

FOUR-CUT IRRIGATED ALFALFA VARIETY TRIAL: 1999-2002 YIELD RESULTS

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Abstract

Alfalfa is an important crop for central Oregon. Thirty-two varieties were planted in August of 1998 at the Central Oregon Agricultural Research Center (COARC), Madras, Oregon. The trial was conducted as a 4-cut harvest management regime. The trial was run for 4 years. The top 14 varieties were '53VO8', '5396', 'Arrowhead', 'Affinity + Z', 'Plumas', 'Archer II', 'Magnum IV', 'ZX 9852', 'Monument II', 'Surpass', 'WL 225 HQ', 'WL 325 HQ', 'ABT 350', and 'Ultra'. These varieties represented the top 7, 9, and 14 varieties that had no statistical yield difference based on PLSD (Protected Least Significant Differences) 0.10, PLSD 0.05, and PLSD 0.01, respectively. The lowest yielding five of the lowest yielding 6 varieties were public varieties with little or no resistance to verticillium wilt. The yield ranges were from 31.93 to 37.39 ton/acre.

Introduction

Alfalfa continues to be an important crop for central and eastern Oregon. Over the years, there has been a range of 35,000 to 50,000 acres of alfalfa grown in Crook, Deschutes, and Jefferson counties. The alfalfa is grown in pure stands and grass/alfalfa mixtures for hay. The hay is marketed to small and large livestock producers, dairies, and feed stores in Oregon, Washington, and California, as well as consumed on the farm and ranch. Some alfalfa is exported to Canada and Pacific Rim countries. Alfalfa is an important rotational crop to help break up disease and insect problems, and adds nitrogen to the soil for subsequent crops. Alfalfa fixes its own nitrogen, so does not require additional nitrogen applications. Seed companies continue to develop and market numerous varieties. The varieties need to be tested locally for their adaptability and yield potential. The information generated by variety trials are important to producers, fieldmen, seed suppliers, and the sponsoring seed companies.

Materials and Methods

Triticale ('Trical 102') was planted in the field in the fall of 1997 and then plowed down as a green manure crop in the summer of 1998. Soil samples were taken in August of 1998 and analyzed by the Oregon State University Plant and Soil Analytical Laboratory, Corvallis, Oregon (Table 1). Based on soil test results, phosphorus, sulfur, boron and potassium (Table 2) were applied and worked into the top 6 inches of soil. The field was leveled and rolled.

Table 1. Soil test analyses from alfalfa variety trial soil samples taken at the COARC, Madras, OR.

Date	Depth (in)	pH	P (ppm)	K (ppm)	Ca (meq/100g)	Mg (meq/100g)	B (ppm)	Zn (ppm)	Sol Salts Mmhos/cm	Se (ppm)
1998										
2000										
2002	0-12	6.7	29	215	--	--				
3/2003	0-12	7.4	29	386	10.9	4.7	0.6	0.52	0.7	<0.10*

* below the minimum detectable level

Table 2. Nutrient applications made to the alfalfa variety trial at the COARC, Madras, OR.

Date applied	N (lb/acre)	P ₂ O ₅ (lb/acre)	K ₂ O (lb/acre)	Ca (lb/acre)	S (lb/acre)	B (lb/acre)	Zn (lb/acre)
8/21/1998	33	259	0	0	72	2.6	0
1999	0	0	0	0	0	0	0
3/24/2000	0	94	0	0	47	0	0
3/20/2001	0	90	180	210	40	2.0	10
3/21/02	0	90	180	210	40	0	0

Thirty-two alfalfa varieties were planted at the Central Oregon Agricultural Research Center (COARC) at the Madras site on August 25, 1998. Variety names, fall dormancy and pest resistance ratings are listed in Table 3 (information supplied by the participating seed company and Alfalfa Council). The trial site is located 2 miles north of Madras and the elevation is 2,340 ft. Inoculated seed of each variety was planted at the rate of eighteen lb/acre with a Oyjard small-plot cone-type drill with nine rows, 6-inch row spacing. The field was rolled after planting. Plot size is 5 ft by 20 ft, while harvested area was 3.5 ft by 15 ft. Soil fertility was monitored (Table 1) and the trial was fertilized annually (Table 2).

