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Turf-Type Tall Fescue Performance in California

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Tall fescue *(Festuca arundinacea* Schreb.), a native of Europe, was introduced into the United States by early settlers for pasture use and soil stabilization purposes. Two varieties of pasture-type tall fescues, Kentucky 31 and Alta, were widely used for low maintenance turf sites because of their comparative low maintenance requirement, high wear tolerance and broad environmental adaptation capability.

Tall fescue is a cool season turfgrass well adapted to California. It is especially useful in the transition zone because of its high tolerance of warm temperature and its ability to grow, without winter dormancy, in relatively cool, but not severe, winter conditions. Because tall fescue stays green throughout the year in most of the state, and because it has high temperature tolerance, tall fescue is also often used for general turf sites in the inland, high temperature zones of California where warm season turfgrasses are well adapted.

Tall fescue grows well in various soil types. Its optimum growth occurs in a pH range of 5.5 to 6.5 but it will produce a suitable turf from pH 4.7 to 8.5. It tolerates saline soil conditions much better than other commonly used cool season turfgrasses such as Kentucky bluegrass *(Poa pratensis L.),* red fescue *(Festuca rubra L.)* or colonial bentgrass *(Agrostis tenuis Sibth.)*

Tall fescue has a dense and extensive root system. Its roots can be found at depths of 24 to 48 inches in deep soils and where less frequent but deep irrigation is practiced. The root system has the ability to penetrate and survive in compacted soils. The deep rooting pattern also positively influences the ability of tall fescue to survive periods of prolonged drought, infrequent irrigation, or those instances where subterranean irrigation is used (1,2).

In the early 1960s, Dr. Reed Funk of Rutgers University initiated a tall fescue breeding program which concentrated on developing a fine-leaf texture, darker green color, increased density and improved resistance to insects and diseases. That work resulted in the release of a turf-type tall fescue in 1979 (3).

To illustrate the dynamic impact of plant breeding efforts with this species, prior to 1979 two varieties were commonly used for turf purposes; in a 1983 variety trial at our UC South Coast Field Station, 17 varieties were tested; and in a 1984 National Turfgrass Variety trial established at UC Riverside, 38 varieties were included.

Two studies that are reported here were conducted in southern California to evaluate the new turf-type tall fescues. The objective of one study was to determine the performance of several varieties to two mowing heights. The objective of a second study was to determine the performance characteristics of commercial and experimental tall fescue varieties.

Table 1. Average Turfscores for 27 months for 10 tall fescue varieties maintained at two cutting heights. Scale l-9, with 9 being best.

	Mowing Height	
Variety	1-1/2"	3/4"
Falcon	6.8 T*	5.6 U
Rebel	6.7 T	5.1 UV
Houndog	6.4 T	5.0 V
Olympic	6.4 T	5.1 UV
Clemfine	5.4 UV	4.3 W
Alta	4.5 W	3.6 X
Kentucky 31	4.3 W	3.2 XYZ
616 x 635	4.3 W	3.1 YZ
616	3.7 X	2.9 Z
635	3.6 XY	2.9 Z
Average	5.3	4.0

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

METHODS

Mowing Height Study

Ten varieties of tall fescue were seeded at the rate of 10 pounds per 1000 square feet, to 130 sq ft plots at the University of California South Coast Field Station, Irvine, in January 1981. Each treatment was replicated three times in a randomized complete block design. After establishment, the plots were mowed regularly at a 1 1/2-inch cutting height, fertilized monthly with ammonium sulfate at the rate of 1/2 pound of actual nitrogen per 1000 square feet, and irrigated based on water loss from a Class A Evaporation Pan adjusted for cool season turfgrass water use. In February 1982, the plots were split with 3/4-inch and 1 1/2-inch mowing heights. Turf quality ratings (Turfscores), based on color, texture, density uniformity and pest presence, were made monthly for 27 months. Data were analyzed with a Duncan's Multiple Range Test.

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Table 2. Color of 10 tail fescue varieties, March 1982; Scale l-9, with 9 being darkest green.

