ESTABLISHING GRASSES IN LAST YEAR ALFALFA STANDS

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Abstract: Studies were conducted in 1990 and 1991 to evaluate interplanting of various grasses into alfalfa stands in their last year of production. Evaluations were made on hay yield and weed control for various grasses, including 'Debra' brome grass, 'Fawn' fescue, 'Latar' orchardgrass, 'Tetraploid' annual ryegrass, 'Kemal Festulolium', 'Ensiler' oats, 'Montezuma' oats, 'Dirkwin' wheat, 'Park' oats, 'Svea' oats, and 'Grey' oats. Grass interplanting was compared to cultivation, paraquat or untreated plots. Hay yields were generally increased when grasses were interseeded, however, the increases were less than what was observed in previous years. Freezing temperatures and/or drought resulted in grass growth being far below normal. Oats planted before the December freeze were killed in many instances. Weeds were reduced by grass interseeding more than by paraquat application or cultivation alone. Cultivation without grass planting often increased weed density over other treatments.

Keywords: Grass interplanting, weed control

INTRODUCTION

The natural thinning of alfalfa stands makes them more prone to weed invasion during the final cutting year. Growers often counteract this weed invasion with a paraquat application since it does not carry over into the next crop. An alternative practice is a shallow cultivation to uproot small annual weeds followed by interplanting oats to provide competition against invading weeds (Lanini et al. 1990). This practice has been shown to decrease weed problems, in addition to increasing first cutting forage yields.

Several growers have also tried other grasses and found that they also increased forage yields, but unlike oats, they regrew after the first cutting and were thought to increase yields in subsequent cuttings as well. The added cover provided by the grasses during the summer may additionally decrease weeds. Hay with grasses other than oats may also be more attractive to buyers, for utilization for livestock other than horses (the major market for alfalfa/oat hay). The objectives of these studies were to compare various forage grasses interseeded into alfalfa, on the forage yield and weed control.

MATERIALS AND METHODS

Studies on grass interseeding in established alfalfa was conducted at Susanville, Lancaster, Stockton, and Santa Ynez, California. The grass species utilized varied between sites

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(Table 1). The Stockton trial was planted on December 27, 1990, with grasses being broadcast and the ground being lightly harrowed to incorporate the seed. Grasses other than oats were seeded at 20 lbs/a with oats being seeded at 50 lbs/a. At Santa Ynez, grasses were broadcast on December 12, 1990 and incorporated with a field cultivator on the same day. Ryegrass was seeded at 20 lbs/a, while oats were seeded at 50, 75, and 100 lbs/a and wheat at 50 or 100 lbs/a. Both Stockton and Santa Ynez received some irrigation during dry winter periods (January and February). Susanville, in the northeast part of the state, was planted last on March 21, 1991. Oat varieties were each broadcast at 50 lbs/acre and disked, with the disk blades set to cut 4 to 5 inches deep (2-3 inch incorporation). The Lancaster trial was planted on February 22, 1991, by harrowing the field and then using a drill to plant the oats. Paraquat (0.5 lbs/a) or paraquat + Velpar (0.5 + 1.0 lbs/a) treatments were applied at the time of grass seeding. at all sites. Nitrogen (34-0-0) was applied to half of all plots at the rate of 30 lbs/acre, to determine if there was an added benefit.

Table 1. Treatments utilized at each location in 1990/91 grass interplanting trials.

Treatment	Location			
	Lancaster	Santa Ynez	Stockton	Susanville
Debra brome grass			X	
Fawn fescue			X	
Latar orchardgrass			X	
Tetraploid ann. ryegrass		X	X	
Kemal Festulolium			X	
Ensiler oats			X	
Montezuma oats	X	X	X	
Park oats				X
Svea oats				X
Grey oats				X
Dirkwin wheat		X		
Cultivation	X	X	X	X
Paraquat	X	X	X	X
Paraquat + Velpar			X	
Untreated	X	X	X	X

Species cover (alfalfa, grass, 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

