CALIFORNIA TURFGRASS CULTURE
FORMERLY, SOUTHERN CALIFORNIA TURFGRASS CULTURE

VOLUME 22, NO. 2 SPRING, 1972

PERENNIAL RYEGRASS IN CALIFORNIA

*V. A. Gibeault, V. B. Youngner, R. Baldwin, J. Breece**

Perennial ryegr *(Lolium perenne L.)* is a cool season species that, in the past, has been established in regions characterized by mild winters and cool moist summers, In these areas ryegrass was used where quick establishment was needed and/or a fairly coarse texture could be tolerated. Recently plant selection and breeding within the species has resulted in several improved plant types for turf use. These varieties, or cultivars, have resulted in an increased adaptation range and usage potential for the species.

Perennial ryegrass is described as a bunchgrass because of the absence of rhizomes and stolons (5, 7). It can be identified by the following vegetative characteristics: the leaves are folded in the bud-shoot (fig. 1) and small, slender auricles are generally obvious. The membranous truncate ligule is 0.4 to 0.6 mm long. The leaves are glossy on the underside and there is usually a reddish coloration at the base of the sheath.

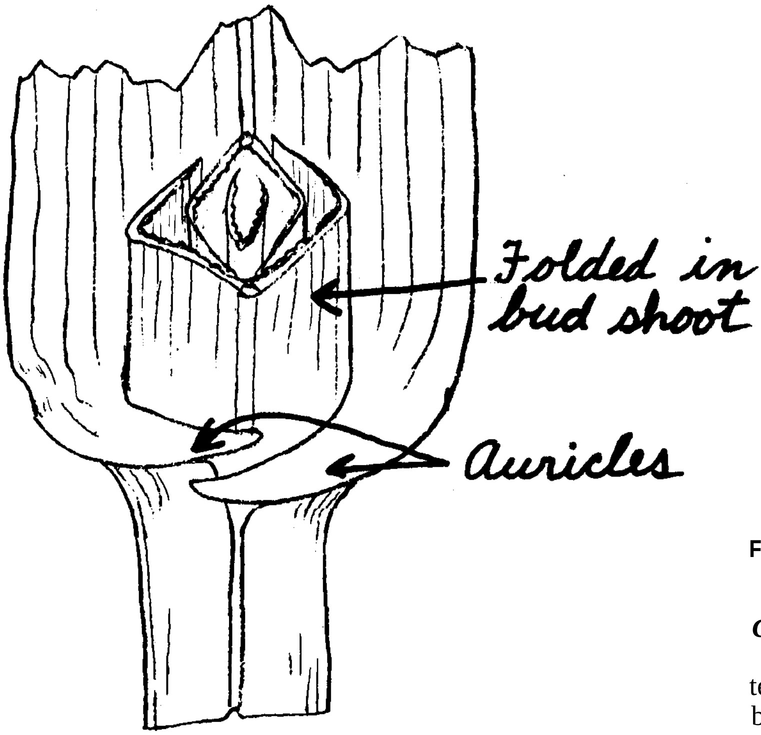

FIGURE 1. Some vegetative characteristics of perennial ryegrass

Adaptation

Perennial ryegrass is best adapted to the coastal region of California north of Santa Barbara County, as is shown in Figure 2 (9). These areas are characterized by moderate temperatures throughout the year so the species seldom encounters high temperature stress. Within this adaptation zone, soils are seldom a limiting factor regarding species performance unless extreme problem conditions prevail. When grown in well adapted regions, perennial ryegra s will perform satisfactorily with normal turfgrass maintenance.

Perennial ryegrass can also be grown in the zone classified as "adaptable with higher maintenance," however, management practices such as mowing, irrigation and fertilization must be modified during the warm summer months (9). In zones of questionable adaptation, the newer improved varieties appear to perform better than the older varieties or common perennial ryegrass.

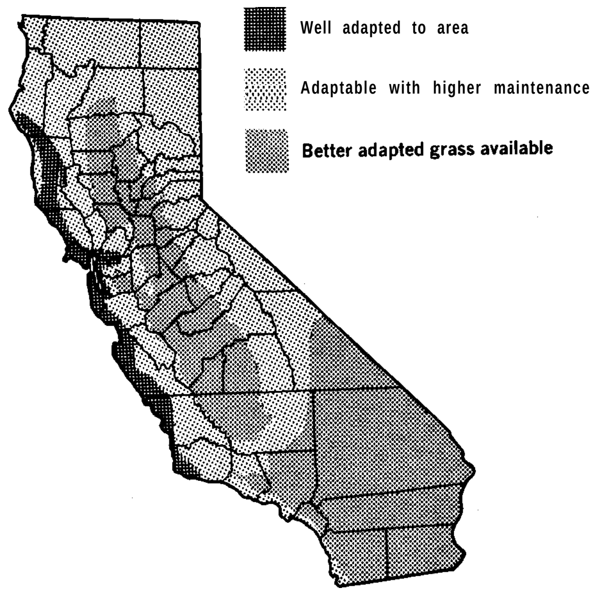

FIGURE 2. Perennial ryegrass is best adapted to climate zones with moderate summer temperatures.

