

# California Turfgrass Culture

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## Mowing California Turfgrasses

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Attractive, well-groomed turfgrass stands and uniform sports playing surfaces depend on proper mowing as well as cultural practices such as irrigation and fertilization. Mowing at a height and frequency that complement the growth habit of grass contributes to uniform, dense turf that discourages weeds and supports much traffic. While mowing is a vital part of turfgrass growth control, mowing too low weakens grass, causing a stand to thin, encouraging weed invasion, susceptibility to traffic and pests, and eventually causing the turfgrass death. Mowing too high produces a ragged, unattractive stand and may encourage buildup of thatch. Mowing frequency, as important as mowing height in maintaining healthy turfgrass, depends on grass growth rate, a product of turfgrass genetics, climatic conditions and turf maintenance practices.

### Determining Height of Cut

Grass survival requires adequate leaf surface for food production through photosynthesis. Thus optimum cutting height is determined by a turfgrass species growth habit and its leaf texture (i.e., width of leaves). Mowing too low removes too much of the grass' food producing tissue, i.e., leaves and stems. Grass mowed too short and/or frequently literally starves, causing the turfgrass stand to thin. Mowing too high, on the other hand, can negatively affect the appearance or usefulness of a turfed area (especially on sports fields).

Due to genetic variation, no single mowing height is desirable for all turfgrasses; therefore, mowers must be set differently for each species. The ranges for optimum mowing height for common California turfgrasses appear in Table 1.

Within the optimum mowing height range for each species, grass will produce a deeper root system and be healthier the

higher it is mowed. Also within the recommended mowing height range for each grass, a higher cut grass is more drought, heat, traffic, shade, disease and pest resistant than a lower cut.

### Mowing Frequency

Turfgrass managers determine mowing frequency from turfgrass growth rate during each season and by the appearance desired for specific use. Cool-season turfgrasses require more frequent mowing in the spring and autumn when they grow most vigorously. Warm-season turfgrasses require more frequent mowing during summer months. "Cool-season" turfgrasses (bentgrass, bluegrass, ryegrass, and fescue) ordinarily do not lose their green color unless the average air temperature drops below 32°F for an extended period. They turn green again as soon as temperatures rise above freezing, and are not usually damaged by subfreezing temperatures. The "warm-season" grasses (bermudagrass, buffalograss, kikuyugrass, St. Augustinegrass, and zoysiagrass) generally lose their green color and are dormant in winter if the average air temperature drops below 50°F to 60°F. Some may die if exposed to subfreezing temperatures for extended periods. Both cool- and warm-season turfgrasses are generally mowed more frequently in formal and ornamental settings than in informal areas.

Agronomically speaking, turfgrass mowing frequency follows the "1/3 rule": mow often enough so that no more than 1/3 of the length of the turfgrass shoot (leaf blade and stem) is removed at any one time. For example, if you maintain a turf-type tall fescue lawn at 2 inches, mow it when the grass reaches 3 inches in height. This may mean mowing tall fescue once a week during the spring and fall when the grass is growing vigorously, but only once every two weeks during the summer. Usually, a turfgrass stand mowed to a low

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height requires more frequent mowing than the same species mowed to a higher height. Depending on the mowing height chosen for a specific turfgrass species, Table 1 also gives the height at which a mower must be set to maintain the desired mowing height.

### Dealing with Clippings

Grass clippings make up a large portion of California's green waste stream during the growing season. With few exceptions, it is better to leave clippings on the turf after mowing. This practice, termed "grasscycling", is increasingly popular as California communities try to reduce the amount of waste going to landfills. Grass clippings (composed primarily of water) dry and decompose quickly, releasing nutrients (mainly nitrogen) back into the turf canopy.

Grasscycling can be practiced on any healthy turfgrass stand as long as turf is properly managed. Unfortunately, in many cases turfed areas are managed like a "crop": over-watered and over-fertilized to encourage maximum growth, then harvested by bagging and transporting grass clippings to a compost pile or landfill.

Proper mowing is required for successful grasscycling. Turfgrasses should be mowed when the surface is dry, mower blades kept sharp, and the "1/3 rule" followed. Frequent mowing produces short clippings which readily filter into the turf canopy and do not cover the grass surface if left on the lawn.

