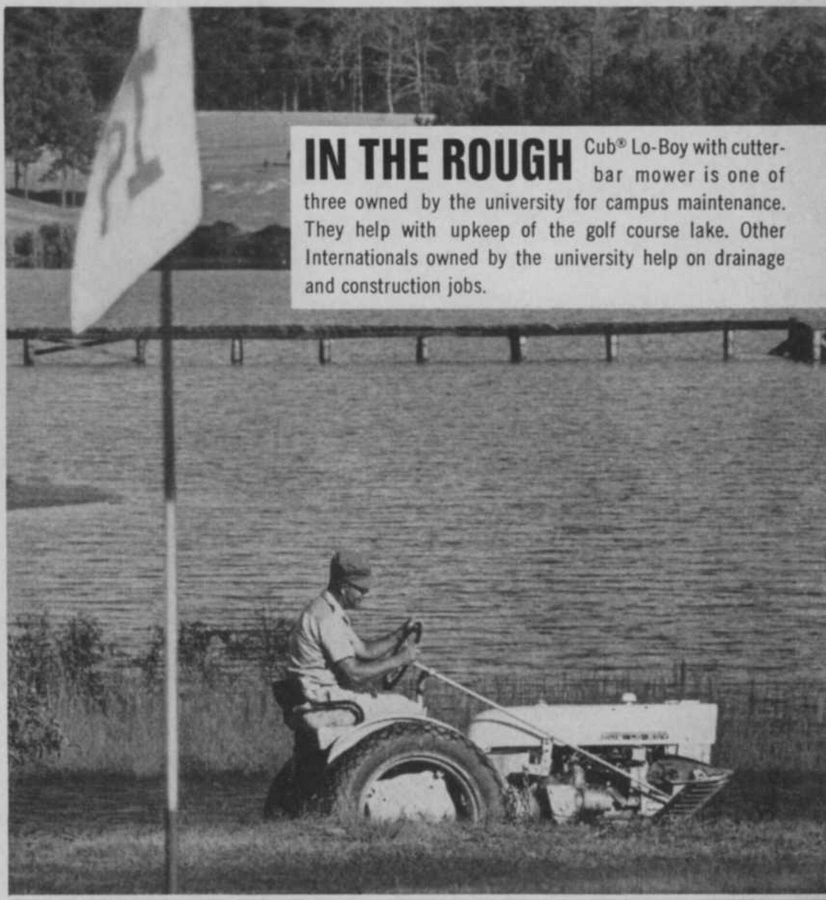
hard-pressed budget on university golf course

University of Southern Mississippi Golf Course at Hattiesburg was built in 1959 atop 250 acres of red clay and clay-gravel. It's a challenging course with steep hills and deceptive valleys, plus a 25-acre lake to harass long drivers.

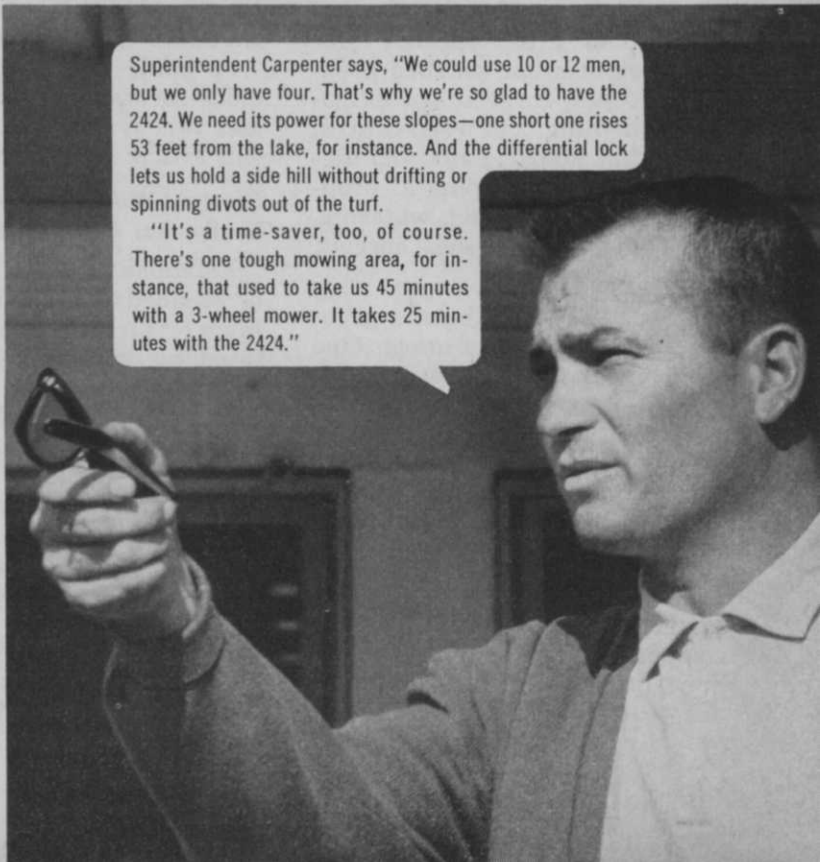
It's a challenging course from a maintenance standpoint, too. Topsoil was already washed away from the slopes when the course was built. Bahia "pasture grass" was first planted for cover and now hangs on stubbornly against over-seedings of Bermuda. For James Ray Carpenter, superintendent, it's a continuing battle against nature with aerators, fertilizers, lime—and limited manpower.

