

of the plant materials are considered in the planning.

Three major factors in planning such programs are (1) numbers, (2) size, (3) selection of species. The numbers of trees and shrubs are usually obtained as part of the design process and are usually determined by the results desired at maturity. The size of the materials determines how soon you will achieve the effect visualized by the designer. Use of larger plants is more expensive, but in effect allows us to "buy time." Considering the growth of an average shade tree we can gain perhaps 4-6 years per inch of additional trunk diameter. The selection of species should not be based on what is available, or what is cheap, but on the effects of texture, color, and form that we need for the situation. These functions must be correlated with existing site factors if we are to make the proper decision as to the optimum species. All too often these "optimum species" are not readily available on the current market. However, planning future needs and close cooperation with enlightened nurserymen can do much to improve our chances of purchasing the necessary plant materials in the numbers, sizes, and species that we need.

Planning also involves the training and equipping of skilled employees to carry out the plans. Without skilled men and specialized machines we are unable to take advantage of the rapidly changing demands and opportunities that are part of today's operations.

Operations:

In procuring plants for our planting operations we must strive to be effective, that is, we must strive to get the right things done. We cannot depend on any one method. While the most common method of procurement is by purchase from commercial nurseries, there are

at least 4 others: collecting, swapping, salvaging, and growing your own. (See Table I for comparisons.)

Collecting, swapping and salvaging are the least used today, but often are the only way of obtaining rare or unusual plant materials. Formal gardens, botanical gardens, arboreta, and restricted street situations often require materials that are "out of style," or "out of stock," or "unobtainable in large sizes." For example, nearly twenty years ago we started using the hophornbeam (*Ostrya virginiana*) as a medium-class street tree for narrow parkways, short spaces and under powerlines. The farm woodlots were our only source of supply. Collected at $\frac{3}{4}$ "-1" diameter, this sprangling understory tree developed in the nursery and later on the street to a soft textured cone shape that functioned very well for the special situations described above. It also makes a good replacement for elms and many residents cannot tell the difference. Yet this excellent tree is still not widely available.

While swapping and salvaging of plant materials may be done in small sized material in various quantities, it is usually not worth the trouble unless we are dealing with exceptional specimens. These may be moved in any size that tree-moving equipment can handle. Transplanting small numbers of individuals usually runs the labor costs sky-high. However, if a department has the skilled men and the modern tree moving equipment, the upheaval of old gardens and large homes by highway construction, urban renewal or other "progress" may offer exceptional opportunities to salvage valuable trees and ornamentals.

A number of years ago a sewage pumping station and large forcemain had to be constructed in one of our riverside parks. A fine old ornamental quince tree was in the way. During the winter before construction we carefully dug and successfully moved the tree with the frozen-ball method. Today its gnarled trunk and twisted branches add just the right

In Brief:

Effective plant procurement is an important link in the operation of a park, cemetery, golf course, street tree planting, or any operation involving public grounds. It depends on the basic management cycle involving objectives, planning, operations, and control. Once the needs are determined through planning we may acquire the plants in five ways: collecting, swapping, salvaging, purchasing, and growing your own.

The majority of the plants will be purchased or grown and the decisions of what to purchase and how much to grow will be based on a combination of economic and public service factors. With the growing shortage of plant materials especially shade and ornamental trees, more consideration is being given to long term contracts based on careful projections of need for specific kinds of plant materials. All phases of the procurement process should be evaluated to see how well the objectives were met and to help forestall mistakes during the next cycle.

As we have more precision in planning, more ingenuity in collecting, swapping and salvaging, more cooperation between growers and buyers, and learn more from our mistakes—then we will have more and more effective procurement of plant materials. T. H.

touch to the rugged exterior of our Nature Science building.

Purchasing:

I know of no department that does not purchase at least a portion of their plant materials. Even those departments operating their own nurseries will often purchase lining out stock and "whips" for growing-on and as many suitably grown planting sized materials as funds permit. The cost-benefit factors of operating one or more departmental nurseries are too complex for full discussion, but to understand a bit more we must first look at the advantages of direct purchasing.

A city department that is just getting into planting street trees or is developing only a few parks or public buildings may well contract the whole operation. In this sense they contract for the skill of the propagators and nurserymen and need only supply an inspector to see that the specifications are followed.

