Hydro-seed with Cellin Fiber Mulch

Economical, weed-free beauty and erosion control

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PROTECTS THE SOIL

Cellin fiber mulch creates absorbent "mini-umbrellas" to protect the ground against rain. This allows the rain water to seep into the soil slowly, preventing erosion.

NO WEEDS IN CELLIN

Cellin fiber mulch is a re-cycled product which contains no weed seeds. Spray in one operation with no possibility of introducing aggressive growing cereal to compete with your spec. seeds.

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The 2-Step Turf Renewal Plan with Roundup® and Pennfine.

One.

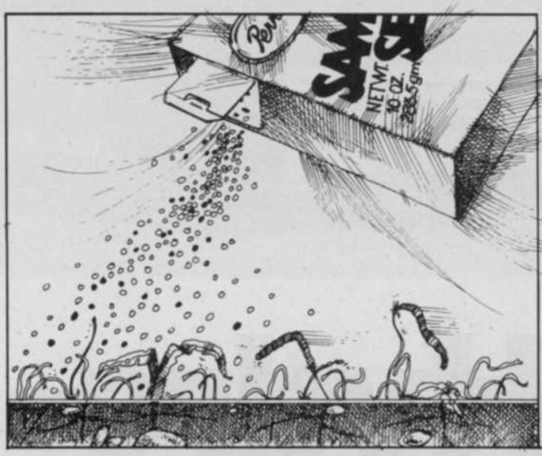
Spray Roundup® on the turf area to be renewed.

With just one application of Roundup® herbicide by Monsanto, you can control or destroy most unwanted vegetation. Including stubborn intruders like annual bluegrass, bermudagrass, quackgrass, johnsongrass, tall fescue, and kikuyu grass.

In a matter of days, Roundup circulates throughout these weeds. Even into the below-ground roots, destroying the entire plant. Yet Roundup has no residual soil activity. That means there is no injury to new seedings planted after application.

ALWAYS READ AND FOLLOW THE LABEL FOR ROUNDUP.®
ROUNDUP® IS A REGISTERED TRADEMARK OF MONSANTO CO., ST. LOUIS, MO.
MONSANTO COMPANY 1979

Two.



Spread Pennfine Perennial Ryegrass seed over the area treated with Roundup.

After applying Roundup, seed with fast-growing, fine-leafed Pennfine Perennial Ryegrass. Pennfine was developed by Dr. Joe Duich at Pennsylvania State University. Pennfine has been proven to germinate quicker, grow denser, and resist disease better than traditional ryegrasses. And it penetrates compact soil, sending its roots to depths of 12 to 18 inches. These qualities make Pennfine an excellent choice for turf renewal and help to explain why it's used by turf professionals from coast to coast. In a short time, you'll see the proof for yourself.

PENNFINE PERENNIAL RYEGRASS HAS BEEN ACCORDED U.S. PLANT VARIETY PROTECTION CERTIFICATE NO. 7200019.

plant. They are most known for their use in preventing winter injury, but they have successfully been used during transplanting. Some growers indicated that they applied anti-transpirants just prior to digging, while other preferred to make their applications just after removal. Some even indicated that if the material was properly cared for, root pruning, misting, etc., that anti-transpirants were not necessary at all.

The summer is a very touchy time to move plant materials, especially for long distances. On hot sunny days, it is best to wait until late afternoon or early evening before loading trucks so that they can travel during the night when the temperatures are cool. Depending on the distance, the materials will still arrive in fairly good condition the following morning. It is, of course, unrealistic to expect all shipping to be done overnight, but it helps preserve the plants. In the case of tall trees which will not fit into enclosed trucks, open trucks must be used and the materials covered to prevent further water losses. Whenever possible, refrigerated trailers are used for materials that are transported long distances.