But an International® 2424 Lo-Boy is helping Mr. Carpenter and his people slowly get the upper hand. Outlook? Bright. "We're thinking of building another nine holes, bring it up to 27," says Mr. Carpenter. "We'll start it off with a rotary behind that 2424 doing the land clearing."

Your International Harvester dealer has the answer to your golf course problems, too. The best answer available. It figures, because he represents the most complete line of industrial tractors and flail, rotary and sickle bar mowers in the industry. Talk to him soon about a demonstration. International Harvester Company, Chicago 60611.



IN THE ROUGH Cub® Lo-Boy with cutter-bar mower is one of three owned by the university for campus maintenance. They help with upkeep of the golf course lake. Other Internationals owned by the university help on drainage and construction jobs.



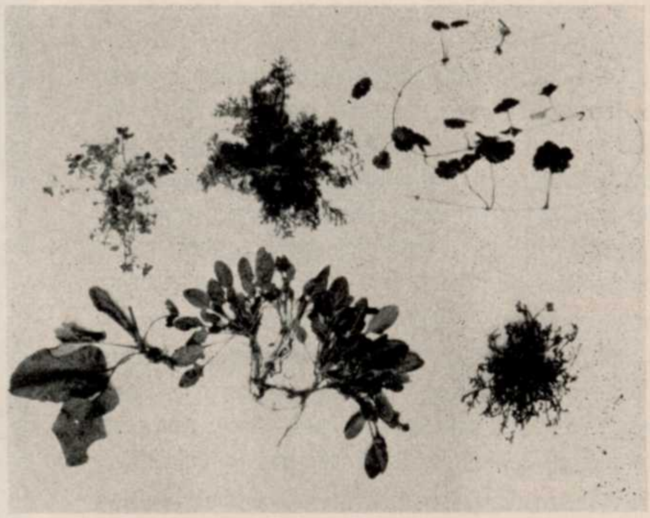
INTERNATIONAL HARVESTER COMPANY

The people who bring you the machines that work

Use The Right Chemical Tool For Weed Control In Lawns

By S. W. BINGHAM and C. L. FOY
Virginia Polytechnic Institute, Blacksburg, Virginia

Representative broadleaved lawn weeds controlled with 2,4-D. Upper (left to right): broadleaf plaintain, dandelion, spotted knapweed. Lower (left to right): buckhorn plantain, cress, chicory. Use either spot treatment or treat with wax bar.



Representative broadleaved lawn weeds not readily controlled by 2,4-D (requiring dicamba, silvex or other comparable product). Upper (left to right): common chickweed, yarrow, ground ivy. Lower (left to right): curly dock, red sorrel, prostrate knotweed.

GOOD LAWN and turf areas add beauty and protect soil from erosion. However, they don't just happen. They are carefully planned and maintained throughout the years. Selection of adapted grass species, preplant fertilization, seedbed preparation, proper seeding, irrigation, mulching, and weed control are initial steps. Later maintenance involves clipping at proper height, topdressing, watering, and control of diseases, insects, and weeds.

Weeds have long been a problem in lawn and turf areas. One of the best forms of weed control is proper grass establishment and maintenance. Improper management leads to weakening the stand of turf and to poor vigor; poor vigor and open stands lead to more weeds.

Only in recent years have good chemical weed controls been developed. There are still situations (such as scattered individual weeds in small home lawns) when hand pulling or digging weeds remains the most effective method. In larger turf areas and with general or mixed weed infestations, however, control is now best achieved by use of chemical weedkillers.

A guide for selecting herbicides for weed control in lawns and turf is included along with this article for your files.

Preplant Weed Control Is Costly, But Often Justified

Establishment of new lawns or seedbeds, or rebuilding of old lawn or turf areas may be facilitated by preseeding treatments with soil fumigants. (See Table 1.) These chemicals (such as methyl bromide and SMDC) should be properly regarded as nonselective temporary soil sterilants that will kill all growing plants. Therefore, they should not be applied where they may contact roots of valuable plants.

These compounds kill weed seeds, rhizomes, and bulbs, and then become decomposed in the soil, allowing planting of the lawn or turf area at a later date (usually a few days to a few weeks). Test plantings on a small area are advised before seeding the entire area to determine whether the herbicide has yet been dissipated to a nontoxic level, making it safe to plant the grass species. Time required for breakdown in the soil depends primarily on temperature and soil microbiological activity.

Preplant soil fumigation for weed control is usually quite a bit more expensive than recommended practices for established lawns and turf. However, the nature of certain weeds, particularly perennial grasses like bermudagrass, quackgrass, fescue, orchardgrass, and nutsedge—requires this approach since there are currently no satisfactory control measures to be recommended for established lawns.

The greater expense of soil fumigants and the objectionable waiting period before seeding are therefore justified. Other beneficial results from soil fumigation include control of nematodes, fungus diseases, and insect pests. These also tend to offset and justify the initial cost of treatment.

