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can be measured in two ways. "We'll take a pre-spray and a post-spray count of insects and thus be able to determine the percent mortality," he said.

"After the feeding of the bud-worms, we'll also take defoliation measurements," Dimond explained. "If we can save 50 percent or more of the foliage, the trees will probably live."

The project will mainly involve testing of Abbott Laboratories' B.t., trade-named Dipel. Depending on funding, Dimond said plans may also include testing of Thuricide, another B.t. brand from Sandoz, Inc.; Orthene, an organic phosphate compound from Chevron; Lannate, a carbamate product from DuPont; Cygon, an organic phosphate insecticide-acaricide from American Cyanamid Co.; and a product from Thompson Hayward known as TH640.

### New York Arborists Group Elects '75 Officers, Directors

At the annual meeting of the New York State Arborists Association in Syracuse, N.Y., officers for 1975 were elected. Carl Lundborg was re-elected president of the Association. He is a vice president of the F. A. Bartlett Tree Expert Company with headquarters at Westbury, N.Y.

Three vice presidents were also elected: first vice president, D. W. Cadwallader of Hopewell Junction, N.Y.; second vice president, Richard Wickey of Westbury, N.Y.; and third vice president, Jacob Bruinooge of Spring Valley, N.Y. James W. Taylor of Gardener, N.Y., was elected secretary-treasurer.

On the board of directors, Jack A. Schultz of Merrick, N.Y. will serve a one-year term as will Dave Kress of Schenectady, N.Y., and Sam Blakley of Mt. Vernon, N.Y. For two-year terms, Philip Brogan of Syracuse, N.Y., and Leo Cook of Vestal, N.Y., were chosen. For three-year terms, the Association selected Raymond Smith of Buffalo, N.Y., and Vincent Cirasole of Bay-side, N.Y.

Margaret Herbst, with headquarters at 101 Park Ave., N.Y., N.Y., was reappointed executive secretary.

(more news on page 52)

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The Southern Weed Science Society elected new officers for the coming year at the Society's recent 28th annual meeting in Memphis. New officers are: (Standing, from left) L. McCormick, Louisiana Extension Service, Baton Rouge, La., member at large; William G. Westmoreland, Ciba-Geigy Corp., outgoing president; Roy J. Smith, USDA-ARS, Stuttgart, Ark., member at large; Wayne Wright, Dow Chemical Co., member at large; Dr. Robert Frans, University of Arkansas, constitution and operating procedures chairman; (seated, from left) Dr. J. B. Weber, North Carolina State University, editor; Dr. Paul W. Santelmann, Oklahoma State University, president; Dr. A. J. Becton, Funk Seeds International, president-elect; Dr. Gale Buchanan, Auburn University, vice president; and Dr. Howard Greer, Oklahoma State University, secretary-treasurer.

## Air Products Expands With 250 Ton/Day Ammonia Plant

Air Products and Chemicals, Inc., said it will expand ammonia production capacity at the company's New Orleans, La., facility with the addition of a 250-ton per day ammonia plant. This new capacity is expected to be on stream in January, 1976.

Ammonia is expected to continue in worldwide short supply into the late seventies. The United States produces about 16 million tons of ammonia annually. Approximately 75 percent of domestic consumption is used in fertilizer products.

Since a grass roots ammonia facility could take approximately three years to complete, Air Products purchased certain idle ammonia production equipment which is being used in this expansion. These otherwise long lead time items will make it possible for the new plant to be in production in approximately one year.

(more news on page 54)

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54

## NEWS (continued)

### Turf Fertilizer Supplies O.K. But Prices Higher Than '74

Fertilizer supplies for home lawns, golf courses, and parks should be adequate this spring but higher in price than last year, said a faculty member of the College of Agriculture at The Pennsylvania State University. Dr. Donald V. Waddington has studied the situation and reported his findings at the 45th Michigan Turfgrass Conference held recently in East Lansing, Mich.

A check of typical turfgrass fertilizers showed price increases of 60 to 67 percent since last spring and 29 to 35 percent increases since last July, he said.

As an example, a 10-6-4 fertilizer with 25 percent slow-release nitrogen increased from \$130 per ton in the spring of 1974 to \$162 in July, 1974, and then to \$212 by January of this year. Obviously, rising costs for materials and manufacturing are passed along to buyers.

