Three Year Summary of Yields, Weed Infestation and Other Attributes of Five Alfalfa Varieties Planted October 1994 on the Colorado River Indian Tribes Reservation

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Abstract

Five alfalfa varieties (CUF 101, SW 14, SW8210, Pioneer 5888, and a grower selection originating from CUF 101 and noted as Baldwin Select) that were planted in October, 1994, into large plots (0.75 acres) to obtain actual field harvest data production during the years of 1995-1997. Varietal hay yields were very similar in 1995 until mid summer, when area soil temperatures reached above 100°F at the four inch depth for a period of about 6 weeks. During the summer months Baldwin Select had significantly higher yields than other varieties tested. Statistical differences in accumulated hay yields were noted beginning in August 1995 and continued through 1997. Baldwin Select was the highest yielding variety each year, producing 8.4% more than CUF 101 during this time period, worth $247/acre more an acre than CUf 101. Alfalfa varieties were similar in relative feed value. Yellowing from Empoasca spp. leafhoppers was greatest during the 1995-1996 winter on varieties with fall dormancy ratings of 9 or greater. Weed infestations during late summer 1996 appear inversely correlated with fall dormancy class. All varieties of dormancy classes 8 and 9 were almost 100% infested with weeds during Septmeber 1997, although Baldwin Select had signficantly less infestation. Differences in plant populations in late September 1997 also appear to be correlated with fall dormancy class.

Introduction

A number of alfalfa varieties have become available for the low desert alfalfa producing areas in Arizona in the past several years. Few, if any, yield comparisons of some varieties have been completed under local conditions, with most testing involving small plots. This trial was designed to evaluate and compare the yields and quality of several alfalfa varieties that had not previously been tested in Arizona using grower conditions and management, and to obtain data from effects that other factors, such as wheel traffic, on stand longevity and yields.

Methods and Materials

Five alfalfa varieties (CUF 101, SW 14, SW 8210, Pioneer 5888, and a grower selection from locally grown plants, primarily CUF 101, and hereafter referred to as Baldwin Select) were planted October 24, 1994, with a Great Plains Solid Stand 14 Drill. Plots were replicated four times in a randomized complete block design and were 27 ft wide by 1,222 ft long in a field that had previously been in alfalfa. Seeding rate for most varieties was approximately 23 lbs/acre, but was 30 lbs/ acre for SW14 and 17 lbs/acre for Pioneer 5888. Field was basin flood irrigated, with initial irrigation on October 25.

Harvest plot sizes were 27 ft wide by 1,222 ft long. Plots were harvested 8 times during 1995 (once per month from March-October), nine times in 1996 and 8 times in 1997 using standard grower operations. After cutting and raking, but before baling, ends of windrows were marked with straw so that determination of actual alfalfa hay by variety could be made. After baling, bales and partial bales from each plot were counted and recorded, as were bale weights by variety. Exceptions to this have been: July 1995, and July, August and September 1997 harvests, when whole bale numbers only were recorded and an average weight of 135 lbs/bale was assigned to all bales, and the April 1996 harvest when whole bale numbers were recorded and the average weight by variety from the previous harvest was used for calculations. For all other harvests a minimum of two bales per plot were weighed. If the weight difference between the two bales was more than 5 lbs, a third bale was weighed so a plot bale weight average could be calculated for each plot. Hay yields per acre were then calculated. Data for the July 1997 harvest were lost due to a wind storm.

Hay quality was obtained from four harvests in the study: August 1995; January 1996; June 1996 and March 1997. Two bales per plot were sampled using a Utah sampler. Samples were then combined from the replicates for a composite sample of each variety. Samples were then analyzed using near infrared (NIR) by Stanworth Crop Consultants, Blythe, CA.

Hopperburn yellows caused by feeding of *Empoasca* spp. leafhoppers was rated in January 1996 prior to harvest by assigning a score of 0-10 (0= none) to each plot based on percentage and severity of yellows.

Plots had noticeable differences in weed encroachment in late summer 1996. Weed infestation was scored on September 13, 1996, by visually estimating percent of plot infested with visible weeds, primarily Mexican sprangletop and some barnyardgrass. Percent infestation for 1997 was obtained in a similar manner on September 15.

Plant height and associated fall dormancy measurements were taken on Jan. 2, 1997. Five to eight measurements of plant height were taken per plot.