Weed Control In New Turf

Chemical control of weeds usually is not advisable in newly planted lawns and turf. Chemicals act through the soil to some extent and affect the susceptible germinating seeds or young seedlings of most lawn and turf grasses. After the established grass has been clipped two or three times, it can safely be treated. Many common field weeds in young lawns can be controlled by the competition of vigorously growing grasses and by subsequent mowing.

Grass Should Be Vigorous Before Chemicals Are Used

Control of most broad-leaved weeds and annual grasses in established lawns and turf is relatively simple with the wide array of new "chemical tools of the trade" now available, providing certain rules are observed

Before any chemicals are applied, grass should have reached a state of vigorous growth. This can be accomplished by good watering and fertilizing. Good vigor will insure rapid coverage by established grasses after weeds are killed or suppressed.

Plants are readily classified into two large groups, grasses and broad-leaved species. This classification is helpful, but it is not enough to make a good herbicide selection. For instance, crabgrass is an annual plant that reproduces by seed and is readily controlled with appropriate herbicides before it emerges from the soil. On the other hand, bermudagrass is a perennial species that reproduces by vegetative means as well as by seed and requires an herbicide that will control a large, growing, more mature plant.

If in doubt about what weed species are present, consult local extension service personnel, commercial representatives, or appropriate literature for positive weed identification before adopting a particular chemical weed control practice.

Herbicides Must Be Carefully Selected

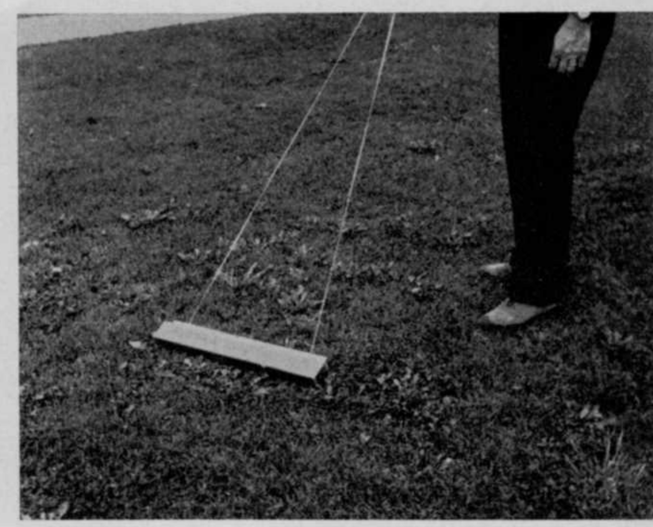
Since we are dealing with "selective" herbicides in lawn and turf weed control, it is necessary to understand something of the nature of chemical compounds involved and the principles of herbicidal selectivity.

A given compound may be toxic or nontoxic to a particular plant population, a single plant, a plant part, or individual cells, depending upon several conditions. Thus herbicidal selectivity is relative, not absolute—a good point to keep in mind.

A *selective herbicide* may be defined as one which, under specified conditions of use, is more toxic to one species of plant (the weed) than to another (in this instance, the lawn or turf grass). Some selective herbicides, such as bensulide, DCPA, and dichlobenil, work best through the soil; whereas others, 2,4-D, dalapon, and amitrole, for example, are most effective when applied to foliage. With still others, dicamba for example, activity through both root and foliar uptake is apparently important.

Among materials applied to

Spot treatment in lawn using plastic detergent jar.



Treating broadleaved weeds in lawn with wax bar 2,4-D.

Table 1. Preplant Chemicals Guide

Herbicide*	Rate: lb/1000 sq. ft.	Remarks
Methyl bromide	10 lb.	Prepare area for seeding and use airtight cover. Expose soil to chemical for at least 24 hrs. and aerate for 24 hrs. Temperature must be above 55°F.
SMDC	10 qt. 5 qt. (with good tarp or airtight cover)	Drench chemical into soil using about 100 gals. of water. Use lower rate if cover can be installed immediately after application of SMDC.

*Caution: Do not breathe gases or allow skin to come in contact with these herbicides. Use only with extreme caution.

foliage, some may kill by contact (as DSMA and PMA), and others may be translocated to exert a toxic response in some other part of the plant (as 2,4-D, dicamba, and dalapon).

In practice, the responses of two dissimilar intact plants to herbicides may not be clearly related to any one selective mechanism, such as differential wetting. The principal factors known or believed to contribute to herbicidal selectivity are outlined below. These processes are not considered to be mutually exclusive, however. The choice of herbicides for a certain weed situation is often determined by several factors:

Principles Influencing Selective Use of Herbicides

Avoidance of contact between desirable plants or sensitive plant parts and toxic amounts of herbicide:

1. Directed or shielded spraying (as herbicides used along sidewalks, borders, etc.).
2. Placement of preemergence chemicals relative to position of grass and weed seeds, or roots of established plants.
3. Postemergence use of pellets or granules.
4. Delaying planting of grass crop until preplant herbicides (soil fumigants) are dissipated.