A more fully developed program may purchase trees and shrubs in planting sizes. In this case the department avoids the investment in land and nursery facilities and will only supply the labor for the planting crews trained and supervised by a city forester, arborist, landscape architect, or horticulturalist.

Tree purchase by government agencies is usually defined and limited in scope by policies, ordinances, and statutes regarding contract purchases. Learn the framework under which you must operate and get to know the men in key positions. Care in these planning stages saves time and confusion. A day saved for the planting seasons is a day well earned.

Contracts:

Contract procedures include preparation of specifications and standards, preparation of a time schedule, inspection of the stock,

and certification of performance.

Specifications may vary from a single page to cover the purchase of a few trees to a multi-page document for the planting requirements of a large city. The complexity of the specifications will increase in proportion to the size of the job since the inclusion of some classes of detail usually requires all classes to be covered in similar detail. Whether a set of specifications is large or small it must perform two functions: (1) with the contract it is a binding document on the parties concerned; and (2) it gives instruction and information to assist and advise toward the proper completion of the contract. A checklist should include:

- a. Scope of project
- b. Definition of terms, detail on materials, supplies, and equipment (if required).
- c. Detail of operations, time schedule and methods.
- d. Special cases and exceptions.

Use of a standard contract form and procedure simplifies bidding and tabulating. We have found that it works best to use scientific names for precision in dealing with the nurserymen, but arrange the items in lots alphabetically and by size class to aid the purchasing agent. Each lot is given a number and the bids are made on a lot basis. A purchasing agent usually finds it easier to refer "lot 14" or "lot 42" than to "150 *Platanus acerifolia* 1¾"-2" or to "20 *Kaelreuteria paniculata* 1¼"-1½". "

In addition to the time schedule for delivery included in the specifications a master time schedule should be prepared covering the preparation of lists, advertising of bids, bidding, approval of best bids by the council or manager, delivery and inspections of the plant materials. Such a schedule serves as a basis for control of progress and is used to check feed-back of reports from inside and outside the de-

partment. Copies should go to the purchasing agent and the field men who will receive and inspect the trees.

Inspection of stock as it is delivered is essential to see that you actually have the numbers, sizes, and species needed to carry out your plan. Your men should use calipers or plywood gauges to check sizes and at the same time inspect for broken roots, dried out roots, inadequate ball size, etc. These conditions or other deviations from the specifications should be noted at the time so that corrective action may be taken. Only in this way can you be sure that you will get what you pay for.

Long Term Contracting:

Emphasis on beautification of growing subdivisions, new highways, urban malls, and other public areas has created a serious shortage of suitable plant materials. This shortage is forcing changes in old methods. One of the most promising changes that is developing is long term contracting. Instead of negotiating 2 purchase contracts each year some departments and nurserymen have developed a system of long-term contracts of, say, 3000 trees of certain basic species per year for the next 5 years.

Harold Hicks, of Cottage Garden Nurseries, Lansing, Michigan, is one of these pioneers. He recently spoke of the need for planning to the Michigan Forestry and Park Association. "If you want to buy a 2"-2½" tree today it should have been born at least ten years ago! The big reserves are gone! Kansas City orders 10,000, Milwaukee orders 11,000 and where are they going to come from?" He advocated departmental planning with at least 10-year projections. These could provide guidelines to the nurserymen. He also recommended earlier requests for quotations, not just a few months earlier, but at least a year. He