Describing increased costs for two special slow-release nitrogen fertilizers, ureaform and IBDU, Waddington said ureaform prices have increased by about 60 percent in the last two years, while costs for IBDU have doubled. In studying the fertilizer market, Waddington, associate professor of soil science at Penn State, contacted representatives of major turfgrass fertilizer manufacturers and some of the largest distributors in Pennsylvania.

According to one manufacturer, the homeowner who paid about \$8.80 in 1972 to fertilize an average lawn of 8,000 square feet will be faced with \$14.40 for one application of the same material in 1975. Two or three applications a season are generally recommended. Thus, some fertilizer suppliers expect a decline in buying by the average homeowner.

People who buy in large quantities, such as superintendents of golf courses and parks, may not always get the exact fertilizer grade or ration they want and deliveries may be delayed, Waddington said. If delivery is delayed, be prepared to pay the price being asked at delivery

(continued on page 60)

## BACILLUS THURINGIENSIS:

### Its Properties And Manufacturers

B.t. is a natural bacterium, *Bacillus thuringiensis*.

When gypsy moths or other caterpillars ingest foliage sprayed with B.t., their digestive mechanisms are disrupted and the pests immediately stop feeding. Death follows from within three hours to three days.

Unlike the organic chemical insecticides, this compound controls only Lepidopterous larvae — the group which includes worms such as gypsy moths, tent caterpillars and inchworm. It is not harmful to desirable insects, animals, fish, humans or plants.

Larvae which have died are not dangerous, either. Tests have shown that birds and other predators readily eat and thrive on sprayed larvae.

B.t. is manufactured as Thuricide by Sandox Wander; as Dipel by Abbott Laboratories, Chicago, Ill.; and as Biotrol XK by Thompson Hayward.



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The slow-release nitrogen that nourishes for months and months without repeated application.

STH75-4



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WEEDS TREES and TURF



## NOTION (from page 10)

Northeast, there have been break-outs in Michigan, West Virginia, Maryland, Florida, and even in California, according to the U. S. Forest Service.

Most of the newly invaded areas have not suffered significant damage as yet, but in Michigan the infestation was heavy enough to warrant spraying with insecticides over several thousand acres, and a spray program was launched in two counties in Maryland last year. Some authorities are afraid that heavy damage may occur in the next few years to the hardwood forests south of the present infestation belt unless preventive measures are taken.

What about the future? To quote the current U. S. Forest Service Report: "One can speculate that, as the gypsy moth is introduced into new areas to the south and west, it will be successful because of an abundance of favored food and a relatively low control exerted by native parasites and predators. Apparently no climatic or geographic barrier exists to inhibit the spread of the species. . . . The gypsy moth might eventually extend its range in this country to include over 100 million acres." Oak and other trees favored by the gypsy moth caterpillars, the report points out, prevail in the southern Appalachians, Tennessee, the Ozarks and hugh areas of the Midwest, offering conditions highly favorable to the gypsy moth.

Attempts to control the persistent pest by a variety of methods date back to 1891. There were times when the control programs were so successful that authorities felt the gypsy moth had been eradicated, but new infestations occurred nevertheless and the areas affected increased, ultimately including every state in the northeast.

Cooperative State/Federal programs directed against the gypsy moth began in 1932. DDT, introduced in 1944, was highly effective, but was phased out in 1968 because of its long-lasting residue, which had adverse effects on the total environment.

In the search for alternatives, experimentation with biological or microbial insecticides was launched in the 1960's. Unlike most chemi-



Each gypsy moth egg mass is capable of hatching up to 500 caterpillars. The newly hatched larvae seldom feed, thus application should be made during the second or third instar stage.

cals, microbial insecticides are specific in their action. That is to say, they will kill the target pest when used properly without harming beneficial insects, birds, fish and wildlife.

A very effective biological agent, *Bacillus thuringiensis*, (B.t.) was dis-

covered in the course of the search for new solutions to the defoliation problem. B.t. is a bacterium which is cultered to produce spores and crystals. It is this crystalline body that has a toxic effect on the gypsy moth caterpillar.

B.t.'s mode of action is unique;

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after ingestion, enzymes in the insect's gut hydrolyze the protein crystals and immediately affect the caterpillar's metabolism. B.t. is relatively specific for Lepidoptera, like gypsy moth, cankerworm, fall webworm and tent caterpillar, due to the alkaline nature of their digestive systems.