Morphological differences (observable features) that primarily influence *retention, penetration,* and *translocation* of herbicides to site(s) of action. *Retention* refers to the amount of herbicide still held by the plant after treatment.

***Penetration,* broadly defined, is the passage of substances into the plant leaves, roots, etc., and their entry into the various tissues, including vascular elements. *Translocation,* defined here, refers to long distance transport within the plant, presumably in association with vascular tissues.**

1. Location of growing points.
2. Differences in growth habit (root systems, dormancy, aquatic as opposed to land plants, etc.).
3. Arrangement and angle of leaves.
4. Differential wetting due to waxiness, pubescence, corrugations, etc.
5. Nature of cuticle (except in roots).
6. Number, distribution, and degree of opening of stomata, insect punctures, and other perforations.
7. Differential interactions among plant surfaces, herbicides, carriers, and additives (such as surfactants, co-solvents, etc.)
8. Differential restriction of herbicide movement while enroute, as a result of absorption, accumulation, chemical complexing, phase distribution effects, etc.
9. Differential loss of translocated herbicides by leakage.

Biophysical-biochemical differences at the cellular level (inherent in constitution of the species and presumably involving enzyme systems).

1. Differential inactivation among species by absorption of herbicides.
2. Cytoplasmic membrane differences among species (sensitivity of membranes).
3. Interference with normal enzymatic processes in some species and not in others.

A Guide for Selecting Herbici

Weed[1]	Herbicide[2]	Rate of Application For Small Areas[3] Tbsp. per 1000 sq. ft.	Preferred Time of Application
Barnyardgrass	See crabgrass		
Bermudagrass	dalapon	10 tbsp. to 1 gal. of water	Spot treat when grasses are actively growing. Wet foliage thoroughly and repeat at 7 to 10-day intervals.
Bindweed	2,4-D	2-2/3	May & June
Bittercress	2,4-D	1-1/3	Oct. & Nov.
Black medic	dicamba or silvex	2/3 2-2/3	April & May April & May
Buttercup	2,4-D	2	Oct. & Nov.
Catsear (false dandelion)	2,4-D	2	Oct. & Nov.
Chickweed common mouseear	dicamba[4] or silvex	2/3 2	Oct. & Nov. Oct. & Nov.
Chicory	2,4-D	1-1/3	Oct. & Nov.
Clover, hop	silvex	2	April & May
Clover, white	dicamba[4] or MCPP[4] or silvex	2/3 5 1-1/3	Oct. & Nov. Oct. & Nov. Oct. & Nov.
Crabgrass Pre-emergence	Bandane or bensulide or DCPA (Dacthal) or DMPA (Zytron) or siduron (Tupersan)	9.2 lbs. of 7.5% gran. 5 lbs. of 7% gran. 1/4 lb. (Active ingredient) 1/3 lb. (Active ingredient) 4.4 lbs. to 8.8 lbs. of 2.34% granules	March Nov. to April 1. Late winter to early spring. Nov. to April 1. Nov. to April 1. March
Crabgrass Post-emergence	CMA (Calcium acid methanearsonate) * or DSMA (Disodium acid methanearsonate) * or MAMA (Monoammonium methanearsonate) * or PMA (Phenyl mercuric acetate) * or MAA (Methanearsonic acid) *	16-32 tbsp. (10%) 1½-3 oz. (70%) 2¾-4½ oz. (20%) 2-4 tbsp. (10%) 10-20 tbsp. (16%)	When crabgrass is less than 1" height, repeat at 7-10 day intervals. Avoid treating during hot weather (above 90° F) June
Carolina geranium (cranesbill)	2,4-D	2	Oct. & Nov.
Dallisgrass	DSMA* (see crabgrass post-emergence)		
Dandelion	2,4-D	2	Oct. & Nov.
Dock curly broadleaf	dicamba	2/3	Feb. to April
Foxtail	see crabgrass		
Goosegrass	see crabgrass		
Ground ivy	dicamba	1	April & May
Hawkweed	2,4-D or dicamba	2-2/3 2/3	Aug. & Sept. Aug. & Sept.
Kentucky 31 fescue	see Bermudagrass		
Knapweed, spotted	2,4-D or silvex	2-2/3 2	Oct. & Nov. Oct. & Nov.
Knawel	dicamba or silvex	1/2 2	Oct. & Nov. Oct. & Nov.

