

Grass interseeding in aging alfalfa stands: implementation and evaluation.

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Introduction:

Weeds reduce nutritional quality and yield of alfalfa hay. Examples include foxtail bristles that cause mechanical damage to mouths of animals, and common groundsel and fiddleneck that are poisonous to livestock. Alfalfa is more susceptible to weed invasion in its last year of production than other years because the alfalfa stand thins as it ages. Currently, weed control in the last year of production of an alfalfa stand utilizes herbicides applied during the dormant season. Weed control using short-residual herbicides can fail because the summer annual weeds can reestablish after breakdown or inactivation of the herbicide. If herbicides with longer residuals are applied, weeds are controlled but crop rotation options are limited.

Research on interseeding mixtures of grasses into alfalfa was shown the technique to be an effective and economic alternative to herbicidal weed control (Lanini, Bendixen, Canevari, Orloff, and Schmierer, unpublished). The grasses filled in the open areas within the alfalfa stand that developed as the stand aged. Weed reductions of 75% in the first cutting and 50% in subsequent cuttings were achieved when oats were interseeded (Lanini and Bendixen, 1990). The annual grasses that were seeded competed well with the weeds during the first few cuttings but the weeds increased during later cuttings. The perennial grasses competed well with the weeds during the later cuttings but not well during earlier cuttings.

Interseeding grass mixtures into alfalfa was shown to decrease damage from alfalfa weevil (Lanini and Bendixen, 1990). If alfalfa weevil populations are reduced significantly, insecticidal treatment can be avoided, preventing disruption of beneficial insects. Avoiding insecticide treatments would make interseeding a desirable alternative to herbicide application.

This study had several objectives. These objectives included demonstrating the technique in large plots, seeding both annual and perennial grasses for season-long weed control, and evaluating the effect of seed-bed preparation on alfalfa weevil populations.

Methods and Procedures:

Two sites were selected, one in Madera County and another in Fresno County. The Madera county site's alfalfa stand was 3

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years old and the Fresno County site's stand was 5 years old. Both sites were flood irrigated. There were 4 treatments arranged in a randomized block design with 3 blocks. The treatments were tetraploid annual ryegrass + Letar orchardgrass, tetraploid annual ryegrass + Fawn tall fescue, diuron + paraquat, and an untreated control. The plot size was 60 by 900 feet at Madera and 70 by 750 feet at Fresno.

In Fresno Co., all plots were cultivated using a spring toothed harrow. The grasses were seeded on January 22, 1993 using a grain drill. The tetraploid annual ryegrass was seeded at 23 lb/ac, the Fawn tall fescue was seeded at 22 lb/ac, and the Letar orchardgrass was seeded at 12 lb/ac. Rains prevented application of herbicides. The surrounding field was seeded to tame oats so the grass treatments could be contrasted against a standard interseeding treatment. One composition sample, one forage quality sample and one yield sample were taken. Yield was taken from a 70 by 550 foot area. There were 3 cuttings at the Fresno Co. site prior to the field being taken out of production.

In Madera Co., the alfalfa was sheeped off and then the plots scheduled for planting grasses were cultivated with a spring-toothed harrow. On December 22, 1992 the grasses were seeded using a Brillion drill. Tetraploid annual ryegrass was seeded at 15 lb/ac, Letar orchardgrass and Fawn tall fescue were seeded at 18 lb/ac. Paraquat and diuron were applied at 0.3 lb ai/ac and 1.4 lb ai/ac, respectively on January 30, 1993.

The Madera Co. site's three year old alfalfa stand produced 7 cuttings. At each harvest, the number of bales were recorded for a 60 by 600 foot area within each plot. Four bales in each plot were weighed to obtain an average bale weight. On each odd numbered harvest, composition samples were taken prior to cutting. The composition samples were separated by forage species (alfalfa, ryegrass, orchardgrass or tall fescue). All weeds were combined into a single sample for each plot. On each odd numbered harvest, samples were taken from each of four bales for forage quality analysis. Sweeping for alfalfa weevils was done three times, twice prior to spraying and once after spraying. Sampling was done according to IPM manual guidelines.

