COOPERATIVE EXTENSION UNIVERSITY OF CALIFORNIA

California Turfgrass Culture

VOLUME 30, NUMBER 1 WINTER 1980

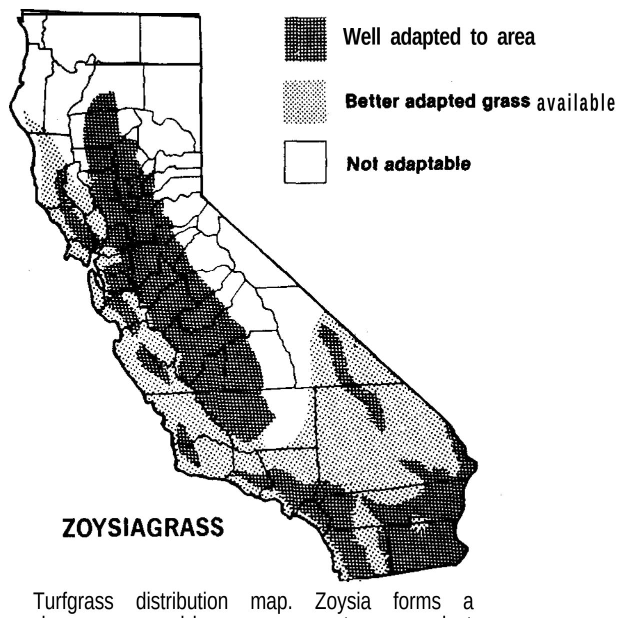
ZOYSIAGRASSES IN CALIFORNIA

*Victor B. Youngner**

Zoysias are warm-season turfgrasses first introduced into the United States early in this century from east Asia. They consist of three closely related species, *Zoysia japonica,* Japanese lawngrass; *Z. matrella,* Manillagrass; and *Z. tenuifolia,* Korean velvetgrass or Macarenegrass. Many botanists and agronomists consider them to be botanical varieties of a single species, because they hybridize readily and have the same chromosome number. They vary in texture from the extremely fine Z. tenuifoiia to side-leaved Z. japonica. The former is used as a ground cover and is not well adapted to mowing as a turf.

Two cultivars are generally available today-Meyer, a strain of Japanese lawngrass, and Emerald, a hybrid between Z. *japonica* and *Z. tenuifolia.* Meyer is not recommended for California because of its long dorman t period and its slowness in establishment. Selected similar strains may be grown by California turfgrass nurseries. New, well-adapted cultivars may be available soon from the University of California breeding program. To ensure satisfaction, planting material should be obtained from local California growers or nurseries.

Zoysia can be grown in all the areas of California where summers are warm and winters mild. It thrives under high temperatures but begins to lose color when temperatures drop below 8O° F for several consecutive nights. Light frosts turn it straw color. Emerald zoysia often remains green throughout the winter in coastal southern California. The length of the winter dormant period varies with location and weather from a few days to several months.



Turfgrass distribution map. Zoysia forms a dense, emerald green carpet, somewhat shade tolerant and requiring heat for good growth.

Zoysia makes a dark green turf resembling Kentucky bluegrass during its growing season. Although it spreads by stolons and rhizomes similarly to bermudagrass, its slow growth rate makes it easier to contain and keep out of flowerbeds or shrub plantings. Zoysia forms a very dense sod and is highly resistant to wear from foot traffic. Its leaves are stiffer than those of Kentucky bluegrass or bermudagrass.

Advantages of Emerald Zoysia

It is heat tolerant and thrives under high summer temperatures.

It has a deep, extensive root system that makes it drought tolerant and able to use water efficiently. Watering can be less frequent than with most other turfgrasses.

It makes a permanent lawn with few insect or disease problems.

Because of its slow growth, mowing and edging are required less frequently than with many turfgrasses.

It is dense and tough, making it resistant to wear and weed invasion.

It makes a satisfactory turf with less nitrogen fertilizer than is required for most turfgrasses.