Growth Response

Optimum germination will be achieved at moderate temperatures, however, perennial ryegrass is characterized by a fairly wide temperature range under which the seed will germinate. Under ideal conditions, seedling emergence can be expected in three to five days. A fairly mature ryegrass stand can be expected in a four to eight week period. The rapid emergence and stand maturation may account for the often observed suppression of annnual bluegrass *(Poa annua)* and other weeds common to newly established turfgrass swards.

The optimum temperature for top growth of perennial ryegrass is between 68° and 77°F. Significant top growth

*Environmental Horticulturist,. "Turf and Landscape," UCR; Professor of Agronomy, Plant Sciences, UCR; Farm Advisor, Ventura; and Farm Advisor, San Diego

can occur at relatively low temperatures, however, growth cessation and potential injury usually occur above 90°F. The growth rate responses, based on the temperatures given will determine the mowing frequency required. Mowing of ryegrass in general is difficult because of extensive fibers in the leaves. High temperatures increase the amount of these fibrous tissues, thereby increasing the toughness and mowing difficulty.

The top growth of perennial ryegrass, like all other turfgrass species, is greatest in full sunlight. It has been shown (1) that light saturation occurs at 2,000-3,000 ft.c. for a single leaf. This indicates that ryegrass is comparable to Kentucky bluegrass in both light requirement and shade tolerance. Youngner, et. al., have classified the shade tolerance of turgrass species as follows:

SHADE TOLERANCE

Shade
- Red fescue
- Zoysio
- St. Augustine
- Dichondro
- Colonial bentgross
- Tall fescue
- Creeping bentgrass
- Meadow fescue
- Kentucky bluegrass
- Perennial ryagross
- Improved bermudas
- Common bermudo

Sun

Tiller production of perennial ryegrass is similar to other cool season species. Maximum tillering occurs when moderate day lengths and cool temperatures of spring and fall prevail. Negligible tillering occurs in the summer months. Tillering is increased following nitrogen applications in the fall and spring, however, this management practice will not improve tillering during the summer.

Research (6) has shown that optimum soil temperature for root growth is 50° to 60°F. Rate of root growth decreases rapidly as temperatures increase above the op timum.

Perennial ryegrass is moderately tolerant to soil salinity, showing little reduction of growth at salt levels below 8 mmhos. The accompanying list shows the relative position of perennial ryegrass in comparison to other commonly used turfgrass species regarding salinity tolerance.

SALINITY TOLERANCE

High
- Improved bermudos
- Common bermudo
- Creeping bentgrass
- Zoysia
- St. Augustine
- Tall fescue
- Perennial ryegrass
- Meadow fescue
- Red fescue
- Kentucky bluegrass
- Colonial bentgross
- Dichondra

Low

Couch (2) has listed perennial ryegrass as susceptible to the following common turfgrass diseases:

- Fairy rings
- Fusarum patch
- Helminthosporium blight and leaf spot
- Rust
- Pythium
- Red thread
- Rhizoctonia brown patch

Disease problems are most frequently encountered on immature plantings. Where proper management practices are followed on established turf, disease activity on perennial ryegrass is minimal.

Varieties

The following varieties of perennial ryegrass are currently available for turfgrass use (3, 4, 5).

Linn

Linn perennial ryegrass was released by the Oregon Agricultural Experiment Station in 1961 based on inspection of established seed fields and comparative tests. No selection for turf characteristics were performed, as far as can be determined. Linn is generally considered similar to common perennial ryegrass in turf performance.

Norlea

Norlea was selected in Ontario, Canada, from a worldwide collection of seed lots. It was released in 1958 by the Canada Department of Agriculture for winter hardiness and good forage and seed production in areas that had been marginal for perennial ryegrass growth. Used in turf, it has been shown to be superior to common and Linn because of its better winter hardiness, slower vertical growth, more attractive fall and spring color, and easier mowing characteristics. Its summer peformance is considered poor in areas of moderately high temperature and the variety is susceptible to rust.

Pelo

Pelo is the result of plant selection and breeding for increased tillering capacity and heat, drought and cold hardiness under turf and field conditions. The variety was released by D. J. van der Have, Netherlands, in 1959 and made available for U.S. use in 1964. Pelo has good rust tolerance. It produces a leafy, quite dense, bright green sward that is lower growing than common perennial ryegrass. Turf performance is good in areas of adaptation and fair in areas with high summer temperatures.

NK 100

NK 100 was selected for desirable turf characteristics such as leafy growth habit, rust tolerance, persistence and good seed production. It was released by Northrup King and Company in 1962. The variety is finer in texture than common perennial ryegrass. Turf performance is good in areas of adaptation.

Manhattan

This variety was released in 1967 by the New Jersey Agricultural Experiment Station from a breeding-selection program at Rutgers. The bright, moderate green colored grass is characterized by a low growing, peristent, dense, fine-leaved turf. Turf performance is good in areas of adaptation.

