AES

Keeping Up With Research

109

May 1995

INTERSEEDING ALFALFA INTO DECLINING ALFALFA STANDS

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Producers have attempted to thicken declining alfalfa stands by interseeding alfalfa into them, often with little or no success. This lack of success is due to a variety of factors, including autotoxicity; water stress; and disease, weed, and insect pressures. Mature alfalfa plants produce compounds that inhibit the germination and growth of seedling alfalfa (autotoxicity). Established alfalfa also provides an environment for pests and diseases that can harm alfalfa seedlings. If water becomes limiting, the seedlings are unable to compete with established alfalfa. For these reasons, researchers have concluded that interseeding alfalfa into existing stands often will not succeed.

Because of the difficulties in establishing a new alfalfa stand in Kansas, considerable interest in interseeding remains. In recent years, this interest has increased because of reports in several farm magazines that the practice could be successful if high rates of fungicide were used to control seedling disease. Our objectives were (1) to test the feasibility of seeding alfalfa into established alfalfa stands in Kansas and (2) to determine if high rates of fungicide had any effect on seedling establishment in declining stands.

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Procedures

Six on-farm locations were selected, three in northeast Kansas and three in southwest Kansas. At each site, the stand of alfalfa had declined to a point where the producer was considering destroying it and establishing a new stand. The experimental design was a randomized complete block with four replications, and a commercially available alfalfa cultivar was seeded at a rate of 12 lb\acre. Experimental plot size varied but was not less than 10 ft x 60 ft.

Northeast Kansas Tests. The three sites used were located in Riley County and were nonirrigated. Each location included untreated plots and applications of the recommended rate and twice the recommended rate of Apron seed fungicide. Plots were planted on April 1, 1994 using an alfalfa no-till drill with 7-inch row spacing. At the time of planting, the existing stand was in an early vegetative growth stage (<15 cm tall and no buds). Within each replication, seedling and existing plant stands were counted in five randomly selected sample sites approximately 10 ft apart within a replication. At each sample site, existing stand counts (number of crowns/ft^2) were taken for a 2 ft^2 area, and seedling counts (number of seedlings\ft^2) were taken for a 1 ft^2 area within the area counted for existing stand. Seedlings and existing stands were counted on April 22, followed by a second seedling count on May 13. Final counts of, existing stands and seedlings were taken on July 13 at only one location.

Southwest Kansas Tests. Interseeding trials were conducted in Gray, Haskell, and Clark counties. The Gray and Haskell County trials were irrigated; the Clark County trial was nonirrigated. Each location included untreated plots and applications of the recommended rates of Apron. Plots were planted on April 8, 1994 using a drill with 2-inch row spacings. At the time of planting, the existing stand was in an early vegetative growth stage (<15 cm tall and no buds). Sampling sites were selected using the same methodology described above. At each sample site, existing stand counts were taken for a 10.5 ft^2 area, and seedling counts were taken for a 1 ft^2 area within the existing-stand count area. Seedlings and existing stands were counted on April 20, May 2, and May 10 for the Gray, Haskell, and Clark County trials, respectively. The Clark County location was lost because of drought stress, but second seedling counts at the Gray and Haskell County locations were taken on June 23 and 24.

Analysis. Within each region, the effects of location and fungicide treatment on seedling emergence and survival were tested. Significant differences among treatment means were detected using Fisher's protected L.S.D. Regression analysis was used to determine if seedling survival was affected by existing stand density. The initial seedling count, second

Table 1. Effects of location and fungicide treatment on alfalfa stand count means in northeast Kansas field trials.

Location	Existing Stand April 22	Seedling Stand April 22	Seedling Stand May 13
		plants/ft^2	
Central Riley County	2.1	15.0	8.2
Western Riley County	1.7	14.1	10.3
Northern Riley County	2.3	15.9	6.5
L.S.D. (P< .05)	.4	n.s.	1.3
Fungicide Treatment			
2 x Recommended Rate–Apron	2.1	15.5	8.9
Recommended Rate–Apron	2.0	14.8	8.3
Untreated	2.1	14.9	7.9
L.S.D. (P< .05)	n.s.	n.s.	n.s.

Table 2. Effects of location and fungicide treatment on alfalfa stand count means in southwest Kansas field trials.

Location	Existing Stand April/May*	Seedling Stand April/May*	Seedling Stand June 23/24
		plants/ft^2	
Haskell County	1.4	7.6	1.3
Gray County	1.0	19.3	4.2
Clark County	1.2	11.3	–**
L.S.D. (P < .05)	.3	4.0	1.4
Fungicide Treatment			
Recommended Rate–Apron	1.2	11.6	1.8
Untreated	1.2	13.9	1.9
L.S.D. (P< .05)	n.s.	n.s.	n.s.