It is tolerant of salt and of urine from dogs.

It will grow in light to moderate shade.

Disadvantages of Emerald Zoysia

In all but the mildest areas of the state, it has dormant periods of varying lengths, at which time color will be poor.

Because it grows slowly, a full summer or more will be required to form a solid turf.

It is more expensive to establish than most turfgrasses.

Thatch may build up on the soil surface, inhibiting water infiltration and causing scalping when mowed.

Its toughness and density require the use of a sharp power mower, preferably a reel type.

It does not tolerate excessively wet or poorly drained soils.

*Professor of Agronomy, Department of Botany and Plant Science, University of California, Riverside.

Planting

Zoysia is usually planted vegetatively with plugs of sod or sprigs (small pieces of the plant with stolons or rhizomes and roots). Seeds are not used to start a zoysia lawn because plants do not grow true from seed and will not make a satisfactory turf.

In plugging, the plugs of sod approximately 2 inches in diameter and 2 to 3 inches deep are set into the prepared lawn surface at 6- to 12-inch intervals. The closer spacing will give more rapid coverage but, of course, will be more expensive.

Sprigging is done by planting the sprigs in rows 4 to 6 inches apart, partially covering them with soil but leaving tips exposed. If the supply of planting material is large, the sprigs may be broadcast over the prepared soil surface, rolled, and topdressed with soil or mulch. Sprigs must not be allowed to dry out at any time and the soil must be kept moist after planting until new growth is well established.

Nitrogen fertilizer at the rate of 1/2 to 1 pound of actual nitrogen per 1,000 square feet of area should be applied before plugging or sprigging. Phosphorus and potash fertilizer should also be applied at this time, if needed. A small amount of organic or slow-release nitrogen fertilizer placed at the bottom of the hole before the plug is set has been shown to improve the rate of spread.

Sprigging is less expensive than plugging and usually gives a more rapid rate of cover. However, care of sprigs, especially watering, is more critical during the establishment period. Zoysia plugs may be set into an old lawn of other grasses and will gradually take over during a period of 2 to 3 years. The best time for planting is spring and early summer.

Care of an established soysia lawn

Mow zoysia lawns at 1/2 to 1 inch. Because of its slow growth rate, zoysia may need mowing only once every 10 to 14 days during most of the year. A rotary mower may be used, but a smoother, neater surface will be obtained with a reel mower.

Light, frequent applications of a soluble material such as ammonium nitrate during fall, winter, and spring will help maintain cool weather color. Usually, 1/4 pound of actual nitrogen per 1,000 square feet monthly from October to March, will suffice. If the lawn becomes dormant, fertilization should be discontinued until warmer spring weather. Applications of 1 pound of nitrogen in April and June will usually keep a zoysia lawn looking good through the summer.

In many areas, irrigation with 1 inch of water per week keeps a zoysia turf green throughout the summer. The actual needs vary with soil type and weather but, in general, are much less than those of most turfgrasses other than bermuda. Rolling of the leaves and development of a deep blue-green color indicate a need for water. Because zoysia has a deep root system, the soil should be kept moist to several feet in depth. During droughts or water shortages, zoysia will remain alive, although poor in color, with greatly reduced amounts of water.

Most zoysia lawns will build up a thatch of dead, undecomposed plant material in time. Mechanical removal of thatch with a renovator or vertical mower may then be required. This must be done well before fall to allow ample time for regrowth. In most areas, April or May would be an excellent time. Fall renovation and overseeding as done on bermuda are not recommended. Application of a good preemergence herbicide immediately after thatch removal will prevent weed invasion during the recovery period.

Summary

In its areas of adaptation, zoysia maintenance requirements are lower than those of most other turfgrasses. A good turf can be maintained with less fertilizer, water, and mowing. Its slow growth may be a problem during establishment, but once it is established, this becomes an advantage. Although generally a home lawn turf, zoysia has been used successfully in golf courses, playgrounds, and parks.