Variety	Color Rating
Falcon	7.3 x *
635	7.3 x
Olympic	7.0 X
616	6.7 x
616 x 635	6.7 x
Houndog	6.3 X
Rebel	6.0 XY
Clemf ine	4.7 YZ
Kentucky 31	4.7 YZ
Alta	4.0 Z

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

Variety Study

In July 1983, 17 varieties of tall fescue were each separately seeded at the 10 pounds per 1000 square feet rate, to 67 1/2 square feet plots replicated three times in a randomized complete block design. After establishment, the turf was regularly mowed at 1 1/2 inches, fertilized with nitrogen at the 1/2 pound per 1000 square feet rate per month, and irrigated at the calculated evapotranspiration rate for cool season turfgrass (from a Class A Pan). Turf quality scores (Turfscores) were taken monthly and significance was determined by the Duncan's Multiple Range Test and a cluster analysis method for grouping means (4).

RESULTS

Mowing Height Study

Of the grasses tested in this study, 'Alta' and 'Kentucky 31' are pasture-types, 'Clemfine' is considered an intermediate-type, and 'Falcon', 'Rebel', 'Olympic' and 'Houndog' are considered turf-type tall fescues. The experimental lines 616, 635 and 616 x 635 are not categorized.

Table 1 presents the average turfscore for the tested grasses at the two mowing heights. The turfgrass quality was better when averaged across varieties at the 1 1/2-inch cutting height versus the same varieties maintained at a 3/4-inch cutting height. Also, each variety performed significantly better at the high cutting height than at the low cutting height. Interestingly, the relative ranking of the varieties, based on turfgrass performance, was nearly the same for both cutting heights.

There was an obvious difference in varietal performance based on the categories of tall fescues previously mentioned. At the high cutting height, the turf-type tall fescues performed significantly better than 'Clemfine: the pasture-types, or the three experimental grasses. The turf-type tall fescues had better color (Table 2), better resistance to crabgrass invasion (Table 3), and better resistance to rust activity (Table 4) than the pasture-type tall fescues. These characteristics, plus their better density and texture, resulted in the superior appearance of the four turf-type tall fescues.

Although the same variety performed better at the high cutting height than at the low cutting height (Table l), the turf-type varieties gave significantly higher turfscores at the 3/4-inch mowing height than did the pasture-type and experimental grasses at both the high and low cutting heights. This supports observations that the turf-type tall fescues do tolerate closer mowing better than previously available varieties. Nevertheless, optimum response of all tall fescues was recorded at the 1 1/2-inch cut, as previously stated.

Table 3. Smooth crabgrass (Digitaria sanguinalis) invasion in tail fescue varieties; Scale l-9, with 9 being total weed invasion.

	Mowing Height	
Variety	1-1/2"	3/4"
Falcon	2.1 s*	3.4 uv
Rebel	2.2 s	3.9 vw
Houndog	2.3 S	4.0 vw
Olympic	2.6 ST	4.3 wx
Clemf ine	3.1 uv	4.4 wx
Alta	4.3 XY	5.4 Y
616 x 635	4.8 XY	6.3 Z
Kentucky 31	5.1 XY	6.5 Z
616	5.2 Y	6.7 Z
635	5.4 Y	6.8 Z
Average	3.7	5.2

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

Table 4. Rust (Puccinia spp.) incidence on tail fescue varieties, March 1982; Rating scale l-9, with 9 being complete rust coverage.

Variety	Rust Rating
Kentucky 3 1	5.7 z*
Alta	4.8 YZ
Clemf ine	3.2 XY
Houndog	2.7 X
Rebel	2.5 X
Olympic	2.3 X
Falcon	2.2 x
616 x 635	2.0 x
635	2.0 x
616	1.5 x

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

Variety Study

The average performance ratings of 17 tall fescue varieties (including experimental grasses) are presented in Table 5. The grasses are listed in ranked order of performance from highest to lowest and are grouped based on a cluster analysis that was performed to further identify homogenous means.

The appearance ratings presented in Table 5 are in large part a function of the density and color of the grasses. There was little, to no weed, insect or disease activity during this study. Tables 6 and 7 give the supporting density and color characteristics of the 17 grasses tested.