A cost analysis for the Madera Co. site was done for each treatment using the cost sheet developed by UCCE for forage alfalfa (Frate et al. 1991). Costs of establishing the grasses, herbicide, swathing and baling costs were included. A premium price was used for non-weedy, pure alfalfa. A \$17 discount was used for the grass mixtures. Weedy alfalfa was discounted by \$34. These discounts were based on actual returns from the alfalfa.

A survey was mailed to alfalfa growers to determine their familiarity with the interseeding technique and to determine the

percentage of growers currently using interseeding in their production practices in Fresno and Madera Counties.

Statistical analysis was done using the ANOVA and GLM procedures of the Statistical Analysis System (SAS). Means were separated using Fischer's Protected LSD at a significance level of $p=0.05$.

Results and Discussion:

At the Fresno Co. site, sufficient data were not available to statistically assess the treatments. However, visual observations indicated annual ryegrass, and to a lesser extent, orchardgrass and tall fescue, did occupy the open areas in the alfalfa stand. The annual ryegrass did not produce as much forage as the tame oats seeded in the area surrounding the experiment. The alfalfa stand was taken out of production prior to full development of the perennial grasses.

Production from the first cutting at the Madera Co. site was lower in the plots treated with herbicide (Figure 1). All other treatments were equal. Alfalfa from the ryegrass + orchardgrass plots yielded 1.8 times more forage (2856 lb/ac versus 1548 lb/ac) than the alfalfa treated with herbicide. Yield from the herbicide treated alfalfa was still lower in the second cutting (Figure 1). However this time the ryegrass + tall fescue had the highest average yield and was 1.2 times higher than the herbicide treated alfalfa (3223 lb/ac versus 2676 lb/ac). There was no consistent production advantage for any treatment from the third through the seventh cuttings. The greatest difference in production amongst these cuttings was 400 lb/ac (3617 lb/ac versus 3228 lb/ac for herbicide treated and ryegrass + tall fescue seeded alfalfa, respectively, at the third cutting).

The production over the entire season was lower from the herbicide treated plots than from all other treatments (Figure 2). No other total yield differences were identified. There were not sufficient yield increases in the third through the seventh cutting for the herbicide treated plots to overcome the first cutting differences between herbicide-treated and grass interseeded plots.

The percentage of the forage production that consisted of weeds was greater for the untreated control than for the other treatments at the first cutting (Figure 3). The grass interseeded and the herbicide treated plots were equivalent for weed control. By the third cutting no differences between treatments were detected (data not shown). Composition may have an impact on forage quality but forage quality samples have yet to be processed.

Alfalfa weevil population levels consistently were twice as high in the untreated plots and in the herbicide treated plots

when contrasted against the interseeded plots. Just prior to insecticide application, alfalfa weevil counts averaged 18 weevils per sweep in the untreated and the herbicide treated plots. Alfalfa weevil counts were 4 weevils per sweep for the seeded plots. Alfalfa weevils normally have moved into the alfalfa fields by the middle of December. Tillage in mid to late December reduces their numbers and may reduce the number of larvae that are able to survive into the season. Avoiding an insecticide treatment for alfalfa weevils will maintain a beneficial insect population that may, in turn, reduce the chance of having to apply insecticides for other insect pests later in the season.

