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## Irrigated Alfalfa Variety Performance, 2002-2004; North Logan, Utah

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This report summarizes production of alfalfa varieties during three years at the Utah Agricultural Experiment Station Greenville Farm at N. Logan (Cache Co.). This site is at an elevation of 4600 ft and averages 4587 growing degree days (base 40° F) per year. Alfalfa cultivars were from breeding programs and seed marketers, plus Vernal and Vernema as check varieties for comparisons with newer genotypes. Fall dormancy (FD) ratings were 2 to 6, and predominantly 4 (Table 1). Additional background on FD and pest- and disease-resistance ratings, breeding histories, release date, performance at other locations, and marketers may be found on Web sites of the National Alfalfa Alliance ([www.alfalfa.org](http://www.alfalfa.org)) and the North American Alfalfa Improvement Conference ([www.naaic.org](http://www.naaic.org)). The NAAIC Web site also lists Winter Survival Index ratings for some varieties under alfalfa trial results from Minnesota and Wisconsin.

Entries were drill-seeded at 18 lb bulk seed/ac into Millville silt loam on August 22, 2001, in a randomized complete block design with five replications. Each 3- by 20-ft plot had five rows spaced 6 in apart, with a 1-ft gap between adjacent plots. Plots were sprinkle-irrigated at approximately 10-day intervals according to soil water content and evaporative demand in 2003-2004, but inadequate irrigation volume in 2002 limited production. Initial soil test levels in the surface foot were pH 7.9, 2.4% organic matter, and 19, 153, and 3 ppm P, K, and SO<sub>4</sub>-S, respectively. While P and K were at adequate levels for high alfalfa yields, S was not.



Sulfur was applied at establishment to raise the soil SO<sub>4</sub>-S level to 10 ppm. Maintenance applications of 80 lb of P<sub>2</sub>O<sub>5</sub> and 100 lb of K<sub>2</sub>O/ac in September-October, 2002, plus 150 lb of P<sub>2</sub>O<sub>5</sub>, 100 lb of K<sub>2</sub>O, and 17 lb of S/ac in July, 2003 were made in accordance with soil test results. Soil test levels at the end of the trial were 11, 62, and 3 ppm P, K, and SO<sub>4</sub>-S, respectively. These are all low levels and underscore the high nutrient removal rates of productive alfalfa stands. Recommended application rates to offset these deficiencies are 100-150 lb of P<sub>2</sub>O<sub>5</sub>, 140-180 lb of K<sub>2</sub>O, and 10-20 lb of S/ac. Few weeds and insect pests were present during 2002-2004 except for some alfalfa weevil and associated feeding damage in first or second harvests. Herbicides and insecticides were not used, with the exception of spot-treatment of a few

patches of field bindweed with glyphosate during establishment in September, 2001.

Plots were harvested three times in 2002 and four times annually in 2003-2004, at early-bud to early-bloom stages (average of mid-bud) with a Carter flail harvester. Harvesting was avoided during the 4-6 week window prior to killing frost, to promote accumulation of root reserves for winter survival. A fifth cutting was harvested after killing frost in November, 2004. Fresh weight of forage above a 3-in stubble was obtained from each plot and an approximately 0.5-lb subsample was used to determine dry matter (DM) concentration by oven drying at 55° C (131° F). Plot management and harvest timing simulated commercial practices as much as possible, except that hay was not windrowed, dried, and baled on the plots. Plots therefore received less machinery traffic than would occur under most commercial conditions. Small-plot oven-dry alfalfa yield is perhaps 10-15% higher than air-dry weight of hay from commercial harvesting and baling of the same material. The usual DM losses from respiration during drying in the windrow, machinery traffic, and leaf shatter from mechanical handling are not encountered in small-plot trials.

Variety means in Table 1 are ranked in decreasing order of mean annual DM production for the 3 years of the trial (excluding fifth harvest). Distribution of total DM production among four annual cuttings, averaged across 2003-2004 (and range among years) was 34% (31-36%) in first cutting, 21% (no variation) in second, 24% (21-27%) in third, and 21% (21-22%) in fourth. A fifth cutting in late November, 2004, added 0.13-0.74 ton DM/ac (mean of 0.41 ton/ac) to seasonal production (6% of 5-harvest season-total DM production). Not surprisingly, the entry with highest production in the fifth cutting was the least fall-dormant (FD 6).

Varieties may be compared in terms of the least significant difference (LSD). This is the minimum difference required between entries in a column for significance at a given level of confidence. Values of LSD are shown for 5% and 30% probabilities that observed differences among entries are merely due to chance, rather than to real variety effects. For example, in Table 1, 3-year mean DM production (excluding fifth harvest) of the top 19 varieties is not different at the 5% probability level, because it varies by less than the LSD of 0.55 ton/ac. Production of the first- and twentieth-ranked entries differs at the 5% probability level, because it varies by at least the

LSD. At 30% probability that yield variations are due to chance, smaller differences become significant. The coefficient of variation (CV) describes variation among replications of the same variety; values below 10% suggest good precision for detecting entry differences.