The alfalfa was harvested at late bud or early flower growth stage. The harvests for second, third (before August 15) and fourth cuttings were calendar timed. Harvest was performed with a sickle-bar forage plot harvester, and fresh wet yield was weighed directly in the field. Aftermath from the plots was cleaned off of the field the following day, with a large tractor (125 hp) and grass seed “vac”. Within a day or two after harvest, the irrigation water was reapplied.

Moisture samples (0.5 - 1.0 lb) were taken for each plot and dried at 145° F until no further change in weight occurred. Yields are presented on an oven-dry, dry matter basis. The trial was laid out in a randomized block design with four replications. SAS statistical software program was used for analysis of variance and results are reported using protected least significant difference (PLSD) for mean separation at the $P > F = 0.10, 0.05, \text{ and } 0.01$ levels.

The trial was solid-set, sprinkler irrigated with a 30 by 40 ft spacing as needed for establishment and during the season. Nelson rotating head Windfighter 2000 7/64 inch nozzles were used the first 3 years and 9/64 inch nozzles were used the last year. Irrigation was determined by crop water use prediction by the Agri-met weather station program and by probing the soil with a soil probe. There is an Agri-met weather station located at the COARC. The trial was usually irrigated once or twice per week, depending upon time of year.

Pursuit® (1 DG Eco Pak bag), Poast® (0.47 lb/acre a.i.) and two quarts of crop oil were applied for weed control on September 18, 1998 of the establishment year. Poast (2 pints/acre) was also applied on April 7, 1999 to control volunteer triticale. The first winter dormant weed control included applying Velpar L® (0.75 lb/acre a.i.), Gramoxone Extra® (0.5 lb/acre a.i.) and Kerb® (1 lb/acre a.i.), on February 9, 2000. Velpar L (0.75 lb/acre a.i.), Kerb (1 lb/acre a.i.), and Gramoxone Extra (0.5 lb/acre a.i.) were applied on November 30, 2000 for the third production year. Velpar (0.75 lb/acre a.i.) and Gramoxone Extra (0.5 lb/acre a.i.) were applied in late fall 2001.

Table 3. The fall dormancy, winter hardiness, disease, insect, and pest ratings for the 1998 planted alfalfa variety trial conducted at the COARC, Madras, OR.

Variety	FD ^{1,2}	WH	Bw	Vw	Fw	An	PRR	SAA	PA	BAA	SN	APH	SRKN	NRKN	RLN
Agate	2		5	1	5	3	4	1	1	1	1	1	1	1	1
Arrowhead	2		5	4	5	4	5	1	1	1	3	4	1	3	1
Vernal	2		4	1	3	1	1	1	1	1	1	1	1	3	1
WL 232 HQ	2		5	5	5	5	5	4	4	1	4	5	1	2	1
5396	3		4	4	4	5	4	4	4	1	4	1	1	3	1
53VO8	3		5	5	5	5	5	4	5	3	5	2	1	5	1
ABT 350	3		5	5	5	5	5	4	4	1	1	5	1	1	1
DK 124	3		5	5	5	5	5	1	4	4	3	5	1	3	1
DK 134	3		5	5	5	5	5	1	4	3	2	5	1	4	1
Leafmaster	3	3	3	5	5	5	5	4	4	1	5	3	1	3	1
Rhino	3		5	4	4	4	4	1	5	1	4	4	1	1	1
Surpass	3		5	4	5	3	4	1	1	1	1	1	1	1	1
Ultra	3		4	4	5	5	4	2	4	1	4	1	1	1	1
Vernema	3		3	3	1	2	2	3	1	1	5	1	1	1	1
WL 325 HQ	3		5	4	5	5	5	4	4	3	4	4	1	1	1
5301 IQ	4		4	4	4	4	4	1	4	1	1	4	1	1	1
ABT400SCL	4		5	5	1	5	5	4	5	1	3	5	1	3	1
Ace	4	2.7	5	4	5	5	5	3	4	4	5	4	1	3	4
Affinity +Z	4		5	5	5	5	5	1	4	1	4	4	1	1	1
Baralfa 54IQ	4		4	4	5	5	5	1	1	1	4	1	1	1	1
Legacy	4		5	4	5	4	5	5	4	1	1	4	1	1	1
Magnum V	4		5	4	5	4	5	4	4	3	4	3	1	3	1
Monument II	4		4	2	5	1	4	1	4	1	1	1	1	1	4
Plumas	4		5	4	5	5	5	4	4	1	5	4	1	3	1
Reno	4		5	4	5	5	5	4	4	1	5	4	1	3	1
Winema	4		3	2	5	1	2	4	1	5	4	1	1	1	1
WL 334 RK	4	3.6	5	5	5	5	5	3	1	1	5	1	1	5	1
Wrangler	2		3	2	4	2	5	5	5	1	1	1	1	1	1
ZX 9850	4		4	5	5	4	5	4	5	3	5	1	1	4	3
Archer II	5		4	5	5	5	4	4	3	5	4	1	1	4	4
Robust	5		4	4	5	4	4	4	4	3	4	1	4	3	1
ZX 9852	5		5	5	5	4	3	5	1	4	5	1	1	4	3