* Haskell County, May 2; Gray County, April 20; Clark County, May 10.
** Stand failed because of drought and was removed from the study.

seedling count, and the proportion of seedlings surviving were regressed independently against existing stand density for each location.

Results

Northeast Kansas Tests. All three locations received adequate rainfall to successfully establish an alfalfa stand. Emergence at all locations was good. Seedling location (relative to existing alfalfa plants) seemed to have little effect on germination. In fact, some seedlings germinated directly next to existing plants. Combined analysis indicated no statistical difference between locations or fungicide treatments for the April 22 seedling stand counts (Table 1). Analysis of the May 13 seedling stand counts indicated that statistical differences existed between locations, but no significant differences were observed for fungicide treatments (Table 1). Regression analysis indicated no correlation between April 22 seedling stand counts and the existing stand density. However, strong negative correlations were observed between May 13 counts of seedling stands and existing stands. The proportion of seedlings surviving from the first to second counts was correlated negatively with existing stand as well (Fig. 1). The same trend was observed in the July counts of seedling stands and existing stand densities at one location (Fig. 1).

Southwest Kansas Tests. Environmental conditions had significant effects on seedling stands at two of the three locations. In the nonirrigated Clark County trial, initial germination was good, but drought killed the seedlings. At the Haskell County site, heavy weed pressure (kochia and grass) reduced initial and subsequent seedling densities, which biased the effects of the existing stand. Combined analyses of the three locations indicated significant differences in seedling density between locations, but fungicide treatments did not affect seedling density (Table 2). Because of drought and weed problems in the Clark and Haskell County trials, regression analysis for the western region was completed only for the data from the Gray County trial. As was

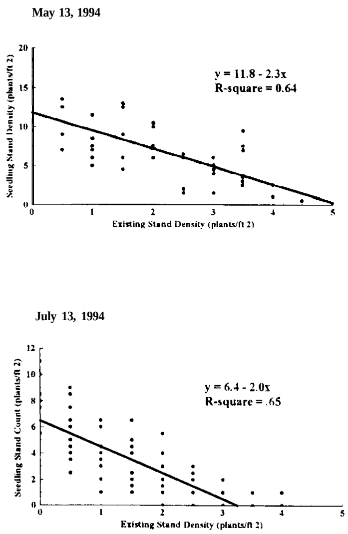

Figure 1. Regression of alfalfa seedling stand variables against existing stand density for the central Riley County location.

observed in the northeast Kansas locations, no correlation was detected between initial seedling stand and existing stand, but negative correlations were detected between the June 23 counts of seedling stands and existing stands and between the proportion of surviving seedlings and the existing stand.

Discussion

In two of six locations, alfalfa seedling establishment in an existing stand failed for the same reasons that newly established alfalfa stands fail. In the other four locations, a newly seeded stand would have been established successfully in the absence of established alfalfa, whereas in the presence of an existing stand, seedling mortality was quite high and seedling numbers were insufficient to replenish the existing stand.

In all locations and on all seedling count dates, fungicide treatments did not improve the survivability of alfalfa seedlings in an existing stand. Apron is a systemic fungicide that is used to control early seedling diseases such as *Pythium* and *Phytopthora. Any* benefit from seed treatments with Apron will be observed in the first 3 weeks after planting. We saw no such benefits from treatments at any location. However, fungicide-treated seed is still recommended for any alfalfa plantings to control seedling diseases.

Although the data collected in this study could not be used to identify the specific cause of seedling death, disease and insect damage was evident on young seedlings. Symptoms of autotoxicity also were observed in the trials.

Seedlings adjacent to existing plants were yellow and stunted by the second count date. At the one location where seedlings were counted on July 13, any surviving seedlings were still stunted and small. Previous field and lab research has shown that autotoxicity can contribute to the decrease in seedling numbers and vigor.

Conclusions

None of the six alfalfa stands in this study were interseeded successfully to a satisfactory stand level. Clearly, fungicide seed treatments do not improve seedling emergence or survival in established alfalfa stands. The survivability of seedlings was correlated negatively with the existing stand density. For every additional crown/ft^2, seedling alfalfa survival was reduced by approximately 10%. Given that seedling counts were taken very early, further attrition could be expected as the season progressed, and this was observed at the one northeast Kansas location where seedling density was measured in July (Fig. 1) . Therefore, survival of any significant numbers of seedlings in existing stands is highly unlikely. Although limited examples of success with interseeding alfalfa into declining stands may exist, the practice is likely to fail and is not recommended in Kansas.

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Contribution no. 95-451-S from the KAES.

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SRL 109 May 1995