Economics of yields were calculated by obtaining the local average high price for alfalfa hay on the baling date and multiplying price/ton by yields for each date. Each date was used rather than an average as varieties differ in their yields from month to month and year to year. Values for hay were reduced when infested with weeds.

Plant population was obtained on Sept. 27, 1997 by placing a 2.67 sq. ft frame in three locations in each plot and recording live crowns. Stems per crown or per sample were not counted. Plant population was then calculated on a per acre basis.

Data were analyzed using a Student-Newman-Kuhls tests (Co-Stat 2.04)

Results

1995 Hay yields were not statistically different for any of the harvests until the fifth cutting in July (Table 1). Baldwin Select had statistically more hay tonnage on this harvest, the following two cuttings (August, September), and for 1995. Statistical differences did not exist between varieties for the October harvest. Accumulated yields for 1995 ranged from 9.63 tons of alfalfa hay per acre for Baldwin Select (103.3% of CUF101) to 9.04 tons/acre for SW14.

SW8210 yielded more hay than other varieties early in the year, but hay yields decreased during the summer months in comparison with other varieties, coinciding with six weeks of area soil temperatures reaching above 100°F at a depth of 4 inches. A similar summer drop off for SW8210 was also noted in the University of California alfalfa variety trial at Holtville, CA, where SW8210 was first or second highest yielding of 48 alfalfa entries during April, May and June cuttings, but then dropped to 31st, 32nd and 38th in July, August and September, respectively, in the first year of production (Putnam et al., 1995).

1996 Baldwin Select had higher yields than other varieties (Table 2) followed by SW 8210. Both varieties increased in average yield/acre from 1995, while CUF 101, SW 14 and Pioneer 5888 decreased in average yield/harvest from 1995. Baldwin Select yielded 112.4% of CUF101 while SW 8210 yielded 106.8% of CUF 101 through August. Statistical differences in yield between varieties were noted at almost every harvest in 1996. Highly significant differences existed between varieties for average 1996 yields.

1997 Baldwin Select produced the most yield (Table 3), averaging 1.19 tons/acre/cutting, followed by CUF 101(1.09 tons/acre). The other three varieties in the trial had more yield than CUF 101 through the June harvest, but did not yeild as well during the last two harvests and for 1997 yielded less than CUF 101.

1995-1997 combined Baldwin Select had the greatest yields (Table 3), averaging 1.21 tons/acre/harvest (8.4% greater than CUF 101), followed by SW 8210 which averaged 1.12 tons/acre/harvest (101.0% of CUF 101). The other varieties were very similar in average yield.

Quality Alfalfa quality characteristics (percent protein, total digestible nutrients, acid detergent fiber and relative feed value) for the varieties are shown in Table 4. No practical differences between varieties for the quality aspects existed and no variety was consistently high or low at harvests sampled for any of the characteristics listed.

Yellows/Hopperburn Significant differences existed between varieties for percentage of leaflets exhibiting hopperburn yellows (Table 5) caused by feeding of the potato leafhopper complex (*Empoasca* spp.). CUF 101 and Baldwin Select had significantly more hopperburn yellows than other varieties, but these two varieties are the least dormant in this test.

Weed Infestation Significant differences were noted for weed infestation during the summer of 1996, with infestations appearing to be inversely correlated with fall dormancy ratings. Plots that have the lowest fall dormancy ratings of 8 (SW8210, Pioneer 5888) had the most weeds, while Baldwin Select, the least dormant of the varieties, had the least weed infestation with less than 3% of its area with weeds (Table 5). Baldwin Select also had the fewest weeds in 1997. All other varieties had almost 100% infestation of plots with weeds.

Fall Dormancy/Winter Plant Height SW 8210 and Pioneer 5888 were the shortest varieties in this study during the winter corresponding to known fall dormancy ratings of 8 (Certified Alfalfa Seed Council, 1996). SW 14 and CUF 101 were the next tallest varieties and are known have fall dormancy ratings of 9. Baldwin Select does not have a fall dormancy rating, however this variety was significantly taller than CUF 101, indicating that Baldwin Select probably has a fall dormancy rating of at least 10 (Table 5).

Economics Economic value of alfalfa varieties (Table 5) is very similar to accumulated yields. Baldwin Select produced $247/acre more hay than CUF 101 based on prices during this study, followed by SW 8210 ($41/acre more hay value). The other varieties have produced alfalfa hay worth approximately $20/acre(± $7) more than CUF 101.