Table I Plant Procurement

Methods	Collecting	Swapping	Salvaging	Purchase from commercial nurseries	Grow your own
Source	Farm woodlots, departmental lands	Friends and associates in other departments, in arboreta, colleges etc.	Highway construction, urban renewal, old gardens, dept. construction projects	Commercial growers and suppliers	Collect seedlings. Propagate from seeds & cuttings, buy lining out stock
Optimum size	Usually small seedling stock up to 2" diameter.	Usually in the larger specimen sizes, but can include almost any size that tree-moving equipment can handle	Ordinarily specimen trees only. Rare species or habit. If root pruned may go to the largest B&B sizes ³	All sizes from lining out stock to balled and burlapped specimen trees	1½"-2" dia. for street trees. Larger sizes for special sites
Bare root ¹					
Balled and burlapped ²	Unless previously root pruned, losses will be higher in larger sizes ³				
Unit cost of labor and equipment	High	Variable: depends on the distance to be moved	High	Low: men needed only during the planting season	Moderate: if equipment and trained men are available
Unit cost of plant material	Low	Low	Relatively low: but hard to figure except by cost comparison	High	Low
Inspection by state	Paid by buyer or owner	Paid by either party	Paid by buyer	Paid by grower	Paid by department annual inspection
Advantages	Often the only way to obtain rare, or exotic plant materials not in mass demand			Low investment in land, inventory. Labor need not be as highly skilled. Men needed only for planting	Insures that material will be available when needed. Develops trained plantsmen
Disadvantages	Plant materials must usually be held in own nursery for a season or two. Losses from transplant shock may be high	Time of the year is critical. Costs may run high if not in dormant season or if distance is great	Time of the year is critical. Costs will run high if not in dormant season or if the distance to be moved is great	Must plant all the current order. Hard to get material in size, species, habit that you may need. Does not develop trained men	High investment in land, and inventory. Labor costs may be higher on a unit basis

(1) Bare root: Deciduous and evergreen seedlings; deciduous trees (most species) up to 2½" diameter
 (2) Balled and burlapped: All evergreens bigger than seedlings, certain sensitive deciduous trees 1" diameter up to 6"-8"; deciduous trees from 2" diameter up to 6"-8"
 (3) Collected material will require a ball at least ½ larger than root pruned stock transplanted from nurseries

cited the 5-year contracts developed by Warren, Livonia, and Flint, Michigan. By removing much of the guess work and need for speculation such planning can insure sufficient quantities, better quality and lower prices.

Arthur C. Drysdale of Sheridan Nurseries Ltd., Etobicoke, Ontario, speaking at the 1968 Great Lakes Park Training Institute, further emphasized the benefits that can be realized through closer cooperation between the nurserymen and the departments. Better understand-

ing of standards and special terminology, and better appreciation of the types and sizes of plant materials needed will come of such cooperation. Canadian growers have recently completed *Guide Specifications of Nursery Stock*, and I understand that *American Standards for Nursery Stock* is in the process of revision. Such improved communication must be encouraged and cannot help but improve the coordination of supply and demand. Research on better selections for improved shape, habit and resistance to insect pests and

plant diseases is increasing the quality, but as yet the quantities have not kept up with the increased demands.

Growing Your Own:

Most larger departments maintain a "nursery" of some sort. This may vary from the large establishments like those of Detroit, Milwaukee, and Kansas City where skilled propagators begin the complete growing cycle, to modest nurseries devoted to "growing on" of liners and whips, to those "holding

stations" where surplus trees and shrubs are heeled in over the summer or set out for a few years until needed.

To determine the best balance between straight purchase and operating a nursery one must first obtain a realistic cost picture. When the department operations are reduced to unit costs (i.e. bedding plants @\$.10, flowering shrubs @\$.25, shade trees @\$3.00) then you can compare the departmental operations with contract purchases and have a sound economic basis for a decision.

Volume is a key factor in the decision whether to propagate or just operate a "growing on" nursery. Labor costs for skilled propagators are high (if they can be found at all) and unless they can be used to full capacity it is better to buy lining out stock. Dr. John Baumgardt suggests that purchases in units of 250-1000 plants will reduce the need for special propagating houses and skilled plantmen. He gives as a guideline "a site big enough to hold approximately 2% of the plant materials maintained by the department (trees, shrubs, and evergreens)." He adds that you should plan for 2 permanent skilled men for each 5 acres. Extra men can be sent in for digging during the planting season.

Robert L. Corbin, horticulturist for the London County Council (England) maintains traditional British standards in grounds maintenance for 250,000 public housing units serving nearly 1 million people in the London area. He maintains 13 nurseries on the outskirts and two within the metropolitan area. His men plant about 5000 trees a year, buying many at 6'-8' and bringing them on for about 5 years. Mr. Corbin said "If we can purchase in the size and species we need, we do." Though they buy a lot of material from nurseries they rely on their own finished material to

guarantee the maintenance of their landscape designs with prompt replacement of the proper plant materials.

