CONTROLLING WEEDS IN ESTABLISHED ALFALFA BY INTERSEEDING OATS

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Abstract: Studies were conducted during the past three years to evaluate interplanting oats into established alfalfa. Evaluations were made on oat variety, oat seeding rate, and nitrogen rate and their effect on weed cover and hay yield. First cutting hay yields were increased when oat seeding rates were 50 to 75 lbs/acre and nitrogen fertilizer rates of 30 lbs/acre applied at oat planting. Weeds have been reduced by over 75 percent in the first cutting and by over 50 percent in all subsequent cuttings. Cultivation without oat planting increased weed density over other treatments. Hay yields increased from 0.25 to over 1.0 tons/acre in the oat interseeded treatments compared to control or paraquat treated plots.

Keywords: Oat interplanting, weed control, alfalfa weevil

INTRODUCTION

Alfalfa stands are generally more sensitive to weed invasion during the final cutting year compared to other years, due to natural stand thinning. In the final cutting year, growers frequently counteract this weed invasion with a herbicide application; generally paraquat since it does not carry over into the next crop. Paraquat is a restricted use pesticide requiring a permit for use. An alternative practice is a shallow cultivation to uproot small annual weeds.

Interplanting oats with alfalfa during establishment has been effective in reducing weed density and biomass (Lanini et al. in press). First cutting hay yields (mixture of oats and alfalfa) were increased 2 to 4 tons/acre compared to alfalfa seeded alone. As a result of oats not being able to regrow if cut after the jointing stage, oats were not found in the second and subsequent cuttings. The mixed hay produced in the first cutting was readily accepted by hay buyers, especially for the horse market, prompting some growers to suggest interplanting oats into established alfalfa. Inputs involved in intercropping oats into established alfalfa would include oat seed, seed broadcasting, harrowing, (or harrowing followed by drilling seed) and a slight increase in baling costs due to increased yields. These inputs represent a slightly greater cost than purchasing and applying paraquat. Mixed hay has sold for approximately $20.00 less per ton than pure alfalfa hay according to the cooperating growers. Therefore, increased yield on the oat/alfalfa fields is necessary to make this practice economically viable.

Alfalfa weevil (Hypera postica and H. brunneipennis) populations can build to the point of requiring insecticide applications. Failure to treat for alfalfa weevil can lead to yield losses (C.G. Summers et al., 1985). Alfalfa weevil overwinter as eggs found on living and dead alfalfa stems, 3 to 6 inches above the soil surface or in plant debris on the ground. The harrowing operation used to incorporate the oat intercrop could potentially kill many of these eggs by burying them, if the operation were properly timed. If alfalfa weevil populations can be reduced below a treatment threshold by this operation, it would further increase the economic viability of this practice. Additionally, the harrowing required to incorporate oats levels out gopher diggings, thus aiding forage harvest. The objective of this study was to evaluate the inter-

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seeding of oats into established alfalfa and its effect on hay yield, weed control, and weevil control.

MATERIALS AND METHODS

Studies on oat interseeding in established alfalfa have been conducted over the past three years at Susanville, Lancaster, and Santa Ynez, California. The experimental design varied between sites, depending on what aspect of intercropping was being evaluated. Studies in 1987 at Susanville included a trial evaluating 'Montezuma', 'Svea', 'Sierra', 'Cayuse', 'Viking 765', 'Grey', and 'Curt' oat varieties each seeded at 50 lbs/acre, compared to alfalfa alone. A second trial evaluated hay yield in response to interseeding Montezuma oats at 50 lbs/acre and adding nitrogen fertilizer at 0, 30, 60, or 90 lbs/acre applied at planting. Both trials were planted on April 6, 1987, with oat seed being broadcast and the field lightly disked to incorporate the seed. At Lancaster, a split-plot design was used with oat seeding rate being the main plot with Montezuma oats at 0, 25, 50 or 75 lbs/acre, and nitrogen rates being subplots. Nitrogen was applied at 0, 30, 60, 90, or 120 lbs/acre. This trial was planted on February 12, 1988, by harrowing the field and then using a drill to plant the oats. At Santa Ynez, studies were conducted in 1989 to examine oat the interseeding of oats into alfalfa compared to paraquat, paraquat plus an insecticide, an insecticide, cultivation, or doing nothing. Oat interseeding was also done at three different rates and with two varieties. Oats were planted on January 4, 1989, by broadcasting the seed and then harrowing the plot to incorporate the seed. Nitrogen (34-0-0) was applied to oat plots at the rate of 30 lbs/acre. Paraquat treatments were made on the same date. Insecticide (furadan) treatments were made on March 24, 1989, when weevil counts indicated a threshold had been reached.