There are times when grasscycling is not appropriate. Prolonged wet weather, mower breakdowns, or other circumstances, which reduce mowing frequency and thus lead to an excessive volume of clippings, probably dictate that grass clippings should be bagged. Grass clippings, however, are excellent additions to a compost pile, which are now commonly maintained by both commercial

landscapers, and homeowners. Turfgrass clippings can also be used as mulch to provide weed control and prevent moisture loss in flowerbeds, and around trees and shrubs. Mulching with clippings should be avoided, however, if the clippings are of an invasive species such as bermudagrass, or if herbicides were recently applied to the turf. Due to "matting" problems (which reduce water and air movement into the soil), using grass clippings to create a mulch layer thicker than an inch is not recommended.

### Mowing Equipment

The two basic mower types are reel and rotary. A reel mower shears grass with a scissor action and is better for fine-textured turfgrasses or where a low mowing height is desirable. A rotary mower depends on impact cutting by a high speed, rotating blade. It is better adapted to higher cutting heights and coarser-textured grasses. The type of mower recommended for the best appearance of each grass species is given in Table 1.

Reel mowers are either pushed by hand or powered by a gasoline engine. Rotary types are driven by electric or gasoline engines. If a gasoline engine is used, add fuel away from the grass, since gasoline will injure plants if accidentally spilled. To adjust mowing height on both reel and rotary mowers, place the mower on a flat surface and measure the distance from that surface to the blade (rotary) or bedknife (reel). Adjust to the desired height, but never adjust the mower height while the engine is running!

Grasscycling can be accomplished with most mowers by removing the mower collection bag to allow clippings to drop on the grass. However, if a mower does not have a safety flap covering the opening where the bag fits into the chute, modify the mower clipping disposal apparatus with the use of a retrofit kit. Almost all lawnmower manufacturers have developed and offer a broad range of mulching or recycling

**Table 1. Proper mowing heights and mowers for California turfgrasses.**

Grass Type	Climate Adaptation	Mower Setting (Inch)	Mow when grass reaches this height (Inch)	Mower Type
Bentgrass	cool	½ - 1	¾ - 1 ½	reel
Bermudagrass (common)	warm	1 - 1 ½	1 ½ - 2 ¼	reel or rotary
Bermudagrass (hybrid)	warm	½ - 1	¾ - 1 ½	reel
Buffalograss	warm	1 - 2	1 ½ - 3	rotary
Kentucky Bluegrass	cool	1 ½ - 2 ½	2 ¼ - 3 ¾	reel or rotary
Kikuyugrass	warm	1 - 1 ½	1 ½ - 2 ¼	reel or rotary
Perennial Ryegrass	cool	1 ½ - 2 ½	2% - 3%	reel or rotary
Tall Fescue	cool	1% - 3	2% - 4%	reel or rotary
St. Augustinegrass	warm	1 - 2	1% - 3	rotary
Zoysiagrass	warm	½ - 1 ½	¾ - 2%	reel or rotary

mowers. These mowers, which have become very popular, cut grass blades into small pieces and force them into the turf canopy and are very effective in grasscycling.

### **Mower Safety**

- Study instruction manual for manufacturer's recommendations on care and use.
- Never leave a running mower unattended.
- Keep people, especially children, and pets away from mowing operations.
- Remove from the turf surface all rocks, sticks, and other objects the mower can throw. Flying objects are hazardous.
- Keep hands and feet clear of moving parts.
- Work across slopes, not up and down.
- Don't pull a walk-behind rotary mower backward.
- ‡ Disengage the cutting blade when moving the mower across passways, driveways, or any other non-turfed area.
- ‡ Stop the engine to clean or adjust mower.
- ‡ Remove the sparkplug wire when working on mower.
- ‡ Keep gasoline only in specialized safety cans.

### **Additional Mowing Tips**

- Mow grass mixtures to favor the predominant or most desirable grass.
- Do not mow wet grass. It sticks to blades and clogs the mower.
- Change the direction of the mowing often to prevent a washboard effect.
- Sharpen lawn mower blades regularly, as dull mowers leave a ragged appearance from crushed or uncut grass blades. Damaged grass may also be more susceptible to disease infection.
- Do not drastically or suddenly change cutting height. If grass has become too high, the recommended height should be regained by gradually lowering the mowing height of successive cuttings.
- Do not mow turfgrasses suffering drought or other climatic stresses. Grass suffering from lack of water should be watered, allowed to dry, then mowed.
- Mow grasses in shade slightly higher and less frequently than normally recommended. Shade reduces photosynthesis, and slightly higher mowing heights, which leave greater leaf surface, compensate for light reduction.