Table 5. Average Turfscores 1983- 1988, for 17 varieties of tail fescue; South Coast Field Station; Scale I-9, with 9 being best.

Variety	Turf Performance
Jaguar	6.7 U*
Rebel	6.6 uv
Adventure	6.6 uv
Arid	6.5 UV
Olympic	6.3 UVW
Apache	6.3 UVW
Falcon	6.1 UVW
Houndog	6.0 VW **
Finelawn	5.8 wx
Brookston	5.5 XY
Willamette	5.4 XY
Galway	5.2 XY
Festorina	5.1 Y
Barcell	5.1 Y
Clemfine	5.0 Y
K31	4.9 Y **
635	2.4 Z

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

** Varieties clustered by homogenous means.

Table 8. Average density ratings for 17 tall fescues. Scale I-9, with 9 being most dense (September 1988).

Variety	Density
Adventure	8.0 U*
Arid	8.0 U
Houndog	8.0 U
Jaguar	8.0 U
Apache	8.0 U
Rebel	8.0 U
Falcon	7.7 uv
Willamette	7.7 uv
Olympic	7.7 uv
Finelawn	7.7 uv
Brookston	7.3 uv
Barcell	7.0 VW **
Festorina	6.3 WX
Galway	6.3 WX
Clemfine	6.0 XY **
K31	5.3 Y **
635	1.0 Z

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

• * Varieties clustered by homogenous means.

Table 7. Average color ratings for 17 tail fescues; Scale I-9, with 9 being darkest green (April 1986).

Variety	Color
Jaguar	7.3 w*
Adventure	7.0 wx
Olympic	7.0 wx
Apache	7.0 wx
Arid	6.7 WXY
Houndog	6.3 WXY
Galway	6.0 WXYZ
Finelawn	6.0 WXYZ **
Brookston	5.7 WXYZ
Rebel	5.7 WXYZ
Barcell	5.0 XYZ
Falcon	5.0 XYZ
Willamette	5.0 XYZ
Festorina	4.7 YZ
Clemfine	4.7 YZ
K31	4.0 z

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

• * Varieties clustered by homogenous means.

Note: Experimental grass 635 was not rated because of insufficient sward.

Summary

Tall fescue is a cool season turfgrass that performs well in all turfgrass climate zones of California. The new turf-type tall fescues that were studied had much better turfgrass quality characteristics than intermediate or pasture-type tall fescues. The turf-type grasses had deeper green color, were more dense and competitive, and tolerated a low cutting height better than pasture-type tall fescues. The turf-type tall fescues offer a major plant material breakthrough in cool season turfgrasses for California.

Acknowledgement

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Strawberry Clover and Common Bermudagrass Combination Turf for Low Maintenance and Energy Conservation

Victor A. Gibeault and Matthew Leonard[1]

A trend of minimum maintenance in turf selection and care has been noted for a dozen years because of the increasing cost of energy, the availability and cost of water, and increased labor costs. Minimum maintenance turfs are those that have an increased efficiency regarding resource utilization and requirement.

Common bermudagrass *(Cynodon dactylon)* is very well adapted to much of California and, when well maintained, forms a dense, wear-resistant turf of good color and medium texture through the warm season. It is drought tolerant and highly efficient in water use. Unfortunately, bermudagrass is dormant and straw-colored for several months during the late fall, winter, and early spring. Also, the grass has a moderate to high nitrogen fertility requirement, depending on the variety used.

A few casual observations of bermudagrass/strawberry clover *(Trifolium fragiferum)* combinations have indicated that this clover can coexist with bermudagrass if given proper maintenance. Clover, of course, can fix atmospheric nitrogen and strawberry clover stays green year-round throughout the bermudagrass growing regions of California.

The objective of this study was to determine the compatibility of common bermudagrass and strawberry clover in terms of providing a low-maintenance turf of good quality that would have satisfactory color throughout the year. Field studies were conducted at the U.C. South Coast Field Station in Irvine and at U.C. Riverside. Studies included germination tests of strawberry clover varieties under various environmental conditions, a strawberry clover variety evaluation, experiments to determine the best method of establishing a common bermudagrass/strawberry clover mix, and a cultural maintenance study to determine optimum mowing and nitrogen fertility practices for a grass/clover mix.