Use in Established Turf †

Weed[1]	Herbicide[2]	Rate of Application For Small Areas[3] Tbsp. per 1000 sq. ft.	Preferred Time of Application
Knotweed	dicamba	2/3	March to May
Lambsquarter	2,4-D	1-1/2	April & May
Lespedeza	silvex	2	April & May
Mosses	ammonium sulfate	10 lbs.	Apply when actively growing. Expect temporary control until poorly drained soil conditions are corrected.
Mugwort	dichlobenil	74 oz. of 2% granular	Late fall or early winter
Mustards	2,4-D	2	Oct. & Nov.
Nimblewill	DMPA (Zytron)	1 pt. (3 lb./gal. A.E.)	June, repeat one month later. Wet actively growing foliage.
Nutsedge	2,4-D	2-2/3 tbsp.	When actively growing. Repeat each time new growth occurs.
Oxalis	silvex	2	April & May
Pennycress	2,4-D	2	Oct. & Nov.
Pepperweed	2,4-D	2	Oct. & Nov.
Pigweed	2,4-D	1-1/3	April & May
Plantain broadleaf buckhorn	2,4-D	2	Oct. & Nov.
Annual bluegrass	bensulide	5 lbs. (7%)	August & Sept.
Poison ivy or oak	amitrole or amitrole T	4 tbsp/gal. water 12 tbsp/gal water	June Wet actively growing foliage.
Pony foot	2,4-D	2	Oct. & Nov.
Prostrate spurge	dicamba	2/3	April & May
Quackgrass	See Bermudagrass		
Red sorrel	dicamba	2/3	Oct. & Nov. or April & May
Shepherdspurse	2,4-D	1-1/3	Oct. & Nov.
Speedwell	silvex	2	April
Wild carrot	2,4-D	2-2/3	Oct. & Nov.
Wild garlic	2,4-D (wax bar or LVE)		Fall and Spring Drag wax bar over wild garlic shoots and repeat at 6-month intervals.
Wild strawberry	dicamba	1	Oct. & Nov.
Yarrow	dicamba	1	Oct. & Nov.
Black medic, chickweed, henbit, or white clover with 2,4-D susceptible weeds	dicamba plus 2,4-D or silvex plus 2,4-D	1/3 + 1-1/3 2/3 + 1-1/3	Oct. & Nov. Oct. & Nov.
Knotweed, red sorrel, or dock with 2,4-D susceptible weeds	dicamba plus 2,4-D	2/3 + 1-1/3	Oct. & Nov.

†Ed. Note: Guidelines offered here pertain, of course, most directly to Virginia conditions. Applicators around the country, however, will find helpful suggestions among the author's recommendations.

[1] For mixed weed populations, mixtures of herbicides are suggested at the end of this list.

[2] Caution: Chemicals or pesticides followed by this designation (*) are extremely poisonous. Read the container label and heed warnings. In case of sickness while or after using, call your physician immediately.

[3] All rates of application for small areas based on 4 lbs. per gal. acid equivalent for 2,4-D, silvex, and dicamba and 2½ lbs. per gal. acid equivalent for MCPP.

[4] MCPP and reduced rates (not more than 1/3 lb. per acre) of dicamba may be used on bentgrasses for white clover and chickweed.

Author's Note: Trade and brand names are used only for the purpose of information and the Virginia Agricultural Experiment Station does not guarantee nor warrant the standard of the product, nor does it imply approval of the product to the exclusion of others which may also be suitable.

4. Differential rates of metabolic degradation or detoxification of the herbicide within the plants.
5. Differential rates of metabolic activation or toxification of an herbicide within plant tissues.

Finally, fluctuations in environmental factors such as temperature, relative humidity, light, and nutritional status are known to influence the response of plants to herbicides. Conceivably, such changes could also induce differential responses among species.

Although not discussed specifically for each recommendation to follow, these factors do bear on practical herbicide use in lawns and turf, and the influence of such factors is reflected in the selection of herbicides shown in the guide at the end of this article. Two factors, stage of weed growth and influence of environment, deserve additional comment in relation to lawn and turf weed control.

Stage of Weed Growth Influences Control

Small weeds respond more effectively to chemical treatments than tougher, more mature plants. Germinating seeds or very young seedlings are most sensitive. Early treatment is particularly important in the case of grassy weeds, even though postemergence herbicides are also available. Where previous crabgrass problems have existed, preemergence herbicides give control without turf discoloration that is characteristic of all available postemergence forms.

With most broad-leaved weeds, a postemergence treatment is used. Chemical treatments are suggested during periods of active vegetative growth. When a plant slows down or stops vegetative growth, because of flowering or because of adverse environmental conditions such as dry weather, control is usually more difficult. Fall-germinating plants that spread by seed and establish rosettes before winter are best treated in October and November. These plants reduce vegetative growth in spring and begin to flower. They are more easily controlled in the rosette stage, and the lawn or turf area is maintained with a better appearance over longer periods of time.

Peak periods of weed seed germination occur in fall and spring. Then, herbicides are applied just prior to emergence (preemergence herbicides) or soon after seedlings begin to develop foliar treatments).

(Continued on page 23)

Solve Tree Production Problems

By
MICHAEL NEWTON
Assistant Professor
Oregon State University, Corvallis

COMMERCIAL growers are producing trees today in a wider variety of species, and for more purposes, than ever before. Whether for Christmas trees, ornamentals, or timber, all growers are faced with producing good quality trees at reasonable cost. Mortality, insect damage, slow growth, and many other problems contribute to costs of growing trees or add to the risk factor that must be considered as a cost of doing business.

A great deal has been learned about the basic nature of some problems of tree culture in recent years, and chemicals have been used successfully to solve many of them. The purpose of this paper is to illustrate that many problems of tree production can be solved at low cost, and with little risk if they are analyzed correctly and the proper chemical prescription applied.