These guidelines have been repeated by a number of North American horticulturalists including Richard Fenicchia, Rochester, N. Y.; Dr. John Baumgardt, Kansas City, Mo.; and R. H. Bishop, London, Ontario. They list a number of factors favoring the operation of departmental nurseries. Decision-making by public officials involves more than pure economics and you will notice that certain advantages are based on quality service to the public:

1. A city must have large numbers of species in relatively small quantities. Planning can guarantee the supply of critical stock if you have your own nursery.
2. A nursery program allows the city to carry on experimental programs and to preserve and perpetuate many plants which might not otherwise be available.
3. The trees can be given special pruning (ex. for street use) several years in advance of planting if desired.
4. Plant materials are on hand and available at any time for special purposes, flower shows, conventions etc.
5. The time lapse between digging and planting can be materially reduced.
6. Over a period of time a nursery operation assures that the department has capable, well trained plantmen available for special landscaping or other critical planting jobs.

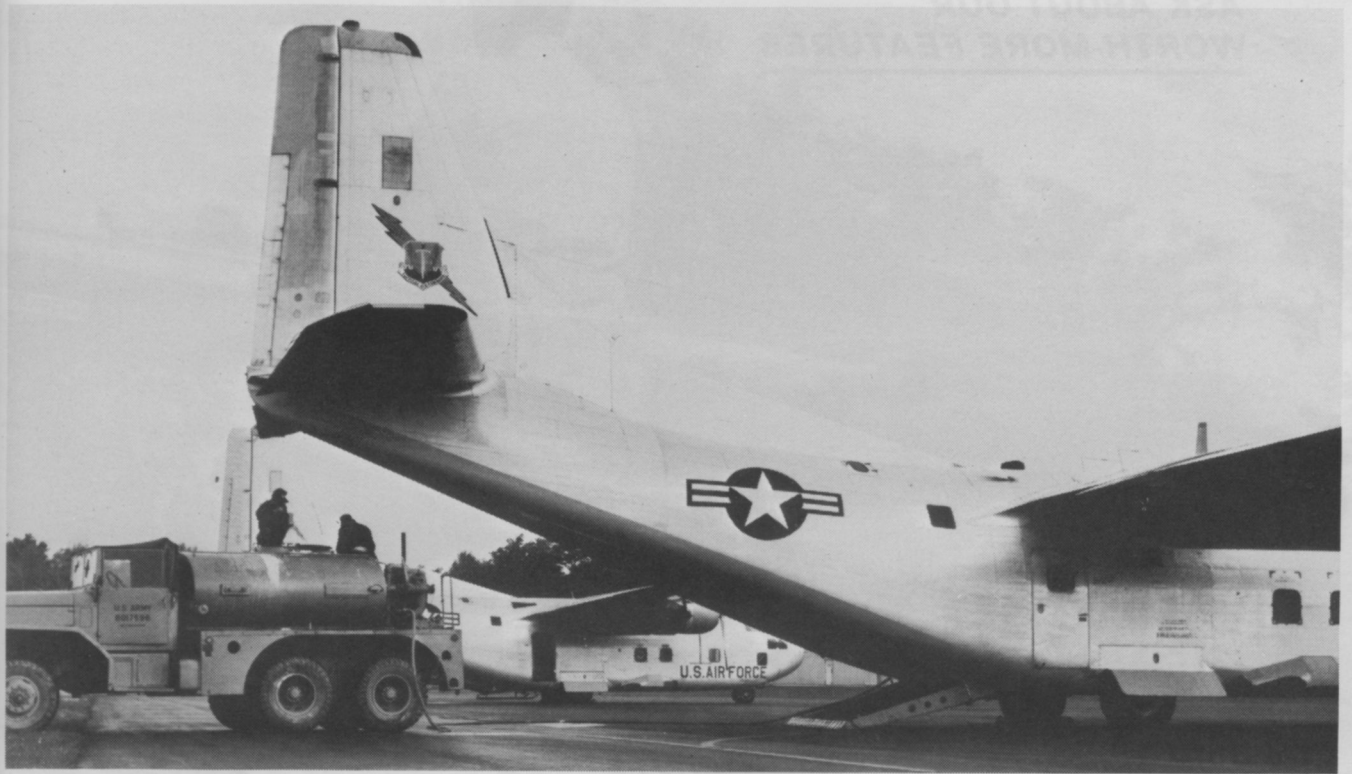
While there are many advantages it must be remembered that such facilities and staff represent a heavy investment in land time and money. City labor costs may be higher (due to fringe benefits in particular) than those of the commercial

nurseryman. Unless the higher costs can be offset by greater, or more effective service to the public, the department might better place emphasis on purchase by contract.