References

Certified Alfalfa Seed Council. 1996. Fall dormancy ratings & pest resistance ratings for alfalfa varieties. 1996/97 edition.

Putnam, D., G. Peterson, L. Teuber, S. Orloff, L. Gibbs, K. Taggard, and D. Kirby. 1995. 1995 Alfalfa Cultivar Forage Production and Fall Dormancy Trial Results. University of California Agricultural Experiment Station - Cooperative Extension, Agronomy Progress Report, No. 250.

Table 1. First year (1995) mean alfalfa yields (lbs/acre) by cutting, planted October 24th, on the Colorado River Indian Tribes Reservation, Poston, Arizona.

	CUTTING DATE									
Variety	Mar. 7[1]	April 17	May 19	June 15	July 13	Aug. 9	Sept. 9	Oct. 25	TOTAL Ton/acre	% of Cuf 101
Baldwin Select	1.02a	1.26a	1.38a	1.73a	1.52 c	1.37 c	0.65 c	0.70 a	9.63b	103.3
CUF 101	1.23a	1.23a	1.33a	1.62a	1.40 b	1.27 b	0.58 bc	0.66 a	9.32a	100.0
Pioneer 5888	1.18a	1.27a	1.41a	1.66a	1.43 bc	1.21 ab	0.50ab	0.67 a	9.33a	100.1
SW 8210	1.17a	1.32a	1.41a	1.60a	1.31a	1.16 a	0.41a	0.67 a	9.05a	97.1
SW 14	1.06a	1.24a	1.29a	1.58a	1.43 bc	1.21 ab	0.54 bc	0.70 a	9.04a	97.0

[1] Means in columns followed by the same letter are not significantly different at the $p \leq 0.05$ level (Co-Stat 2.0)

Table 2. Second year (1996) yield summary (tons of hay/acre) for five alfalfa varieties planted October 24th, on the Colorado River Indian Tribes Reservation, Poston, Arizona.

Variety	Cut 1 Jan. 4	Cut 2 Mar. 4	Cut 3 Apr. 5	Cut 4 May 9	Cut 5 Jun. 11	Cut 6 Jul. 10	Cut 7 Aug. 8	Cut 8 Sept. 16	Cut 9 Nov. 1	**Total**	% of Cuf 101
Baldwin Select	0.63 a	1.41 a	1.19 a	1.58 a	1.97 a	1.31 a	0.99 a	0.95 a	1.00 a	11.04a	112.4
SW 8210	0.59 a	1.40 a	1.20 a	1.62 a	1.87 b	1.11 b	0.82 ab	0.99 a	0.89 a	10.49 b	106.8
SW 14	0.59 a	1.33 ab	1.03 ab	1.50 a	1.69 c	1.22 ab	0.86 ab	0.94 a	0.96 a	10.12 bc	103.1
Pioneer 5888	0.59 a	1.39 ab	0.97 b	1.55 a	1.74 c	1.13 b	0.66 b	0.97 a	0.92 a	9.87 c	100.5
Cuf 101	0.61 a	1.29 b	1.03 ab	1.48 a	1.71 c	1.10 b	0.79 ab	0.93 a	0.90 a	9.82 c	100.0

Means in columns followed by the same letter are not significant in the $p<0.05$ level, except for March, June, July and August cuttings which are shown at the $p<0.01$ level.

Table 3. Third year (1997) yield summary (tons of hay/acre) for five alfalfa varieties planted October 24th, on Colorado River Indian Tribes Reservation, Poston, Arizona

	Cutting date									
Variety	Jan. 31	Mar. 27	Apr. 23	May 23	June 21	July 17	Aug. 23*	Sept 23.	*Total	% of CUF 101
Baldwin Select	0.71a	1.46a	1.40a	1.53a	1.38a	data lost	0.87	0.98	8.32	109.3
SW 8210	0.56b	1.36a	1.34a	1.46a	1.19 b	data lost	0.80	0.79	7.49	98.4
SW 14	0.64ab	1.43a	1.31a	1.47a	1.13 b	data lost	0.82	0.78	7.57	99.5
Pioneer 5888	0.70a	1.35a	1.30a	1.41a	1.12 b	data lost	0.75	0.74	7.49	98.4
CUF 101	0.63ab	1.31a	1.26a	1.42a	1.18 b	data lost	0.85	0.96	7.61	100.0

Means in columns followed by the same letter are not significant at the $p<0.05$ level, except for the June cutting, which is shown at the $p<0.01$ level (S-N-K test, Co-Stat, 2.04).