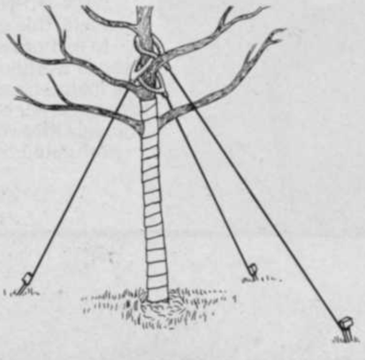
Water is the most critical factor in maintaining plant materials in the retail yard or Garden Center. If the plants are constantly allowed to dry out, their chances of survival are greatly reduced.

As for planting, it is wise to plant the same day or as close to the day of purchase as possible. This means knowing exactly where you or your customer want the trees or shrubs. Unfortunately, most homeowners are unknowledgeable when it comes to caring for nursery stock before it is planted. It has been my experience as an extension horticulturist that the homeowner feels it's okay to sprinkle them lightly with the hose whenever they think of it and that will suffice until they get around to planting them. They can get by with this in the spring or the fall, perhaps, but not in the summer.

Soil type and drainage are important factors in the survival of plant materials. Generally a porus soil is better than one with a high clay content, which tends to hold excessive amounts of water. If the soil has a lot of clay, a raised bed can be used to get around this problem. A raised bed consists of raising the area twelve to fifteen inches with a porus soil mixed with peat moss and surrounding the area with blocks or railroad ties to keep the soil from drifting. This method of raising the soil level should never be used if there are existing plant materials already in the bed.

Another way of dealing with wet soils is to plant trees and/or shrubs which will grow in moist soil conditions. Your Cooperative Extension Agent can help in providing a list of such materials for your area.

Protecting trees
after planting



Fertilizer can be added to the planting hole at the rate of two cupfuls per three foot of hole diameter. A complete fertilizer, higher in phosphate than the other two nutrients, should be used. These trees won't need to be fertilized again until next spring.

If the soil is well-drained, then dig a hole about twice the width and depth of the root ball. Then back fill with six inches of good top soil and place the rootball. Then backfill the hole with a mixture of one part peat to two parts of good top soil until the hole is the same depth as the root ball.

The top of the ball must be level with the ground. Remember to remove the rope or lace and pull down the burlap. If the burlap is not biodegradable remove it. Anything that will not degrade will hinder the plant's growth.

The hole can then be filled three-quarters full and tamped well, being careful not to damage the established soil ball. Then water and finish filling the hole, leaving a saucer type depression around the base of the tree or shrub. This will help to confine the water to the area around the root ball.

During the summer it is extremely important to water each plant immediately after planting. It is difficult to do when an entire area is being planted, but the extra effort will pay off in the long run.

Aftercare is extremely important and the homeowner should be made aware of that. New plantings should be thoroughly watered at least twice a week. For this can make the difference as to how well the material comes through the summer, or if it comes through at all.

Guying is usually recommended for newly planted trees to give them support and to prevent damage from heavy winds. Guy wires are attached to the tree and staked to the ground in three places. A plastic or rubber hose is used as a cushion between the wire and the trunk of the tree. They are placed in the area of the lower branches. This support should be taken off after one to two years after planting. By that time, the tree will be able to support itself. If guy wires are left on, they can girdle the trunk and eventually kill or weaken the tree so that it could easily break over during a storm.

Young trees — especially ones with thin bark, such as dogwoods, beeches and maples, and whose bark is susceptible to drying out or sunscald should be wrapped. Wrap them from the base of the tree to just below the lower branches. The wrap can be left on for one to three years.

Mulching can be a real asset to summer planting since the purpose of mulches are twofold: to conserve soil moisture and to prevent weeds from competing with plant materials for water supplies. Some good mulches are: wood chips, chopped bark, pine needles, small stones, peanut or cocoa hulls, black polyethylene or even sawdust.

All transplanted materials should be observed carefully, especially the first year. Make absolutely sure that they are watered well. If the water is neglected, the entire effort will be wasted. **WTT**

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NEED FOR GROWTH REGULATORS ACCENTUATED BY RISING COSTS

R. P. Freeborg, Purdue University, West Lafayette, Indiana

The concept of controlling plant growth with natural plant substances, such as auxins, was first developed in 1926-28 when F. W. Went identified and measured plant growth differences resulting from the application of very minute quantities of these natural plant hormones.