Stockton The grasses did not significantly increase first cutting yields compared to untreated plots (Table 2). The oats failed to establish, possibly because of the freeze at the time of planting reducing the incorporation depth (Table 4). The grasses that established best under these conditions were 'tetraploid' annual ryegrass, 'Latar' orchardgrass, and 'Kemal' festulolium. Species which established well had increased growth with the addition of nitrogen. In the second cutting, 'tetraploid' annual ryegrass and the paraquat plus Velpar treated plots yielded significantly more forage than untreated plots (Table 2). Yield differences were not common after the first two cuttings or in season total yields, but differences in quality (proportion of weeds) became more pronounced (Table 3). By the fourth or fifth cutting, several of the grasses, including the fescue, brome grass, orchardgrass, and festulolium, became well established and contributed to the forage yield, displacing weeds. In the first cutting, weed growth was greatest on paraquat treated plots or those plots that were cultivated and no grass was planted or failed to grow. Winter weeds were increased by cultivation, as buried weed seeds were brought to the surface, where they could germinate without much competition. Summer grasses germinated after both cultivation and paraquat application and were not affected by these treatments (Table 3 and 4). The 'tetraploid' annual ryegrass and the paraquat plus Velpar treated plots were very good at keeping weed cover down during the first two cuttings, but summer grasses invaded and were common in the last cuttings (Table 3). Of the grasses, orchardgrass was the best at suppressing weeds (Table 3). Orchardgrass growth was relatively good throughout the cutting season, filling in gaps in the stand that would otherwise be occupied by weeds. Most of the other grasses grew well early or late in the season, allowing weeds to occupy this niche during their absence (Tables 3 & 4).

Table 2. Forage Yield (tons/acre) from six cuttings in Stockton, 1991

Treatment:	4/8	5/9	6/17	7/17	8/19	9/30	Total
	---------- tons/acre ----------						
1 Montezuma oats	1.83	0.92	1.10	0.86	0.70	1.46	6.88
2 Paraquat (no cultivation)	1.94	0.98	1.09	0.90	0.89	1.43	7.22
3 Cultivate	1.86	0.98	1.14	0.89	1.09	1.44	7.41
4 Untreated (no cultivation)	1.77	1.02	1.33	1.00	0.92	1.53	7.58
5 'Debra' Brome grass	1.87	0.96	1.06	0.81	0.85	1.29	6.84
6 'Fawn' Fescue	1.88	0.99	1.10	0.82	0.82	1.50	7.12
7 'Latar' Orchardgrass	1.98	1.01	1.24	0.87	0.73	1.09	6.92
8 'Tetraploid' Annual Ryegrass	2.02	1.21	1.08	0.76	0.89	1.63	7.58
9 'Kemal' Festulolium	1.76	1.05	1.06	0.75	0.67	1.12	6.42
10 'Ensiler' Oats	1.85	0.86	1.07	0.89	0.85	1.47	6.98
11 Paraquat plus Velpar	1.66	1.26	1.38	0.93	1.12	1.20	7.54
LSD .05	0.30	0.20	0.21	0.15	0.37	0.18	0.83

Table 3. Percent of Forage Yield composed of weeds from six cuttings in Stockton, 1991.

Treatment:	5/9	6/17	7/17	8/19	9/30	Average
	---------- % ----------					
1 Montezuma oats	10.2	1.2	30.0	45.6	68.8	71.9	38.0
2 Paraquat (no cultivation)	16.2	4.6	38.8	44.4	69.4	76.2	41.7
3 Cultivate	10.5	5.1	32.9	45.6	70.0	77.5	40.6
4 Untreated (no cultivation)	8.3	2.2	26.2	42.5	66.9	68.8	36.5
5 'Debra' Brome grass	7.2	2.3	7.6	24.4	39.4	36.2	19.6
6 'Fawn' Fescue	8.0	1.7	13.0	6.9	13.8	25.0	12.1
7 'Latar' Orchardgrass	2.6	0.2	2.8	0.6	19.4	41.9	11.3
8 'Tetraploid' Annual Ryegrass	1.0	0.4	5.2	33.1	76.9	84.4	33.5
9 'Kemal Festulolium'	4.2	0.0	2.1	6.9	18.1	45.6	12.8
10 'Ensiler' Oats	13.8	1.9	36.6	46.2	75.0	78.1	42.2
11 Paraquat plus Velpar	3.4	1.0	21.2	26.9	52.5	42.5	24.6
LSD .05	6.6	3.7	17.6	15.2	16.3	21.	8.6

Table 4 First cutting protein and acid detergent fiber (ADF) and percent of forage Yield composed of grass from cuttings in Stockton, 1991.

Treatment:	Protein	ADF	4/8	5/9	6/17	7/17	8/19	9/30	Average
	----- % -----		---------- % ----------						
1 Montezuma oats	26.95	29.86	2.7	0.6		0.0	0.0	0.0	0.7
2 Paraquat (no cultivation)	25.41	32.59	0.0	0.0		0.0	0.0	0.0	0.0
3 Cultivate	25.05	31.62	0.0	1.0		1.2	0.0	0.0	0.4
4 Untreated (no cultivation)	25.90	29.19	0.0	0.0		0.0	0.0	0.0	0.0
5 'Debra' Brome grass	24.95	31.55	1.7	8.2		25.6	36.2	31.9	20.7
6 'Fawn' Fescue	25.98	30.38	3.7	10.0		40.6	66.2	56.9	35.5
7 'Latar' Orchardgrass	25.90	30.60	8.2	10.5		33.8	51.2	27.5	26.2
8 'Tetraploid' Annual Ryegrass	25.48	34.09	25.0	45.8		8.8	0.0	0.0	15.9
9 'Kemal Festulolium'	25.71	31.18	9.1	24.3		40.6	59.4	30.0	32.7
10 'Ensiler' Oats	24.70	31.72	0.0	8.8		0.0	0.0	0.0	1.8
11 Paraquat plus Velpar	25.92	32.14	0.0	0.0		0.0	0.0	0.0	0.0
LSD .05	1.75	NS	4.3	13.7		9.0	10.7	13.3	