Lamora

Lamora is a low growing fine leaved perennial ryegrass with a light green color. It was selected by H. Mommersteeg's, Holland, for desirable turfgrass characteristics such as persistency, winter hardiness, high percentage of vegetative tillers, etc. It shows moderate resistance to rust.

Pennfine

Pennfine was released from the turfgrass breeding selection program at Pennsylvania State University in 1971. It has a medium bright green color and was selected for good texture (narrow leaf blade), density, uniformity, ease of mowing, and resistance to a number of perennial ryegrass diseases. It has moderate resistance to rust.

NK-200

NK-200 was released by Northrup King and Company in 1972. This turf-type variety was selected for winter hardiness, good density and texture, ease of mowing, and a resistance to leaf spot and dollar spot diseases. Rust resistance is moderate.

Management

Most cultural practice for perennial ryegrass are not greatly different from those followed for Kentucky bluegrass turf.

Planting is most easily done during the cool fall, winter and early spring months. Optimum seeding rates are not well defined. In practice they presently range from three to ten or more pounds per 1000 sq. ft. Studies are presently underway to determine the best rates for the various varieties as well as common.

For most turfs a mowing height of 1 1/2-2 inches is satisfactory. A lower height will weaken the turf and reduce its life span. Because of its tough fibrous leaves perennial ryegrass must be mowed with a very sharp mower to avoid shredding of the cut edge. A sharp reel mower will give a more event cut than a rotary.

Nitrogen fertilization rates averaging 1/2-1 pound of actual nitrogen for 1000 sq. ft. per month are required for good quality. During hot summer months nitrogen fertilization should be greatly reduced or it can be eliminated entirely if the turf is well fertilized during the cool seasons.

Irrigation should be as for any cool season grass turf. However, since perennial ryegrass is not especially deep rooted the frequency may be somewhat greater than for Kentucky bluegrass. Perennial ryegrass will not survive prolonged drought and even moderate water stress will lower its quality and increase its toughness to mow.

On the other hand perennial ryegrass will not tolerate saturated soils so good drainage is required. Fine textured or compacted soils should be aerated regularly.

Summary:

Although perennial ryegrass is often considered to be a turfgrass of mediocre quality it is a useful species in the climatic regions where it is well adapted. It is usually criticized for its coarse texture, short life span, and bunchy growth habit. The recent introduction of several improved varieties may place it in a much more favorable light in the future.

CITATIONS

1. Cooper, J. P. and N. M. Tainton. Light and Temperature Requirements for the Growth of Tropical and Temperate Grasses. Herbage Abstracts 38:167-176. 1968.
2. Couch, H. B. Diseases of Turfgrass. New York: Reinhold Publishing Co. 1962. 389p.
3. Funk, C. R., R. E. Engel. Manhattan Perennial Ryegrass for Turf. Turfgrass Times 4(1) :1,8. 1968.
4. Hanson, A. A. Grass Varieties in the United States. Washington, DC.: U.S. Government Printing Office. USDA, ARS-Handbook No. 170. 1965. 102p.
5. Hanson, A. A., F. V. Juska, G. W. Burton. Species and Varieties. In Turfgrass Science (Ed. A. A. Hanson, F. V. Juska) . Madison: American Society of Agronomy. 1969. 715p.
6. Milthorpe, F. L. and J. D. Ivins. The Growth of Cereals and Grasses. Butterworth, London. 1966. 359 pp.
7. Phillips, C. E. Some Grasses of the Northeast. University of Delaware Agricultural Experiment Station. Field Manual No. 2. 1962. 77p.
8. Youngner, V. B., J. H. Madison, W. B. Davis. Which is the Best Turfgrass. University of California Agricultural Extension Service AXT-227.
9. Youngner, V. B., J. H. Madison, M. H. Kimball, W. B. Davis. Climatic Zones for Turfgrass in California. California Agricultur 16(7):2-4. 1962.

AN EVALUATION OF PERENNIAL RYGRASS VARIETIES FOR WINTER OVERSEEDING

Victor A. Gibeault and John Van Dam*

Eight varieties of perennial ryegrass were overseeded to a common bermudagrass sward and observed for performance qualities and survival longevity in an area of high summer temperatures. It was found that all varieties tested gave an acceptable turf appearance the first winter season. The varieties Manhattan and Pennfine were better able to uniformly survive high temperature stress and thereby produce an acceptable winter appearance through the second season.

In areas of California where common bermudagrass is used for lawn-type turf, several methods are used to enhance winter appearance by supplying green color to the otherwise dormant turf. These methods include an increased frequency of soluble nitrogen application prior to dormancy, dyeing the turf with colorants following dormancy, and overseeding the turf with cool season species. At present overseeding is the most common practice employed. The various cool season grasses used for overseeding are annual ryegrass, Kentucky bluegrass, red fescue, rough stalk bluegrass, colonial bentgrass, and perennial ryegrass. Each species has advantages and disadvantages which are usually related to the management given, the intensity of use the species receives, the species adaptation to the on-site environment, and the relative ease of transition from cool to warm season grass cover.

