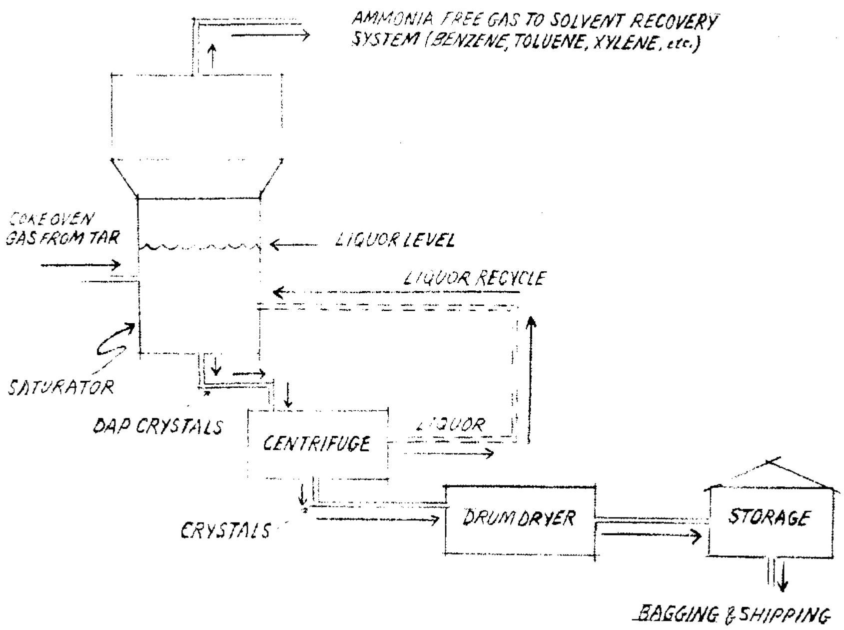


The flowsheet for DAP manufacture is very similar to that for ammonium sulfate

value unit of 10-20-0. At $162 per ton, DAP's common value unit cost is $1.88.

Related Products May Help

DAP is new and will doubtless need some educational backing, but older, related products may have at least prepared the way. Consolidated Mining & Smelting began making monoammonium phosphate (11-48-0) and ammonium phosphate sulfate (16-20-0) at Trail, B. C., in 1936. CM&S markets both products widely in the western and northmidwestern U. S. Stauffer at Tacoma, Wash., and Mathieson at Pasadena, Tex., has made ammonium phosphate sulfate for some years; Stauffer also makes monoammonium phosphate at Tacoma and at Garfield, Utah. Missouri Farmers Association at Joplin, Mo., got under way last year with both 11-48-0 and 16-20-0.

One noteworthy trend is toward a nitrogen-phosphate ratio of 1:1 or higher. Phosphate sulfate was a move in this direction. Stauffer came out last year with an 8-12-0 and is toying with a 12-8-0; CM&S is introducing a 27-14-0 this season. Should this continue, DAP might look better for high analysis mixes than as a simple.

Until recently, wet process phosphoric acid's impurities have made it an impractical raw material for diammonium phosphate. TVA, however, recently announced a wet process acid method (not suitable for coke oven conversion) and reports brisk interest; at least six firms have requested process economics data. Monsanto, meanwhile, reports two imminent prospects for the furnace acid process. And yet a third route to higher analyses is nitric acidulation of phosphate rock, used by Allied at South Point, Ohio, and Associated Cooperatives at Sheffield, Ala. (Nitric acidulation becomes more economical when sulfuric acid is in short supply.) Perhaps all that can be said for certain is that the technical advance goes on.

Indirect Insect Control

There may be a future for compounds that slow growth—they may even solve resistance problem

THE INDIRECT APPROACH to insect control is being explored by a research group at the USDA's research Center in Beltsville, Md. A group of insect physiologists has been investigating nontoxic chemicals that affect the development of insects. Traditionally, screening of chemical compounds for insect control has been directed to finding materials which would kill bugs at low concentrations. The physiologists, however, are interested in the effects of low levels of chemicals which don't kill the insects but do affect their development.