## **An Evaluation of Plant Growth Regulator and Contact Herbicide Pre-Treatments During Initial Overseeding of Bermudagrass With Perennial Ryegrass**

*J. Michael Henry'*

### **Introduction**

Warm fall temperatures in the low elevation desert areas of southern California (Palm Springs) can allow renovated common bermudagrass (*Cynodon dactylon* (L.) Pers.) to regrow quickly and compete with seedling perennial ryegrass (*Lolium perenne* L.) overseed species. This study evaluated common overseeding pre-treatments used by turfgrass managers to improve the speed, density and uniformity of ryegrass seed establishment where overseeded into bermudagrass lawns, fairways and roughs. A contact herbicide and a plant growth regulator were evaluated to determine if they offered any advantage or disadvantage in obtaining a high quality stand of overseeded perennial ryegrass in the short time-frame (4 weeks) before the turf areas opened for use.

Treatments included, Scythe (Pelargonic Acid), and Prima (Trinexapac - ethyl) at one and two applications compared with the "check" treatment, which received no chemical application. The chemical treatments were applied

with a Hahn boom sprayer with a 16-foot application width using TeeJet nozzles at 30 psi. It was calibrated to apply 1.3 gal/1000 ft<sup>2</sup>. A blue dye marker, Blazon, was used to help visually evaluate the evenness of the applications. Treatment details are summarized in Table 1. The plots were watered up to the time of pre-treatment chemical application. This was necessary for the materials to be of maximum effectiveness. This meant that the study did not undergo the normal "dry-down" for the month prior to renovation.

The renovation was done using large renovation equipment on October 22-23, 1996. The plots were overseeded on October 24, 1996 at approximately 600 pounds of perennial ryegrass seed per acre.

The plots were rated regularly for turf color and during the initial grow-in phase clipping weights were taken from each plot.

The turf color rating used a 1 to 9 scale, where 1 represented dead turf (100% brown) and 9 represented 100% uniform

Treatment	Rate/Acre	Date	Comments
Check		10/23/96	No chemical treatment prior to renovation.
Primo <sup>a</sup> 1x	.25 gal.	10-11-96	
Primo <sup>a</sup> 2x	.25 gal.	10-11-96/ 11-25-96	Second application at same rate with CO2 backpack sprayer.
Scythe <sup>b</sup>	6 gal.	10-11/96	Excess water used for application.
<sup>a</sup> Primo® = Trinexapac - ethyl (Plant Growth Regulator) <sup>b</sup> Scythe® = Pelargonic Acid (Contact Herbicide)			

green grass (Table 2). Off-color weeds, pest damage or bare soil decreased the color rating, but emphasis was placed on the turfgrass stand itself.

Visual estimates of the percentage of perennial ryegrass and common bermudagrass were taken (Table 3). The remaining percentage (to equal 100%) in each plot was bare soil.

Clippings were collected with a Trimmer@ front-throw reel mower set at 0.75 inches mowing height. Clippings were bagged in paper bags, labeled, dried at 104°F for at least 48 hours. Weights were then taken to the nearest 0.10 gram (Table 4).

Turf quality ratings used a 1 to 9 scale, with 1 representing dead turf (100% dead) and 9 representing a perfect stand of turfgrass. Rating scores of 7 or higher are considered excellent quality with little or no need of improvement (Table 5).

Data collection concluded on January 6, 1997, 10 weeks after overseeding.

Statistical analyses were performed using MSTAT and SAS statistical analysis programs. Clipping weight analysis was done using transformed data by adding one (1) to each weight, then taking the log to base 10. The analysis was then run on the log-transformed data, (Table 4).

## Results and Discussion

There was no difference in color ratings in November and December 1996 between the treatments, except on the December 16<sup>th</sup> rating, where plots that received a second Primo® application were less green than those that received only one Primo® application, as shown in Table 2.

The percent cover (Table 3), an indicator of the establishment

of the ryegrass and the regrowth of the bermudagrass, showed no differences except in the first month after overseeding, (November 25<sup>th</sup> rating date). The check had significantly better ryegrass cover than the treated plots. This difference was not present by the December 9<sup>th</sup> rating date. No differences were shown between the check and the treated plots in the percent bermudagrass cover for the November and December rating dates.

