Glyphosate doesn't harm tall fescue

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Hydroseeded tall fescue plot (left) did not perform as well as overseeded plot (right) in the winter trial. None of the test plots showed seedling inhibition caused by glyphosate treatment in either winter or summer trials.

Reports that glyphosate, the active ingredient of a post-emergence broad-spectrum herbicide, may inhibit tall fescue germination when applied before seeding were not supported by field experiments. The method of seeding (hydroseeding or overseeding), however, may contribute to poor establishment.

Glyphosate has been a popular herbicide for control of annual and perennial grasses in nurseries and landscapes since its introduction in 1976. This herbicide has also been associated with problems after its use. Although no field studies have shown that the herbicide inhibits germination of seeds, greenhouse studies show that glyphosate at high rates may persist in soil and eventually inhibit seedling growth.

Hydroseeding or hydromulching has become a common practice for seeding ground covers and turfgrasses into landscapes. Hydroseeding is a process of applying seed with a paper mulch and sticking agent. It is a fast and easy way to seed steep slopes that cannot be easily planted any other way.

There have been reports in southern California of reduced germination and inhibited seedling growth in hydroseeded areas that had been treated with glyphosate. The objective of our study was to test the validity of such reports.

Winter trial

On December 2, 1986, a split-split plot randomized complete block design with four replications was established on a silty clay loam soil at Ventura Community College, 3 miles from the Pacific Ocean. The existing turf was primarily kikuyugrass (*Pennisetum clandestinum* Hochst.) Treatments included four rates of glyphosate: 0, 4, 8, and 16 pounds active ingredient per acre. All treatments were applied by backpack sprayer with a CO_2 pressure source at 30 pounds psi and a spray volume of 30 gallons per acre.

Thatch was removed from half of the subplots with a flail mower 20 days later. The mower was set so that more than 75% of the dead thatch was removed, leaving bare soil in most plots. On January 5, 1987, 14 days later, a blend of tall fescue (*Festuca arundinacea* Schreb.) cultivars consisting of 'Bonanza' (50%), 'Olympic' (25%), and 'Apache' (25%) was seeded on the plots. The sub-plots were split so that half were hydroseeded and the other half overseeded. All plots were seeded at a rate of 23 pounds per 1,000 square feet.

The hydroseeded plots received 500 gallons of water, 175 pounds of mulch (100% wood fiber spray mulch), and 7 pounds of sticking agent (Aztac Brand). Seeds were uniformly distributed by hand in the remaining 80-inch by 10-foot plots and covered with a light topdressing of steer manure. All plots were irrigated daily until seedlings were visible, and then watered as needed.

No dethatching, aerification, or other secondary turfgrass maintenance was done during the trial, and no pesticide was applied after initial renovation. Plots received 1 pound of nitrogen per 1,000 square feet during the study. No fertilizers were applied at seeding in either the winter or summer trials. Plots were mowed biweekly to 1.5 inches.

The plots were rated on February 2, 1987 for turf quality, tall fescue density, and presence or absence of kikuyugrass. Turf quality was rated on the basis of color, texture, density, uniformity of the sward, and pest activity. The information obtained in the trial was statistically analyzed with ANOVA and Fisher's Least Significant Difference test to separate means.

Summer trial

The same site preparation and turf management methods were used for the summer trial. However, the predominant turfgrasses in the summer trial before renovation were hybrid bermudagrass (*Cynodon* hybrid + *Cynodon dactylon* L. [Pers.]) and kikuyugrass. The seed was a blend of tall fescue containing 'Bonanza' (45%), 'Apache' (45%), and 'Olympic' (10%). The same seedlot was used for both hydroseeded and overseeded plots.

The hydroseeding mix was applied with 300 gallons of water, 150 pounds of wood fiber mulch, and Sentinel sticking agent at 1 pound per 1,000 gallons of water on the afternoon of July 27, 1987. Overseeding was done the next morning. The seeding rate was 14 pounds of seed per 1,000 square feet in both the hydroseeded and overseeded plots.

The summer trial was rated on August 19, 1987 in the same way as the winter trial.

Results

The presence of glyphosate in either hydroseeded or overseeded plots did not sig-

TABLE 1. Effect of glyphosate and seeding method on germination and quality of tall fescue

Treatment	Tall fescue counts* Winter trial	Tall fescue counts* Summer trial	Turf scores† Winter trial	Turf scores† Summer trial
Hydroseeded:				
Gly 0 lb	73	63	3.1	3.3
Gly 4 lb	39	76	1.1	2.8
Gly 8 lb	43	68	1.1	2.9
Gly 16 lb	55	82	1.2	2.9
Overseeded:				
Gly 0 lb	114	67	4.8	2.8
Gly 4 lb	128	34	4.6	2.4
Gly 8 lb	154	55	5.3	2.0
Gly 16 lb	152	40	4.9	1.9
LSD§	40.29	32.17	1.05	0.94
LSD¶	63.89	31.73	1.91	0.75

* Number of tall fescue plants in a 6-inch-diameter sampling ring randomly tossed. Two tosses per plot were averaged for each sample.
† Turf scores on a range of 0 to 10: 0=dead or no turf; and 10=highest quality possible.
§ LSD for glyphosate rates for the same seeding method indicate significance at 5% level.
¶ LSD for glyphosate rates for all other seeding-by-glyphosate comparisons indicate significance at 5% level.