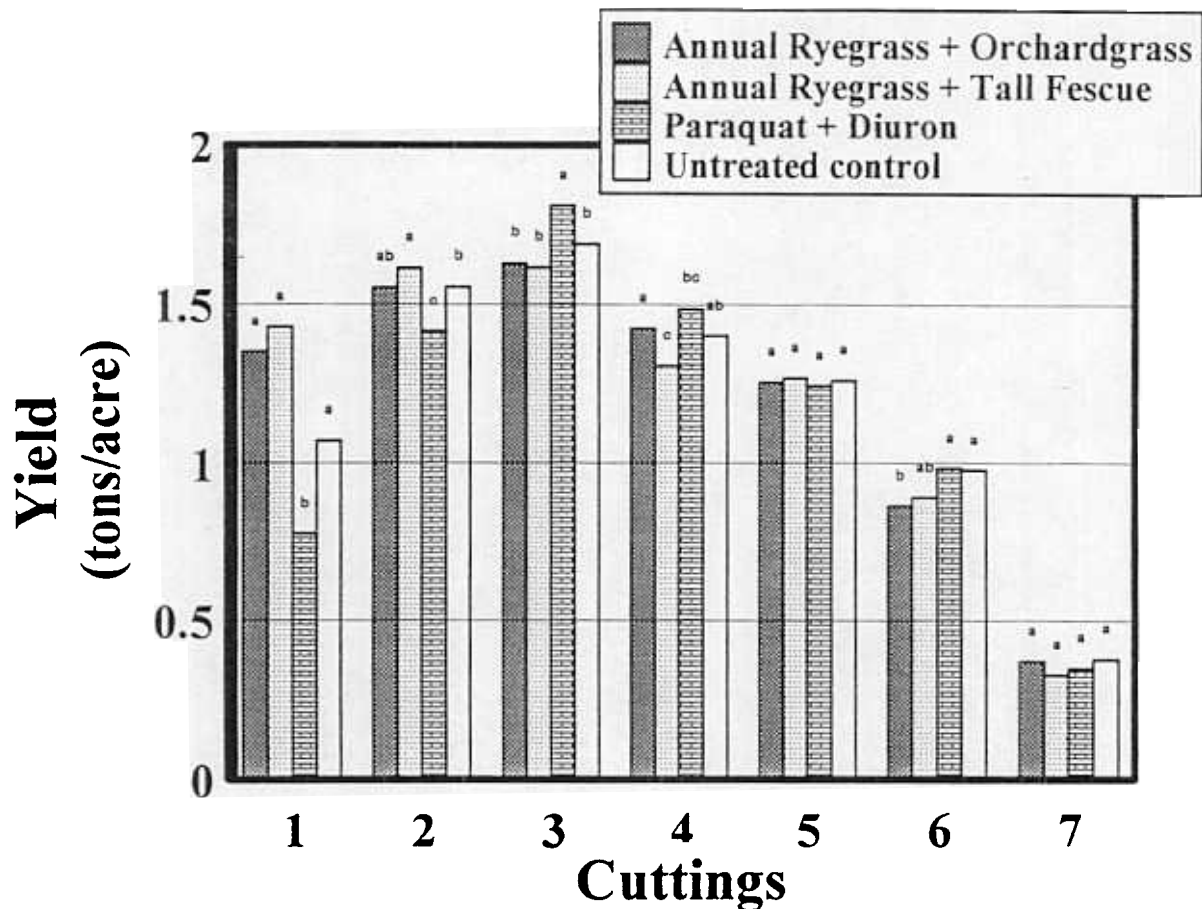


Figure 1. Alfalfa yield at each harvest from treatments consisting of interseeded tetraploid annual ryegrass + orchardgrass, interseeded tetraploid annual ryegrass + tall fescue, paraquat/diuron application and untreated control. Mean comparisons were made between treatments of the same cutting. No comparisons were made between cuttings. Bars within the same cutting with the same letter are not statistically different. Protected LSD values for each cutting were: 1) LSD = 0.35, 2) LSD = 0.08, 3) LSD = 0.10, 4) LSD = 0.09, 5) LSD = 0.12, 6) LSD = 0.11, and 7) LSD = 0.10.