Species cover (alfalfa, oat, and weeds) were visually assessed prior to each harvest. Yield determinations were made on each plot, using a flail type forage harvester, cutting a two meter by six meter section from the center of plots. Subsamples were taken from each plot for moisture determination and conversion of harvest weight to dry weight. Any subsequent cuttings made after the first harvest were also assessed for species composition and yield.

RESULTS AND DISCUSSION

In the oat variety study, yield differences were not statistically significant from the check plot (table 1). The check plots contained 10 to 15 percent weeds (no Paraquat application was made) which added to the overall forage weight, while plots seeded with oats had less than 5 percent weeds. The oat variety 'Grey' was observed to have more regrowth in the second cutting than other varieties, although no differences in maturity were observed at the time of the first cutting.

The second trial at the Susanville location compared Montezuma oats at 50 lbs/acre at various nitrogen rates. Yields were increased by 30 lbs/acre more than by higher or lower nitrogen treatments (table 2). The addition of nitrogen appeared to stimulate both oat and alfalfa growth. The lack of yield response to oat interseeding with no nitrogen may explain why the various oat varieties failed to significantly effect yields.

At Lancaster, on the no nitrogen plots, interseeding oats did not significantly increase yields (table 3). However, when 30 lbs/acre of nitrogen was applied on either 50 or 75 lbs/acre of oat interseeded plots, yields increased. Increasing nitrogen rates above 30 lbs/acre failed to consistently improve yields as was previously observed at the Susanville site.

At Santa Ynez in 1989, weevils were not significantly reduced by oat interseeding or cultivation (data not shown); an earlier planting or

increased cultivation may have increased weevil control and will be evaluated in future studies. Weed measurements indicated that oat interplanting reduced weed cover (table 4). Cultivation was observed to increase weed cover relative to doing nothing. Cultivation removes existing weeds but also brings new weed seeds to the surface where they can germinate in openings in the alfalfa stand. By interseeding oats, less openings occur for weeds to germinate and competition is greater for those weeds which do survive. First cutting yields were increased by the addition of oats (table 5). The oat varieties did not differ significantly in the yield increases they produced. The oat varieties considered best to use for this practice are fine stemmed and leafy, as they make the best forage. The two varieties differed in that the Montezuma is a slightly shorter season variety then Cal Red. It was anticipated that the Cal Red would be less mature and would possibly increase forage in the second and possibly the third cuttings as well as the first. However, the differences in maturity were not great enough and both varieties increased forage slightly in the second cutting compared to other treatments. In the third, fourth and last cutting of the year, plots that had oats yielded less than untreated plots. Correlations indicated that oats were no longer a significant proportion of the yield by the third cutting, but that in plots which had no oats, weeds were significantly increasing yields. Plots which had oats interseeded had less weeds throughout the season as did the plots treated with paraquat.

CONCLUSIONS

A 50 to 60 lb/acre rate appears to be optimum to achieve significant yield increases and reduce weeds. The addition of 30 to 40 lbs/acre of nitrogen has also been shown to be essential. Nitrogen has been applied at planting, but a topdress application later in the year may also be effective. Alfalfa should be cut at the normal time regardless of the stage of oat growth. Oats that are still vegetative will recover and help to increase yield in the following cutting. Oats require a slightly longer period to dry (1 day or so), primarily to the nodes (the knuckles) needing longer to dry. If the oats have formed seed, do not rake excessively as the seed will shatter, creating an oat weed problem in subsequent years.

Most summer weeds germinate during the spring growth period, prior to the first cutting. Competition provided by oats reduces germination of most of these weeds and thus less weeds were observed in all cuttings. Although paraquat controlled winter weeds, summer weed invasion was not influenced by the winter paraquat application. 'Montezuma' oats has been identified by most growers as the preferred variety due to availability of seed and favorable forage characteristics.