Recently an increased use of perennial ryegrass has occurred, mainly because of the availability of several new varieties. These varieties are characterized by improved turf qualities such as a finer leaf texture, a better density, and a grass type that facilitates easier mowing. Unfortunately, little quantitative performance information is available for the new varieties, especially regarding their overseeding characteristics and their persistence past the

*Environmental Horticulturist, "Turf and Landscape," UCR, and Farm Advisor, Los Angeles County respectively.

first overseeding season as influenced by high summer temperatures. Therefore, a trial was conducted on a lawn area at Cal-Tech, Pasadena, to supply this information. The Pasadena location was considered typical of many plant-climate zones where the warm season grasses are adapted. Summer temperatures in this area frequently exceed 95°F. for extended periods.

Methods: Five commercially available and three experimental perennial ryegrass varieties (as given in Table 1) were overseeded to a common bermudagrass sward that had been moderately scalped, verticut and swept clean of debris. Seeding was performed on October 30, 1970. Except for the checks which were not seeded, each 5 ft. by 10 ft. plot was seeded at the rate equivalent to 10 lbs. per 1000 sq. ft. Each variety treatment was replicated four times and the plots were arranged in a completely randomized design. The experimental area was irrigated frequently until initial establishment of the ryegrasses was complete; thereafter the normal irrigation schedule for the campus turf areas was followed. A month following establishment the plot area was fertilized with a 16-8-8 fertilizer (1 lb. N/1000 sq. ft.) and then fertilized on a three-times-a-year schedule. The area was mowed at regular intervals at a cutting height of approximately 1 3/4 inches. No other primary or secondary management practice was given for the duration of the test.

Visual ratings of varietal performance were made at periodic intervals following establishment. The primary observations were recorded as turf scores, a rating system based on a 0 to 10 scale where 0 represents a completely dead sward and 10 represents an ideal turf stand of uniform density, texture, color, etc., of the desired species mixture. To picture the scale more clearly, a rating in the O-3 range would indicate a completely unacceptable turfgrass stand with either a very high weed percentage or a sward that is composed of mainly dead or discolored grass. A score in the 3-6 range would indicate a plot with at least 50 percent live grass that, with additional management, could be improved to an acceptable level. A score in the 6-10 range would indicate degrees of acceptable turf. Turf score ratings were supplemented by observations on weed invasion, percent ryegrass present at two intervals following establishment, and percent turf cover at specific times. Again, visual ratings were made in this regard.

All data were subjected to an analysis of variance test and significance was determined by the Duncan's Multiple Range Test.

Results: Tbe turf scores, as an indication of general appearance, for the test period are presented in Table 1. As can be noted, most of the varieties tested gave. an acceptable turf cover two weeks following overseeding and this level of performance continued or increased through the winter of 1971. The results indicated that K9-124, NKl00, Manhattan and Pennfine gave the quickest cover of desirable turf, but little establishment difference among varieties was observed thereafter. It was noted that common perennial ryegrass had the coarsest texture during this evaluation period. Of course, all varieties were superior in appearance to the non-seeded dormant bermudagrass check plots. A color designation was made during the winter of 1971 with the following being observed:

Variety	Color Designation
K9-123	Medium Green
K9-123	Dark Green
K9-125	Dark Green
NK-100	Light Green
Pelo	Light Green
Manhattan	Medium Green
Pennfine	Dark Green
Common	Light Green

Observations on weed invasion were also noted during the winter of 1971 and the results are presented in Table 2. Evidently, the thorough fall verticutting had allowed the germination of a winter annual clover; all plots, overseeded with perennial ryegrass had less weeds than the unseeded check as would be expected, however, there was no significant difference on weed invasion among the different varieties. Most weeds were eliminated, by natural competition, from the test area in the spring and summer of 1971.

During the summer of 1971 obvious quality differences among the varieties were observed. The varieties Manhattan and Pennfine were characterized by significantly higher scores than the remaining grasses. These observations were evidently due to a differential ability among the varieties to withstand the high temperature stress that occurred just previous to, and during, the July 7 and July 19 reading dates. This conclusion was supported by percent turfgrass cover readings that are presented in Table 3. It should be noted that those varieties with extremely low appearance ratings also had a very low turfgrass cover. The effect of high air pollution levels that occurred in the Pasadena area during the summer months could not be determined, however, no characteristic leaf banding was observed on either the injured or actively growing varieties.

In the winter of 1971-1972 (November and February observation dates) Manhattan and Pennfine gave a better winter appearance in contrast to the remaining varieties. Plots overseeded a year earlier to Manhattan and Pennfine were uniform in texture, density and color and were as good, if not better, than the first overseeding season. Plots overseeded to K9-123, K9-124, K9-125, NKlOO, Pelo and common perennial ryegrass showed the effects of summer injury, however they were still superior in appearance to the non-seeded check plots. As the common bermudagrass went dormant in the winter of 1971, observations on the percent perennial ryegrass that remained were recorded and the results are presented in Table 4. As would be expected from the general appearance ratings, Manhattan and Pennfine had a significantly greater percentage of the ryegrass present than did the other varieties,

Observations made in May, 1972, further supported the previous results. Plots that had been overseeded to Manhattan and Pennfine were signficantly better in general appearance than the remaining varieties or the straight common bermudagrass check plots. Both Manhattan and Pennfine plots were characterized by a very uniform mixture of the respective ryegrass variety and the interspersed common bermudagrass. Plots overseeded with the remaining varieties were uneven in appearance because of a decreased population density of the ryegrass.