Susanville First cutting forage yields were increased by oat interplanting, compared to untreated plots (Table 5). The oats produced good growth, particularly when nitrogen as included. In the second cutting, no significant differences were observed among treatments. Cultivation alone or treating with paraquat resulted in a yield decrease for the season (Table 5). The weed growth at this site was minimal at both cutting dates, and differed only slightly among treatments, with cultivated and untreated plots having more weeds than other plots (Table 6). Oats lowered forage protein (correlation r = -0.621***) and increased acid detergent fiber slightly (r = 0.361**) compared to

untreated plots (Table 6). These plots were cut late for the alfalfa, in order to allow the oats to reach the dough stage of development. This hay is used for horse feed where having some oat grain is considered desirable. Cutting earlier would have resulted in higher protein and lower acid detergent fiber, as observed on the Stockton plots.

Table 5. Forage Yield (tons/acre) from two cuttings in Susanville, 1991.

Treatment:	7/11	8/21	Total
1 Untreated (no cultivation)	2.75	1.53	4.28
2 Cultivate - no oats	2.52	1.35	3.87
3 Paraquat (no cultivation)	2.53	1.39	3.92
4 Park Oats 50 lbs/a	3.05	1.38	4.43
5 Svea Oats 50 lbs/a	2.87	1.51	4.38
6 Grey Oats 50 lbs/a	2.84	1.49	4.33
LSD .05	0.27	NS	

Table 6. Forage composition (% / acre) for two cuttings and quality for the 1st cutting at Susanville, 1991

Treatment:	July 11, 1991			Aug. 21, 1991			July 11, 1991	
	Alf	Oat	Weed	Alf	Oat	Weed	Protein	ADF
	----- % ------			----- % ------			---%--	---%---
1 Untreated (no cultivation)	99	0		98	0	2	16.12	44.10
2 Cultivate - no oats	99	0		97	0	3	16.21	42.72
3 Paraquat (no cultivation)	100	0	0	100	0	0	18.12	42.15
4 Park Oats 50 lbs/a	57	43	0	97	2	1	14.20	45.27
5 Svea Oats 50 lbs/a	54	46	0	97	2	1	14.52	46.02
6 Grey Oats 50 lbs/a	59	41	0	95	5	0	15.00	44.41
LSD .05	13	13	NS	2	2	1	1.35	2.64

Lancaster Oats increased first cutting yields compared to paraquat treated plots, but not relative to cultivated or untreated plots (Table 7). An earlier planting may have allowed an even greater yield increase, however, with the drought experienced in 1991, irrigations may have also been needed. In the second cutting, the oat plots yielded less than other plots, possibly due to competition from the oats. Seasonal yields (four cuttings) did not differ among the four treatments. Differences in weed biomass in the first cutting were evident among treatments (Table 8). In the first cutting, weed growth was suppressed by either oat competition or paraquat treatment, while cultivation had no effect compared to untreated plots (Table 8). Weed or oat growth in the second and subsequent cuttings was minimal (data not shown). Protein was highest on paraquat

treated plots, which had a low weed cover and lowest on the oat plots (Table 8). Oats appear to be slightly higher in protein than the weeds they displace. Acid detergent fiber was lowest on paraquat plots and about equal among the other treatments.

Table 7. Forage Yield (tons/acre) from four cuttings in Lancaster, 1991.

Treatment:	6/4	7/17	8/21	10/4	Total
	---------- tons/acre ----------				
1 Montezuma oats	2.29	1.58	1.56	1.50	6.93
2 Paraquat (no cultivation)	1.99	1.92	1.62	1.59	7.12
3 Cultivate	2.14	1.73	1.59	1.49	6.95
4 Untreated (no cultivation)	2.17	1.66	1.63	1.58	7.04
LSD .05	0.18	0.34	NS	NS	NS

Table 8. First cutting forage composition (%) and quality (%) in Lancaster, 1991.