The project has evolved from one aimed at investigating the normal growth rate of insects. These normal development studies have now been expanded to include screening of compounds which affect development, especially in insect larvae. A wide variety of compounds has been found to affect development; colchicine and aminopterin prevent normal cell division and growth; sulfanilamide and coumarin seem to slow down the metabolism.

The insecticide synergist, piperonyl butoxide, is usually considered nontoxic to insects. It is added to insecticide formulations to increase the effectiveness of active insecticides. When added to the medium on which housefly larvae are grown, piperonyl butoxide has been found to slow down the development of the larvae, in some cases preventing them from becoming adults.

Added at a level of about 0.1% by weight to the larval-rearing medium, it allowed only about a quarter of the flies to develop into normal adults, and their development took two days longer than that of normal flies. Increasing piperonyl butoxide levels to about 0.25% prevented adult development of nearly all larvae. One interesting note turned up by the studies: piperonyl butoxide seemed to affect DDT-resistant flies more than normal flies.

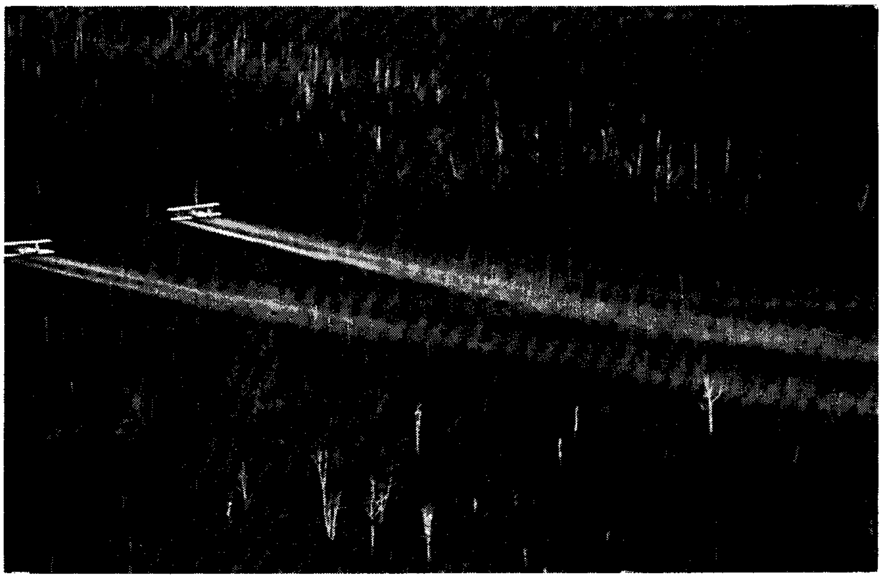
The studies of DDT-resistant flies are considered to be particularly important, for in many areas the effectiveness of DDT as a control of houseflies has decreased to the point where it is nearly worthless. The physiologists are investigating the metabolic background for this DDT resistance with the aim of finding spots in the metabolism of the DDT resistant flies which might be susceptible to chemical attack. The attack from the physiologists' point of view would not necessarily have to kill the flies immediately but a long term poison of the antimetabolite type might be the right thing.

As yet the researchers see no immediate practical application of the work on growth or development inhibitors; in the long run they may be opening up a new approach to insect control.

Forest Insects

Insects now epidemic in most western forests, and losses exceed 5 billion feet/year; chemicals halt some but improvement vital

ASK WESTERN forest industry men about forest insects and their estimates can only be classified as "bunyonesque" in true forest industry tradition: Millions of infested acres require millions of dollars for control efforts. The goal: saving all or most of well over 5 billion



Spraying against budworm; planes often fly in pairs. Air turbulence so created provides wider dispersal of spray particles and gives more efficient coverage

board feet lost annually in western forests because of insects and diseases.

Forest pests have been endemic for many years and even epidemic from time to time in specific areas. Only in recent post-war years, however, have foresters attempted to control such widespread infestations. For instance, spruce budworm is now epidemic in Oregon, Washington, Idaho, Montana, and New Mexico, with some 3.7 million acres urgently demanding control in 1955; Englemann spruce beetle has been epidemic in Colorado since 1942, requires a $1 million control program this year; and Douglas fir beetle is now epidemic in several western states, to mention only some of the major infestations bedeviling western forests today.