Within 30 minutes after ingestion of B.t., the insect's gut wall is badly disorganized, but even before that happens it loses its desire to feed. The fragmented protein perforates the gut wall, and at the same time, the pH in the gut falls to a level at which the B.t. spores can germinate. There ensues a rapid multiplication of the bacteria and the insect dies of septicemia.

The important thing is that feeding stops almost immediately after ingestion of B.t. although the insect may continue to live for hours or days afterwards. In other words, defoliation ceases.

B.t., sold commercially under the trade name THURICIDE, is produced by Sandoz, Inc., Crop

Protection, Homestead, Florida.

Through continued research and development, Sandoz has brought to the market thuricide 16B, designed specifically as a low-volume aerial spray against the gypsy moth and other forest caterpillars. This formulation has consistently given 75 to 90 percent foliage protection from gypsy moth caterpillars when properly applied. Application costs can be reduced, since this easy-to-use liquid can be loaded aboard an aircraft, undiluted, or premixed 1:1 with water at the spray site without expensive mixing equipment or addition of adjuvants.

In the spring, application should begin when leaf expansion has reached a minimum of 20 to 30 percent of normal growth, to ensure sufficient leaf surface upon which to deposit the bacteria. A gypsy moth egg hatch often may occur over a period of several weeks, usually in mid-April to early-May. During this period, young, newly hatched gypsy moth caterpillars seldom feed until the second instar stage. Thus,

application is most effective when timed to coincide with second and third instar larval development and maximum leaf or foliage expansion. Spray applications applied too early will likely make a second application necessary, while late applications result in excessive leaf injury.

Thuricide 16B should be applied at the rate of 1-2 quarts per acre, either undiluted, or diluted in water at a 1:1 ratio, depending upon the capabilities of the aerial application equipment. Either rotary or fan type nozzles arranged on a spray boom, consistent with the aircraft capabilities and calibration desires, have been proven effective. Spray droplets, ranging in size from 80 to 300 microns are satisfactory, but average mean diameter should be kept in the range of 80 to 120 microns (for optimum deposit.) Spray adjuvants or additives are not required in any case.

If egg hatch occurs over a long period of time, two applications may be required as with most other commonly used insecticides. □

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**'ADELGIDS'** (from page 32)

interesting group of insects because of their bizarre life histories and host relationships. All of them feed exclusively on conifer bark or needles. Most of them have very complicated life cycles during which two to eight distinctly different morphological forms can occur.

Many adelgids are capable of causing gall formation and spend one phase of their cycle inside these induced plant structures. Galls are formed only on spruce and their form varies according to the species of adelgid which stimulates their production. On other hosts adelgids are free-living and are typically protected by white woolly wax which they produce.

Nearly all species of adelgids infest different host genera during certain parts of the complete life cycle. Some forms reproduce sexually and others are entirely female and produce offspring from unfertilized eggs. Each species of adelgids has specific hosts and the various forms are produced only on the appropriate host. One form serves the function of dispersal to the alternate host.

The galls formed on spruces can be aesthetically objectionable and, if

numerous, can result in disruption of the symmetry which is frequently desirable in landscape plants. The free-living forms which feed on needles cause discoloration, distortion and premature needle drop. Adelgids which feed on the tender bark of new shoots frequently cause stunting and distorted growth. Some species, such as balsam woolly aphid, severely injure trees and, if numerous, can cause tree mortality. Individual trees vary in their susceptibility to adelgid attack, some suffer repeated severe attacks and others are essentially resistant.

The two most common adelgids in ornamental plantings are Cooley spruce gall aphid (CSGA) and eastern spruce gall aphid (ESGA). Both can be found in any part of the world where their hosts occur. Discussion of their life histories will illustrate the diversity to be found in this group of insects.

CSGA induces galls on spruces, mainly Colorado blue, Sitka, and Englemann. It also feeds on the needles of Douglas-fir. The galls are terminal on new growth, green through the summer when the adelgids are active inside and then brown after the adelgids leave in late summer. There are six forms of individuals in the complete cycle of CSGA — two found only on the bark of spruce twigs, one which develops within the galls and then moves to other twigs of the same tree or flies to another spruce or to Douglas-fir, two found only on the needles of Douglas-fir and one which develops on Douglas-fir needles and then flies to spruce. One of the two forms of spruce twigs is the sexual state, the other five are all parthenogenetic. These six forms are all different in structure and habit.