It was shown that 'O'Connors' strawberry clover germinated quickly and at a high germination percentage. 'Fresa' strawberry clover has a comparatively low germination rate (30%) with a very high number of hard seeds in the seed lots that were tested. Chemical scarification, depth of seeding, or light-dark treatments did not alter the germination characteristics of the two strawberry cultivars. A seeding rate of between 1 and 2 pounds per 1,000 square feet gave complete cover after a 12-week time period.

A cultivar study that evaluated the turf performance characteristics of 'O'Connors' and 'Fresa' strawberry clover showed that both cultivars were virtually identical in appearance and color when mature. It was noted that an Australian seed source of 'O'Connors' was faster to establish than a domestic 'O'Connors' which, in turn, was slightly better in establishment rate than 'Fresa'.

Field studies evaluated the results of establishing the common bermudagrass/strawberry clover mix together, seeding common bermudagrass into a previously established strawberry clover sward, and seeding strawberry clover into a previously established common bermudagrass sward. It was determined that strawberry clover at a 1 to 2 pounds per 1,000 square feet seeding rate seeded in the fall into an established common bermudagrass sward that had been vertical mowed and/or close mowed resulted in the most uniform mix of the two species.

A uniformly mixed stand of common bermudagrass and 'O'Connors' strawberry clover (innoculated with type B Rhizobium) was established and allowed to mature. Mowing height treatments of 3/4, 1 1/4 and 1 3/4 inch and soluble nitrogen treatments of 0, 1/4, 1/2, 3/4, and 1 pound of nitrogen per 1,000 square feet per month were tested for a one year time period.

Measurements of shoot density made prior to the start of nitrogen fertilization showed that the ratio of bermudagrass to clover shoots was approximately 1:l. Shoot density of both species declined significantly as the mowing height increased.

Mowing height also had a significant influence on clover leaf size. Mean length of a middle trifoliate leaflet increased from 0.25 in. to 0.35 in. as mowing height increased from 3/4 to 13/4 inch. Rate of nitrogen fertilization had no effect on leaflet length.

The turf scores presented in Table 1 are based on turf appearance made at monthly intervals for one year.

As can be noted, turf quality during the warm months was unaffected by nitrogen level or mowing height. Mixing of the two species was excellent at all cutting heights and fertility rates. Bermudagrass was more obvious as nitrogen rates increased but uniformity was very good.

During the cool months of the year, there was a significant reduction in turf quality as nitrogen levels increased. Dormant bermudagrass was most noticeable in the high nitrogen treatments thereby decreasing turf quality ratings. Mowing height also significantly influenced the turf scores during the cool season. Turf scores were higher on high cut treatments than on low cut treatments. Again, dormant bermudagrass was more obvious with low cutting heights.

There was abundant flowering of the clover during the summer months with less flowering measured under lower cutting heights. It was noted that this flowering attracted a large number of bees which would be a distinct disadvantage for use in facilities such as parks, playgrounds, or home lawns during the summer months. Also, gophers and squirrels found the clover to be an attractive food source. This pest activity was not related to any experimental treatments.

Study Summary

It was shown that a common bermudagrass/strawberry clover mix can be best established by overseeding *Rhizobium* innoculated strawberry clover at a 1 to 2 pound per 1,000 square feet seeding rate, in the fall to low cut, vertically mowed common bermuda-

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Table 1. Turfscores (1-9,9 best) of bermudagrass/clover mix at five nitrogen levels and three mowing heights during cool (October-March) and warm (April-September) months.

Treatments	Cool Season	Warm Season
N level (lb/1000 ft^2)		
0.00	6.9**	6.9
0.25	6.7	6.8
0.50	6.6	6.8
0.75	6.5	6.8
1.00	6.4	6.9
Mowing height (in.)		
0.75	6.2***	6.9
1.25	6.7	6.9
1.75	6.9	6.8

** and *** = significant differences among treatments.

grass sward. The mixture compatibility of the two species was good. Similarities in color and growth habit resulted in a fairly uniform turf with little evidence of patchy growth, especially when no or low nitrogen and high cutting heights were practiced.