Conclusion: Eight varieties of perennial ryegrass were overseeded to a common bermudagrass sward and observed for performance qualities and survival longevity in an area of high summer temperatures. It was found that all varieties tested gave an acceptable turf appearance the first winter season. The varieties Manhattan and Pennfine were better able to uniformly survive high temperture stress and thereby produce an acceptable winter apparance through the second season.

Acknowledgements

Appreciation is extended to Germain's Inc. and Northrup King and Company for supplying seed for this evaluation. The cooperation of Art Brown, Superintendent of Grounds, Cal-Tech, Pasadena, is appreciated for supplying and maintaining the test area.

TABLE 1. Turf Scores *(General appearance ratings) Of Eight Perennial Ryegrass Varieties For An 18 Month Period Following Overseeding.

VARIETY	U-13-70	l-15-71	3-17-71	7-7-71	7-19-71	6-4-71	10-12-71	11-11-71	2-16-72	5-23-72
K9123	5.7 a b**	7.0 be	7.1 bc	3.9 ab	3.7 ab	4.7 c	4.8 ab	4.1 abcd	3.5ab	5.8 a
K9-124	7.2 c	6.0ab	7.1 bc	4.8 ab	4.5ab	4.9 c	5.8 bc	4.7 bcd	5.0 bc	4.8 a
K9-125	5.5 a	6.5 b	7.2 bc	4.8 a b	4.7 ab	4.6 bc	6.2 bc	5.5 d	6.2 c	5.5 a
NK-100	7.7 c	7.8 c	7.6 bc	4.6 ab	2.5 a	3.3 a	5.0 ab	4.0 abc	5.7 c	5.4 a
Pelo	5.2 a	7.0 bc	6.8 bc	3.2 ab	2.7 a	3.4 ab	5.0ab	3.5 ab	4.5 abc	5.1 a
Manhattan	8.2 c	6.8 lx	7.7 c	7.1 c	8.0 c	6.4 d	5.8 bc	7.2 e	9.0 d	8.0 b
Pennfine	7.7 c	5.2 a	7.2 bc	7.4 c	7.7 c	5.7 cd	7.1 c	7.5 e	8.0 d	7.6 b
Common	7.0 bc	7.0 bc	6.7 b	5.0 b	6.5 bc	4.6 lx	5.7 bc	5.5 d	5.0 bc	5.4 a
Check	Dormant	Dormant	l.Oa	29a	6.5 bc	5.1 cd	4.0 a	3.la	Dormant	5.1 a

*0-10 rating where 0 represents a dead turf stand and 10 represents an ideal grass sward.

**Scores followed by the same letter(s) are not significantly different at the 5 percent level.

TABLE 2. Percent Weed Invasion (Trifolium sp.) At Two Dates Following Overseeding.

	Percent Weed Invasion	
Variety	Jan.15,'71	March 17,'71
K9-123	3.5 a*	18.7 a
K9-124	4.5 a	19.7 a
K9-125	4.7 a	22.0 a
NK-100	3.0 a	12.7 a
Pelo	5.2 a	22.0 a
Manhattan	3.2 a	10.0 a
Pennfine	7.2 a	17.5 a
Common	7.0 a	13.0 a
Check	23.7 b	100.0 b

*Values followed by the same letter(s) are not significantly different at the 5 percent level.

TABLE 3. Percent Turfgrass Cover Of Common Bermudagrass And Perennial Ryegrass On Two Observation Dates.

	Percent Turfgrass Cover	
Varlety	July 7,'71	July 10, '71
K9-123	56a*	57ab
K9-124	82 bc	75 abc
K9-125	86 bs	86 bc
NK 100	881x	42a
Pelo	66ab	48a
Manhattan	99c	92c
Pennfine	98c	84 bc
Common	92c	76ab
Check	52a	92c

*Values followed by the same letter(s) are not significantly different at the 5 percent level.

TABLE 4. Percent Perennial Ryegrass At 13 and 16 Months Following Overseeding.

	Percent Perennial Ryegrass	
Variety	November11,'71	February16,'72
K9-123	30 ab*	38a
K9-124	39 b	49abc
K9-125	51 b	60 bc
NK 100	36 b	5Oabc
Pelo	12a	44ab
Manhattan	91 c	88d
Pennfine	90 c	82d
Common	5Ob	64C
Check	—	—

*Values followed by the same letter(s) are not significantly different at the 5 percent level.

PROGRESS REPORT ON CRABGRASS CONTROL IN TURF 1971

C. L. Elmore, K. Mueller, K. Gowans, and B. Fischer [1]

Four commonly used and numerous experimental herbicides were evaluated at four locations for crabgrass control characteristics. The results are presented in a progress report form because many of the herbicides tested are not commercially available.