PROGRESS REPORT: CHEMICAL CONTROL OF BLUEGRASS RUST

Arthur H. McCain, Howard D. Ohr, David L. Hanson, Richard L. Baldwin, and J. Michael Henry*

Rust of Kentucky bluegrass, *Poa pratensis* L., in California is principally stripe rust, caused by *Puccinia striiformis*. Stem rust caused by *P. graminis* is not common. Cultivars vary in their reactions to rust and few, if any, are immune to the disease. There are many specialized forms of the fungus, just as there are many cultivars of bluegrass. Consequently, a cultivax resistant to stripe rust today may be attacked in the future if another form of rust appears.

In the mild California climate, the fungus survives on

*Plant Pathologist, Cooperative Extension, University of California, Berkeley; Plant Pathologist, Cooperative Extension, U.C., Riverside; and Farm Advisors, San Mateo, Ventura, and Orange counties, respectively.

the host in the uredial stage, the orange spore stage, and bluegrass may become infected whenever environmental conditions favor the rust. The disease is troublesome in the cool, wet weather of fall and early spring.

Rust can be managed in some turfgrass plantings by keeping the grass growing vigorously through fertilization and irrigation. The grass then outgrows the rust: mowing removes infected tissues before the fungus can sporulate, and the disease does not develop. However, maintaining a vigorously growing turf is more costly in mowing labor, water, and fertilizer. At times, it is not possible to manage turf so that it outgrows the rust, and use of a fungicide may be the best control method. Several fungicides are registered for controlling rust of turfgrasses, including chlorothalonil, cycloheximide, mancozeb, maneb, and oxycarboxin. In addition, there are several promising experimental fungicides that have activity against the rust fungi. A trial was designed to compare the registered and experimental compounds.

TABLE 1. Bluegrass Rust Fungicides

Fungicide (active Ingredient)	Amount/ 1,000 sq. ft.	Rust rating*		
		3/30/79	4111179	4/30/79
Bayleton † 25% triadimefon	4.0 oz.	5.0 a	4.5 a	5.0 a
CGA 64251‡ 1.125 lb./gal.	1.6 fl. oz.	4.75 a	4.0 a	4.5 ab
CGA 64251	3.3 fl. oz.	4.75 a	4.0 a	4.25 bc
Plantvax 75% oxycarboxin	1.3 oz.	3.75 ab	2.25 b	3.75 c
Fore 80% mancozeb	4.0 oz.	3.0 bc	1.5 bc	1.0 d
Plantvax§ 75% oxycarboxin	2.6 oz.	3.0 bc	1.25 cd	1.0 d
Daconil 2787 75% chlorothalonil	5.0 oz.	2.5 bcd	1.0 cd	1.0 d
Acti-dione TGF 21% cycloheximide	1.5 oz.	2.5 bcd	1.0 cd	1.0 d
Tersan LSR 80% mancozeb	3.5 oz.	2.0 cd	1.0 cd	1.0 d
Baycor** 25%	0.7 oz.	2.0 cd	1.0 cd	1.0 d
check		1.75 cd	0.5 d	Plot converted to 1/2 lb. N
Furavax‡‡ 0.5 lb. gal.	12.0 fl. oz.	1.5 d	Plot converted to 1/2 lb. N	Plot converted to 1/2 lb. N

*Ratings are on a scale of 1 to 5, where 1 = most severe rust, and 5 = no rust. Figures followed by the same letter are not significantly different at the 5 percent level of probability.
†1-(4-Chlorophenoxy)-3,3 dimethyl-1-(lH-1,2,4-triazol-1-yl)9-butanone; an experimental product of Mobay.
‡Formula confidential; an experimental product of Ciba-Geigy
§Not treated on 12128178.
***b*-[(,1'-Biphenyl)-4-yloxy]-*a*-(1,1-dimethylethyl)-1H-1,2,4-triazole-1-ethanol; an experimental product of Mobay.
‡‡2,4,5-Trimethyl - N-phenyl -3. furancarboxamide; an experimental product of Uniroyal.