¹ FD = Fall dormancy, WH = Winter hardiness, BW = Bacterial wilt, VW = Verticillium wilt, FW = Fusarium wilt, AN = Anthracnose race 1, PRR = Phytophthora root rot, SAA = Spotted alfalfa aphid, PA = Pea aphid, BAA = Blue alfalfa aphid, SN = Stem nematode, APH = Aphanomyces, SRKN = Southern root knot nematode, NRKN = Northern root knot nematode, RLN = Root lesion nematode.

² Fall dormancy (FD) Ratings: 1 = most dormant, 11 = least dormant.

³ Winter hardiness (WH): 1 = most winter hardy, 6 = least winter hardy.

⁴ Resistance ratings: 1 = Susceptible (S) (0-5% of plants) or has not been tested, 2 = Low resistance (LR) (5-15% of plants), 3 = Moderate resistance (MR) (15-30% of plants), 4 = Resistance (R) (30-50% of plants), 5 = High resistance (HR) (> 50% of plants)

Results and Discussion

There were some irrigation problems with this trial, resulting in unequal coverage. In 1999, there was an irrigation set that was missed during second cutting. In 2000, an uneven coverage problem on the third cutting, also affected the fourth cutting. More coverage problems occurred in 2001. At the end of the 3rd cutting in 2001, it was “discovered” that the source of the irrigation problem was undersized nozzles. Between third and fourth cutting in 2001, the nozzles were changed from 7/64-inch to 9/64-inch (Nelson rotating head Wind-fighter 2000 nozzles). Irrigation problems continued in 2002. There may have been some soil compaction (from the large tractor and “vac”) in certain areas as well as coverage problems.

Weed control was excellent for the trial and the winters were relatively mild for the 4 years of the trial.

The yield data for each year and end-of-trial are presented in table 4. The annual and individual cutting and annual yield data for production years 1999-2002 are presented in tables 5-8. Table 9 presents the annual and total yield data in percent relative yield compared to the annual mean yield, and the total four year cumulative yield in percent relative yield compared to ‘Vernal’.

The public varieties (‘Vernema’, ‘Winema’, ‘Agate’, ‘Vernal’, and ‘Wrangler’) yielded below average at the beginning of the trial (1999) and were ranked 18, 23, 26, 28, 29 out of 32 entries. Their ranking declined, compared to the private company entries in general, as the trial progressed. At the end of 4 years, ‘Vernema’, ‘Wrangler’, ‘Agate’, ‘Vernal’, and ‘Winema’ were ranked 27, 29, 30, 31, and 32 out of 32 varieties. These varieties have little or no resistance to verticillium wilt. These varieties did not respond well to intensive cutting management.

However, if verticillium wilt was the main factor limiting yield of the public varieties, then ‘Monument II’ (rated 2 or LR) should have been at the bottom of the yield trial, but it was not. It ranked above average for yield and was above average in the fourth year of production. Based on their yield ranking, one would have expected ‘Baralfa 54 IQ’, ‘WL 334 RK’, and ‘Legacy’ to be varieties with little resistance to verticillium wilt, but all have resistance levels of 4 (R) to 5 (HR). These three varieties were near the bottom of the rankings after 4 production years. This suggests that 4 (R) or 5 (HR) ratings for verticillium wilt, do not always assure one of the highest yields. Only regional variety trials can refine the selection of variety adaptation to a given area, under specific management.