Since hairy crabgrass *(Digitaria sanguinalis)* and smooth crabgrass *(D. ischoemum)* are common weed problems throughout California, trials to evaluate control materials were established in four regions of the state. These four locations gave different climatic conditions and turf types to test the same herbicides for crabgrass control and phytotoxicity characteristics.

Methods

The trial locations and application details were as follows.

Location 1. Several preemergence herbicides were applied February 2, 1971 on a bluegrass-bentgrass turf at the Los Gatos Civic Center in Los Gatos, California. The herbicides were applied with a Champion knapsack sprayer operated at 30 psi in a volume equivalent to 100 gpa. The plot size was 5' x 10' with each treatment replicated four times. The area was sprinkler irrigated immediately after application to wash the herbicide from the foliage.

Evaluations for phytotoxicity were made February 14, March 23, and June 25, 1971. Weed control evaluations were made June 25 and November 4, 1971.

Location 2. A Kentucky bluegrass turf site was selected in Leisure World, Laguna Hills, California for a preemergence trial on smooth crabgrass. The herbicides were applied January 19, 1971, with a Namco Stainless Steel sprayer operated at 30 psi in a volume of water equivalent to 100 gpa. The plot size was 10' x 10' and each treatment was replicated four times. The turf was sprinkler irrigated after application to wash the herbicides from the foliage.

Evaluations for phytotoxicity were made February 23 and March 16, 1971. Weed control evaluations were made August 11, September 9, and October 27, 1971. Crabgrass infestation was not extensive or uniform throughout the trial.

Location 3. Several herbicides were applied March 3, 1971, to a common bermudagrass turf in Roeding Park, Fresno, California. All treatments were applied with a Namco CO_2 pressure sprayer operated at 30 psi in a water volume equivalent to 50 gpa. The plots were 10' x 10' and each treatment was replicated four times. The turf was sprinkler irrigated immediately after application.

Smooth crabgrass *(D. ischaemum)* control and turf phytotoxicity were evaluated June 1, 1971.

Location 4. Three trials were established on the U.C. Davis Campus. Trial 1 was a preemergence test like the previously described locations. Trial 2 was applied as early postemergence, and trial 3 evaluated combinations for post and preemergence activity. A redtop/bentgrass turf was used to evaluate several herbicides in these trials. The three trials were applied February 2, March 8, and April 1, 1971, respectively. Each was applied with a Namco CO, pressure sprayer operated at 30 psi and the materials were applied in the equivalent of 108 gpa water. Granular materials were applied by hand with a shaker canister. In Trial 1 irrigation was applied the following day for 30 min. whereas in Trial 2 water was applied four hours after application for 30 min. Trial 3 was irrigated the following day for 3 min (allowing 24 hours for foliage effect). The temperature at application time was 50° F., and 60-65° F., and 65-75° F.respectively for each of the trials.

In Trial 1, phytotoxicity evaluations were made March 8, April 1, and June 4, 1971. Weed control evaluations were made June 4 and July 15, 1971. Trial 2 and 3 were evaluated June 3 and July 15, 1971.

Results

The results of the trials are presented in Tables 1, 2, 3 and 4. Excellent preemergence crabgrass control was achieved with the herbicides that were used as standards namely, DCPA, bensulide, benefin, and terbutol. Although NC 8438 (Fisons) gave good crabgrass control in Location 2, control was not good at the other locations. Phytotoxicity at 2 and 4 lb./A was observed on bluegrass, redtop, and bentgrass turf. Although injury was severe 2 weeks after application, regrowth occurred and was satisfactory 4 months after application. No injury was observed on bermudagrass turf at Location 3.

The herbicide CGA 10832 (CIBA-Geigy) gave good to excellent weed control at 3 of the 4 locations at 1, 2, and 4 lb./A. Only 4 lb./A gave good control of crabgrass at Location 4 (Davis).

Crabgrass control was not adequate at 1 lb./A of AN 56477 (Torpedo) at all locations. Marginal control was achieved at all locations except Location 2 (Laguna Hills) with 2 lb./A. Control at this location was good at 2 lb./A.

Four pounds per acre of AN 56477 was needed for good control in 3 of the 4 locations. Adequate tolerance was found on bluegrass, redtop, bentgrass, and bermudagrass turf in these trials.

The herbicide R-7465 (Devrin o®) gave excellent weed control at 0.5 1, and 2 lb./A at Location 2. Weed control was adequate at only 2 lb./A in Location 1 and not adequate in the other trials. Phytotoxicity was observed at all rates at Location 1 on a bluegrass turf and at Location 4 on a redtop/bentgrass turf.

Good to excellent crabgrass control was achieved with RP 17623 (Ronsta®) in all trials at 2 and 4 lb./A. One lb./A was adequate to control crabgrass preemergence in Location 3 and 4, however, not in Location 1. From the one evaluation after 9 months at Location 1, it would appear to give similar residual control as bensulide. The emulsifiable concentrate formulation used in these trials gave excessive turfgrass injury except on bermudagrass.