TABLE 2. Bluegrass Rust Fungicides

Fungicide (active ingredient)	Amount/ 1,000 sq. ft.	Rust rating* 3/13/79	Rust rating* 5/3/79
Bayleton 25% triadimefon	4.0 oz.	4.75 a	4.7 abt
CGA 64251 0.646 lb./gal.	1.7 fl. oz.	4.6 a	5.0 a†
CGA 64251 0.646 lb./gal	3.3 fl. oz.	4.6 a	5.0 at
CGA 64251 0.846 lb./gal	0.8 fl. oz.	3.9 ab	5.0 at
Plantvax 75% oxycarboxin	1.5 oz.	3.5 b	4.6 abt
Tersan LSR 80% WP	3.5 oz.	2.6 c	3.0 bc†
Fore 80% mancozeb	4.0 oz.	2.4 c	3.2 bc†
Daconil 2787 75% chlorothalonil	5.0 oz.	2.1 c	2.5 c†
Furavax 0.5 lb./gal	12.0 fl. oz.	2.1 c	3.5 abc†
Acti-dione TGF 2.1% cycloheximide	1.5 oz.	1.9 c	2.5 c†
Bay 0599 25% WP	0.7 oz.	1.9 c	2.3 c†
check		1.75 c	1.8 c†

*Ratings are on a scale of 1 to 5, where 1 = most severe rust, and 5 = no rust. Figures followed by the same letter are not significantly different at the 5 percent level of probability.
†One plot lost to dryness.

San Jose trials

The fungicides were applied to 25-square-foot plots of 'Merion' Kentucky bluegrass using an air-pressurized Hudson garden sprayer at an equivalent rate of 5 gallons of liquid per 1,000 square feet. Applications were made at three-week intervals on November 16, December 7, and December 28, 1978. Rust did not develop, so no disease evaluations were made at that time. The tips of the grass blades were yellowed in the cycloheximide-sprayed plots. No phytotoxicity was noted in the other plots.

Rust evaluations were made the following spring on March 30, April 11, and April 30, 1979, and sprayed again on April 11, 1979 (table 1). In April 1980 activity from the April 1979 Bayleton application was still quite evident.

Ventura trials

The fungicides were applied to 25-square-foot plots, using a carbon dioxide (30 psi) pressurized Hudson garden sprayer at an equivalent rate of 5 gallons of liquid per 1,000 square feet. Applications were made December 21, 1978, and January 8,1979. Although rust was present before applications, the grass did not grow, making it impossible to evaluate.

The plots were evaluated March 13, and sprayed on March 13, April 5, and April 19, 1979. A second evaluation was made May 5, 1979 (table 2).

Of the registered products, only Plantvax provided acceptable control. The other registered products probably would have performed better had they been applied more frequently. Both Bayleton and CGA 64251 provided long-lasting, outstanding control.

PROGRESS REPORT: WEED CONTROL IN GOLF COURSE BUNKERS WITH GLYPHOSATE*

*Charles L. Murdoch and Roy K. Nishimoto***

Golf course bunkers are expensive to maintain (Record, 1975). Weeds grow in them and fairway grasses often encroach; perennial weeds and stoloniferous grasses are particularly difficult to control. Little information is available on use of herbicides in bunkers (Johnson, 1974). One difficulty in using herbicides is related to the nature of play from sand. As the ball is hit from the bunker, a large amount of sand can be blasted onto the adjacent turf. Herbicide residue on the sand may lead to serious phytotoxicity to the turf contacted, which is especially critical where bunkers are adjacent to putting greens. Weed control in bunkers has, therefore, been accomplished primarily by mechanical methods or by hand.

Glyphosate [N-(phosphonomethyl) glycine] is a relatively new herbicide reported to be extremely effective in controlling a wide range of weeds when applied post-emergence (Baird, 1971, and Derting et al., 1973).

*Adapted from Journal Series No. 1993 of the Hawaii Agricultural Experiment Station.
**Horticulture Department, University of Hawaii, Honolulu.