The top-yielding varieties at the end of the 4 years did not start out on top. Out of the top-ranked 14 varieties for the first year, only six of the varieties finished in the top 14 ranking after 4 years of production (Table 4). The top 14 varieties were not different from each other statistically for end-of-trial yield based on PLSD 0.01 = 2.15 ton/acre). There was no difference between the top 9 varieties based on PLSD 0.05 = 1.62 ton/acre. There was no difference in varieties between the top 7 varieties based on PLSD 0.10 = 1.36 ton/acre. These top 14 varieties produced 0.5-6.5 percent more yield than the mean yield, or produced from 8.0 to 14.3 percent more yield than did ‘Vernal’.

The end-of-trial top seven varieties, ‘53VO8’, ‘5396’, ‘Arrowhead’, ‘Affinity + Z’, ‘Plumas’, ‘Archer II’, and ‘Magnum IV’ (PLSD 0.10 = 1.36 ton/acre) started out ranked 24, 15, 16, 12, 1,

20, and 13, respectively, after 1 year of production (Tables 4-5). The next end-of-trial top two varieties, 'ZX 9852' and 'Monument II' (PLSD 0.05 = 1.62 ton/acre), started out ranked 21 and 30, respectively. The next end-of-trial top five varieties, 'Surpass', 'WL 232 HQ', 'WL 325 HQ', 'ABT 350', and 'Ultra' (PLSD 0.01 = 2.15 ton/acre), started out ranked 7, 9, 32, 22 and 11, respectively.

If a variety is chosen for a very short rotation of 1-2 years, check how that variety yielded in the first year or two. Varieties that produced very well in the first year included 'Plumas', 'DK 134', 'WL 334 RK', 'Reno', and 'Leafmaster' (see tables 4-5 and 9). Choosing a variety for two years, one would pick 'Plumas', 'WL 334 RK', 'Afinity + Z', '5396', 'Leafmaster', '53VO8', and 'Arrowhead', in that order, based on these specific field conditions and pests present (see Tables 4-6 and 9). To choose a variety for long-term rotation, check out its total yield at the end of 4 years (see tables 4 and 9). If one is planning on an even longer term stand, also pay attention to its yield in the last production year for which there are data (see table 8 and 9). Was the variety still producing strong, above average for the trial, or yielding higher than its contemporaries? Varieties that were yielding higher than the average for the trial in the fourth year, included 'Archer II', 'Arrowhead', '5396', '53VO8', 'WL 325 HQ', 'Monument II', 'Surpass', and 'Magnum IV' (PLSD 0.10 = 0.61 ton/acre) (see table 8 and 9). But yield alone may not predict a variety's performance if pests and certain management decisions differ from the conditions of the trial (see Table 3).

'Archer II', a fall dormancy 5 was one of the top yielders in the trial. It also was the top numerical yielder in the last year of the trial. The other fall dormancy 5 rated varieties 'ZX 9852' and 'Robust' ranked eighth and tenth, in yield in the last year of the trial; and they ranked eighth and fifteenth for the 4-year total.

Selecting an alfalfa variety for an individual field is important for maximum forage production over the life of the stand. Producers should test their soil for nematodes prior to establishment of an alfalfa field. Nematode tests for presence and species identification should be done well in advance so that information can be used for better variety selection. Stem nematode, root lesion nematode, and northern root knot nematode are species of particular interest to be aware of, and are present, in central Oregon. There is a fair number of alfalfa varieties with varying degrees of resistance to stem nematode and northern root knot nematode. There are less varieties that have resistance to root lesion nematodes. And there are fewer varieties with resistance to all three nematodes, but there are some (see Table 3).

Producers should take into account other diseases and pests. Verticillium wilt resistance is necessary. Strong resistance to bacterial wilt and fusarium wilt is also good to have. Soil type and texture, and irrigation system are other variables that one should consider when choosing a variety. Flood irrigating soils with heavy clay soil will require more root disease resistance. Lighter soils with sprinkler irrigation may not require as high of a resistance level for the wilts, phytophthora root rot, and aphanomyces (see Table 3).

Insect resistance is important. There are no varieties with Egyptian alfalfa weevil resistance. Resistance to the blue alfalfa, spotted alfalfa, and pea aphid is important. Usually the aphids do not cause much damage during the growing season, but occasionally there is an outbreak in central Oregon that causes severe damage (see Table 3).

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Table 4. Four-year yield (ton/acre) summary of the 1998 August-planted alfalfa variety trial at Madras, OR.

