# GROWTH REGULATORS FOR TREES AND SHRUBS

The further development of plant growth regulators may make them more applicable to landscaping.

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The most common use for growth regulators in landscape management and nursery production is to suppress growth. Under certain circumstances, growth suppression may be useful for managing turfgrasses, trees, shrubs and even bedding plants.

Growth regulators have been used for a number of years in the production of greenhouse crops such as poinsettias and mums, and also in the production of container-grown nursery plants such as azaleas. Their use in the landscape has come slower, probably because some of the older chemicals cause phytotoxic symptoms at effective rates on shrubs, trees, and turf.

Some recent developments in plant growth regulators may make this group of chemicals more useful to those involved in landscape maintenance. Some of these products are so new that they are not yet commercially available, but all of the products discussed here are on the market or are expected to be available within the next year.

## Controlling tree growth

The most serious problem with trees is controlling their growth into utility lines. Utility companies spend millions of dollars each year trimming trees away from power lines. Therefore, utility company foresters and line clearance managers have been among the first to use growth regulators to control trees. Although most of the earlier work with tree growth regulators was done on trees under utility lines, recent developments are opening up a potential for the using of growth regulators on trees in the general landscape.

The idea with growth regulators is not to stop growth, but to reduce it so that the tree can renew itself and achieve a reasonably normal appear-

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ance. The hoped advantages of growth regulators are:

• Reducing growth—especially sprout growth—following extensive trimming. This extends the trimming cycle which leads to reduced maintenance expenses.

• Reducing the amount of wounding due to repeated trimming. It is estimated that the average tree trim exposes about 400 sq. in. of cut surface. This stresses the tree due to the energy needed to heal this area, and it exposes a large area to disease organisms.

• Improving stress resistance by reducing surface area exposed to water loss and reducing the energy wasted on excess regrowth.

• Allowing normally large trees to be planted in smaller spaces. In many cases the appearance of the tree is improved by using a growth regulator. That's due to a reduction in sprout

# PGRs: a tool to manage mowing

It may seem that the ideal growth regulator would stop growth completely, making mowing unnecessary. But that is an unrealistic expectation. Turfgrasses are constantly subjected to environmental stresses such as traffic, disease, insects and pollution. The only way grasses have to repair the damage from these stresses is by growing and replacing the damaged shoots. Therefore, some growth must be allowed.

Growth regulators should be thought of as a tool to help manage the mowing schedule, not to replace mowing completely.

There are two major potential uses for growth regulators in turf maintenance. One is control of low-maintenance, low-quality turf such as along roadsides, steep slopes, fencerows, ditches, and stream banks. The second is in difficult-to-mow areas of higher quality turf.

Another possible use is on more formal, high-quality turf where mowing is continued, but a growth regulator is applied at a low rate to reduce some mowing. Currently, this application for growth regulators is highly limited, probably because most lawns are exposed to injury by foot traffic and that growth is needed in order for the grass to rejuvenate itself.

**Difficult-to-mow areas such as steep slopes may be ideal sites to use growth regulators.**

### Types of PGRs

The greatest potential use of turfgrass growth regulators for general landscape management is for difficult-to-mow areas such as steep slopes, along fences, or around obstacles.

Some specific characteristics of turfgrass growth regulators are as follows:

● Maleic hydrazide (Royal Slo-Gro, Drexal Retard): first growth regulator available for turf; for cool-season grasses only; inhibits growth by suppressing cell division in the shoots, roots, and buds; suppresses root and rhizome development; seedhead formation inhibited if application is timed properly; best application time is in spring when forsythia and dandelions are in full bloom; use limited to low maintenance areas due to possible phytotoxicity and excessive growth inhibition; not recommended for home lawns except possibly for edge treatments along walls and around trees.

● Mefluidide (Embark): newer growth regulator for both cool- and warm-season grasses; considered a standard of the industry for grass control; suppresses vegetative growth and seedhead production in plant areas; may be used to arrest seedhead development of *Poa annua*; not readily translocated; does not restrict roots and rhizomes low phytotoxicity potential; good product for general landscape maintenance work; should still be considered for use only on low-maintenance, hard-to-mow and trim areas.

● Amidochlor (Limit): cool-season grasses only; suppresses shoot growth, inhibits seedhead formation; needs rainfall or irrigation within three to five days of application; does not suppress root development; features low phytotoxicity and tolerance of application overlap.

● EPTC (Shortstop): new growth regulator recommended for tall fescue; can cause severe phytotoxicity on finer turfs; root-absorbed; suppresses both shoot growth and seedhead formation; also provides some broad-leaf weed suppression.

● Chlorflurenol (Maintain CF-125): cool-season grasses; suppresses shoot growth, inhibits seedhead formation; also controls some broadleaf weeds.