Because of the need for safe, effective herbicides for weed control in bunkers, we conducted experiments in Hawaii during 1974-75 to test the safety of glyphosate-treated sands to bermudagrass turf. Control of common bermudagrass and purple nutsedge in bunkers was also tested.

Two experiments were conducted at the Waimanalo Research Station, Oahu, with treated sand applied to an established sod of 'Sunturf' bermudagrass *(Cynodon magennisii* Hurcombe) maintained at a 1/2-inch mowing height. Both silica sand and beach sand were used. Beach sand composed of coral and broken seashells finely ground by wave action is used exclusively in Hawaii in golf course bunkers. It has a high pH (approximately 8.5) and is primarily CaC03 (approximately 98 percent). The silica sand used in these experiments was obtained from the local cement industry; no chemical analysis of this sand was made.

In the first test, glyphosate was applied at rates of 0 and 3 ppm to oven-dry beach and silica sand in sufficient water to moisten the sand thoroughly. The sands were stored in plastic bags for 0, 24, and 48 hours and then applied uniformly to 'Sunturf' bermudagrass in small plots in a randomized complete block design with four replications. The treated sands were applied at three rates per plot, and an untreated control was included in each replication. Sands were left on the turf surface for 48 hours before washing in with sprinkler irrigation. Mowing was delayed for 24 hours after the sands were washed into the turf. The plots were observed for phytotoxicity symptoms at weekly intervals for eight weeks after the sands were applied.

The second field experiment was conducted on an adjacent area to determine if higher glyphosate rates on sand injured the turf. In this experiment,-'beach and silica sands were treated with 0, 100, 500, 1,000, and 2,000 ppm glyphosate and stored for 0,24, and 48 hours. The sands were then applied to plots arranged in a randomized complete block design with four replications. Methods of applying sands, washing into turf, mowing, and observing phytotoxicity were the same as described for the first experiment.

Lastly, bunkers at the Hawaii Kai Golf Course were used to evaluate common bermudagrass control, while purple nutsedge control was evaluated at the Kaneohe Marine Corps Air Station Golf Course. Glyphosate was applied at rates of 0, 1.5 and 3.0 pounds per acre in 100 gallons per acre of spray solution. Two replications of these treatments were applied to plots in each of two bunkers at each location. Percent weed control was rated visually after one month.

Turf phytotoxicity studies

No phytotoxicity symptoms were observed at any time during these tests from any of the materials applied to the turf.

The lack of phytotoxicity symptoms when beach sand containing high levels of glyphosate was placed in contact with the turf was probably due to inactivation of glyphosate by calcium binding. Phillips (1975) has shown that the effectiveness of glyphosate is greatly reduced by calcium, iron, and aluminum ions. Although no chemical or physical analysis of the silica sand was made, this sand may have contained small amounts of clay, calcium, iron, or aluminum ions. Sprankle, Meggitt, and Penner (1975a, b) have shown that wheat plants grown in sand culture are severely injured by glyphosate in the culture. In clay soils, wheat was unaffected by glyphosate in the soil.

The rates of glyphosate used in our experiments were many times greater than would be applied in normal weed control practices. If one assumes that glyphosate applied at the normal rate of approximately 3 pounds per acre is all retained in the upper 1 inch of sand, this would result in approximately 9 ppm glyphosate in the sand. We repeatedly failed to demonstrate phytotoxicity when sands containing up to 2,000 ppm glyphosate were placed in contact with the turf. With silica sands of low clay, calcium, iron, or aluminum contents, however, phytotoxicity might occur if sand containing glyphosate contacts the turf.

Weed control studies

Excellent control of both common bermudagrass and purple nutsedge was obtained with 3 pounds per acre glyphosate (see table). A rate of 11/2 pounds per acre gave significantly better control than the untreated plots, but the degree of control would be unacceptable from a practical standpoint.