Variety	1999 Yield ton/acre	2000 Yield ton/acre	2001 Yield ton/acre	2002 Yield ton/acre	1999-2000 Yield ton/acre	1999-2001 Yield ton/acre	1999-2002 Yield ton/acre
53V08	9.21	10.53	9.06	8.59	19.74	28.80	37.39
5396	9.40	10.49	8.80	8.68	19.89	28.69	37.36
Arrowhead	9.35	10.28	8.97	8.75	19.63	28.60	37.34
Affinity+Z	9.50	10.46	8.46	8.12	19.96	28.43	36.55
Plumas	10.16	9.90	8.48	7.86	20.06	28.54	36.40
Archer II	9.27	9.63	8.59	8.81	18.90	27.49	36.30
Magnum IV	9.45	9.89	8.63	8.21	19.34	27.97	36.18
ZX 9852	9.32	9.92	8.59	8.23	19.24	27.49	35.84
Monument II	9.01	9.76	8.73	8.33	18.77	27.49	35.82
Surpass	9.70	9.26	8.28	8.25	18.96	27.33	35.49
WL 232HQ	9.66	9.59	8.52	7.73	19.25	27.76	35.49
WL 325HQ	8.68	9.37	8.85	8.54	18.05	26.89	35.43
ABT 350	9.25	9.29	8.80	8.00	18.54	27.33	35.33
Ultra	9.54	9.61	8.18	7.99	19.15	27.33	35.32
Robust	9.14	9.27	8.65	8.15	18.41	27.06	35.21
Ace	9.18	10.03	8.48	7.85	19.21	27.28	35.18
Reno	9.77	9.79	7.76	7.76	19.56	27.33	35.09
Leafmaster	9.77	10.00	8.17	7.52	19.77	27.55	35.08
ABT 400SCL	9.77	9.56	8.05	7.61	19.33	27.38	34.99
Rhino	9.33	9.15	8.43	8.04	18.48	26.91	34.94
5301 IQ	9.68	9.62	8.30	7.09	19.30	27.61	34.69
DK 124	9.33	9.74	8.25	7.32	19.07	27.32	34.64
ZX 9850	8.80	9.51	8.34	7.98	18.31	26.66	34.64
DK 134	10.06	9.10	8.00	7.46	19.16	27.16	34.61
Baralfa 54 IQ	9.41	9.40	8.47	7.25	18.81	27.28	34.56
WL 334 RK	9.84	10.17	7.46	6.77	20.01	27.47	34.24
Vernema	9.33	9.27	8.03	7.31	18.60	26.64	33.95
Legacy	9.64	9.36	7.91	6.96	19.00	26.91	33.87
Wrangler	9.02	8.95	7.75	7.85	17.97	25.72	33.57
Agate	9.15	8.67	7.77	7.85	17.82	25.59	33.44
Vernal	9.07	8.92	7.57	7.15	17.99	25.56	32.71
Winema	9.22	8.66	7.03	7.01	17.88	24.92	31.93
Mean	9.41	9.59	8.29	7.85	18.99	27.27	35.11
PLSD (0.01)	NS	0.89	0.86	0.96	1.28	1.68	2.15
PLSD (0.05)	0.71	0.67	0.65	0.73	0.97	1.27	1.62
PLSD (0.10)	0.59	0.56	0.54	0.61	0.60	0.66	1.36
CV %	5	5	6	7	4	3	3
Prob.	0.0171	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

Table 5. 1999 yield (ton/acre) summary for the 1998 alfalfa variety trial at Madras, OR.

