast. It is an expensive way to operate, and requires heavier than normal production to meet peak loads. It may also be wasteful of equipment investment and manpower. But the company has found no other way to combat a bad situation.

Infestation Reports

Inventories would not offer the pesticides manufacturers much of a problem if infestations could be forecast with any reasonable certainty. Producers have their own lines of intelligence for this purpose, relying on salesmen and their customers to a fairly large degree. In one case the sales representatives and technical supervisors call upon colleges, experiment stations, government agencies, dealers, and consumers. Reports of infestations go to regional managers and top management.

Lines of intelligence for determining or reporting infestations, in another instance, are based strictly on the manufacturer's relationships with customers, through salesmen. Where the company is a basic producer of insecticide concentrates, and all of its materials are for manufacturing purposes only, the problem is more difficult. It is impossible for a company so engaged to shift quickly to meet infestations, except on a limited basis. Most in this category feel that it is better to lose out on the last order than to risk having material remain in inventory until the next infestation.

Government Surveys

Government reports and surveys continue to meet with a mixed reception in the pesticides industry. Some employ them in planning production and raw materials purchases. Others make little or no use of them. A western interest makes specific use of the following in his production and purchase programs: the Cooperative Economic Insect Report; Shepard (USDA) inventory surveys; monthly reports on the status of calcium arsenate; recommendations by state and federal agencies; information on insect resistance; and the status of tolerances under the Miller Amendment to the Food, Drug, and Cosmetic Act.

Some insect survey reports are of value, according to another manufacturer, but usually they are so late that very little use can be made of them. An eastern pesticides producer says the Shepard inventory surveys are helpful but do not go far enough. More detailed statistics on pesticide consumption are needed to provide adequate background information for this growing industry. Still another producer in the Northeast says he makes practically no use of government reports. He feels that each independent manufacturer of insecticides in his own area can better appraise his own individual situation, and should run his business accordingly.

Cause for Weakness

No one argues with the contention that inadequate inventory management is one of the causes of financial weakness in the pesticides industry. "I cannot think of a time in the last 15 years," says a large pesticides factor, "when there hasn't been one or more companies involved in a liquidation process due to high inventories—which, of course, is bound to affect the rest of us."

Closer control of inventories should certainly result in a higher return on investment for any pesticide company. Unfortunately, widespread consignment of technical materials by basic manufacturers has been followed by reconsignment of finished formulations, thus weakening inventory control.

Curtail Consignments

An industry spokesman in the South feels that members of the pesticide industry could improve inventory control within their own companies by:

- Curtailing consignments of finished materials to various distribution points.
- Making accurate monthly inventory checks.
- Carefully and frequently analyzing sales and production forecasts.
- Properly evaluating how the amount of money tied up in inventories affects their return on their business.

According to the same view, more detailed and complete statistics on pesticide production and supplies could improve the over-all situation by properly informing formulators of the amount of material in the "pipeline," leading to better production and inventory control. Improvement in the industry's statistical information could be achieved through:

- More accurate and conscientious reporting by national companies—less secretiveness on the part of many manufacturers with regard to actual status of inventories. (One way to assure better data would be to request industry to submit information to private agencies that are especially equipped to gather, correlate, and issue information, with adequate protection of manufacturing information.)
- Revising the categories of products as reported, in better conformity with those being sold in today's market.

The Need for Experience

Other spokesmen would have surveys made at the grass roots level, by competent people—"not soap salesmen." Improvement in inventory control could be built upon this collection of information at the field level, the proper analysis of this information, and the ability to adjust production rapidly upward or downward, and to shift quickly the point-to-point movement of finished stock.

Management in the pesticides industry has become painfully aware of its inventory problems, and welcomes helpful information on a situation peculiar to this industry.