ESGA is known only from Nor-

way spruce and white spruce and has only two morphological forms; one is free-living on bark twigs and the other develops withing galls which are basal on new growth and open to release the inhabitants in late summer or early autumn. These move to other branches or to other trees. Both forms of ESGA are parthenogenetic.

About 20 additional species of adelgids are known to occur in the United States. Various ones cause galls on all species of spruce and the free-living forms are found on larch, hemlock, fir and pine.

Control studies in Ohio, Maryland, Pennsylvania and Washington have shown that prevention of galls on spruce can be accomplished by a thorough application of insecticide in the autumn, sometime between the time the old galls open and the first frost. This generally gives at least six weeks leeway and can be easily scheduled.

Endosulfan at 0.5 lb. active ingredient per 100 gallons of spray or carbaryl (the only carbamate registered for CSGA and ESGA) at one lb. active ingredient per 100 gallons are most effective. The free-living forms can be controlled by the same insecticides whenever they are present. Of course, if new foliage is to be protected, insecticide application must be made before damage occurs, and should be applied shortly after bud break. Repeated applications in the same season are almost never necessary.

While these two materials have Environmental Protection Agency approval for control of adelgids, an applicator should always check local regulations, insecticide labels, and State recommendations before applying them. □



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Table 1.

Type	Material	Lb. AI/100	% reduction from untreated check
carbamate	carbaryl	1	99
phosphate	parathion	0.5	44
phosphate	malathion	1	0
systemic carbamate	aldicarb	*	100
systemic carbamate	carbofuran	1	96
systemic phosphate	monocrotophos	1	0
chlorinated	endosulfan	0.5	97

\*6 g. AI/in. d.b.h. applied to the soil.

Table 1 illustrates selected results from several experiments.



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## NEWS (from page 54)

time rather than at ordering time, he said.

Waddington suggested several ways to cut fertilizer costs. Quick-release or soluble fertilizers furnish nitrogen at lower costs than the slow-release types. If a switch to solubles is made, adjust the rate and timing of use to avoid fertilizer burn or overstimulation of growth from quick-release fertilizers.

In buying different fertilizer

grades with the same ratio of nitrogen, phosphorus, and potash, a higher analysis such as 16-8-8 is normally a better buy than the same ratio at 10-5-5. This is due to a lower cost per unit of plant food, less material for handling and storage, and lower shipping costs.

Dry products are less costly than liquid fertilizers, Waddington said. Blends may be lower priced than granular or pelleted fertilizers. However, separation of materials due to

size or density differences is a problem with some blends. Higher costs for granular or pelleted fertilizers may be justified, he said, in order to obtain a balanced distribution of nutrients with spinner-type spreaders.

Homeowners should look for discounts during early season sales campaigns or late in the season. Above all, have the soil tested to determine the need for nutrients.

Turf professionals using large amounts of fertilizer should continue buying bulk supplies, where savings are generally available. Some suppliers will deliver in portable bins if storage space is not available.

## Why Not Spray the DEPENDABLE Way ...

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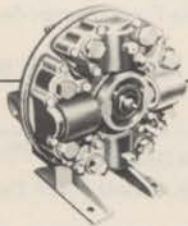
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## Missouri Distributor Moves Into 44,000-Sq.-Ft. Building

Robison's Lawn & Golf, Inc., a 30-year-old professional turf maintenance equipment and golf car distributorship, has moved into a remodeled 44,000-square-foot building in Grandview, Mo.

The building is on five acres and serves as Robison's sales and service outlet throughout Kansas and western Missouri. William E. Robison, Jr. and Jack W. Robison co-own the 23-member distributorship which handles RainBird sprinkler systems and Cushman golf cars and turf care equipment.

## Hesston's Production Tripled By Move to Larger Facility

The Lawn Equipment Division of Hesston Corporation recently tripled its production capacity and office space by moving its headquarters to a two-year-old building in southeast Indianapolis.

According to Bill Howard, division general manager, the move to the 54,000 square foot facility makes it possible to streamline the division's manufacturing process. The Front Runner grounds maintenance tractor, its attachments and the newly-designed StumpRazor tree stump remover can now be produced simultaneously, increasing the division's ability to fill distributor and dealer orders.

"The move also improves the working conditions of Lawn Equip-

(continued)