The effectiveness of glyphosate in controlling common bermudagrass and purple nutsedge supports the results of others (Baird, 1971; Derting, et al., 1973). These are two of the most common and difficult-to-control weeds occurring in bunkers in Hawaii. The known effectiveness of glyphosate in controlling a wide range of weeds and the safety from phytotoxic residues on the sands used in our experiments give the turf manager an effective tool for eliminating costly hand weeding of golf course bunkers.

Control of Common Bermudagrass and Purple Nutsedge in Golf Course Bunkers with Giyphosate

	Weed kill*	
Giyphosate	Common bermudagrass	Purple nutsedge
lblA	%	%
0	0 a	0 a
1.5	60 b	45 b
3.0	98 c	100c

*Means in the same column followed by the same letter do not differ at the 5 percent level as determined by Duncan's muitipie range test.

References

Baird, D. D. 1971. Introduction of a new broad spectrum herbicide class with utility for herbaceous perennial weed control. Proc. N. Cent. Weed Contr. Conf. 26:21.

Derting, C. W., 0. N. Andrews, Jr., R. G. Duncan, and K. R. Frost, Jr. 1973. Two years of perennial weed control investigations with glyphosate. Proc. South. Weed Sci. Soc. 26:44-50.

Johnson, B. J. 1974. Grass control with EPTC in sand traps on golf courses. Weed Sci. 22:434-436.

Phillips, W. M. 1975. Glyphosate activity as affected by carrier quality and application volume. Proc. N. Cent. Weed Contr. Conf. 30:115.

Record, Lee. 1975. Bunkers: Major concern for maintenance. USGA Green Section Record 13(6):1-4.

Sprankle, Paul, W. F. Meggitt, and Donald Penner. 1975a. Rapid inactivation of glyphosate in the soil. Weed Sci. 23~224-228.

Sprankle, Paul, W. F. Meggitt, and Donald Penner, 1975b. Absorption, mobility, and microbial degradation of glyphosate in the soil. Weed Sci. 23:229-234.

UC TURF CORNER

Victor A. Gibeault and Forrest D. Cress*

UC Turf Corner contains summaries of recently reported research results, abstracts of certain conference presentations, and announcements of new turf management publications. The source of each summary is given for the purpose of further reference.

COMPETITIVE EFFECTS OF TURFGRASS ON GROWTH OF ORNAMENTAL SHRUBS

Planting shrubs or trees in a mature grass sod may result in poor establishment of the woody species. An experiment was conducted at the University of Rhode Island to measure the field response of four species of ornamental shrubs to turfgrass competition.

Shrubs used in the experiment were forsythia, azalea, Japanese barberry, and taxus. Turfgrass treatments included plots maintained at high or low rates of nitrogen fertilizer and receiving, in some cases, supplemental irrigation to maintain high soil moisture. Treatments with no turfgrass were either bark mulch or bare ground, Turfgrass plots were mowed regularly to a height of 3 inches (7.6 centimeters) The effects of these variables were measured by evaluating several aspects of growth and development of each shrub species.

Turfgrass established two years previously on an Enfield silt loam significantly suppressed the growth and development of all four species of shrubs as compared with plots where turfgrass was not a competitor. Differences in soil moisture or temperature are not believed to have been responsible for the differences observed in these findings. Plant competition for nitrogen was suggested by both the color ratings and analyses of leaf tissue of the shrubs during the first year of shrub establishment. Additional fertilizer, applied as a topdressing, was more beneficial to the turfgrass than to the shrubs and, in most cases, did not significantly increase their growth. The addition of potassium and phosphorus did not increase growth in any of the treatments and apparently was not a factor in the competition between the grass and the shrubs.

[See "Competitive Effects of Turfgrass on the Growth of Ornamental Shrubs," by A. P. Nielsen and R. C. Wakefield, *Agronomy Journal,* Vol. 70, No. 1, Jan.-Feb. 1978.1

PHYSICAL CHARACTERISTICS OF THATCH AS A TURFGRASS GROWING MEDIUM

Results from a recent Illinois Agricultural Experiment Station study at Urbana shed some new light on the physical characteristics of thatch as a turfgrass growth medium. The objective of the study was to determine the bulk density, total porosity, moisture characteristics, and organic matter contents of thatch and surface soils of thatched and thatch-free Kentucky bluegrass sites.