TABLE 2. Effect of glyphosate and thatch removal on germination and quality of tall fescue

Treatment	Tall fescue counts Winter trial	Tall fescue counts Summer trial	Turf scores Winter trial	Turf scores Summer trial
Thatch remains:				
Gly 0 lb	89	63	4.4	3.0
Gly 4 lb	85	52	2.8	2.5
Gly 8 lb	89	55	2.6	2.3
Gly 16 lb	110	58	2.9	2.1
Thatch removed:				
Gly 0 lb	98	66	3.5	3.0
Gly 4 lb	82	58	3.0	2.6
Gly 8 lb	108	67	3.8	2.6
Gly 16 lb	97	64	3.1	2.6

NOTES: Tall fescue counts and turf scores were obtained in same way as described in table 1. Data within columns are not statistically different according to ANOVA.

nificantly affect counts of tall fescue plants (table 1). Turf scores were also unaffected by glyphosate, except where chemically or physically untreated plots had a higher quality before tall fescue seedlings became established (tables 1 and 2). There was no difference in tall fescue counts in glyphosate-treated versus untreated plots during either cool or warm weather trials.

Seeds germinated very slowly in the winter trial. It was over a month before germination was adequate to rate all the plots. The hydroseeded plots were slower to germinate (21 days) than the overseeded plots (14 days) in the winter trial. All plots germinated in about the same amount of time in the summer trial (about 7 days).

Removal of thatch did not affect tall fescue counts or turf scores in either hydroseeded or overseeded sub-plots. There also were no significant interactions between thatch removal and glyphosate application in their effects on either tall fescue counts or turf scores (table 2).

Seeding method affected both counts and turf quality ratings. In the winter trial, counts and turf scores were lower in hydroseeded plots than in overseeded plots. In the summer trial, some tall fescue counts and turf scores in hydroseeded plots were higher than in overseeded plots (table 1).

Discussion

Other research has shown glyphosate to be safe and effective for renovating warm-season turfgrasses infested with kikuyugrass. Although there have been reports that this herbicide may be harmful when used in conjunction with hydroseeding, our study found no evidence of this. There was no tall fescue seedling inhibition in any of the glyphosate plots in either winter or summer trials. There were differences, however, which seem to be attributable to the seeding method used at a given time of year. These differences have also been recently observed by others.

As measured by tall fescue counts and turf scores, hydroseeded plots did not perform as well as overseeded plots in the winter trial, but they were of slightly higher quality and density in the summer trial. Hydromulches are usually applied with a green dye, which fades to a very light tan color in 3 days or less. Overseeded plots that have been topdressed with manure hold their dark color for some time. The reflective nature of the hydromulch may have lowered temperatures within the mulch, while the absorptive properties of the manure may have increased seed temperatures in overseeded plots.

It was observed that, when manure of overseeded plots was spilled accidently on borders of hydroseeded plots during application, the seeds in those borders germinated at the same time as those in the overseeded plots.

The average daily air temperature (reporting station in Oxnard) during January 1987 was 53.7°F, and the average in August 1987 was 63.8°F. Temperature differences may have accounted for delayed germination in the hydroseeded plots.

Germination delays in hydroseeded plots appear to resemble stunting or chemical inhibition. The plants grow slowly and weakly when compared with their overseeded counterparts. These differences may have caused some turfgrass managers to believe that glyphosate was the inhibiting factor. The herbicide caused no changes in tall fescue densities in this study.

Tall fescue plants in both hydroseeded and overseeded plots in the summer trial germinated rapidly (7 days); the hydroseeded plots had higher tall fescue counts and quality. This difference may have been because of frequent drying out during germination and early establishment. The hydromulch may have served as a reservoir for moisture and a barrier to drying out, while the manure seemed to dry rapidly. The reflective nature of the hydromulch may also be of benefit during high summer temperatures, while the dark absorptive nature of manure topdressings may stall establishment of turfgrasses if irrigations are not adequate.

Glyphosate applications should pose no threat to seedling establishment when used before hydroseeding or overseeding new turfgrass areas. Although hydroseeding may not be the seeding method of choice during the coolest winter months in southern California, it may be the better method during warm summer months when newly seeded areas are prone to drying out.

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