Some problems associated with the use of strawberry clover in common bermudagrass were noted. The most serious problem is the heavy clover inflorescence in the summer which is both unsightly and a bee attractant. Facility use with bee activity would be reduced or eliminated. A less serious problem, but one worthy of note, was that the succulent clover growth resulted in a mowing problem. The succulent sward oftentimes clogged the rotary mower.

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An Evaluation of Herbicides on Seashore Paspalum

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Seashore paspalum (*Paspalum vaginatum* Swartz.) is a perennial warm-season grass believed to be native to tropical and subtropical regions of North and South America. Within the past 10 years, two vegetatively selected seashore paspalum cultivars from Australian mother plants have been introduced to California: 'Futurf' and 'Adalayd' ('Excalibre') , of which only the latter is currently commercially available in California.

The following three studies were conducted to evaluate post-emergence and preemergence herbicides on seashore paspalum.

Study 1

Two preemergence herbicides-bensulide (Betasan) and pronamide (Kerb) -and two postemergence materials 2,4-D amine and dicamba (Banvel) plus a combination of 2,4-D, MCPP and dicamba (Trexsan) were applied in the Spring of 1979. Their application rates appear in Table 1. These materials were applied to a 3-year-old stand of 'Futuff, mowed at 3/4-inch and managed under normal turf practices at the University of California South Coast Field Station, Irvine. Each treatment was replicated three times in a randomized complete block design. The herbicides were applied using a CO_2 pressurized sprayer at 80 gallons per acre water carrier. One week after application phytotoxicity was evaluated followed by a second evaluation eight days later.

Study 2

In 1978, both seashore paspalum cultivars, 'Futurf' and 'Adalayd: were planted (stolonized) at the University of California Deciduous Fruit Field Station in San Jose. In Feb., 1980, a study

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was initiated to evaluate the tolerance of the two cultivars to four preemergente herbicides. The herbicides benefin (Balan) at 3 and 6 lb ai/A, DCPA (Dacthal) at 10 and 20 lb ai/A, bensulide (Betasan) at 10 and 20 lb ai/A and oxadiazon (Ronstar) at 2 and 4 lb ai/A were applied to 25 ft^2 plots and replicated four times in a randomized complete block design for each cultivar. Retreatments were made in Feb. 1981. Not enough weeds were present to evaluate them. Phytotoxicity was visually evaluated.

Study 3

Using the same turfgrass area in Study 2, an experiment was initiated in 1984 to evaluate possible injurious effects of several postemergence turf herbicides on the two cultivars.

The herbicides 2,4-D amine, dicamba (Banvel), MSMA (Bueno 6), 2,4-D + dicamba + MCPP + MSMA (Quadmec), triclopyr (Turflon) and 2,4-D + dicamba + 2,4-DP (Trimec ester) were applied to 25 ft^2 plots of 'Futurf' and 'Adalayd' on June 22, 1984 using a CO_2 pressurized sprayer at 50 gallons of liquid per acre. Herbicide application rates appear in Tables 2, 3 and 4. Each treatment and a check plot were replicated four times in a randomized complete block design. Plots were not watered for 24 hours after the application of herbicides. The treatments were repeated three months later on Sept. 27, 1984. During the course of the experiment, until the two cultivars went dormant, plots were mowed to a height of 1 inch with a reel mower and clippings were returned. Plots were watered as needed. The two cultivars received 0.5 lb N/ 1000 ft^2/month during their growing months in the form of ammonium nitrate. No dethatching or aerification was practiced. Plots were visually evaluated for turf quality and herbicide phytotoxicity effects on a monthly basis until the initiation of dormancy (early November), and once again after complete greening in May 1985.

Results of phytotoxicity for Study 1 are summarized in Table 1. Since there were not enough weeds to evaluate and no phytotoxicity was observed with four preemergence herbicides, no data are presented for Study 2. Summary results of the visual evaluations for Study 3 are shown in Tables 2 and 3.