Control and Evaluation:

Whichever methods are used to work toward the objectives of plant procurement we must provide for control and evaluation. This is the final step of the management cycle and involves the measurement and correction of the performance of those in the operation. We compare the results with the plans and make corrections for the next time. In effect, we *plan for control and control for the next plan.*

1. Set the standards and determine what deviations will be allowed. We do not require that all the columnar maples be exactly 2" diameter, but that they measure between 1 $\frac{3}{4}$ " and 2" when measured six inches above the ground.
2. Determine precedence, what things logically come before other things. For example: Inspect nursery, compile inventory, order trees, write planting orders, write digging orders etc.
3. Establish estimated time requirement for each activity. Establish deadlines and work back.
4. Watch the feedback of periodic reports during the operation to detect critical deviations from the plans.
5. Hold an operations critique and discuss the problems and solutions with the men concerned. Often an emergency decision may be a decided improvement and should be continued. Avoid the attitude "if only we had done thus-and-so" and concentrate on the more positive "next time we will do it this way."



Sevin insecticide is pumped from army tank truck to waiting Air Force C-123 transport plane for spraying. Plane covers 500-foot swath.

Gigantic Spray Campaign Stymies

Gypsy Moth Tree Damage

DEFOLIATION of trees by gypsy moth has long been a problem in the northeastern US. Trees are seldom killed immediately, but leaf out the following year. However, many weaker trees eventually perish, especially if they suffer a second year of infestation.

To fight the moth, New York State has long had an extensive program of egg mass counts followed by spraying of the areas of heaviest infestation. A count of more than 500 egg clusters per acre marks an area as a prime target for spraying.

This was the case this past season when the State via its Bureau of Forest Pest Control cooperated with the US Military Academy and the US Air Force to spray 11,000 acres of New York's Hudson River Valley.

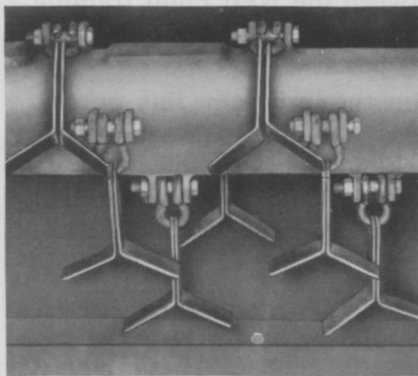
Army authorities were concerned about West Point land because it is extensively used for training and foliage is necessary. Also, despite quarantine and inspection procedures, gypsy moth infestations could be transported by military vehicles which range between the West Point training reservation and southern military posts.

In the program this spring, parts of Long Island, Ulster, Rockland, Orange, and Dutchess counties, and Bear Mountain State Park were sprayed in addition to the big acreage at West Point. Spraying was done with a variety of equipment. Included were the New York State jet-powered "Huey" helicopter, four custom operated fixed wing aircraft, two Air Force C-123 transports, and several ground application rigs. The ground equipment was used for close-in work



Trees without leaves were photographed in July. Damage was caused by severe gypsy moth caterpillar feeding. Spray program of New York State and military group prevented widespread damage this season.