The clipping weight comparisons as given in Table 4 showed little differences between the treated plots and the check. At this time of year, both bermudagrass and ryegrass were still growing and contributed to the clippings. In early December (12/2/96), there were no differences between the treatments in clipping weights. By the second week (12/9/96), the differences were significant between the check and the other treatments, and between the plots treated once with Primo® and those treated a second time with Primo®. Comparing the Primo® treatments and the Scythe@ treated plots showed no significant differences at any time.

The graph in Figure 1 illustrates the data summarized in Table 4.

Treatment	11/25/96	12/9/96	12/16/96
Check	6.0	5.8	5.9
Primo 1x	4.8	5.5	6.4
Primo 2x	5.2	5.0	5.0
Scythe	4.5	5.2	5.5
check vs. Treatment	NS	NS	NS
Primo vs. Scythe	NS	NS	NS
Primo 1x vs. 2x	NS	NS	*

**Table 3. Percent cover of grass species by treatment.**

Treatment	Ryegrass		Bermudagrass	
	11/25	12/9	11/25	12/9
Check	35.0	50.0	44.0	33.3
Primo 1x	23.8	53.3	50.2	38.3
Primo 2x	18.8	36.7	51.2	43.3
Scythe	25.8	44.7	46.5	37.0
Check vs. Tmt	*	NS	NS	NS
Primo vs. Scythe	NS	NS	NS	NS
Primo 1x vs. 2x	NS	NS	NS	NS

**Table 4. Clipping weights (grams)' of samples taken from study plots.**

Treatment	12/2/96	12/9/96	1/6/97
Check	58.9	21.8	31.0
Primo 1x	24.3	7.8	26.1
Primo 2x	19.4	1.8	5.2
Scythe	33.9	8.2	22.8
Check vs. Treatment	NS	*	NS
Primo vs. Scythe	NS	NS	NS
Primo 1x vs. 2x	NS	*	*

\*Statistical analysis used log<sub>10</sub> transformed data.

NS = not significant

\* = significant at the 0.05 level.

The Primo® treatments did reduce the clippings (growth) of the treated plots, but they showed no benefit over the untreated check in turf color or percent cover during the initial grow-in phase or early months of winter play. The last rating made January 6, 1997 for overall turf quality gave no statistically significant differences between treatments and the untreated check.

Table 5 shows there were no significant differences in turf quality scores comparing treatments and check, Primo® vs Scythe®, nor Primo® 1x vs Primo® 2x at this evaluation point, two and one-half months after overseeding.

The results of this study, (and a similar study performed in fall 1995 at Desert Princess Country Club, also in the Coachella Valley area of California, but not reported here), indicates that under the conditions of this study there was no advantage to applying the studied pre-treatment chemicals to retard the regrowth of common bermudagrass during the germination and early establishment of perennial ryegrass in the overseeding process.

**Table 5. Turf quality rating taken January 6, 1997.**

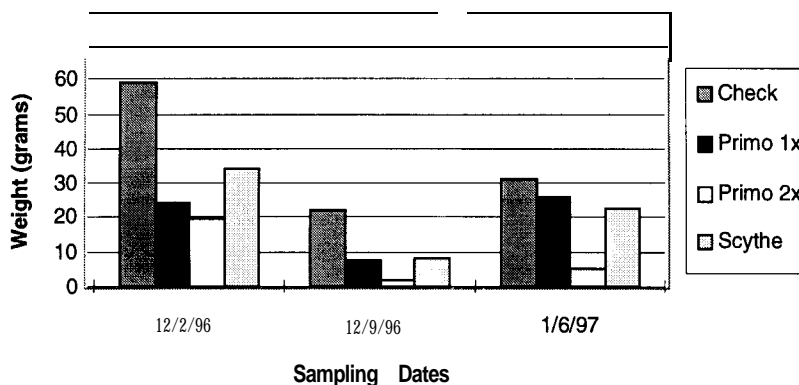
Treatment	Turf Quality Score
Check	4.75
Primo 1x	5.25
Primo 2x	5.5
Scythe	5.0
LSD at 0.05 alpha level = 1.265	NS

The normal practice of withholding water on bermudagrass fairways for a period of weeks prior to renovation and overseeding is thought to retard the bermudagrass growth, theoretically giving the newly seeded ryegrass a chance for more uniform establishment. In this study, the bermudagrass was watered up to application of the pre-treatment chemicals, (12 days before renovation and overseeding) yet the quality of the ryegrass establishment in the untreated check plots was equal to those plots treated to slow bermudagrass competition with the establishing ryegrass. There did not appear to be any difference in the initial establishment of the check plots and those treated with either of the pre-overseeding chemicals.