Table 1. Phytoxicity Evaluations on Seashore Paspalum 'Futurf'

Herbicide	Lb. ai/A Rate	Phytoicity* May 21	nay 29
2,4-D amine	1**	1.7	1.7
2,4-D amine	2	2.7	3.3
2,4-D amine	4	3.7	5.7
dicamba	1/4**	0.3	0.3
dicamba	1/2	0.3	0.3
dicamba	1	1.7	1.0
bensulide	10	0	0
bensulide	15	0	0
bensulide	30	0	0
pronamide	1/2	0	0
pronamide	1**	0	0
pronamide	2	0	0
2,4-D, MCPP, dicamba	1**	2.7	2.3
2,4-D, MCPP, dicamba	2	3.3	4.3
2,4-D, MCPP, dicamba	4	3.7	6.0
Check		0	0

* Phytotoxicity 0 = no injury 10 = dead or brown foliage
* Label rate of herbicides on other turf species. Not registered on seashore paspalum.

Table 2. Effects of Turf Herbicides on Seashore Paspalum 'Adalayd'

Herbicide*	lb ai/A	6/ '84 Turf Quality	6/ '84 Phyto-toxicity	7/ '84 Turf Quality	7/ '84 Phyto-toxicity	8/l 84 Turf Quality	8/l 84 Phyto-toxicity	10/ /84 Turf Quality	10/ /84 Phyto-toxicity	0/29/84 Color	5/20/ 85 Turf + Quality
		Visual Ratings **									
2,4-D amine	1	8.2 ab	1.0 c	7.7 ab	2.0 cd	8.7 a	1.0 c	6.5 abc	2.5 d	2.0 b	6.7
2,4-D amine	2	8.2 ab	1.0 c	7.2 ab	1.2 d	a.7 a	1.2 c	5.2 cd	5.7 bc	2.0 b	6.7
dicamba	0.25	9.0 a	1.0 c	8.7 a	1.0 d	8.5 a	1.0 c	8.2 a	1.2 d	7.0 a	7.0
MSMA	3	4.0 c	6.0 a	3.7 e	5.0 a	7.7 a	2.5 b	2.5 e	9.2 a	2.7 b	6.2
2,4-D, MCPP, dicamba, MSMA (Quadmec)	(ML)	4.2 c	5.2 b	4.7 cd	3.5 b	8.5 a	1.5 bc	2.2 e	9.7 a	2.2 b	6.5
triclopyr	0.50	8.0 b	1.2 c	5.5 cd	3.5 cd	5.7 b	4.0 a	6.0 bc	3.5 cd	3.2 b	6.2
2,4-D, 2,4-DP, dicamba (Trimec ester)	1+ 1+ 0.25	7.7 b	1.2 c	6.5 bc	2.7 bc	7.7 a	1.7 bc	4.0 de	7.5 ab	2.2 b	6.7
Check		9.0 a	1.0 c	a.5 a	1.0 d	a.2 a	1.0 c	7.5 ab	1.5 d	7.0 a	7.0

* First application: 6/22/84; Second application: 9/27/84
** Visual. ratings are mean values on a scale of l-10 with 10 being: the highest turf quality or phytotoxicity (complete kill or paspalum), or darkest green color. Values followed by similar letter(s) are not significantly different from each other (DMR at 5% within columns).

\+ No statistically significant differences among treatments.

Table 3. Effects of Turf Herbicides on Seashore Paspalum 'Futurf'