Variety	1 st Cut yield ton/acre	2 nd Cut yield ton/acre	3 rd Cut yield ton/acre	4 th Cut yield ton/acre	Total yield tons/acre
Plumas	3.57	2.18	1.83	2.58	10.16
DK 134	3.83	2.12	1.72	2.39	10.06
WL 334 RK	3.52	1.84	1.84	2.64	9.84
Reno	3.50	1.97	1.75	2.57	9.77
Leafmaster	3.43	1.99	1.85	2.50	9.77
ABT 400SCL	3.78	1.84	1.79	2.35	9.77
Surpass	3.54	1.99	1.71	2.45	9.70
5301 IQ	3.55	1.95	1.78	2.40	9.68
WL 232HQ	3.72	2.00	1.60	2.35	9.66
Legacy	3.45	2.03	1.68	2.48	9.64
Ultra	3.56	1.56	1.82	2.59	9.54
Affinity+Z	3.62	1.86	1.75	2.28	9.50
Magnum IV	3.91	1.68	1.67	2.19	9.45
Baralfa 54 IQ	3.65	1.74	1.71	2.31	9.41
5396	3.50	1.81	1.74	2.35	9.40
Arrowhead	3.63	1.96	1.63	2.13	9.35
DK 124	3.46	1.60	1.79	2.48	9.33
Vernema	3.35	1.97	1.80	2.21	9.33
Rhino	3.62	1.74	1.69	2.27	9.33
Archer II	3.33	1.94	1.63	2.41	9.32
ZX 9352	3.48	1.76	1.64	2.39	9.27
ABT 350	3.56	1.76	1.66	2.26	9.25
Winema	3.38	1.96	1.60	2.29	9.22
53V08	3.44	1.95	1.68	2.14	9.21
Ace	3.51	1.65	1.73	2.28	9.18
Agate	3.44	1.86	1.53	2.33	9.15
Robust	3.66	1.66	1.52	2.29	9.14
Vernal	3.79	1.70	1.63	1.95	9.07
Wrangler	3.53	1.65	1.62	2.21	9.02
Monument II	3.28	2.09	1.51	2.13	9.01
ZX 9850	3.07	1.64	1.70	2.40	8.80
WL 325HQ	3.24	1.80	1.54	2.10	8.68
Mean	3.53	1.85	1.69	2.33	9.41
PLSD (0.01)	NS	NS	0.21	0.40	NS
PLSD (0.05)	NS	NS	0.16	0.30	0.71
PLSD (0.10)	NS	NS	0.13	0.25	0.59
CV %	9	15	7	9	5
Prob.	0.2231	0.1489	0.0001	0.0023	0.0171
Harvest Date	6/4	7/13	8/18	10/14	N.A.

Table 6. 2000 yield (ton/acre) summary for the 1998 alfalfa variety trial at Madras, OR.

Variety	1 st Cut yield ton/acre	2 nd Cut yield ton/acre	3 rd Cut yield ton/acre	4 th Cut yield ton/acre	Total yield ton/acre
53V08	3.35	2.77	2.55	1.86	10.53
5396	3.32	2.71	2.34	2.12	10.49
Affinity+Z	3.50	2.79	2.10	2.08	10.46
Arrowhead	3.16	2.66	2.52	1.95	10.28
WL 334 RK	3.17	3.05	2.16	1.79	10.17
Ace	2.90	3.06	2.23	1.94	10.13
Leafmaster	3.17	2.66	2.20	1.97	10.00
ZX 9852	2.81	2.78	2.31	2.03	9.92
Plumas	3.00	2.51	2.45	1.94	9.90
Magnum IV	3.11	2.58	2.18	2.02	9.89
Reno	3.10	2.69	1.93	2.07	9.79
Monument II	3.12	2.66	1.95	2.03	9.76
DK 124	2.95	2.57	1.95	2.28	9.74
Archer II	2.95	2.64	1.97	2.06	9.63
5301 IQ	3.09	2.46	2.12	1.95	9.62
Ultra	3.13	2.60	1.99	1.88	9.61
WL 232HQ	3.14	2.35	2.22	1.87	9.59
ABT 400SCL	2.95	2.62	2.06	1.93	9.56
ZX 9850	2.82	2.54	2.20	1.95	9.51
Baralfa 54 IQ	3.05	2.50	1.88	1.97	9.40
WL 325HQ	2.95	2.47	2.11	1.84	9.37
Legacy	2.91	2.46	2.16	1.83	9.36
ABT 350	3.15	2.51	1.71	1.93	9.29
Vernema	3.10	2.41	1.93	1.83	9.27
Robust	2.70	2.42	2.13	2.02	9.27
Surpass	3.27	2.32	1.77	1.90	9.26
Rhino	2.95	2.52	1.85	1.83	9.15
DK 134	2.86	2.34	2.20	1.71	9.10
Wrangler	3.01	2.29	1.87	1.78	8.95
Vernal	2.99	2.32	1.93	1.68	8.92
Agate	2.97	2.23	1.75	1.72	8.67
Winema	2.54	2.27	2.04	1.81	8.66
Mean	3.04	2.54	2.09	1.92	9.59
PLSD (0.01)	0.34	0.45	NS	NS	0.89
PLSD (0.05)	0.25	0.34	0.45	NS	0.67
PLSD (0.10)	0.21	0.28	0.38	NS	0.56
CV %	6	9	15	12	5
Prob.	0.0001	0.0013	0.0204	0.1665	0.0001
Harvest Date	5/24	7/5	8/9	9/27	N.A.