Averaged over 3 years (excluding fifth harvest), annual forage production differed by 1.2 tons DM/ac between top and bottom entries. Varieties with FD 4 and 5 were spread throughout the yield rankings, indicating a wide range of performance potential within these dormancy classes. Annual yields peaked in the second harvest year, then tapered by approximately 1.6 tons DM/ac between second and third years. Yield rankings in a particular year do not necessarily reflect the rankings of 3-year means, confirming that selection of high-performing varieties should be based on data from multiple years.

The public cultivar Vernal, released in 1953 with some resistance to bacterial wilt, Fusarium wilt, stem nematode, and root-knot nematode, was near the bottom of the trial. The public cultivar Vernema, released in 1983 with some resistance to bacterial wilt, anthracnose, Verticillium wilt, and stem nematode, ranked near the top of the trial. Compared to Vernema and Vernal, other varieties in the trial have broader packages and higher levels of resistance to many of the previously-mentioned alfalfa pests and diseases, plus Phytophthora root rot, that are common in Utah. Stands of these varieties are therefore likely to persist longer than those of older or non-certified varieties where disease and pest resistance characteristics are lacking or unknown.

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Table 1. Alfalfa cultivars ranked by 3-year mean annual dry matter (DM) production at N. Logan, UT. Plots were cut three times in 2002 and four times annually in 2003-2004, at early-bud to early-bloom stages. Plots were seeded at 18 lb bulk seed/ac on August 22, 2001.

Entry (cultivar)	Fall dormancy <sup>a</sup>	Season-total DM production				
		2002 <sup>b</sup>	2003	2004	3-yr mean <sup>c</sup>	
					w/ 5th 2004	w/o 5th 2004
----- Tons DM/ac -----						
WL 342	4	4.96	9.26	7.83	7.38	<b>7.23</b>
Endurance	4	5.43	8.97	7.20	7.05	<b>7.19</b>
Ruccus	5	4.61	9.34	7.50	7.29	<b>7.14</b>
Cimmaron 3i	4	5.13	8.90	7.30	7.28	<b>7.12</b>
Hayday	4	4.73	9.29	7.80	7.62	<b>7.06</b>
Vernema, cert.	4	5.48	9.22	6.60	7.18	<b>7.03</b>
54Q53	4	4.59	9.67	7.31	7.11	<b>6.99</b>
ZX9453	5	4.75	9.04	7.80	6.99	<b>6.96</b>
Magnum V	4	4.43	9.13	7.93	6.99	<b>6.96</b>
Select	4	5.21	8.82	7.30	7.12	<b>6.93</b>
GS 9723	6	4.77	9.16	7.03	6.44	<b>6.89</b>
Reward II	4	4.17	9.18	7.44	7.10	<b>6.84</b>
HybriForce-400	4	4.28	9.41	7.35	7.11	<b>6.80</b>
WinterGold	4	4.87	8.57	7.39	6.90	<b>6.77</b>
Archer II	5	4.56	8.73	7.35	6.81	<b>6.76</b>
Payday	4	4.92	8.48	6.56	6.65	<b>6.73</b>
3R134	4	4.82	8.29	7.68	6.86	<b>6.71</b>
GP01VL4	4	4.49	8.80	7.32	6.78	<b>6.70</b>
Goliath	4	4.99	8.52	6.57	6.57	<b>6.70</b>
WL 327	4	4.11	8.84	7.41	6.81	<b>6.68</b>
Stamina	4	5.11	8.09	6.51	6.59	<b>6.50</b>
Vernal, cert.	2	4.93	8.35	6.18	6.37	<b>6.49</b>
Multi 777	4	4.29	8.04	7.02	6.60	<b>6.26</b>
Ameristand 403T	4	5.14	7.78	6.58	6.53	<b>6.24</b>
Plumas	4	3.98	8.06	6.39	6.13	<b>6.01</b>
Mean		4.82	8.76	7.12	6.92	<b>6.78</b>
Significance of F test (P)		0.52	<0.01	<0.01	0.04	<0.01
LSD (0.05)		NS <sup>d</sup>	0.70	0.58	0.68	0.55
LSD (0.30)		NS	0.37	0.30	0.35	0.29
CV (%)		15.5	5.9	5.5	5.2	5.3

<sup>a</sup>Fall dormancy ratings relate height of fall regrowth following a late summer cutting to heights of standard check cultivars, and range from 1 (extremely fall-dormant) to 11 (extremely non-dormant).

<sup>b</sup>Irrigation was insufficient in 2002 and adequate in 2003-04. Application in 2004 was 22 in.

<sup>c</sup>Season-total means are calculated over 3 yr, with and without data from the 5th harvest of 2004. Due to missing data from Harvest 1, 2002 and Harvest 5, 2004, 3-yr means are based on more replicates if 5th harvest data are excluded, as shown in bold.

<sup>d</sup>NS: no significant (P>0.05) differences among cultivars within a column.