Herbicide*	lb ai/A	Usual Ratings** 6/2[illegible]/84 Turf Quality	6/2[illegible]/84 Phytotoxicity	7/1[illegible]/84 Turf Quality	7/1[illegible]/84 Phytotoxicity	8/13/84 Turf Quality	8/13/84 Phytotoxicity	10/24/84 Turf+ Quality	10/24/84 Phyto+ toxicity	11/29/84 Color+	5/20/85 Turf+ Quality
2,4-D amine	1	7.0 ab	1.7 bc	6.7 ab	2.2 bc	6.5 bc	2.2 b	4.5	4.5	3.2	6.7
2.4-D amine	2	6.7 ab	1.7 bc	6.2 abc	2.5 abc	6.5 bc	2.2 b	4.0	4.7	3.7	6.0
dicamba	0.25	7.2 ab	1.2 c	7.2 a	1.5 c	6.0 bc	2.2 b	5.7	2.5	5.7	6.0
MSMA	3	4.0 c	6.0 a	6.0 abc	3.5 ab	7.5 a	1.2 c	2.7	8.0	4.2	6.5
2,4-D, MCPP, dicamba, MSMA (Quadmec)	3 (MSMA)	3.7 c	6.2 a	3.5 bc	4.0 ab	6.7 ab,	2.2 b	4.2	5.7	5.5	6.0
triclopyr	0.5	6.7 ab	1.5 bc	5.5 bc	4.2 a	5.5 c	3.2 a	4.0	5.2	3.5	5.7
2,4-Q, 2,4-DP, dicamba (Trimec ester)	1+ 1+ 0.25	6.5 b	2.5 b	5.2 c	3.5 ab	6.2 bc	2.5 b	2.7	7.7	3.7	6.2
Check	-	7.7 a	1.2 c	7.2 a	1.0 c	6.2 bc	2.2 b	5.0	4.0	5.7	6.0

* First application: 6/22/84; Second application: 9/27/84

** Visual ratings are mean values on a scale of l-10 with 10 being the highest turf quality or highest phytotoxicity (complete kill or paspalum), or darkest green color. Values followed by similar letter(s) are not significantly different from each other (DMR at 5% within columns).

\+ No statistically significant differences among treatments.

Table 4. Effects of Turf Herbicides on Seashore Paspalum ('Futurf' and 'Adalayd') Seed Head Production

Herbicides*	Pounds ai/A	Visual Ratings** Futurf 6/29/84	Futurf 8/13/84	Adalayd 6/29/84	Adalayd 8/13/84+
2,4-D amine	1	8.5 a	5.0 a	3.2 a	1.7
2,4-D amine	2	8.0 ab	3.5 ab	2.7 ab	1.5
dicamba	0.25	5.7 bc	3.5 ab	1.5 bc	1.7
MSMA	3	2.2 d	1.2 c	1.2 c	1.5
2,4-D, MCPP, dicamba , MSMA (Quadmec)	3 (MSMA)	5.2 c	2.5 bc	3.5 a	1.0
triclopyr	0.5	7.7 ab	5.5 a	3.2 a	1.5
2,4-D, 2,4-DP dicamba (Trimec ester)	1+ 1+ 0.25	a.7 a	2.2 bc	3.5 a	1.0
Check		5.7 bc	3.7 ab	1.0 c	2.2

* First application: 6/22/84 Second application: 9/27/84

** Visual ratings are mean values on a scale of l-10 with 10 being: the highest seed head production. Values followed by similar letter(s) are not significantly different from each other (DMR at 5% within columns).

\+ No statistically significant differences among treatments.

Results and Discussion

Study 1. Pronamide and bensulide did not cause any early phytotoxic effects on 'Futurf'. Later evaluations were not taken to show their long-term effects on the established turf.

Label rates of 2,4-D amine and dicamba caused slight to moderate turf yellowing. This effect was temporary and regrowth was normal. At one and two times the label rates, both materials caused observable injury. The combination of three herbicides mixture also injured the turf, probably due to the 2,4-D and dicamba.

Study 2. Weeds were not present in adequate populations for evaluation. Phytotoxicity was not observed with any of the four preemergence herbicides- benefin, DCPA, bensulide or oxadiazon-applied annually in February over a two-year period.

Study 3. One week after the first application of herbicides, plots of both cultivars treated with MSMA and Quadmec exhibited phytotoxicity. Trimec ester also caused a slight phytotoxic effect on 'Futurf' only. One month after the first application, phytotoxic effects caused by MSMA, Quadmec, triclopyr and Trimec were observed on both cultivars. Apparently, triclopyr and Trimec were slower in causing injury to the grass and damage was much less severe than those of either MSMA or Quadmec. MSMA and triclopyr's phytotoxic symptoms persisted for at least two months after the first application. One month after the second treatment, phytotoxic symptoms caused by 2,4-D amine (2 lb ai/A), MSMA, Quadmec and Trimec appeared on 'Adalayd: There were no statistically significant phytotoxic effects by any of the herbicides on

'Futuff. The 'Futurf had initiated dormancy, thus phytotoxic effects may have been masked.