Table 7. 2001 yield (ton/acre) summary for the 1998 alfalfa variety trial at Madras, OR.

Variety	1 st Cut yield ton/acre	2 nd Cut yield ton/acre	3 rd Cut yield ton/acre	4 th Cut yield ton/acre	Total yield Ton/acre
53V08	2.88	2.77	1.62	1.79	9.06
Arrowhead	3.10	2.44	1.55	1.87	8.97
WL 325HQ	2.93	2.51	1.62	1.78	8.85
5396	3.11	2.55	1.53	1.61	8.80
ABT 350	3.02	2.53	1.63	1.62	8.80
Monument II	3.14	2.61	1.29	1.68	8.73
Robust	2.81	2.48	1.58	1.79	8.65
Magnum IV	3.13	2.33	1.42	1.75	8.63
Archer II	2.84	2.40	1.36	1.99	8.59
WL 232HQ	2.90	2.40	1.45	1.76	8.52
Ace	2.67	2.57	1.40	1.84	8.48
Plumas	2.71	2.48	1.42	1.86	8.48
Baralfa 54 IQ	2.80	2.59	1.39	1.70	8.47
Affinity+Z	2.96	2.41	1.31	1.78	8.46
Rhino	2.94	2.34	1.34	1.81	8.43
ZX 9852	2.72	2.46	1.36	1.84	8.37
ZX 9850	2.59	2.42	1.42	1.91	8.34
5301 IQ	2.70	2.30	1.44	1.86	8.30
Surpass	2.84	2.31	1.28	1.86	8.28
DK 124	2.63	3.32	1.45	1.84	8.25
Ultra	2.72	2.37	1.35	1.75	8.18
Leafmaster	2.77	2.19	1.33	1.80	8.17
ABT 400SCL	2.52	2.29	1.39	1.85	8.05
Vernema	2.42	2.49	1.39	1.73	8.03
DK 134	2.70	2.13	1.37	1.79	8.00
Legacy	2.61	2.27	1.19	1.84	7.91
Agate	2.68	2.21	1.40	1.48	7.77
Reno	2.45	2.22	1.34	1.76	7.76
Wrangler	2.77	2.13	1.22	1.62	7.75
Vernal	2.83	2.17	1.22	1.34	7.57
WL 334 RK	2.53	1.99	1.27	1.67	7.46
Winema	2.39	1.94	1.21	1.49	7.03
Mean	2.78	2.36	1.39	1.75	8.29
PLSD (0.01)	0.53	0.34	NS	0.33	0.86
PLSD (0.05)	0.40	0.26	NS	0.24	0.65
PLSD (0.10)	0.34	0.21	0.23	0.20	0.54
CV %	10	8	14	10	6
Prob.	0.0051	0.0001	0.0768	0.0007	0.0001
Harvest Date	5/31	7/11	8/13	10/15	N.A.

Table 8. 2002 yield (ton/acre) summary for the 1998 alfalfa variety trial at Madras, OR.