● Paclobutrazol (Clipper, O.M. Scott's TGR): new growth regulator for both cool- and warm-season grasses; good residual control of shoot growth, but does not suppress seedheads; foliar and root absorbed; does not restrict roots or rhizomes; also provides some broadleaf weed suppression; will gradually reduce *Poa annua* in perennial turfs; yellowing of leaf blade tips four to six weeks after application possible; Scott's TGR is a granular formulation, which also provides nitrogen fertilization.

● Flurprimidol (Cutless): very new growth regulator, not yet available commercially; effects on turfgrass very similar paclobutrazol.

In general, plant growth regulators can be helpful in managing turfgrasses, but they should be used with caution and should be selected carefully to match the situation involved. They are still not recommended for high quality turf situations, except for edging and difficult-to-mow areas. Plant growth regulators inhibit the renewal process of grass plants. This can lead to increased disease, insect, and traffic prblems and result in lower turf density.

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growth that occurs following extensive trimming, and because certain growth regulators cause a darker green color.

Basically two groups of growth regulators are for woody plants. Terminal bud inhibitors comprise the first and oldest group. This includes maleic hydrazide (Royal Slo-Gro, MH-30, Drexal Retard), chlorfluorenol esters (Maintain) and dikegulac (Atrinal, Atrimmec).

Although all of these materials have been used effectively to control tree growth, injury symptoms have been observed and regrowth has been variable. Also, inhibition of the terminal buds tends to stimulate branching, which may be desirable with certain shrubs to promote bushiness, but is not particularly desirable for tree regrowth.

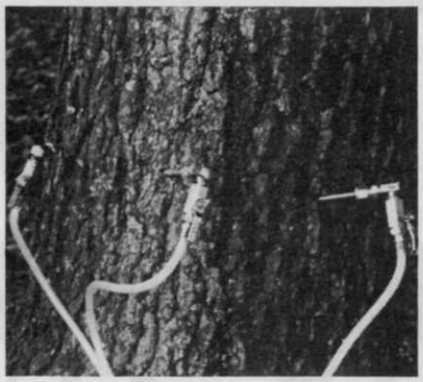
The second group includes the subapical meristematic (gibberellin biosynthesis) inhibitors ("growth retardants"). These compounds act by inhibiting the synthesis of gibberellin in the plant. Gibberellin is a natural growth hormone that promotes cell elongation in the stem just below the apical meristem. By inhibiting the production of this growth hormone, stem length is greatly reduced.

Recently-developed representatives of this class of regulators include paclobutrazol (Clipper), flurprimidol (Cutless) and uniconizole (Prunit). These materials are extremely active, requiring a relatively little active ingredient for growth control, without producing noticeable injury symptoms. Their effect lasts up to three years, and they are highly specific to the stem elongation process. Other processes, such as root growth, stem diameter enlargement and flower and fruit development continue normally.

## Application methods

The above-mentioned compounds can enter the tree through the trunk or through the roots. The chemical is carried by the xylem cells in the sapwood of the tree, upwards, along with water and other nutrients, to the growing ends of the stems. Growth regulators such as Clipper have been successfully applied using trunk injection, soil drench, soil injection, and soil band spraying. The most effective and environmentally safe method is trunk injection.

To prepare for the injection, measure the trunk's diameter within two feet of the ground. The diameter is used to determine the amount of chemical to inject and the number of injector holes needed. This information is found on the label. Drill holes uniformly around



**The most effective and environmentally safe method of applying growth regulators is trunk injection.**

the trunk, horizontal or with a slight downward angle, and at a 30 to 45 degree angle to the plane of the trunk to intercept the outer sapwood. Place the injectors in the holes, adjust the system for the proper dose and activate. Injection time may vary from a few seconds to a few minutes depending upon the injector system, tree species, and time of year.

Afterwards, the holes may be sealed with a vinyl plug or silicone caulk to prevent bleeding, which can cause discoloration of the trunk.

Some concern has arisen regarding the potential for internal injury during the injection procedure. Drilling into the wood certainly wounds the tree and opens it up to decay organisms. The research of A.L. Shigo and Frank S. Santamour Jr. and others has shown that a healthy tree is capable of compartmentalizing a wound area with a wall of phenolic compounds that retard the spread of micro-organisms. A weak, unhealthy, or stressed tree may not have the carbohydrate reserves necessary to wall off the wound area, and decay will result. Therefore, it is essential that the injected tree be healthy and unstressed, and that the injection site not be near a previous wound or injection.

The potential for injury with repeated injections should be weighed against the injury which occurs from repeated trimming. Based on limited evaluation of injection sites, injection does not appear at this time to be detrimental to healthy trees. However, it may be that if a tree needs repeated trimming and growth regulator control to keep it within bounds, it is the wrong tree for the location and replacement should be considered.

The new growth retardants are also effective when applied as a soil drench or soil injection. As a drench, a small trench is scraped around the soil line of the tree, and the recommended dose of the chemical is poured into the trench. Alternatively, the chemical may be poured around the base of the trunk, allowing it to run down along the trunk-soil interface.