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**Figure 1. Clipping yields by treatment, starting 6 weeks after overseeding. Second Primo treatment applied 11/25/96.**



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## Green Kyllinga

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Green kyllinga (*Kyllinga brevifolia*) is a weedy sedge that is becoming a major problem in turf and ornamental plantings in California. The genus *Kyllinga* consists of about 40 species that are distributed worldwide in subtropical and warm, temperate regions. Green kyllinga has been reported as a weedy problem from Florida across the southeastern United States into Arizona, California, and Hawaii. In California it occurs from San Diego in the south to the Sacramento Valley in the north. Green kyllinga is believed to have originated in Asia and was reported as a weed in California over 50 years ago. In the last few years, however, it has developed into a major problem for turfgrass and ornamental managers. Green kyllinga is often confused with yellow or purple nutsedge because it is similar in size and in the way it grows. However, the flower of the green kyllinga plant and the absence of underground tubers make it easy to distinguish from nutsedge.

### Identification and Life Cycle

Green kyllinga (Fig. 1) is a perennial plant that grows best in moist or wet areas that receive full sun, but it can survive some shade and drying once established. *Kyllinga* grows well during the warm weather from April through October. It is dormant in winter but remains green in warm climates where freezing does not occur. When left unmowed, green kyllinga can reach a height of about 15 inches. In areas that are mowed, it grows in a prostrate manner, producing a network of numerous underground stems or rhizomes. It roots and sends out leaves at each stem node. If green kyllinga rhizomes are removed and chopped into pieces, new plants can be produced from each node or stem section.

Leaves are long and narrow, ranging from 1 to more than 5 inches in length. Flowering usually occurs from May to October, but it can occur earlier in warm locations. Flower stalks are triangular in cross section and 2 to 8 inches in length. The stalks terminate in a globular inflorescence (flower) that is green and about 3/8 inch in diameter (Fig. 2). Directly below the flower is a group of three leaves that

radiate out from the stalk. There are 30 to 75 spikelets within each flower and each one is capable of producing one seed. A mature plant can produce over 100 flowers within a growing season and up to 5,000 seeds.

The seed of the green kyllinga plant is highly viable. It has an oval shape and is flat in cross section; it is about 1/8 inch long and 1/16 inch wide. Seed germination occurs at or very near the soil surface. Burying seed as little as 1/3 inch below the soil surface reduced germination 12-fold in one Arizona study. The tan-colored seed germinates when soil moisture is adequate and soil temperatures reach about 65°F. Germination continues throughout the summer. Seedling growth is slow initially and plants may require several weeks to become established. Once established, green kyllinga

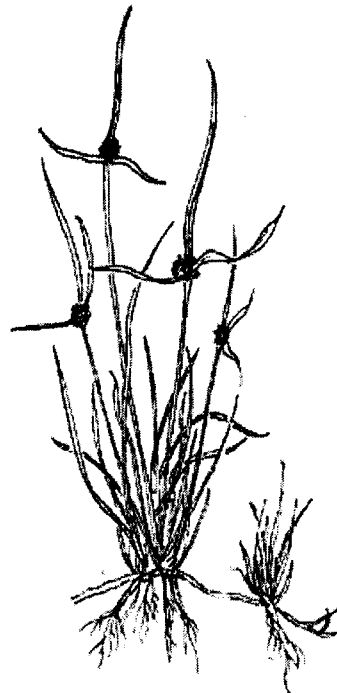


Figure 1. Mature plant of green kyllinga showing rhizome, roots, stem, and inflorescence.

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forms a vigorous system of rhizomes. It can survive and even flower and produce seed at mowing heights of 3/4 inch.

### Impact

Green kyllinga can be a major weed problem for turfgrass and ornamental managers. In turf it forms a weak sod that gives poor footing for athletic fields and golf courses. Although green kyllinga is most often a problem in bermudagrass, it has been found in cool-season turf species as well. Green kyllinga has a texture and color that varies from normal turfgrass species and reduces the aesthetic quality of the turf. Also, green kyllinga grows faster than most turfgrass species, which gives infested turfgrass an undulating or irregular surface in as little as 2 days after mowing.