Growers' Problems Are Related to Environment

Most technical problems of tree growers are based on environment. Some factors are beyond our control; many are controllable today that were not a few years ago. Virtually all problems related to the action of biological organisms or activated by them can be treated with chemicals at a cost that will ultimately reduce the cost per salable tree, or per unit of sales.

Success depends sometimes on control of an organism that is causing damage actively and sometimes on elimination of either flora or fauna that intensify the action of climate and soil. Inasmuch as the agent causing problems may be microscopic or otherwise obscured, selection of the proper chemical treatment requires very careful diagnosis of the problem.

Weed, Fungus Losses Heavy in Nurseries

Weeds and fungi cause heavy losses in nursery beds. Effects from weeds are easy to confuse with signs of some fungi. Watering regimes are generally adequate in nursery beds to prevent excessive mortality from weed-caused drought, but growth and general condition of seedlings is influenced markedly by heavy competition.

The first few weeks after emergence is the period when much mortality occurs, and the stage of growth in which seedlings are weak and succulent is prolonged substantially by weed competition. It is during this period that damping-off fungi take their toll.

Application of fungicides may cause temporary reduction of activity of harmful fungi. But, failure to provide good control of weeds can prolong the sensitive period until harmful fungi are once more active; hence a combined treatment for fungi and weeds may be justifiable. Recent work with herbicides for weed control in nurseries has indicated that some beneficial physiological response to the herbicide has been exhibited by conifer seedlings. There is evidence that some soil fumigants may produce the same response, together with their potential for control of weeds, fungi, and nematodes.

The likelihood of damage from the above biotic agents may be reduced with chemical treatments. Control measures will be required less frequently if other cultural techniques are applied that will promote growth of large, healthy stock — especially such techniques as applying fer-

New injection system permits accurate placement of systemic herbicides and insecticides at up to 600 trees per hour.

Spread it on. Or spray it on. Either way, you get a fast and easy kill of broad-leaved and grassy weeds with Hooker MBC.

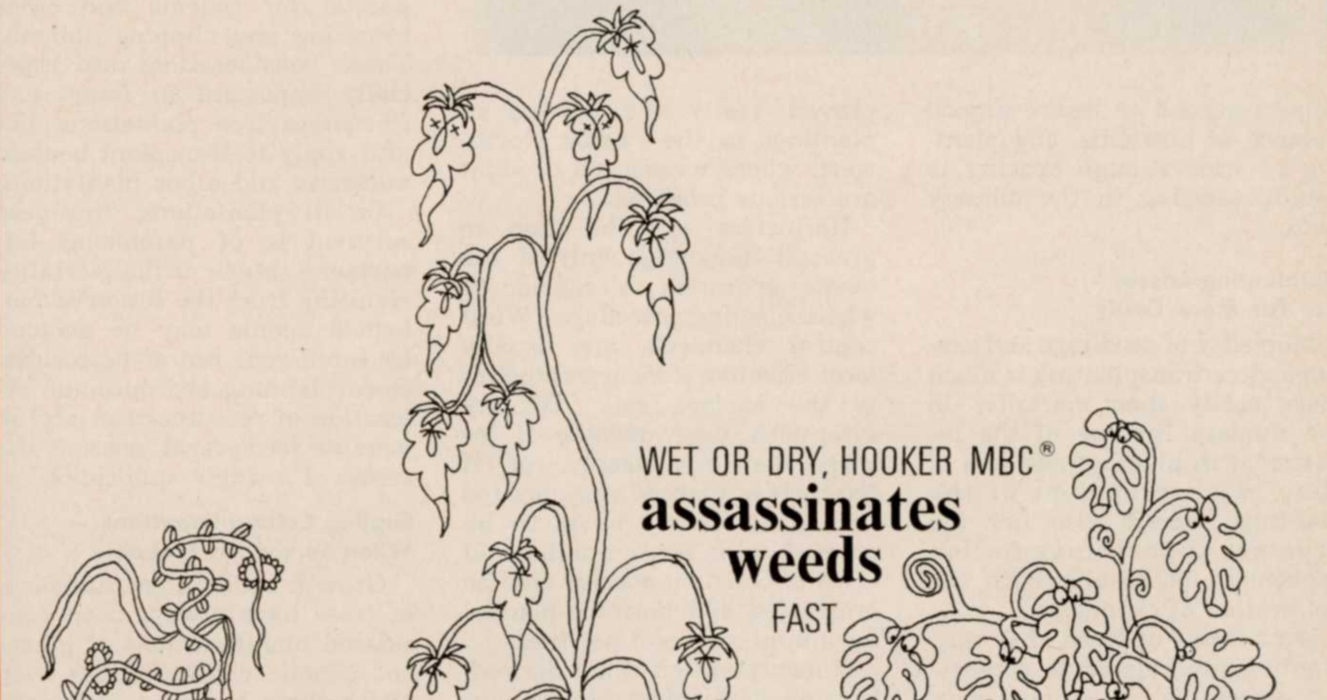
MBC leaches into the soil after rain or irrigation. Attacks roots. Sterilizes the soil for a season or longer. It kills top growth almost on contact.