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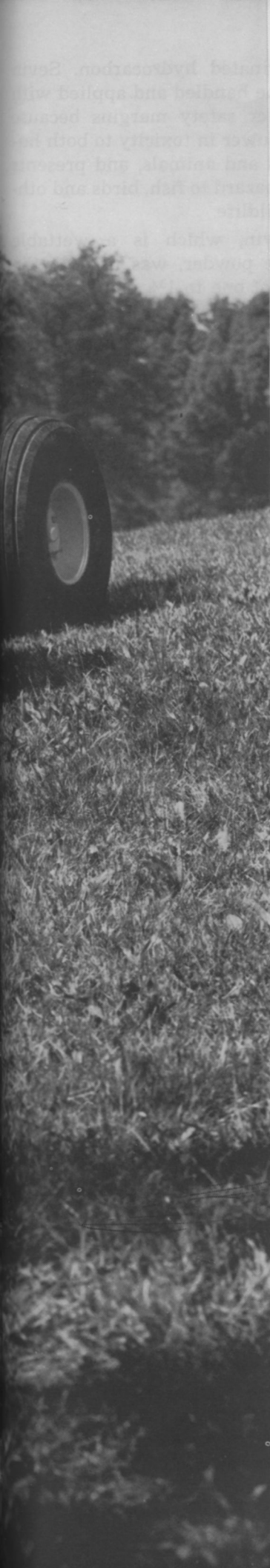
Reversible, double-edge knives

Reverse them to double their life. Knives can be resharpened individually. Does a better mowing job than a cutterbar mower even with dull knives. Cutting height is adjustable from $\frac{3}{4}$ to 5 inches.



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So safe with thrown debris that many purchasing agents insist on a flail-type mower. And you get the aggressive cutting action of a rotary cutter with the safety of a reel mower.



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New International 2444 tractor and 70 flail mower.

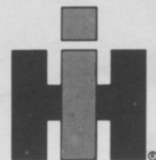
Quiet tractor. New 2444 shushes along. Won't bother the operator or others. **Quiet mower.** No noisy, vibrating housing. It's contour-formed to the heavy frame. Then continuous bead-welded to the frame to *last*.

Safe tractor. New 2444 has great sidehill stability. A low center of gravity. A low profile. Big, wide grass tires. A differential lock reduces wheel spin, turf gouging, tractor drifting. 8.5-foot turning radius with 70-inch wheelbase and easy hydrostatic power steering. **Safe flail mower.** Knife action throws debris straight to the ground, not out. Rugged rubber (not canvas) safety shield—won't rot, rip, shred. For added safety, the universal joint is shielded.

Thrifty team! Choose your transmission. Standard hi-lo with 8 speeds forward, 2 reverse. Or optional 8 and 8. And save on mower maintenance. One man can change any flail blade individually without removing every knife in the row. See your dealer for additional worth-more features and an International 2444 tractor demonstration—with a 5 or 7-foot 70 flail mower. His finance plan can help you write this new equipment into the budget.

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Spray nozzles on helicopter spray rig are cleaned and adjusted prior to loading with insecticide.

near buildings and pond water areas.

Pilots and military planes were part of the Special Aerial Spray Flight unit of the Air Force. They are headquartered at Langley Air Force Base, Va., but all spray work in the Hudson River Valley operation was done from Stewart Air Force Base. All Air Force pilots were veterans of the defoliation spray program in Vietnam.

Prior to this year, DDT and Sevin carbaryl insecticides have been used. And until four years ago, DDT was used in remote areas where there was no danger of water or pasture contamination. However, DDT use was abandoned in favor of the newer Sevin insecticide.

The switch to Sevin was made because as a carbamate, Sevin is an entirely different chemical family than DDT which is a

chlorinated hydrocarbon. Sevin can be handled and applied with greater safety margins because it is lower in toxicity to both humans and animals, and presents less hazard to fish, birds and other wildlife.

Sevin, which is a wettable white powder, was used at the rate of one to 1¼ pounds of actual insecticide in one gallon of water per acre. Pinolene, a pine-oil based material, was used as a spreader-sticker. Generally, the New York State spray programs are conducted between May 15 and June 15 each year. At this time caterpillars are young and easier to kill. Also, foliage is almost fully developed and has sufficient leaf surface area to catch the sprayed insecticide.

Practically any type tree is subject to gypsy moth infestation. Certain species such as oaks, willows, larch, linden, poplars, speckled alders, basswood, apple, aspen, gray birch, river birch, and red birch are preferred. Less favored by the gyp larvae in their late instar stage are cherry, elm, hickory, chestnut, hornbeam, maple, black birch, paper birch, yellow birch, sassafras, and black gum. However, these are also often attacked by the moth. Older gyp larvae will also eat native eastern pine, spruce, southern white cedar, hemlock, and beech. Gypsy moth infestations can be found in much of New England including parts of New York, Connecticut, New Jersey, Pennsylvania, and Michigan.