Once a few plants become established in turfgrass or ornamental areas, spread can be rapid. In warm weather, rhizomes can grow by more than 1 inch per day, forming thick mats in just a few weeks. Seed and rhizomes are spread by mowing, foot traffic, and cultivation. This allows the production of new plants and hastens spread.

### Management

The primary method of control is to prevent new infestations. Thoroughly clean mowers and cultivation equipment before moving from infested to weed-free areas. If solitary plants of green kyllinga are found, they should be grubbed out (i.e., remove the entire plant, roots and all) and the area monitored for several months to make sure that removal was complete. When green kyllinga infests ornamental plantings, it forms a dense mat that crowds out desirable species and reduces the vigor of those plants that survive. Because of the extensive rhizome system in established stands, hand-pulling or hoeing to remove green kyllinga is usually futile unless done repeatedly over a long period of time. Thus control by this means is very expensive and not always successful. Areas with infestations should be isolated until control can be accomplished. Turfgrass and ornamental areas should be well maintained to promote maximum vigor. This will aid in making these plantings as competitive as possible to slow invasion of the weed. Dense turfgrass and ornamentals will shade the soil surface making the establishment of green kyllinga seedlings difficult.

### Control in Turfgrass

No single control procedure has been successful in controlling green kyllinga in turfgrass.

Early grubbing of solitary infestations has been successful when practiced diligently. Spot-spraying isolated plants with glyphosate can be helpful, but the turfgrass is also killed, leaving open areas and making kyllinga reestablishment easier.

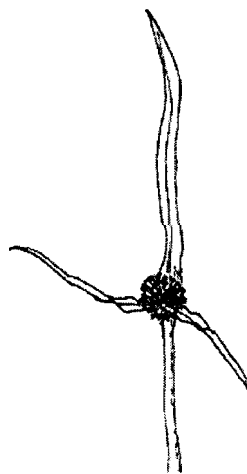


Figure 2. -Seed heads of green kyllinga showing three subtending leaves on a short stem.

The open spots should be overseeded to establish a vigorous turf.

Preemergent herbicides have been successful in limiting germination of green kyllinga seeds. These herbicides could be applied in spring before soil temperatures reach 60°F to limit germination in late spring and early summer. Preemergent materials that can be used by home gardeners include pendimethalin, bensulide, and benefin. Commercial applicators may also use prodiamine and dithiopyr.

Postemergent herbicides can limit growth of green kyllinga. For commercial applicators, best control has been obtained when halosulfuron has been applied in two applications spaced about 2 weeks apart. Multiple applications of MSMA will reduce infestations (at least three applications at 7- to 10-day intervals are needed). Bentazon has reduced green kyllinga growth when two applications were made about 2 weeks apart. Both MSMA and bentazon can be applied only by licensed pesticide applicators.

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## WARNING ON THE USE OF CHEMICALS

Pesticides are poisonous. Always read and carefully follow all precautions and safety recommendations given on the container label. Store all chemicals in their original labeled containers in a locked cabinet or shed, away from food or feeds and out of the reach of children, unauthorized persons, pets, and livestock.

Recommendations are based on the best information currently available, and treatments based on them should not leave residues exceeding the tolerance established for any particular chemical. Confine chemicals to the area being treated. **THE GROWER IS LEGALLY RESPONSIBLE** for residues on his crops as well as for problems caused by drift from his property to other properties or crops.

Consult your County Agricultural Commissioner for correct methods of disposing of leftover spray material and empty containers. Never **burn pesticide containers**.

**PHYTOTOXICITY:** Certain Chemicals may cause plant injury if used at the wrong stage of plant development or when temperatures are too high. injury may also result from excessive amounts of the wrong formulation or from mixing incompatible materials, Inert ingredients, such as wetters, spreaders, emulsifiers, diluents and solvents, can cause plant injury. Since formulations are often changed by manufacturers, it is possible that plant injury may occur, even though no injury was noted in previous seasons.

**NOTE:** Progress reports give experimental data that should not be considered as recommendations for use. Until the products and the uses given appear on a registered pesticide label or other legal, supplementary direction for use, it is illegal to use the chemicals as described.

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