As expected, turf quality ratings were generally inversely related to phytotoxicity ratings. Those herbicides causing the greatest phytotoxic effects, therefore, were also evaluated as having poor quality ratings.

By Sept. 27, 1984, three months after the first herbicide application, all evidence of phytotoxicity on both cultivars was gone. All plots scored quality ratings of 7 8 on a scale of 1 - 10 (with 10 being ideal turf). Herbicide applications were repeated on this date with phytotoxicity then reappearing and persisting until the two cultivars were completely dormant in mid-December 1984. Color ratings of November 11, 1984 (Tables 2 and 3) reveal the effects of the herbicides in advancing dormancy in seashore paspalum. This effect is particularly apparent on 'Adalayd:' all herbicides except dicamba advanced the onset of its dormancy (Table 2, 11/29/84). Dicamba and Quadmec appeared to affect 'Futuff similarly, although by the time of the rating in mid-November, their effect was not statistically significant.

On May 20, 1985, after both cultivars had broken dormancy and completely greened, plots were visually rated for turf quality (Tables 2 and 3). No phytotoxic herbicide effect was detectable, and plots within each cultivar were not significantly different from one another with respect to quality. 'Adalayd' generally produced a higher quality turf than 'Futuff.

During the course of Study 3, several periods of rainy weather made weekly mowing impossible. This change in maintenance regime resulted in a striking degree of seed head production in several plots. Therefore, these effects were measure-d and Statistically analyzed to determine if herbicide treatments were involved (Table 4).

With the exception of MSMA and dicamba on both cultivars and Quadmec and triclopyr on 'Futurf', all herbicides significantly increased seed head production one week after treatment. Seven weeks after treatment, only the 2,4-D amine (1 lb ai/A) treatment on 'Futuff resulted in increased seed head production. At the second rating, none of the herbicides affected 'Adalayd' seed head production.

It must be noted that seed head production was not detected on either cultivar when plots were mowed weekly; at least two weeks without mowing were required before seed head production was noticeable.

In conclusion, results from these studies indicate MSMA and the MSMA containing Quadmec are not safe to use on seashore paspalum.

The herbicide 2,4-D amine gave some injury in early spring applications (Study l), but not in late June (Study 3). After a second application in Sept., however, injury was very apparent at 2 times the label rate. The label rate of 1 lb ai/A application only produced slight yellowing injury in both trials. Dicamba at 0.25 pounds per acre was safe to the turf in both trials.

Dicamba at 0.25 lb ai/A was safe to the turf in both studies. Excessive rates of dicamba gave a slight turf response but were not significant.

Triclopyr gave some turf injury after one month. The mixture of 2,4-D, MCPP and dicamba (Trexsan) gave injury at the high rates used.

If short term phytotoxicity effects on seashoe paspalum are not of major concern, labelled rates of several herbicides could be' tolerated on both cultivars.

Note: Data in this progress report do not constitute recommendations for use. Until the chemicals with their uses appear on a registered pesticide label or other legal form of instructions, it is illegal to use them as described herein.. Reference to commercial names does not constitute a University of California recommendation or discriminate, implied or otherwise.

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WARNING ON THE. USE OF CHEMICALS

Pesticides are poison9ous Always read and carefully follow all precautions and safely recommendations givn on the container label Store a,, 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 **bum pesticide containees.**

PHYTOTOXICITY: Ceratin chemicals may cause plant injury i used at the wrong stage of plant development or when temperatures are too high injury may also result from excessive amounts or the wrong formualtion or from mixing incompatible materials Inert ingredients. such as wetters. spreaders. emulsifiers. diluents. and solvents, can cause plant injury Since formulaitons are often changed by manufacturers it is possible that plant injury may occur even though no injury was noted i" 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 descrbed

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