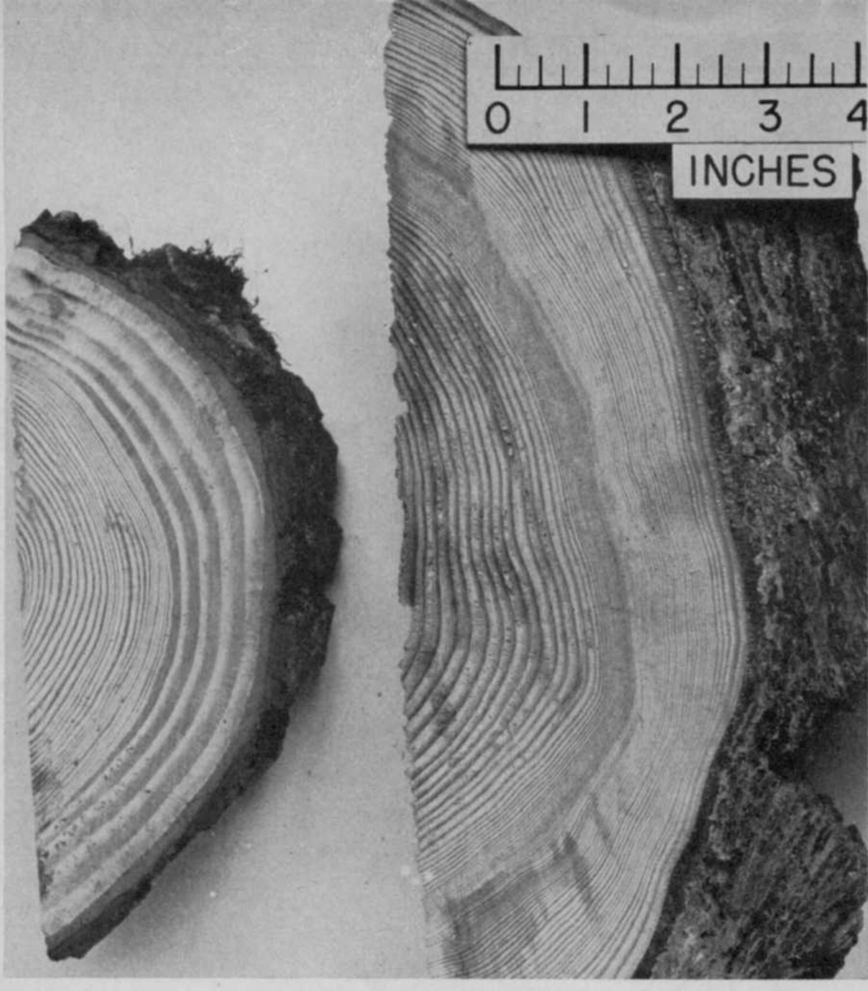
MBC wipes out such hard-to-kill pests as Johnson grass, bur ragweed, hoary cress, and bindweed along ditches, roadsides, and on industrial and other noncrop land.

It is very soluble in water. Lets you clean your equipment easily.

For application information on this powerful, nonselective herbicide, write for our descriptive folder. Agricultural Chemicals, Hooker Chemical Corporation, 406 Buffalo Avenue, Niagara Falls, N.Y. 14302.

hooker





Chemical thinning or cull tree control in saw-timber stands pays handsome dividends. Two examples of this can be seen at left in the last five growth rings after hardwood control in Douglas-fir forest.

tilizers needed to insure a good balance of nutrients, and planting at wide enough spacing to avoid crowding in the nursery beds.

Outplanting Losses Are Far More Costly

Mortality of seedlings and saplings after transplanting is much more costly than mortality in the nursery because of the investment in planting and loss of time in development of the planting. Herein also lies the greatest opportunity for improvement of results with the application of chemicals.

Most losses of trees after outplanting are related to competing vegetation in some way; much of the trouble is from drought alone, caused by depletion of available moisture supply by weeds. Selective chemicals and methods that permit good control of weeds in conifer plantings with no adverse effects are presently in use, and in many instances cause some stimulation of growth. Chemicals of the s-triazine group have been registered for this use, and have improved vastly the success of plantings in the Pacific Northwest, where weeds and drought are serious problems.

Herbicides may be used to greatest advantage only if the whole operation is considered when selecting procedures. Weed control chemicals are usually most effective if incorporated into the surface soil. Toxicity symptoms may develop if incorporated too deeply, or if the roots of planted stock are too shallow. Heavy soils to be planted with large numbers of trees of resistant species may be pretreated and machine-planted for a minimum cost per tree.

If incorporation is not desired, triazine herbicides may be applied directly over conifer plantations already in the ground. Atrazine is recommended specifically for this use on heavy soils of the Pacific Northwest and has eliminated the need for virtually any other weed control measures during the year of establishment.

Method of application depends on available equipment and the size of the operation. Spot treatments around individual trees are often recommended and have the advantage of ease of application for small-scale plantings. Band treatments provide weed control in the vicinity of individual trees or rows and may be applied with better control of dosage than is possible with spots.