Commercial soil injection equipment may be used to inject the chemical into the soil to a depth of about six inches. The retardants may also be applied as a soil band-spray or sometimes a bark band-spray. However, if the chemical contacts grass or other plants nearby, they will become severely stunted. Regulations regarding soil and groundwater contamination must also be considered when applying chemicals to the soil.

For controlling sprout growth on a more limited scale, you may want to consider using an aerosol spray on the cut surface. Sproutgard is one percent naphthalene acetic acid (NAA) in an asphalt-based spray. NAA is a hormone that is sometimes used to promote cutting rootings, but at higher concentrations it inhibits shoot development. Chlorflurenol (marketed as Maintain A by Uniroyal) is also available in an asphalt-based aerosol formulation. Both these products come in ready-to-use 13-oz. pressurized spray canisters.

Using growth regulators for sprout control in trees is not a substitute for proper pruning practices. Limbs should always be cut back to a lateral branch growing in the desired direction and should not be stubbed off. Stubs promote excessive sprout regrowth and sometimes infection and dieback.

## Other PGRs

Growth regulators for shrubs, hedges, groundcovers and other plants is an area with a large potential for expansion as the newer growth regulators become available.

The first material used to chemically control shrub growth was Off-Shoot-O. This is not a hormone-like growth regulator, but a fatty acid that destroys the meristematic tissue of the shoot apex. This inhibits shoot elongation and promotes lateral branching in the same way that manual pinching or pruning does. A major drawback to its use, however, has been the potential for foliar burning.

A newer, safer material is dikegulac, sold as Atrinal or Atrimmec. This growth regulator acts systemically to reduce apical dominance and induce lateral shoot development. It may be used both in nursery production to produce bushier, more compact plants, or in landscape management. In the landscape, it is generally used after pruning or shearing to maintain the plant in the desired

shape through the growing season. A problem with dikegulac is that it can cause chlorosis of the growing tips two or three weeks after spraying. This effect is usually transient, but on some species such as forsythia, oleander and privet, it may persist up to six weeks.

Dikegulac is applied as a foliar spray, usually in conjunction with trimming or shearing. The rate is selected from an extensive list of woody plants on the label. The plants may be trimmed in the fall or in the spring, but they should be sprayed in the spring while they are actively growing. One application per growing season is usually sufficient, but a second application may be made if necessary.

Dikegulac may also be used to suppress flowering and fruit development of certain plants such as ornamental olive (*Olea europaea*), glossy privet (*Ligustrum lucidum*), and Japanese holly (*Ilex crenata*). It should be applied pre-bloom or during the flowering period to reduce or eliminate bloom and prevent fruit set.

Mefluidide (Embark) may be used on some woody ornamentals, but it is not labelled for nearly as many species as dikegulac. Embark may be used to control growth of ligustrum, English ivy, and burford and Japanese hollies. A spray of 2/3-oz. Embark per gallon of water reduces growth for up to eight weeks.

Chlorflurenol (Maintain CF-125) retards the growth of most trees, shrubs and vines when applied as a foliar spray. It should be applied after the new leaves are fully developed, as it may cause curling and twisting of tender new growth. Maintain is also effective on conifers, although it should be applied before the buds expand. Application to tender candles causes distortion of the new growth.

Paclobutrazol (Clipper), marketed as Bonzi for greenhouse use, is labelled for use on poinsettias.

Uniconizole (Sumagic, Prunit), a similar compound, still has only an experimental label, but is expected to be available in 1989. Both of these materials are gibberellin biosysthesis inhibitors, taken up by stems and roots and translocated to the growing points. They are apparently effective on a wide variety of plants including floral crops, bedding plants and woody ornamentals. Azaleas and rhododendrons respond to foliar sprays of Sumagic in the range of 5 to 25 ppm.

In our research on containerized liners of the Indica azalea 'Formosa.' we applied 5 ml of a 15 ppm spray to give the most effective rate of .075 mg active ingredient per plant. The Bonzi was applied as a 90 ppm spray. Sprays of Atrinal or B-Nine would require rates of 3000 to 5000 ppm to obtain comparable results. Soil drenches may be more effective than sprays, depending on the soil or container medium. Some media (particularly those with a high percentage of bark) can tie up the active ingredient and make it less effective.

It must be pointed out that these newer materials are extremely active and the amount applied must be carefully calculated, either on a square foot or a per plant basis. Spray concentrations in the range of 25 to 300 ppm have been effective on cultivars of juniper, viburnum, ligustrum, English and Algerian ivy and pyracantha. Optimum rates and timing still need to be determined experimentally for these and other woody species.

The prospects are good for more effective growth regulators for control of trees and shrubs, increasing the efficiency of landscape managers. **LM**