Grain Fumigants and Protectants

Chemicals for stored grain sanitation find expanding markets

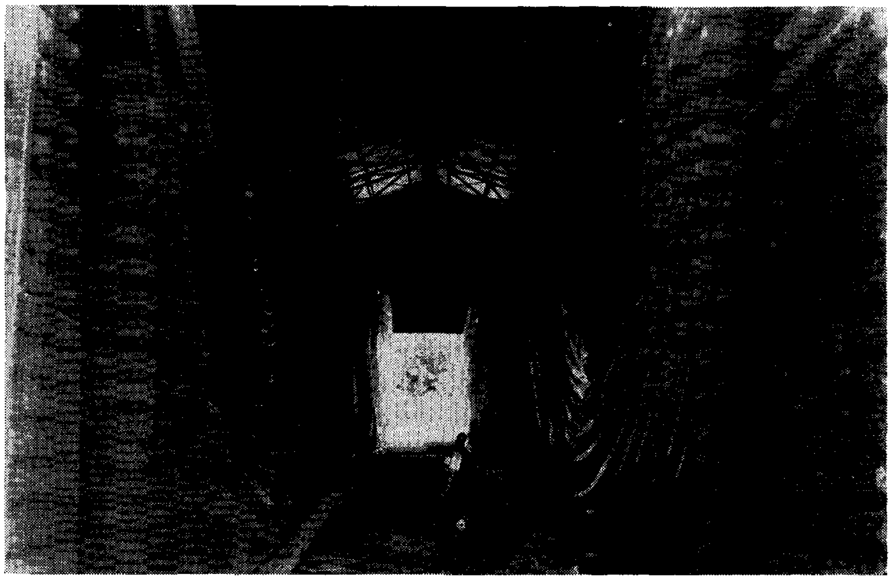
On a larger scale than ever, chemicals are waging war on insects that attack stored grains. According to one leading supplier, use of grain fumigants is 25% greater this year than last. Consumption of grain protectants is also on the increase. With surpluses of stored grains mounting, demand for these chemicals should increase significantly in the years ahead.

Fumigants destroy existing insects in stored grain, but do not give continued protection. On the other hand, protectants, which are much longer acting, are applied to grain to guard against the entry of insects. At present, fumigants find much more extensive use than protectants.

Despite the growing use of both types for such grains as wheat, oats, rice, and corn, insects remain a major menace. Insects attacking stored grains reportedly cause losses in excess of $300 million a year. Without chemicals, of course, these losses would be vastly higher.

Grain handlers today are more alert to the insect problem than ever before. Part of the reason is that strict government regulations have given special incentive for the maintenance of clean grain. FDA says, for example, that if wheat contains 1% or more of insect-damaged kernels it is unfit for human consumption. It is automatically reduced to feed grade, and the price drops from about $1.80 a bushel to about $1.00 a bushel. On carload quantities, these losses can add up to sizable sums.

Cost of fumigating is estimated to be anywhere from about 0.5 to 2 cents a bushel. "Obviously, at this cost," one company says, "fumigants are mighty cheap insurance."



Bagged rice is ready for fumigation in a Texas warehouse

Stored grain must be protected against dozens of insects. Over 30 species infest stored rice and rice products alone. Among the most common grain pests are flour beetle, saw-toothed grain beetle, granary weevil, Angoumois grain moth, Indian meal moth, and lesser grain borers. Insects that feed either externally or internally on grain can cause heating and serious destruction of grain if allowed to develop in quantity and form "hot spots."

Widespread Fumigation

In such states as Minnesota, the Dakotas, Kansas, Iowa, Nebraska, Texas, and Oklahoma, which do a large share of the nation's grain storing, fumigation continues to be the most widely used method of coping with grain insects. The first fumigant to find large-scale use for this purpose, years ago, was carbon disulfide. But besides being highly toxic to insects, it is a fire hazard and potentially explosive.

As a result, carbon disulfide is now almost always used in combination with 80% by volume of carbon tetrachloride. Carbon tetrachloride not only is itself a fumigant (although not so quick acting as carbon disulfide) but also makes carbon disulfide safer to handle. The combination of 80% carbon tetrachloride and 20% carbon disulfide probably accounts for about half of all the grain fumigant used in the U. S. Sold by most grain fumigant manufacturers, it goes under a variety of brand names (Dowfume 80-20, Diamond 80-20, or Stauffer 80-20).

In the early 1930's, USDA developed a combination of 75% ethylene dichloride and 25% carbon tet for fumigating grain. This mixture found widespread use as a substitute during the Korean War, when the Government restricted the use of carbon disulfide. Now, however, the 75-25 grade is taking a much smaller share of the market. A drawback with 75-25 is that it has to be used in relatively high dosages.

Also available today are three-component fumigants. One of these contains ethylene dichloride, carbon tet, and ethylene dibromide. This is reported to be especially useful in controlling insects in surface layers of grain.

Dow, which last month opened a new grain fumigants terminal in Kansas City, Kans., has introduced a four-ingredient product that contains, in addition to these materials, carbon disulfide. Called Serafume, it is described as being superior to other fumigants at lower temperatures. Many commercial fumigants are not too useful at temperatures below 65° F. On the other hand, most insects that attack stored grains are relatively dormant at these lower temperatures. For this reason fumigation is ordinarily not required in wintertime.

A mixture of 70% ethylene dibromide and 30% methyl bromide has recently been introduced as an on-the-farm fumigant packed in special applicator canisters. The operator merely punches holes in the can and inverts it in the grain. Three to five of these 6-ounce cans will reportedly treat 1000 bushels of grain in storage. The product is marketed under such trade names as Calspray's Ortho Grain

Fumigant 73 and United Cooperative's Grain Fumigant 73.