Auxins, as natural plant hormones, were thus able to stimulate plant growth. Eventually purely synthetic compounds were artificially made that could simulate their actions.

From this discovery followed the identification of natural organic substances in plants that could either inhibit or suppress various growth functions in plants. Some of these naturally occurring inhibitory functions we are familiar with include:

1. The maintenance of a dormant state in seeds of many plants until acceptable environmental conditions favorable for growth development.
2. Prevention of premature germination before adequate seed dispersal is attained.
3. Spreading germination over a long period, amounting to years in some cases, to assure the continuity of a species.
4. The ability of plants to compete in a mixed stand is also attributed, in some instances, to the release of an inhibitor by the plant that can prevent the development of other potentially competitive species. One example is that of a wheatrye stand able to suppress growth of several competitive weeds.

The concept of chemically controlled growth inhibition for specific purposes developed. Initially this became most important as in the development of herbicides for the selective control of undesirable weed species. One of the earliest and most successful of these was the family of phenoxy herbicides of which 2.4-D was the most important. Since this discovery there has been a rapid increase in the introduction and use of plant growth regulators in agriculture, on recreational sites, and in horticulture. The many selective preemergent herbicides are an excellent example of growth inhibitors selectively controlling undesired species.

It is only recently that the concept of growth stimulation to increase crop yields in agriculture and growth regulation or growth suppression in horticultural and turf maintenance have been successfully applied on a large scale.

Increased yields in agriculture are now obtained with the application of synthetic plant hormones that can increase corn production, sugar content in sugar cane, and pineapple yields. It has been stated that the next major breakthrough in food production world wide will be through the use of plant growth regulators. The potential is there and only limited by the imagination.

Since we are now going to discuss growth regulators and their present day application in plant growth, the term should be defined. A growth regulator is a substance used for controlling or modifying plant growth processes without appreciable phytotoxic effect at the dosage applied.

In horticulture we now see the use of growth regulators to control height, as a substitution for cold treatment, for chemical disbudding, to hasten flowering, to produce longer lasting flowers, and for defoliation. (See "Growth Regulators Effective on Floricultural Crops" by R. D. Heins, R. E. Widmer, and H. F. Wilkins, Dept. of Horticultural Science and Landscape Architecture, University of Minnesota, St. Paul, MN for a complete list of compounds and uses). Fruit production is also enhanced by artificial thinning with these compounds. Uniformity of ripening in tomatoes with the use of ethylene has also been successful. There are many other examples to demonstrate the usefulness of these compounds. These early success stories are impressive, yet the industry is only in the early stages of development.

The controlled growth of turfgrass species also demonstrates the practicality of this controlled growth concept. Today with high labor costs and fuel shortages, and the continued increase in fuel costs, the need for effective growth regulators is accentuated. A recent example, for the first time in 1979 the Indiana State Highway Department used a growth regulator when there were no acceptable mowing contracts submitted. In turf growth control, as in other fields, there remains a great potential and need for more effective compounds.

One of the first plant growth regulators sold in the United States was maleic hydrazide (M.H.) introduced in 1950. By 1965 more than three million pounds of growth regulators were sold in the U.S.

Height of unmowed Merlon bluegrass next to treated bluegrass four weeks after application.

M.H. accounted for approximately 90%. By 1972 the quantity used increased to six million pounds, with M.H. comprising 70%. By 1975, newer growth regulators were estimated to have accounted for more than 50% of the total market.

There are two primary methods by which growth regulators control plant growth functions.

1. **Terminal growth inhibition.** Some of the effective growth inhibitors now available, including maleic hydrazide, the flurenols, and ethylene releasing compounds act by inhibiting terminal bud growth. These growth inhibiting compounds usually alter geotropic responses, cause axillary bud break or induce early leaf loss, and reduce stem elongation in some plants. Inhibitors such as M.H., the flurenols, and ethylene, that disturb terminal bud growth activity cannot, generally, be used where normal leaf and flower initiation and development are necessary.