Prior to the New York State spraying operation each year, each property owner is contacted. If too many object, a spray campaign is not economically feasible and cannot be carried out. However, publicity and education over a period of years has largely eliminated objections and complaints are few. Citizens generally have come to realize the value of a carefully planned and conducted spray program designed to prevent ravaging of the tree population.

Cardboard check scraps help spraymen keep tab on effectiveness of insecticide coverage. Test here was made during spraying on New York's Bear Mountain.





Lew Seflon



Portland, Ore., was the site of the annual Spray-O-Rama sponsored by the Northwestern Spraymen's Association. Scene shows early arrivals for the Saturday session.

Northwest Spraymen Discuss Association At Portland Annual

A PANEL with 90 years experience in the spray business, discussed the worth of their association at the recent Spray-O-Rama, annual meeting of the Northwest Spraymen's Association, Inc., Portland, Ore.

Panel moderator William Owen, General Spray Service, Clackamas, Ore., led four veteran operators in comparing their business before and after becoming members of a spray association.

"My association keeps me in touch with people who can help solve problems and with people who can get information." This key statement was by Ray F. Collier, Collier Spray Service, Portland, Ore. Collier said members have to work but that they thereby gain in education, and in association with educated and experienced men. A group such as the Northwest Spraymen brings in top speakers, both local and from throughout the country, he said. By joining together, Collier

pointed out, his group helps on legislation to protect members, and to protect the public. Members learn to appreciate their competitors as people and are able to exchange ideas with both local and distant spraymen. Collier said he personally wanted to see the educational program of the association continued. He called for more information on

new materials and equipment. In return for the many association benefits, Collier said that he in turn pays dues, spends time in meetings and on committee work and gives talks to garden clubs and similar groups. He also discusses pesticides on television and radio when asked.

Another pesticide applicator, John Haines, Haines Tree Ser-

Verle Woods, Crop King Chemicals, left, and Chuck Nichols, Nu-Life Fertilizers, discuss products during Spray-O-Rama.





New officers for 1969 for the Northwest Spraymen's Association are, left to right: Stan Raplee, Seattle, Wash., president; Lew Seflon, Portland, Ore., vice-president; and Ken Crane, Edmonds, Wash., secretary-treasurer.

vice, Bellingham, Wash., said he received far more in benefits than many because he lived in a sparsely populated area. The association, he said, gives him the chance to talk with and associate with other spraymen. From others, Haines stated, he finds standards by which to judge his own business. He can freely talk over problems and keep in touch with the industry. Haines depends on

the association for meeting and seminar notices and further, he said, the organization gives an operator satisfaction in being a sprayman. Haines believes his greatest contribution can be help on recruitment of spraymen from smaller towns who are not as yet association members.

Full-Time Business

Owner of the Eastside Spray-

ing & Fogging Service at Kirkland, Wash., John Behey, gave the association full credit for getting him into the business full-time. He not only learned to know his competitors, Behey said, but he developed a high regard for them and the quality of service they rendered. Behey said he found them, through the association, to be very helpful in exchanging ideas on methods and equipment. As he personally grew in the business, Behey became a leader in educational programs to improve the business. He hired an agronomist to teach him and his employees, plus other association members, more about soil testing. Since that time, Behey has developed a full training course for new employees. He offered the group more of his time and stated that he would willingly do anything asked by the association.

An aerial applicator and pilot who operates a fixed-wing aerial spray service, Bill Powell, told the group that he would like to see aerial and ground applicators work more closely together. He said that group action was especially needed regarding legislation. Powell who is not a member of the N. W. Spraymen's Asso-

Panel discussing subject of association benefits is, left to right: Bill Powell, pilot; John Behey, Eastside Spray Service, Seattle, Wash.; John Haines, Haines Tree Service, Bellingham, Wash.; Ray Collier, Collier Spray Service, Portland, Ore.; and panel moderator, William Owen, General Spray Service, Clackamas, Ore.