Also used in grain fumigation are various other materials, such as chloropicrin, and hydrogen cyanide (from calcium cyanide). Sulfur dioxide is sometimes added to fumigants not only because of its killing action but because its smell warns personnel that better ventilation is needed.

Minimizing Hazards

In recent years, a big effort has been made to reduce fire hazards in handling grain fumigants. The ordinary combination of 80% carbon tet and 20% carbon disulfide has an Underwriters Laboratories rating of 80 to 100. Several companies make a grade containing 1% of a fire suppressant that drops the flammability rating down to 1 to 5. For its 80-20 grade, Diamond Alkali recently received a patent on a fire and explosion inhibitor that is a mixture of sulfur dioxide and a petroleum hydrocarbon.

Properly used, a good grain fumigant destroys all stages of the insect. Consequently, there is no damage from late-hatching larvae after the fumigant has disappeared. Furthermore, no residual odor or off-flavor is imparted. If the grain is later to be used as seed, it is also important that the fumigant not interfere with germination.

In large elevators, fumigants are usually applied as the grain enters the bin; they may be applied as a coarse spray at the top of a farm bin that has previously been filled. With a liquid fumigant, the material vaporizes and the heavier-than-air fumes spread throughout the mass of grain by gravity and by the ability of the grain to absorb the fumigant. This method is simple, requiring relatively little equipment. However, it may be rather slow and may not give uniform results.

Recent years have seen increasing use of forced-ventilation methods. The result is quicker, more uniform distribution of the fumigant. Better distribution permits smaller dosages. In addition, forced circulation makes it possible to remove the toxic vapors rapidly after fumigation. Originally designed for methyl bromide and similar gaseous fumigants, forced ventilation is also highly effective in handling the common liquid fumigants, including the 80-20 type. Although forced-circulation involves a greater investment in equipment, many companies using it say that the added cost is more than justified.

Value of Grain Protectants

Where longer-lasting protection is needed, growers turn to a number of insecticidal sprays and dusts that are safe enough to be used on grain. With these, wheat, for instance, can be sprayed as it is being unloaded into a storage bin. Or it is sometimes initially sprayed at the combine. This treatment has the advantage of protecting the grain until it can be fumigated in storage. It also protects the grain against reinfestation by insects after it is fumigated.

Spraying of grain is usually done with pyrethrins synergized with piperonyl butoxide. Synergized allethrin is also used for this purpose, although to a lesser extent. Sprays are not only applied to grain but can also be used on the walls, floors, and equipment which may be sources of infestation in storage areas. In some cases, however, an insecticide that is suitable for treating floors and bins is not safe enough for direct use on grain.

As storage officials point out, one of the best ways to minimize insect infestations is to keep storage facilities and outside areas as clean as possible (this may also require use of weed killers in nearby areas). In storage bins, grain should be removed from crevices to prevent it from accumulating; insects can breed rapidly in grain left undisturbed for long periods.

After cleaning, storage areas should be thoroughly sprayed with insecticide. Another way to cut down on insects is to make sure that grain is kept dry enough during storage.

New Products Gain Acceptance

Chemicals now used in grain sanitation are, with a few exceptions, the same as those used several years ago. But new ones are coming along. German researchers, for example, have developed a pelletized material, Phostoxin, that generates hydrogen phosphide gas when exposed to moisture. Now used as a grain fumigant in Europe and Australia, it is being carefully studied in the U. S. Reportedly, it has excellent penetrating properties.

Late last year, malathion got FDA clearance for direct application to a variety of stored grains. Tolerance limit is 8 p.p.m. Recently, USDA purchased over 1000 gallons of malathion emulsifiable concentrate to protect about 8.5 million bushels of grain stored by the Commodity Credit Corp. in nine midwestern states.

Properly applied, malathion can protect clean grain from insect infestation for a year or more. According to American Cyanamid, it will find rapidly increasing use in treating grain both in flat storage (where there are no facilities for turning the grain) and in upright storage (where the grain can be circulated). Grain protection calls for premium-grade malathion, which is odorless.

Methoxychlor also has been approved both for use as a bin spray and for direct application to grain. Tolerance limit: 2 p.p.m. As for ryania, FDA says that any use of this insecticide on stored grain resulting in a residue on the grain as shipped constitutes adulteration.

Under continuing study has been the use of gamma rays, infrared rays, and even sound waves to destroy insects in grain. Repeated tests have shown that insects can be killed by radiant energy. But the big problems at present are the high cost and limited capacity of equipment. Also important is the question of whether the radiation will adversely affect the nutritional value, flavor, and other properties of the finished food product. Many observers say it will be at least 10 years before the radiation approach will actually go commercial.