2. **Internode elongation inhibition.** These are compounds which inhibit internode elongation without disrupting terminal bud development. Retardants such as CCC (Cycocel®), ancymidol (A-Rest®), etc. are usually recommended to reduce plant height in potted plants, nursery crops and fruit trees since leaf and flower initiation are not severely delayed.

Some of the existing growth regulatory compounds would include:

1. Ancymidol (A-Rest®)
2. CBBP (Phosphon-D®)
3. CCC (Cycocel®)
4. Chlorflurenol (Maintain CF125®), (Po-San®)
5. Mefluidide (Embark®)
6. Ethephon (Ethrel®), (Cepha®), (Florel®)
7. Maleic hydrazide (Slo-Gro®), (Royal Slo-Gro®)
8. Daminozide (Alar-87®), (B-Nine SP®)
9. Gibberellic acids (GA^3, GB^4, $6A^7$)

The choice of inhibitor will depend on the objective. In turf the selection of a compound to control plant height often depends to a great extent on the degree of plant discoloration on thinning that can be tolerated and whether only seedhead prevention is desired. The M.H., flurenols, mefluidide (Embark®) and ethephon can all control excessive plant height. There are situations, however, where high temperatures, excess drought, insect or disease activity can cause turf thinning and discoloration since the turf is unable to recover rapidly due to the growth regulator activity. There are sites where these conditions can be tolerated and where these compounds have a very important place. This would be true for plants viewed from some distance, such as from moving vehicles. Thus the phytotoxic side effects of some compounds can be tolerated.

M.H., the flurenols, and now Embark have successfully reduced the need for mowing grassy areas in the United States and Europe. Reduced blade and sheath elongation are beneficial effects. The reduced length of the seed stalk and reduction of seedhead formation are major factors in the use of these products for roadside maintenance.

For most lawn turf, inhibition of the plant stem and leaf blade elongation is all that is desired. Complete prolonged inhibition of new leaf formation, tillering, rhizome, and root formation is undesirable and will eventually lead to a reduction in turf density as the existing plant parts die and there is not adequate regrowth for recovery.

The M.H., flurenols and Embark, though effective growth regulators, cause a general reduction in quality of good turfs of Kentucky bluegrass, bentgrass, and bermudagrass. This reduction in quality is especially severe under either pest or environmental stress.

Maleic hydrazide at 4 lbs. ai/A restricts stem and leaf growth and inhibits seedhead development. It is best on minimum use turfgrass sites such as roadsides, steep slopes, pond or stream banks, along fence rows and around trees where trimming costs are excessive. Root and rhizome growth may be restricted. Repeat applications, without a turf recovery period, can result in additional thinning.

Flurenols used at 1-3 lbs. ai/A give good shoot growth retardation as well as inhibition of apical bud formation. Leaf color is enhanced. They are most effective when used in combination with the maleic hydrazide.

Embark 2-S at 0.12 to 1 lb. ai/A on cool season grasses and 0.5 lb. to 1 lb. ai/A on the warm season grasses offers good turfgrass growth inhibition and suppression of seedheads. The leaf has a darker green color than that of untreated grasses. There is also some evidence of root growth stimulation. It has some herbicidal activity and therefore can be toxic if rates are not carefully controlled. The compound successfully inhibits fine turf, but here again, under environmental and/or pest incidence stress thinning results.

Another growth regulator that has some potential for the turf market is ethephon. When used at 4-6 lbs. ai/A moderate to good growth inhibition of perennial bluegrass is observed. Green leaf color is enhanced. There is also some evidence of tiller stimulation although with some inhibition of rhizome development. There is an increase in leaf numbers per plant. The leaves are shortened with slightly elongated internodes. This tends to dwarf the plant and thus results in the necessary growth reduction. Therefore, the plant, although dwarfed, continues to grow and offers some protection from environmental stress and pest damage.

The efficacy of these growth regulators can be seen in the data from Purdue 1976 presented in Table 1.

The potential of some existing experimental growth regulators is encouraging. Growth regulators are able to change the bluegrass plant form by shortening the leaf and lengthen the internode, to stimulate rhizome bud formation on perennial bluegrass, and to enhanced tiller formation as rates increase.