Variety	1 st Cut Yield ton/acre	2 nd Cut Yield ton/acre	3 rd Cut Yield ton/acre	4 th Cut Yield ton/acre	Total Yield Ton/acre
Archer II	2.83	1.88	1.99	2.12	8.81
Arrowhead	3.14	1.99	1.82	1.79	8.75
5396	3.19	1.94	1.80	1.74	8.68
53V08	3.16	1.86	1.72	1.86	8.59
WL 325HQ	3.17	1.79	1.79	1.78	8.54
Monument II	3.07	1.86	1.76	1.65	8.33
Surpass	2.90	1.83	1.79	1.73	8.25
ZX 9852	2.56	1.84	1.86	1.97	8.23
Magnum IV	3.07	1.76	1.71	1.70	8.21
Robust	2.66	1.76	1.77	1.95	8.15
Affinity+Z	2.84	1.75	1.67	1.87	8.12
Rhino	2.77	1.69	1.77	1.80	8.04
ABT 350	2.87	1.72	1.78	1.63	8.00
Ultra	2.49	1.74	1.76	2.00	7.99
ZX 9850	2.79	1.83	1.79	1.57	7.98
Plumas	2.47	1.66	1.76	1.97	7.86
Ace	2.43	1.81	1.78	1.83	7.85
Agate	2.77	1.69	1.67	1.72	7.85
Wrangler	2.79	1.57	1.69	1.82	7.85
Reno	2.60	1.61	1.69	1.86	7.76
WL 232HQ	2.72	1.71	1.77	1.53	7.73
ABT 400SCL	2.32	1.66	1.68	1.95	7.61
Leafmaster	2.37	1.54	1.62	1.99	7.52
DK 134	2.42	1.62	1.57	1.85	7.46
DK 124	2.37	1.65	1.76	1.54	7.32
Vernema	2.46	1.67	1.60	1.58	7.31
Baralfa 54 IQ	2.38	1.66	1.72	1.52	7.28
Vernal	2.55	1.61	1.47	1.52	7.15
5301 IQ	2.52	1.55	1.63	1.66	7.09
Winema	2.18	1.55	1.50	1.79	7.01
Legacy	2.16	1.50	1.50	1.80	6.96
WL 334 RK	2.07	1.45	1.41	1.84	6.77
Mean	2.65	1.71	1.71	1.78	7.85
PLSD (0.01)	0.56	0.30	NS	NS	0.96
PLSD (0.05)	0.42	0.23	0.61	NS	0.73
PLSD (0.10)	0.35	0.19	0.35	NS	0.61
CV %	11.3	9.4	11.1	17.0	6.6
Prob.	0.0001	0.0002	0.0362	0.3251	0.0001

Harvest Date	6/3	7/3	8/7	10/8	N.A.
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Table 9. Relative yield (percent) comparison, for the annual and total yield means, and total yield compared to 'Vernal', for the alfalfa varieties tested at Madras, OR.

Variety	1999 yield (% of mean)	2000 yield (% of mean)	2001 yield (% of mean)	2002 yield (% of mean)	Total yield (% of mean)	Total yield (% of Vernal)
53V08	97.9	109.8	109.2	109.4	106.5	114.3
5396	99.9	109.4	106.2	110.6	106.4	114.2
Arrowhead	99.4	107.2	108.2	111.5	106.4	114.2
Affinity+Z	101.0	109.1	102.0	103.4	104.1	111.7
Plumas	112.6	103.2	102.3	100.1	103.4	111.3
Archer II	98.5	100.4	106.3	112.2	103.4	111.0
Magnum IV	100.4	103.1	104.1	104.6	103.0	110.6
ZX 9852	99.0	103.4	103.6	104.8	102.1	109.6
Monument II	95.7	101.8	105.3	106.1	102.0	109.5
Surpass	103.1	96.6	99.9	105.1	101.1	108.5
WL 232HQ	102.7	100.0	102.8	98.5	101.1	108.5
WL 325HQ	92.2	97.7	106.8	108.8	100.9	108.3
ABT 350	98.3	96.9	106.2	101.9	100.6	108.0
Ultra	101.4	99.5	98.7	101.8	100.5	108.0
Robust	97.1	95.3	104.3	103.8	100.3	107.6
Ace	97.6	104.6	102.3	100.0	100.2	107.6
Reno	103.8	102.1	93.6	98.9	99.9	107.3
Leafmaster	103.8	104.3	98.6	95.8	99.9	107.2
ABT400SCL	103.8	99.7	97.1	96.9	99.7	107.0
Rhino	99.1	95.4	101.7	102.4	99.5	106.8
5301 IQ	102.9	100.3	100.1	90.3	98.8	106.1
DK 124	99.1	101.6	99.5	93.2	98.7	105.9
ZX 9850	93.5	99.2	100.6	101.7	98.7	105.9
DK 134	106.9	94.9	96.5	95.0	98.6	105.8
Baralfa 54IQ	100.0	98.0	102.2	92.3	98.4	105.7
WL 334 RK	104.6	106.0	90.0	86.2	97.5	104.7
Vernema	99.1	96.7	96.9	93.1	96.7	103.4
Legacy	102.4	97.6	95.4	88.7	96.5	103.5
Wrangler	95.9	93.3	93.5	100.0	95.6	102.6
Agate	97.2	90.7	93.7	100.0	95.2	102.2
Vernal	96.4	93.0	91.3	91.1	93.2	100.0
Winema	97.9	90.3	84.8	89.3	90.9	97.6
Mean	100.0	100.0	100.0	100.0	100.0	107.3