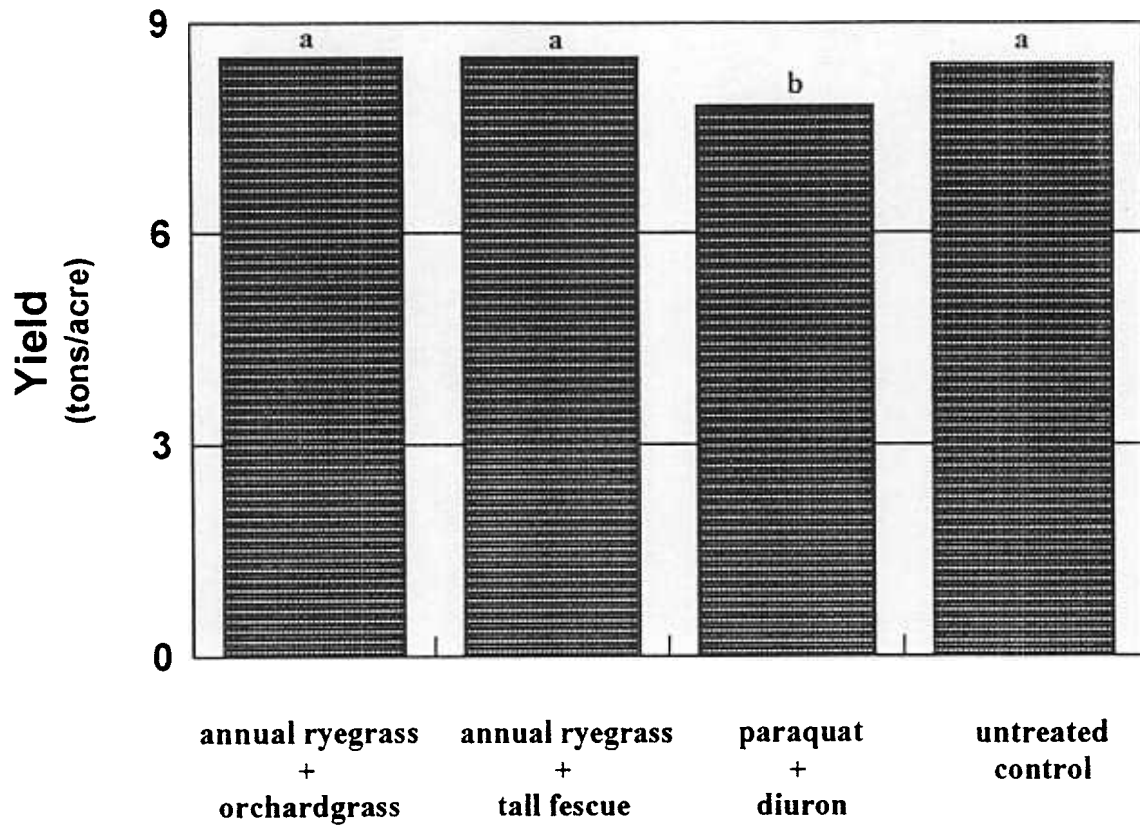
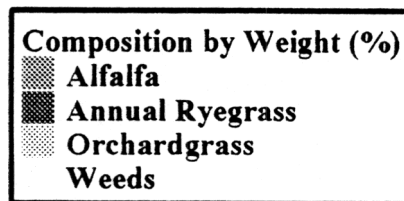
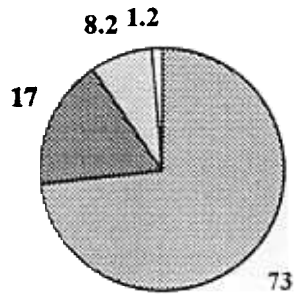


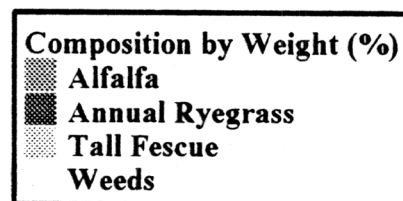
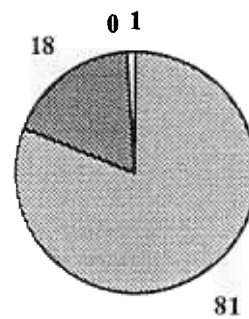
Figure 2. Forage yield from the entire season. Letters with the same letter are not significantly different (LSD = 0.4).

First Alfalfa Cutting

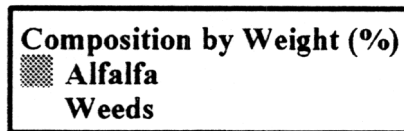
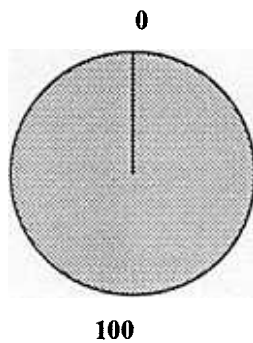
Annual Ryegrass + Orchardgrass



Annual Ryegrass + Tall Fescue



Diuron + Paraquat



Untreated control

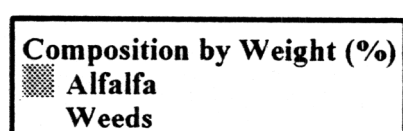
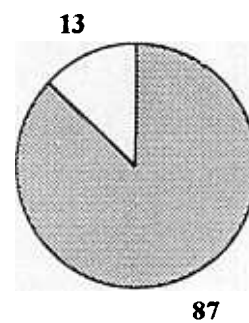


Figure 3. Composition percentage by weight for forage and weedy species at the first cutting.