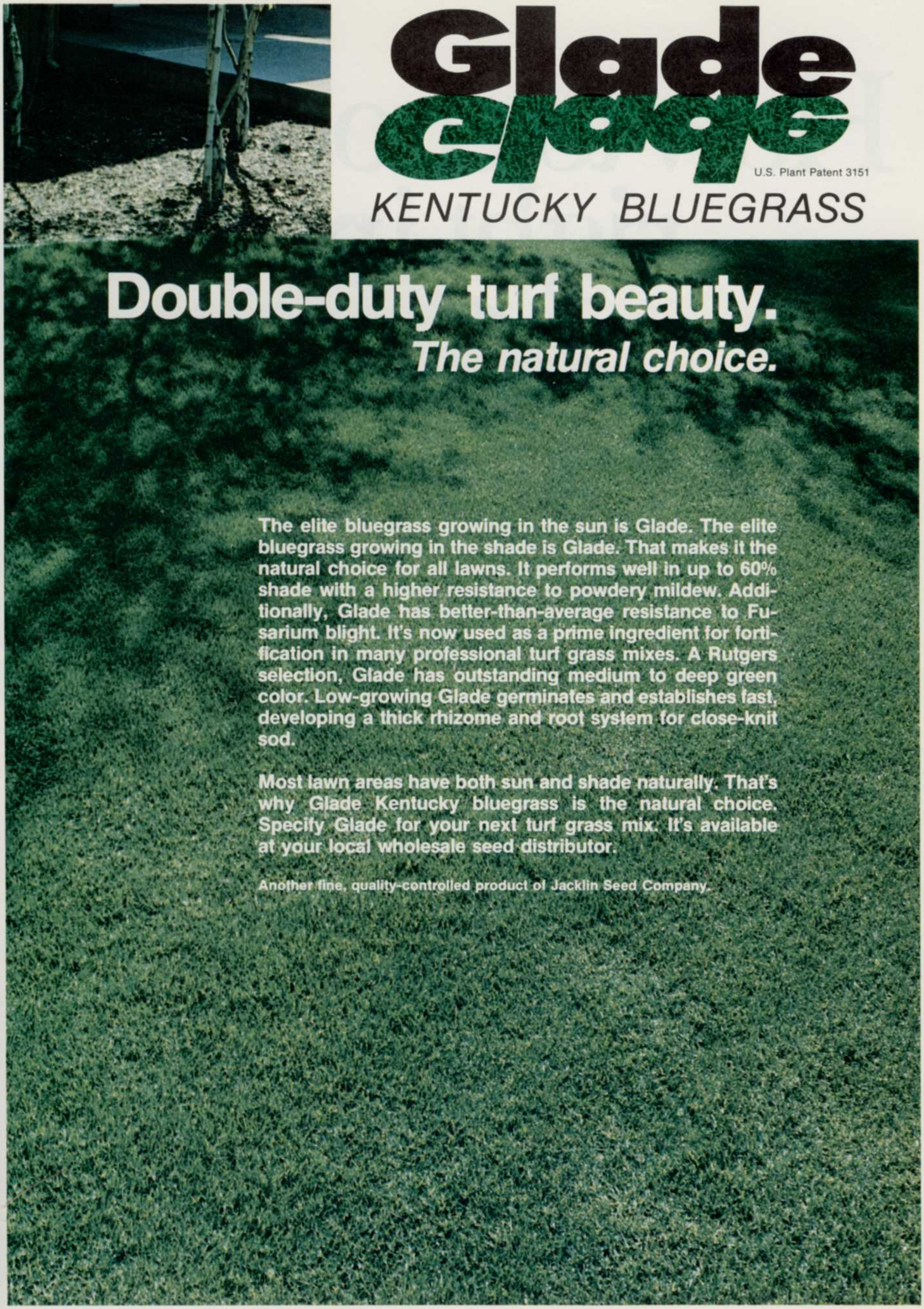
The ideal turfgrass growth regulator is one that will reduce leaf and stem height and produce many small leaves to maintain surface density and