*Data were calculated for alfalfa harvest using bale counts, weights of 135 pounds per bale, and subtracting calculated grasses.

Table 4. Percent Protein, Percent Total Digestible Nutrients, Percent Acid Detergent Fiber, and Relative Feed Value of Five Alfalfa Varieties from Various Harvests, 1995-1997.

	Percent Protein (100% Dry Matter)						% Total Digestible Nutrients (90% D.M)				
Variety	Aug. 95	Jan. 96	Jan. 96[1]	June 96	Mar 97	Average[2]	Aug. 95	Jan. 96	June 96	Mar. 97	Average
Baldwin Select	21.2	21.1	20.7	19.0	23.2	21.1	55.9	57.3	51.8	56.9	55.5
CUF 101	21.0	22.9	22.1	19.5	23.6	21.8	55.7	58.1	52.1	57.9	56.0
Pioneer 5888	21.7	21.9	21.3	19.2	23.3	21.5	56.0	57.2	51.9	57.3	55.6
SW 14	21.3	21.9	21.9	18.8	24.4	21.9	55.7	59.0	51.2	57.0	55.7
SW 8210	21.3	23.7	22.8	19.3	23.4	21.8	55.2	57.9	51.3	57.1	55.4

	Percent Acid Detergent Fiber (100% Dry Matter)					Relative Feed Value				
Variety	Aug. 95	Jan. 96	June 96	Mar. 97	Average	Aug. 95	Jan. 96	June 96	Mar. 97	Average
Baldwin Select	27.0	22.4	33.1	23.1	26.4	178.0	214.8	143.3	197.8	183.5
CUF 101	27.2	19.4	32.6	22.2	25.4	177.2	221.0	146.5	203.4	187.1
Pioneer 5888	26.8	20.7	32.9	22.8	25.8	179.0	210.6	146.8	201.5	184.5
SW 14	27.3	21.0	33.9	25.4	26.9	172.6	217.8	138.8	188.4	179.4
SW8210	28.0	17.9	33.8	23.2	25.7	172.8	228.0	139.5	200.3	185.2

[1] Percent protein dervied using Kjeldaal analysis, as leafhopper yellowing may have altered color values that NIR may utilize in analysis.

[2]Averages of NIR samples only.

Table 5. Mean winter plant height (Jan.), yellows, late summer weed infestation, and crowns/acre at end of third summer.

Variety	Fall Dormancy Class	Plant Ht. (In.) Jan. 2, 1997	Mean % Yellows Jan. 4, 1996	% plot area infested with weeds Sept. 13, 1996	% plot area infested with weeds Sept. 15, 1997	Crowns per acre Sept. 27, 1997	Final stand % of CUF 101
Pioneer 5888	8	12.5 ab	37.5 bc	34.25 b	99.9 b	173,896 c	77.6
SW 8210	8	11.4 a	27.5 c	40.25 b	100.0 b	202,077 bc	80.3
SW 14	9	12.8 ab	41.25 b	23.25 ab	98.0 b	208,951 bc	83.1
Cuf 101	9	13.5 b	65.0 a	23.25 ab	95.5 b	251,565 b	100.0
Baldwin Select	10?	14.9 c	68.75 a	2.0 a	51.25a	305,178 a	121.3

Means in columns followed by the same letter are not significant in the $p \leq 0.05$ level, with the exceptions of plant height and 1997 weeds which are shown at the $p \leq 0.01$ level. (S-N-K test, Co-Stat 2.04)

Table 6. Alfalfa hay yields (tons/acre) and associated economic value, 1995-1997.

Variety	Yield by year 1995	1996	1997	Total	% of Cuf 101	Value ($/acre) of hay produced 1995	1996	1997	Total	Comparison with Cuf 101
Baldwin Select	9.32	11.04	8.32	29.01	108.4	832	1,057	1,036	2,925	+ $247
SW 8210	9.05	10.49	7.49	27.03	101.0	794	997	928	2,719	+ $ 41
Pioneer 5888	9.33	9.87	7.38	26.59	99.4	815	936	940	2,691	+ $ 13
SW 14	9.04	10.12	7.57	26.74	100.0	785	958	961	2,704	+ $ 26
CUF 101	9.32	9.82	7.61	26.75	100.0	810	931	937	2,678	-------