EL 119 (oryzalin) was applied in only one trial (Location 3) on bermudagrass turf. Crabgrass control was excellent at 1, 2, and 4 lb/A 3 months after application. No 'injury was observed at 3 months on bermudagrass in this trial, however, the Kentucky bluegrass present was severely injured at all rates.

*Extension Weed Control Specialist, UCD; Farm Advisor, Orange County; Farm Advisor, Alameda County; and Farm Advisor, Fresno County.

Nitrofen (Tok®) at 2 and 4 lb./A did not give good weed control in 2 of the 3 locations. Good control was achieved only at Location 2. Since the crab grass population was low at this location, control evaluations might appear higher than from other locations. No phytotoxicity was observed at 2 or 4 lb./A on blue grass, red top, or bentgrass turf.

he herbicide RH 315 (Kerb®) was applied preemergence for crabgrass at Location 3 only. Acceptable control was not achieved at either 2 or 4 lb./A. Byzantine speedwell *(Veronica buxbuumii)* was controlled in this trial at 2 lb./A of RH 315. No injury was observed with RH 315 on common bermudagrass turf at 2 or 4 lb./A.

In the early postemergence crabgrass control trial at Davis, granular alachor (Lasso®) at 2, 4, or 6 lb./A did not control smooth grabgrass. The herbicide A-820 (Amchem) gave control of smooth crabgrass for 88 days at 2, 4, or 6 lb./A; however, only 6 lb./A gave residual control to 132 days after application. Injury to the redtop and bentgrass was observed at the 4 and 6 lb./A rate of A-820 at 88 days. No injury was evident at 132 days after application.

Of the three herbicides bensulide, benefin and DCPA, bensulide gave the best preemergence control. DCPA was probably less effective because of its lower solubility and was not leached down to the germinating seed in sufficient concentrations to get control. Injury was quite pronounced at 88 days on bentgrass with DCPA.

In the trial using combinations of herbicides for early postemergence and residual preemergence control, all treatments gave outstanding weed control without injury to the redtop and bentgrass turf.

TABLE 1. Preemergence Crabgrass Control in Turfgrass from Four Locations in California.'

Herbicide	Rate lb. ai/A²	Formulation	Location 1 6/25	Location 1 11/4	Location 2 8/11	Location 2 10/27	Location 3 6/1	Location 4 6/4	Location 4 7/15
DCPA	10	75WP	—	—	9.8	9.8	—	—	—
DCPA	15		—		10.0	10.0	9.0	—	—
bensul ide	15	4EC	10.0	9.0	10.0	10.0	10.0	10.0	9.9
benefin	3	1.5EC	—	—	9.9	8.8	—	—	—
terbutol	15	80WP	—	—	10.0	10.0	—	—	—
NC 8438	2	18.2WP	6.5	6.5	9.6	9.0	4.3	3.2	3.5
NC 8438	4		3.5	6.6	8.0	7.5	6.2	3.2	3.2
CGA 10832	1	4EC	8.7	7.2	9.9	9.5	—	4.2	4.5
CGA 10832	2		8.7	6.2	9.7	9.0	9.0	6.8	5.8
CGA 10832	4		a.7	7.8	10.0	10.0	10.0	9.0	7.5
AN 56477	1	3EC	7.5	7.5	a.9	7.8	—	3.5	3.2
AN 56477	2		8.5	6.0	9.5	8.9	8.1	6.5	5.8
AN 56477	4		10.0	5.8	9.3	8.1	10.0	7.8	7.0
R-7465	0.5	50WP	4.0	4.0	9.5	8.1	—	6.0	2.5
R-7465	1		8.0	4.5	9.6	8.9	6.8	5.2	3.8
R-7465	2		10.0	6.0	9.9	9.6	7.5	5.2	3.5
oxidiazon	1	2EC	8.2	6.2	—	—	9.0	9.5	9.5
oxidiazon	2		10.0	5.5	—	—	10.0	a.5	9.5
oxidiazon	4		9.7	6.0	—	—	—	10.0	10.0
EL 119	1	75WP	—	—	—	—	10.0	—	—
EL 119	2		—	—	—	—	9.5	—	—
EL 119	4		—	—	—	—	10.0	—	—
nitrofen	2	50WP	6.2	4.0	9.9	9.6	—	3.5	1.5
nitrofen	4		7.5	4.2	9.4	8.6	—	5.0	4.0
RH 315	2	75WP	—	—	—	—	5.0	—	—
RH 315	4		—	—	—	—	6.2	—	—
Control	—	—	0.0	3.2	7.8	7.5	0.0	0.0	1.0

'Crabgrass control: 0=no effect; 10=complete control
²lb ai/A: pounds of active ingredient per-acre.

TABLE 2. Phytotoxicity from Preemergence Crabgrass Herbicides from Four Locations in California.'