Although the oat intercrop has not been observed to reduce alfalfa weevil damage, treating with paraquat resulted in increased weevil damage compared to doing nothing or to harrowing alone (Lanini and Bendixen unpublished; R.F. Norris and S. Steinmaus unpublished).

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Table 1. Hay yields in the first and second cuttings at Susanville, 1987, relative to oat variety.

	Oat Variety	Yield (tons/acre) 6/29/87	9/9/87	Total 2 cuttings
1	Montezuma	2.30	1.51	3.81
2	Svea	2.52	1.62	4.14
3	Grey	2.16	1.94	4.10
4	Cayuse	2.36	1.45	3.81
5	Curt	2.40	1.52	3.92
6	Sierra	2.58	1.38	4.06
7	Viking 765	2.48	1.50	3.98
8	Check	2.05	1.60	3.65

Table 2. Hay yields in the first and second cuttings at Susanville, 1987, relative to nitrogen rate.

	Nitrogen Rate (lbs/acre)	Yield (tons/acre) 6/29/87	9/9/87	Total 2 cuttings
1	0	2.30	1.86	4.16
2	30	2.75	2.22	4.97
3	60	2.29	2.04	4.33
4	90	2.46	2.26	4.72
	Check	2.05	1.60	3.65

Table 3. Hay yield (tons/acre) at Lancaster, 1988, relative to oat seeding rate and nitrogen rate.

Oat Rate (lbs/a)	Nitrogen Rate (lbs/acre) 0	30	60	90	120	Avg.
0	2.74	2.91	2.63	2.55	2.68	2.70
25	2.66	3.10	3.22	3.07	3.17	3.04
50	2.91	3.40	3.27	3.19	3.42	3.24
75	2.81	3.81	3.44	3.64	3.24	3.39
Avg.	2.78	3.30	3.14	3.11	3.13	

Table 4. Weed Cover on March 24, 1989 relative to treatment at Santa Ynez, 1989.

	Treatment	Weed Cover (%)
1	Montezuma Oats 25 lbs/a	4.25
2	Montezuma Oats 50 lbs/a	0.50
3	Montezuma Oats 75 lbs/a	0.25
4	Cal Red Oats 25 lbs/a	1.00
5	Cal Red Oats 50 lbs/a	2.50
6	Cal Red Oats 75 lbs/a	1.75
7	Paraquat 0.5 lb/a	0.00
8	Furadan	6.00
9	Paraquat + Furadan	0.00
10	Cultivated Check	7.50
11	Untreated Control	6.00

Table 5. Yields at each cutting relative to treatment at Santa Ynez, 1989.

	Treatment	Forage Yields (Tons/acre) Apr 26	May 31	Jul 7
1	Montezuma Oats 25 lbs/a	1.78	1.50	.99
2	Montezuma Oats 50 lbs/a	2.28	1.40	1.02
3	Montezuma Oats 75 lbs/a	2.12	1.51	1.08
4	Cal Red Oats 25 lbs/a	1.90	1.42	.99
5	Cal Red Oats 50 lbs/a	1.80	1.36	1.02
6	Cal Red Oats 75 lbs/a	2.22	1.69	1.04
7	Paraquat 0.5 lb/a	1.30	1.32	1.26
8	Furadan	1.12	1.01	1.17
9	Paraquat + Furadan	1.21	1.47	1.26
10	Cultivated Check	1.03	1.27	1.27
11	Untreated Control	1.16	1.17	1.32

	Treatment	Aug 9	Sept 16	Season Total
1	Montezuma Oats 25 lbs/a	1.39	1.36	7.02
2	Montezuma Oats 50 lbs/a	1.25	1.23	7.17
3	Montezuma Oats 75 lbs/a	1.37	1.22	7.30
4	Cal Red Oats 25 lbs/a	1.27	1.29	6.87
5	Cal Red Oats 50 lbs/a	1.17	1.18	6.52
6	Cal Red Oats 75 lbs/a	1.24	1.20	7.40
7	Paraquat 0.5 lb/a	1.35	1.20	6.44
8	Furadan	1.32	1.24	5.95
9	Paraquat + Furadan	1.42	1.35	6.62
10	Cultivated Check	1.38	1.39	6.34
11	Untreated Control	1.40	1.24	6.28