Precision of application may be very important when degree of selectivity is marginal, as on some light soils where complete weed control is not needed. Where possible, broadcast treatment should be used to provide maximum benefits. Broadcast applications permit closest control of application rates, eliminate transpiration losses from peripheral weeds, and reduce habitat for rodents and other browsing and clipping animals. These considerations are especially important in forest and Christmas tree plantations, but also apply to transplant beds in nurseries and other plantations.

In all plantations, first-year survival is of paramount importance. Much of the mortality resulting from the action of biological agents may be avoided by intelligent use of herbicides. Good planning and optimum allocation of resources can accrue benefits for several years as the result of a single application.

Sapling Culture Important When Survival Is Probable

Growth habits, color, and form of trees have always been considered manifestations of inherent genetic characteristics over which there has been little control. These features become of substantial importance after the tree is well enough established that survival is probable, and measures may be sought to improve marketability, appearance, growth rate, etc. Fortunately, desirable form, color, and growth rates usually occur together. Treatments designed to promote one feature will frequently enhance all.

Under circumstances where growth is too rapid for proper form, and where such vigor is necessary to achieve desirable color, trees in good health often respond well to shearing or pruning. Measures taken to reduce growth without shearing frequently result in poor color and reduction of leaf size, and are not generally recommended where tree appearance is of value.

Treatments used to improve general vigor of trees usually involve reduction of competing weeds or brush. These may be combined with fertilization and watering. One of the most common applications of weed control in sapling plantations is in Christmas tree culture, where cultivation has been practiced in the past decade to promote growth and color of trees. More recent has been the adoption by some growers of complete weed control applications.

Atrazine for herbaceous weed control has been applied by aircraft over plantations up to harvest age to improve uniformity and color, and to enhance density of branching and budding. This practice has increased percentage of trees in high market grades, reduced culls, and reduced rotation length by one to several years. Elimination of weed cover has reduced or eliminated need for fertilization for satisfactory Christmas tree growth on many plantations. Phenoxy herbicides may be applied before bursting of buds of conifers other than pines for selective brush control.

Young trees are often subjected to heavy damage from a wide variety of animals. Measures to protect trees are costly, and may cause mechanical injury nearly as severe as injury of some animals from which they are protected. Pure stands of tree seedlings or saplings are seldom complete habitats for animals that cause damage. Small rodents and rabbits depend on herb cover for protection and food; deer will seldom seek trees exclusively if other forage is available.

Complete weed control for two or more years reduces effective animal habitats temporarily without injuring the animals themselves, and at the same time provides for a vigorous spurt of growth that may well place trees out of reach of serious damage. Effects of these treatments may persist for the life of the plantation, because released trees seldom return to their former slow growth. Moreover, trees developing in the uniform environment of a weedless culture are much more even in size and shape.

Chemical Tree Kill Offers Great Promise

Natural forest stands seldom have optimum composition of species and spacing of desirable trees. Until recently, alternatives in management have been limited to doing nothing toward stand regulation, or to doing it mechanically. Chemicals have been developed for tree injection that will kill almost any unwanted trees at low cost, permitting culture of uniformly desirable trees with little investment. If stands are treated in the large sapling stage, there will never be appreciable loss of growth in merchantable trees.

Application of this simple practice in forest management requires only a little professional direction, yet has the potential of bringing to maximum productivity almost any forest where the soil is occupied completely by trees. If this practice alone were applied to all the commercial forests of the United States where it was needed, it is likely that all projected demands for forest products in the foreseeable future could be met,

Trees planted in sod are subjected to severe competition for moisture and nutrients. Heavy cover harbors many rodents.

Mechanical scalping reduces competition briefly. Local cover attracts rabbits, deer and other animals that damage seedlings.

Selective control of trees in mixed stands favors desirable species only. Trees at left are badly suppressed, while released trees on right will need no further treatments.

with great improvement in quality at the same time.

Harvesting trees for sawtimber is an expensive business, and often contributes hazards to adjacent forests from fire and insects. Foresters soon will be seen in the woods marking timber with chemicals that will kill the tree to be harvested, protecting the drying timber from insects and fungal stains, and eliminating the accumulation of trash with dry leaves. Reduction of weight with increase in strength will permit loggers to fell timber with less breakage, and to ship logs at lower cost. As a conservation measure, this practice will permit the handling of marginal timber that has heretofore been left in the woods because of the cost of handling.

Insects and Fungi Are Constant Tree Threats

Throughout the life of a tree or forest, insects and fungi represent constant threats, ready to exploit any weakness or entry. Occasional insect outbreaks in forests have been treated with broadcast applications of insecticides.

The use of insect sprays in forests and on shade trees has become a highly emotional issue, and the subject of much controversy. Actually, the treatments now used are often monitored closely, with the finding that most forms of life are little disturbed. Forest pest control operations eventually will include systemics in sensitive or high-hazard areas.

Systemics may be introduced into trees by injection with no environmental contamination whatsoever, and the tailoring of formulation and season to the target insect will permit the restriction of most of the insecticide to the specific tissue on which the target insect is feeding. Some of these treatments

Decreasing rate of growth indicates heavy competition. Weed or brush control alone may greatly improve sapling vigor.