Westerners understandably are not standing idly by watching timber fall prey to these and other insects, are instead applying both proper forest management and chemical control to halt the invasions. To date, foresters achieved one of their most spectacular successes with chemical control on spruce budworm in Washington and Oregon. Some 3.2 million acres got a DDT-in-oil spraying from 1949 to 1954. Kill has been better than 99%, and the 2.3 million acres classified as "epidemic" during the outbreak's peak in 1949 dropped to 1 million last year. But while chemical control has been excellent where used, budworms are intensifying in unsprayed timber, and a 3.7-million-acre spraying must get under way this year throughout the West if losses are not to be counted in billions of dollars.

Pest Action Committees Spark Regional Control Programs

Spark plugs behind insect control in the West's forests today are a series of regional forest pest action committees. Of what has turned out to be the prototype committee, Ernest L. Kolbe, Western Pine Association forester, says, "Private, state, and federal foresters banded together in the Pacific Northwest to do a job on spruce budworm control that none could do alone. We had been going along separately from crisis to crisis, improvising as we went and always lagging behind insects and diseases."

Appalled at four years of increasing budworm infestation, interested parties therefore founded Northwest Forest Pest Action Committee in 1948, immediately started a crash research program on control measures. Aircraft spraying of DDT in diesel oil was soon found to give virtually 100% control, and this method is now standard for budworm throughout the West.

The committee concept, so often resulting in inaction in other fields, proved so successful in Oregon and Washington that five additional committees now function in the West's major forest regions—northern Idaho, Montana; southern Idaho; Colorado, Wyoming, and South Dakota; Arizona, New Mexico; and California. Each coordinates work by federal, state, and industry groups on infestation surveys, makes recommendations for specific spray programs, and analyzes research needs in its area.

Not All Insects Are Now Susceptible to Chemical Control

Specific insects plaguing western forests fall into two broad categories—foliage feeders and bark feeders. Foliage feeders, of which spruce budworm is currently the prime offender, defoliate trees, cause reduced growth and even death. Bark feeders, such as Englemann spruce, Douglas fir, and pine bark beetles, burrow beneath the bark, then "girdle" the tree. Since this girdling occurs at the very layer where tree growth takes place damage is obvious.

Of the two types, defoliators are at present most easily treated by chemicals. DDT is entirely satisfactory—of 3 million acres sprayed for budworm in Oregon and Washington, less than 1% needed respraying. No DDT resistance has been noted yet, and no new insecticides are prospective replacements at the present time.

Proper forest management is still the best attack against bark insects. Highly susceptible trees, such as those declining in vigor as well as wind and fire damaged, must be removed. Still in the experimental stage is potential control measure of felling special "trap trees" which can be removed when bark beetles have congregated in them. Labor costs for these measures are high, however.

Chemical control of bark insects depends on effectively penetrating the bark and is possible only in certain regions. In the Rocky Mountains, for instance, trees are mainly thin barked and short. Hand-spraying each infested tree with fumigants such as ethylene dibromide has been successful, although at high cost. Elsewhere in the West, however, trees are mostly thick-barked and much taller, and chemical control will not be practical generally until better penetrants are found.

Basic research on new materials and new methods is what is needed, not merely a search for new outlets for materials developed for other purposes.

Meeting Needs of Future Promises Large Chemical Use

While foresters bank ultimately on forest management to settle their insect problems, they are not overlooking new chemical controls or improvements on present ones. The chemical industry screens hundreds of new insecticides each year, and forestry industry people would like to see at least one or two forest insects included in the industry's present standardized screening methods. DDT may be largely satisfactory for some insects, but undoubtedly is not the final answer. Standardized procedures for further testing new chemicals under forest conditions are also needed. Improved aerial and ground application methods might make practicable some chemical control programs now prohibitively expensive. For bark insects, new bark-penetrating sprays are needed, and possibilities for systemic insecticides applied through foliage or by cambium injection require investigation.

Forests underlie the basic economy of many a western state, and it appears there are indeed some volume outlets for chemicals in the offing.