Cost analysis of these treatments showed the highest profit for the untreated control (Table 1). The alfalfa stand was very healthy and only the first two cuttings contained weeds. The price of the alfalfa from the untreated control for the first two cuttings was discounted for having weeds but the rest of the cuttings were not discounted because they were weed-free. The interseeded plots that contained annual ryegrass and tall fescue were slightly behind the control and had the second highest profits (Table 1). The annual ryegrass was gone after the second cutting and the tall fescue was not a component of yield so the hay was given a premium price after the second cutting. The herbicide treated alfalfa received a premium price but the effect of the herbicide on yield reduced the profit. The orchardgrass persisted through all cuttings, resulting in a discount being applied to alfalfa for all cuttings. While the annual ryegrass + orchardgrass treatment was successful in maintaining a grass through the season, it had the smallest profit margin. If the alfalfa stand had been older (this particular producer always takes alfalfa out after 3 years) the discount on weedy hay may have made the addition of orchardgrass a benefit. If summer weeds were a problem then either the addition of orchardgrass or the use of paraquat+diuron would most likely be the most profitable treatments.

Table 1. Cost analysis of alfalfa production using four weed management options.

	Ryegrass + Orchard grass	Ryegrass + Tall Fescue	Paraquat + Diuron	Untreated Control
Cultural ¹	118	118	150	150
Harvest	173	173	173	173
Post Harvest ²	69	52	22	13
Capital	13	13	13	13
Overhead	516	516	516	516
Yield (tons/acre) ³	8.48	8.45	7.8	8.42
Price (\$/ton) ⁴	110	120.88	127	120.60
Profit (\$/acre)	44	149	119	151

¹Cultural costs do not include insecticide sprays for the interseeded areas because sampling showed alfalfa weevil was under the threshold.

²Post harvest costs include the cost of seeding the grasses and herbicide costs.

³Yield is in tons per acre.

⁴Price for the alfalfa from the ryegrass+tall fescue treatment was discounted during the first two cuttings but not in the subsequent cuttings since grasses were not a component of yield. The alfalfa from the control treatment was discounted for the first two cuttings but given a premium price for subsequent cuttings because weeds were not a component of yield.

Survey data are still being compiled but to date, approximately 20% of alfalfa growers surveyed (60% of those surveyed responded) in Madera and Fresno counties have interseeded grasses into established alfalfa. This level of adoption indicates interseeding is a viable management option.

Findings from this study suggests there are a number of management options that should be considered depending on the health of the stand and the rotational constraints. First, if the alfalfa is healthy, the weed pressure low, and no poisonous weed species present, it may be more profitable not to apply herbicide, nor to interseed grasses. Most of the weeds would be cut prior to setting seed so addition to the seed bank would be minimal. A second option, interseeding an annual grass for increased production and weed control during the first two cuttings, appears to be profitable. Additional benefits result if alfalfa weevil monitoring determines that weevils are below the threshold. Not spraying insecticides for alfalfa weevil should maintain populations of beneficial insects that may keep damage from other pests below an economic level. A third option is interseeding grasses or applying herbicide when weed populations are moderate to high. If the stand will be taken out of production after 3 to 4 cuttings, interseeding with an annual forage grass should be an economically viable option. Herbicide application with moderate to high weed populations would also be an economically viable option, especially if the stand will remain in production for the entire season.

Literature Cited

Lanini, W.T. and W. E. Bendixen. 1990. Interplanting oats into the last year of an alfalfa stand. In: The 1990 Research Progress Reports, Western Society of Weed Science p. 217-218.

Frate, C., S. Mueller, B. Roberts, R. Vargas, K. Klonsky and P. Livingston. 1991. U.C. Cooperative extension sample costs to establish and produce alfalfa hay in the Central San Joaquin Valley.