Meanwhile, granary operators are placing prime dependence on chemicals. As yet, no single chemical or mixture of chemicals has proved ideal for handling all grain fumigation or protection problems. But many already available, if properly applied, are highly effective.

New Additives Law

With minor reservations, industry approves

AFTER 10 long years of wrangling, Congress has finally passed a food additives bill. In a sudden, last-minute reversal of position, the Manufacturing Chemists' Association announced its support of the Williams Bill—H.R. 13254—and added industry support to that of the Food and Drug Administration. The move paved the way for passage of the bill just before the 85th Congress adjourned.

Generally, the chemical and food processing industries are satisfied with the new law, if only because they will now have some concrete guideposts. Happiest note in the law, at least so far as industry is concerned, is the provision that lets FDA set tolerances on, and thereby allow controlled use of, additives that might be toxic under some conditions.

Here are some other key provisions of the new law:

Covered are "intentional additives," "incidental additives," and sources of radiation. ("Accidental additives" are not within the scope of this law; they are covered by sections of the Federal Food, Drug, and Cosmetic Act dealing with adulteration.)

Conditions of safe use are set by FDA. An additives manufacturer files with FDA a petition asking approval of an additive, detailing in his petition the material's chemical identity and composition, reports of scientific studies on its safety, conditions of proposed use, effects produced by the additive and amounts needed to produce these effects, manufacturing methods, and analytical procedures used to determine possible residues on foods.

Pretesting by the manufacturer must establish with reasonable certainty that the additive is safe under conditions of proposed use. If FDA finds it necessary, it can set tolerance limits for the additive, such limits to be no higher than amounts required to achieve the intended effect.

Anyone adversely affected by an FDA decision may file objections with FDA and ask for a public hearing. FDA must make a "fair evaluation of the entire record" before ruling at this point. Judicial review of this FDA order can be had in a U. S. Court of Appeals. The court must sustain FDA if it finds that FDA based its order on a fair evaluation of the entire record. If it finds otherwise, the court will not sustain the order.

To comply with the new law, which was signed by President Eisenhower on Sept. 6, additives in use before Jan. 1, 1958, must be proved safe within 18 months after the act becomes effective. FDA can extend this period an additional 12 months. George P. Larrick, FDA Commissioner, has said that substances used before Jan. 1, 1958, and generally recognized as safe are exempt from the law.

Pretesting of new additives apparently will pose no problems for industry. Spokesmen for additives makers say pretesting has been a normal procedure for some time. Industry people estimate that "at least 95%" of all new chemicals added to foods in recent years have been thoroughly pretested.

As for costs, consensus is that there will be no significant increase since most companies already have facilities and staff engaged in pretesting. Some staff increases may have to be made to satisfy the requirement of supplying an analytical procedure for each new additive, but no one questioned considers this a major hurdle.

Industry is a little worried, though, about having to retest existing additives. The problem here is the large number of additives involved. It takes nearly two years to test an additive thoroughly, and with the law allowing between 18 and 30 months, some industry people look for a real squeeze—especially if all additives in common use must be tested. Result: there will be no chance to work on new additives. Industry hopes FDA will decide that long-time experience with and use of an additive give proof enough of its safety.

Quite pleasing to industry is the elimination of the "poison per se" rule in the old law, under which any evidence of toxicity at any concentration was enough to preclude use of a chemical. Now, FDA can set tolerances that permit use of a toxic substance at concentrations at which it has been proved safe. This change will let more additives be used, and will spur additives research and technology, say industry spokesmen. They see better quality foods and less waste and spoilage as direct benefits.

Not so pleasing to industry is an amendment put into the bill at the last moment by Rep. James J. Delaney (D.-N. Y.). The Delaney amendment forbids FDA to allow use of an additive otherwise allowable if it has been shown to be capable of causing cancer when ingested in any amount.

Right now, say industry observers, this is only a minor amendment in an otherwise satisfactory law. Nothing being eaten today has been shown to cause cancer. But in 15 or 20 years, when more is known about cancer, it may be found that some additives could cause cancer if eaten in large amounts. No quantitative terms are attached to the Delaney amendment, the critics point out, so it is possible that the "poison per se" argument may pop up again. If so, industry may again have to fight for amendment of the food additives law.

No real stumbling blocks are foreseen by industry in the near future, though. In fact, now that major hurdles seem to have been removed from the path of additives research and technology, industry expects to see higher quality foods with lower risk of waste through spoilage. The consumer will be the big gainer.