Continues on page 30

Glade

U.S. Plant Patent 3151

KENTUCKY BLUEGRASS



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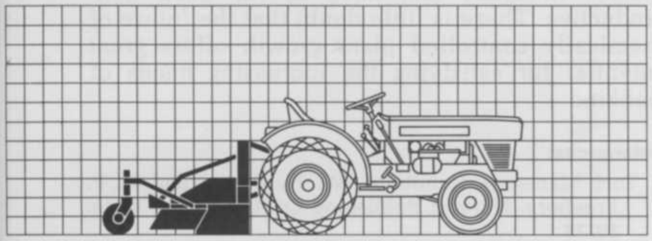

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Table 1. Reduction in Kentucky Bluegrass Growth

	ai/A lbs.	Growth Reduction 20 days	49 days	89 days	Effects on plant
		%	%	%	
Control	—	normal	normal	normal	—
Ethephon	6	50	54	32	darker green
M. H.	4	50	73	22	slight chlorosis
Embark	0.5	56	65	33	darker green
Sustar	4	61	35	23	darker green

color and permit continued growth or stimulation of tiller, rhizome and root formation, thus reducing mowing requirements yet maintaining the plant in a vigorous growth state to enable it to overcome the environmental or pest incidence stresses.

Application of growth inhibitors may be as foliar sprays, fogs, and as soil drenches. Inhibitors such as M.H. flurenols, Embark, and ethephon are generally applied as foliage sprays. Adequate moisture is essential at application to assure proper entry into the plant.

M.H. and the flurenols have been applied as a soil drench to effectively reduce shoot growth. Some of the phytotoxic side effects of foliar applied M.H. are minimized by soil applications. However, labels should be checked for rates and application procedures. Soil applications to shrubs and other ornamentals for growth retardation have not been successful due to rooting depths of the plants.

The effectiveness of foliar sprays may be increased by reducing the average droplet size and using more concentrated solutions. Fogging applications may be useful for foliar applied compounds, especially in enclosed or isolated areas where drift is not a problem. The finer mist offers greater potential for chemical effectiveness because both the upper and lower leaf surfaces are covered offering greater potential for plant uptake.

Adjuvants which aid in surface wetting and thus absorption of the active ingredient can be combined with growth regulators. There is general agreement that the action of surfactants in improving foliar absorption is complex involving more than the increase in surface wetting. M. H. has recently been formulated with a special surfactant (Royal Slo-Gro formulation) that further enhances the activity on a limited number of species. Foliar absorption of M.H. is reduced after the droplet has dried.

Test plots show seedhead suppression and growth retardation six weeks after treatment to Kentucky bluegrass. Photo courtesy J. A. Jagschitz, Virginia Polytechnic Institute.

Cumulative phytotoxicity caused by applications of growth regulators has not generally been reported. M.H., flurenols, Embark, and ethephon however, appear to have a residual effect on some species.

Solutions of 0.3 to 0.4% M.H. are normally applied annually to tops of trees under power lines. M.H. is applied only to trees in which bud break and leaf growth were normal the previous spring. For this reason, cumulative phytotoxicity has not been observed. Some regrowth is necessary before growth regulator applications are repeated.

As yet there is no method of predicting sensitivity of a species to a compound. One species may respond to a compound when another does not. This may be due, in part, to differences in absorption, transport or metabolism of the compound.

Finally, the growth regulators available to date, though effective, have some limitations. These may be due either to phytotoxicity, thinning, excess or inadequate inhibition, or due to short or a prolonged residual inhibition period. Continued investigations will produce newer compounds that will permit the chemical manipulation of plant growth in specific directions. There is no reason why drought resistance and winter hardiness, rhizome, tiller and root formation with vertical leaf growth suppression should not be obtained by chemical treatment, thus permitting the agriculturalist to modify plant growth to meet local conditions or needs, and expand and introduce plant species in areas that have so far been nonproductive. There is little doubt that the future of chemically controlled plant growth offers great potential for satisfying the increasing needs of mankind.

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