Herbicide	Rate lb. ai/A²	Formulation	Location 1 2/14	Location 1 3/23	Location 1 6/25	Location 2 2/23	Location 2 3/16	Location 3	Location 4 3/3	Location 4 4/l	Location 4 6/4
DCPA	10	75WP				0.8	0.0		—	—	—
DCPA	15		—	—	—	0.5	0.4	(N)	—	—	—
bensulide	15	4EC	0.0	0.0	0.0	1.0	0.5	(N)	0.0	0.0	0.0
benefin	3	1.5EC	—	—	—	1.0	1.0	—	—	—	—
terbutol	15	80WP	—	—	—	0.8	0.5		—	—	—
NC 8438	2	18.2WP	3.5	5.0	0.5	6.8	5.8	(N)	20	1.8	1.2
NC 8438	4		5.0	6.2	1.0	8.2	8.1	(N)	5.8	7.0	21
CGA 10832	1	4EC	0.0	0.0	0.0	0.5	1.1		0.3	0.0	0.0
CGA 10832	2		0.0	0.5	0.0	0.8	0.4	(N)	0.0	0.0	0.0
CGA 10832	4		1.0	1.5	2.5	1.2	2.5	(N)	0.8	0.3	0.5
AN 56477	1	3EC	0.0	0.5	0.0	0.8	0.0		0.3	0.0	0.0
AN 56477	2		0.0	0.0	0.0	0.8	0.9	(N)	0.0	0.0	0.0
AN 56477	4		0.0	0.0	0.5	1.0	0.9	(N)	0.0	0.0	0.8
R-7465	0.5	50WP	0.5	0.5	0.2	1.0	1.0		0.0	0.0	0.0
R-7465	1		0.0	0.0	0.0	3.8	2.5	(N)	0.3	0.5	0.0
R-7465	2		0.5	0.0	0.0	5.2	4.7	(N)	2.3	0.8	0.2
oxidation	1	2EC	2.5	0.5	0.0	—	—	(N)	1.3	0.5	0.2
oxidation	2		5.5	1.8	0.5	—	—	(N)	2.0	0.5	1.2
oxidation	4		9.0	7.0	5.2	—	—		3.3	1.3	3.5
EL 119	1	75WP	—	—	—	—	—	(N)	—	—	—
EL 119	2		—	—	—	—	—	(N)	—	—	—
EL 119	4		—	—	—	—	—	(N)	—	—	—
nitrofen	2	50WP	0.5	0.5	0.0	0.2	0.2	—	0.0	0.0	0.0
nitrofen	4		0.5	0.0	0.0	1.0	0.7		0.0	0.0	0.0
RH 315	2	75WP	—	—	—	—	—	(N)	—	—	—
RH 315	4		—	—	—	—	—	(N)	—	—	—
Control	—		0.0	0.0	0.0	0.5	0.5	(N)	0.0	0.0	0.0

'Phytotoxicity: 0=no effect; 10=dead turf
(N) No phytotoxicity
² lb, ai/A: pounds active ingredient per acre.

TABLE 3. Early Postemergence (at emergence) Control of Crabgrass and Phytotoxicity to a Redtop-Bentgrass Turf at Davis, California.

Herbicide	Rate lb. ai/A3	Formulation	Crabgrass Control' 88 days	132 days	Phytotoxicity' 88 days	132 days
alachlor	2	10% gran	4.2	2.8	0.2	0.0
alachlor	4		2.8	1.0	0.5	0.0
alachlor	6		5.5	2.0	0.8	0.0
A-820	2	2.3% gran	8.2	6.1	0.2	0.0
A-820	4		8.2	5.5	2.0	0.0
A-820	6		8.8	8.2	2.7	0.0
bensulide	15	4 lb/gal.	10.0	9.9	0.3	0.0
benefin	3	25% gran	8.5	8.8	1.0	0.0
DCPA	15	75WP	8.5	8.0	4.0	0.0
Control	—		0.5	2.5	0.0	0.0

[1]Crabgrass control: O=no effect; l0=complete control

[2]Phytotoxicity: O=no effect: lO=dead turf

[3]ib. ai/A: pounds active ingredient per acre.

TABLE 4. Postemergence Control of Crabgrass in a Redtop-Bentgrass Turf at Davis, California.

Herbicide	Rate lb. ai/A3	Formulation	Crabgrass Control' 88 days	132 days	Phytotoxicity" 88 days	132 days
NC 8438 + bensulide	0.5 + 10	18.2WP + 4EC	10.0	8.0	0.0	0.0
NC 8438 + bensulide	1 + 10		10.0	10.0	0.5	0.0
MSMA + bensulide	4 + 10	4s + 4EC	10.0	9.6	0.0	0.0
nitrofen + bensulide	4 +10	50WP + 4EC	9.2	8.0	0.5	0.0
nitrofen + bensulide	8 + 10		10.0	8.8	0.8	0.0
Control	—		3.2	2.8	0.0	0.0

'Crabgrass control: O=no effect; l0=complete control

2Phytotoxicity:O=no effect; lO=dead turf

3ib. ai/A: pounds active ingredient per acre.

CALIFORNIA TURFGRASS CULTURE
Department of Plant Science, University of California
Riverside,. California 92502
Editors, Victor B. Youngner and Victor A. Gibeault

CALIFORNIA TURFGRASS CULTURE is sponsored and financed by the regional Turfgrass Councils and other turf/landscape organizations. Subscription to this publication is through membership in one of the councils listed below.