Treatment:	Alfalfa	Oats	Weeds	Protein	ADF
1 Montezuma oats	42	48	10	14.8	43.85
2 Paraquat (no cultivation)	88	0	12	18.1	37.22
3 Cultivate	68	0	32	15.8	43.31
4 Untreated (no cultivation)	67	0	33	15.7	43.69
LSD .05	12	7	9	1.8	3.67

Santa Ynez Grasses increased first cutting yields by approximately 0.5 ton/acre compared to non-grass plots (Table 9). This coastal location was not affected by the December freeze to the degree that the Valley sites were affected, and it also received regular irrigations during the drought period, which allowed the grasses to achieve good growth by first harvest. In the second and subsequent cuttings, no significant yield differences were observed among treatments. Seasonal yields (five cuttings) were highest when oats were interseeded at 75 lbs/a or higher or wheat at either rate were used with alfalfa (Table 9). Differences in weed cover in the first cutting were evident among treatments, but not significant (Table 10). In the first cutting, weed growth was suppressed by either grass competition or paraquat treatment, while cultivation had no effect (Table 10). In the second cutting, neither grasses or weeds were common in any treatment. However, by the third cutting, ryegrass started to grow vigorously, displacing some alfalfa. In the fourth cutting, summer weeds were common in all treatments. Protein was highest on plots without grass interseeding (Table 10). Oats appear to be slightly higher in protein than the weeds they displace. Acid detergent fiber was

lowest on paraquat plots and about equal among the other treatments.

Table 9. Forage Yield (tons/acre) from six cuttings in Santa Ynez, 1991.

Treatment:	4/27	6/11	7/18	9/6	10/20	Total
	tons/acre					
1 Montezuma oats @ 50 lbs/a	1.89	1.68	1.26	1.64	1.16	7.63
2 Montezuma oats @ 75 lbs/a	2.01	1.67	1.29	1.69	1.32	7.98
3 Montezuma oats @ 100 lbs/a	1.98	1.83	1.24	1.62	1.24	7.90
4 Dirkwin wheat @ 50 lbs/a	1.84	1.74	1.33	1.69	1.23	7.83
5 Dirkwin wheat @ 100 lbs/a	1.98	1.72	1.14	1.72	1.27	7.82
6 'Tetraploid' Annual Ryegrass	1.83	1.87	1.23	1.54	1.27	7.74
7 Paraquat	1.41	1.74	1.29	1.51	1.19	7.15
8 Cultivate	1.56	1.71	1.36	1.53	1.29	7.44
9 Untreated (no cultivation)	1.48	1.70	1.10	1.58	1.24	7.09
LSD .05	0.25	NS	NS	NS	NS	0.62

Table 10. Forage composition (% / acre) for five cuttings and quality for the 1st cutting at Santa Ynez, 1991.

Treatment:	April 27, 1991					June 11, 1991		
	Alf	Grass	Weed	Protein	ADF	Alf	Grass	Weed
	--- % ---			---%---	---%---	----- % -----		
1 Montezuma oats @ 50 lbs/a	58	40	2	19.50	38.56	96	4	0
2 Montezuma oats @ 75 lbs/a	47	53	0	18.58	38.31	98	2	0
3 Montezuma oats @ 100 lbs/a	44	56	0	19.04	39.21	98	2	0
4 Dirkwin wheat @ 50 lbs/a	48	52	0	21.80	38.98	98	2	0
5 Dirkwin wheat @ 100 lbs/a	46	53	1	18.45	38.95	99	0	1
6 'Tetraploid' Annual Ryegrass	35	65	0	18.98	35.61	100	0	0
7 Paraquat	100	0	0	24.02	38.12	99	0	1
8 Cultivate	98	0	2	24.01	40.50	99	0	
9 Untreated (no cultivation)	90	0	3	24.58	38.15	100	0	0
LSD .05	20	18	NS	2.73	NS	NS	2	0

Table 10. Continued

Treatment:	July 18, 1991 Alf	Grass	Weed	Sept. 6, 1991 Alf	Grass	Weed
	----- % ------			----- % -----		
1 Montezuma oats @ 50 lbs/a	98	0	2	99	0	1
2 Montezuma oats @ 75 lbs/a	98	0	2	98	0	2
3 Montezuma oats @ 100 lbs/a	95	1	4	92	0	8
4 Dirkwin wheat @ 50 lbs/a	98	0	2	94	0	6
5 Dirkwin wheat @ 100 lbs/a	97	1	2	97	0	3
6 'Tetraploid' Annual Ryegrass	78	22	0	86	13	1
7 Paraquat	94	0	6	97	0	3
8 Cultivate	97	0	3	95	0	5
9 Untreated (no cultivation)	96	0	4	97	0	3
LSD .05	4	2	4	6	2	NS

LITERATURE CITED

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