Bulk density of thatch was significantly lower than that of soil but varied among thatch samples, depending on the amount of soil within the thatch. Total porosity was not significantly different among thatch samples but was greater than soil porosity. Moisture retention of thatch at low water potentials was less than the surface soil from thatch-free sites, indicating that most of these pores are macro-size pores. Results from this study suggest that cultural practices such as irrigation may need to be modified to sustain aesthetic turf where thatch is a predominant component of the soil environment.

[See "Physical Characteristics of Thatch as a Turfgrass Growing Medium," by K. A. Hurto, A. J. Turgeon, and L. A. Spomer, *Agronomy Journal*, Vol. 72, No. 1, Jan.-Feb. 1980.1

*Environmental Horticulturist and Communications Specialist; respectively, Cooperative Extension, University of California, Riverside.

EFFECT OF THATCH ON PREEMERGENCE HERBICIDE ACTIVITY IN KENTUCKY BLUEGRASS

Researchers at the Illinois Agricultural Experiment Station, Urbana, have measured the effects of five preemergence herbicides on Kentucky bluegrass quality and on control of crabgrass to determine the influence of thatch on the herbicides.

Field applications of benefin, oxadiazon, and prosulfalin to thatchy Kentucky bluegrass turf in spring caused injury that was apparent during periods of summer stress, while DCPA and bensulide caused little or no injury. The same treatments on thatch-free sites revealed that only prosulfalin was injurious. Absorption of benefin, bensulide, and DCPA from solution was greater by thatch than by soil. However, the Illinois researchers report that mobility of these herbicides in undisturbed thatch profiles was greater than that measured in undisturbed surface soil from thatch-free sites. Thus, turfgrass injury from preemergence herbicides on thatchy sites is due to at least two factors: the greater mobility of preemergence herbicides in thatch than in soil and the inherent susceptibility of Kentucky bluegrass to injury from preemergence herbicides that come into direct contact with roots and other absorbing organs.

[See “Influence of Thatch on Preemergence Herbicide Activity in Kentucky Bluegrass (Poa pratensis) Turf,” by K. A. Hurto and A. J. Turgeon, Weed Science, Vol. 27, No. 2, March 1979.1

DEGRADATION OF BENEFIN AND DCPA IN THATCH AND SOIL FROM KENTUCKY BLUEGRASS TURF

Results from a recent study suggest that herbicides applied preemergence in turf will persist for shorter periods of time because of the carbon-enriched medium (thatch) and that higher rates or more frequent applications may be required to maintain concentrations at effective levels.

In the study, rates of benefin and DCPA degradation were significantly faster in thatch than in soil from a Kentucky bluegrass *(Poa pratensis L.)* turf.

[See “Degradation of Benefin and DCPA in Thatch and Soil from a Kentucky Bluegrass *(Poa pratensis)* Turf,” by K. A. Hurto, A. J. Turgeon and M. A. Cole, Weed Science, Vol. 27, No. 2, March 1979.1

COOPERATIVE EXTENSION
U.S. DEPARTMENT OF AGRICULTURE
UNIVERSITY OF CALIFORNIA
Berkeley, California 94720

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE $300

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF
AGRICULTURE
AGR 101

U.S.MAIL

Vice President – Agriculture
and University Services

Pesticides ore poisonous and must be used with caution. Read the label carefully before opening a container. Precautions and directions must be followed exactly. Special protective equipment as indicated must be used.

To simplify information trade names of products have been used No endorsement of named products is Intended. nor s criticism implied of similar products which are not mentioned

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 chemicls as described.

Correspondence concerning *California Turfgrass* Culture should be *sent* to:

Victor A. Gibeault
Plant Sciences Department
University of California
Riverside, CA 92521