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## Cultivar Test in South Dakota, 1991 Report: Alfalfa Yields

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**CULTIVAR TESTS  
IN SOUTH DAKOTA,  
1991 REPORT:**

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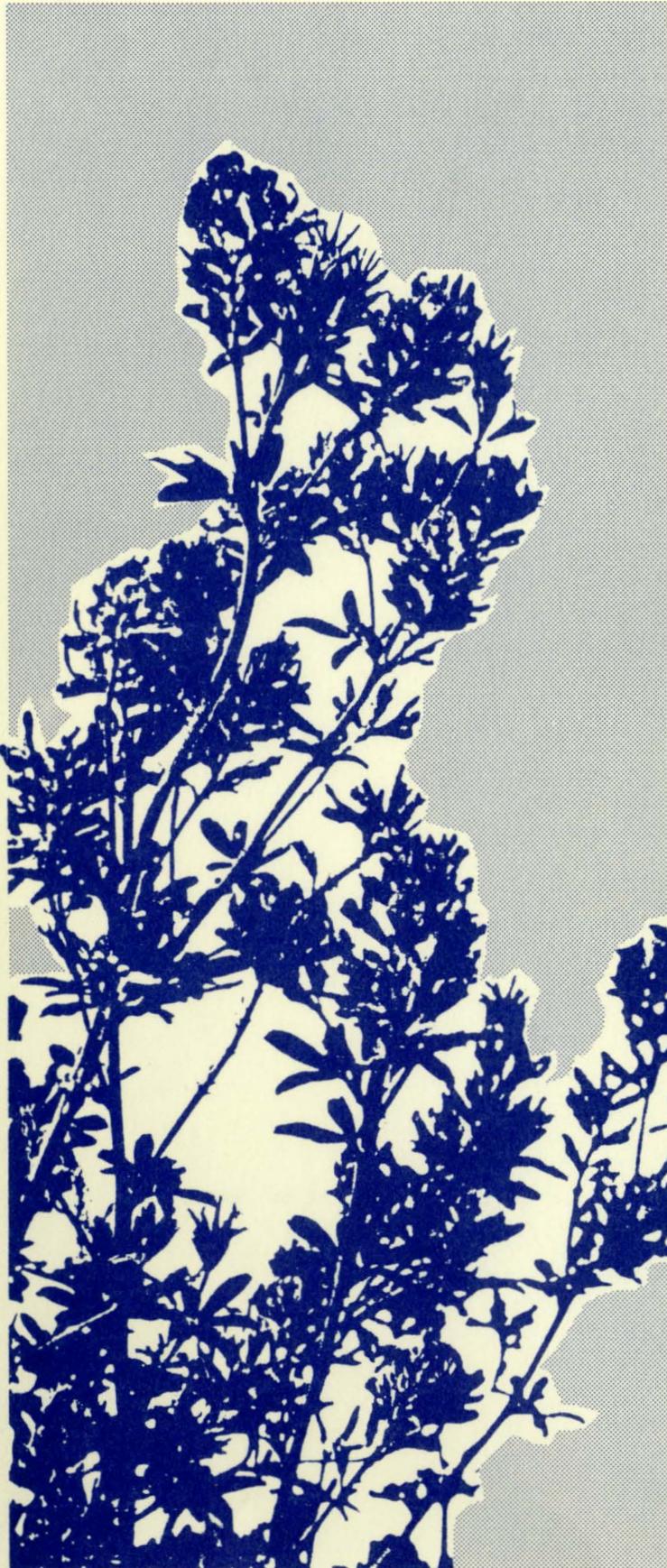
# **ALFALFA YIELDS**

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**Agricultural Experiment Station  
South Dakota State University  
U.S. Department of Agriculture**

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## CULTIVAR TESTS IN SOUTH DAKOTA, 1991 REPORT:

## ALFALFA YIELDS

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Plant Science Department  
South Dakota State University



Public and commercial breeding programs produce new alfalfa cultivars for the market every year. Selecting the proper cultivar for your situation is no easy task, and you should have yield information from several South Dakota locations to make a proper choice. From the SDSU Alfalfa Cultivar Yield Tests you can compare the critical forage production characteristics—yield, winterhardiness, and disease resistance—for available cultivars and experimental lines at several locations in South Dakota.

### Materials and Methods

Alfalfa experiments were established in 1989 at the Southeast Research Station (Beresford) and the Central Crops and Soils Research Station (Highmore) and in 1988 and 1990 at the Northeast Research Station (Watertown) and the SDSU Research Station (Brookings).

Alfalfa was planted between mid-April and late-May into a firmly packed seedbed using a five-row planter with 6-inch row spacings. Seeding rate in 1988 and 1989 was 12 lb pure live seed (PLS) per acre and in 1990 was 15 lb PLS per acre. A preplant herbi-

cide (Eptam at 3 lb active ingredient per acre) was used for weed control during alfalfa establishment. The experimental design was a randomized complete block with four replicates. Each experimental unit consisted of a 75-ft<sup>2</sup> (3 ft x 25 ft) plot. Plots were fertilized after planting with 50 lb P<sub>2</sub>O<sub>5</sub> per acre or in accordance with SDSU soil test results for growth periods after the seeding year. Insect pests did not reach problem levels, so chemical control was not used.

Harvesting was done with one of two flail-type forage plot harvesters with a harvest area of either 44 or 66 ft<sup>2</sup> per plot. Fresh herbage weights were obtained for each plot immediately following herbage removal. Moisture samples were randomly taken from half of the entries in each replicate, dried at 100° F for 72 hours in a forced-air oven, and weighed to determine dry-matter (DM) concentration. Mean DM concentrations for each replicate were multiplied by fresh herbage weights for each experimental unit and then divided by harvest area to obtain forage DM production per unit area of harvest. Data were converted into tons of dry matter per acre (tons DM/A).

Data were subjected to analysis of variance, and DM yield differ-

ences among cultivars were tested by the least significant difference (LSD) procedure at the 0.05 level of probability. Relative performance among cultivars was calculated by dividing average total seasonal yield over years by the mean forage yield of a given location.

Alfalfa cultivars were evaluated for stage of maturity at time of harvest for the Brookings experiments. Ten shoots randomly selected from each plot were rated for maturity according to the Kalu and Fick (1983, *Crop Science* 23:1167-1172) mean-stage-by-count scheme (Table 1).

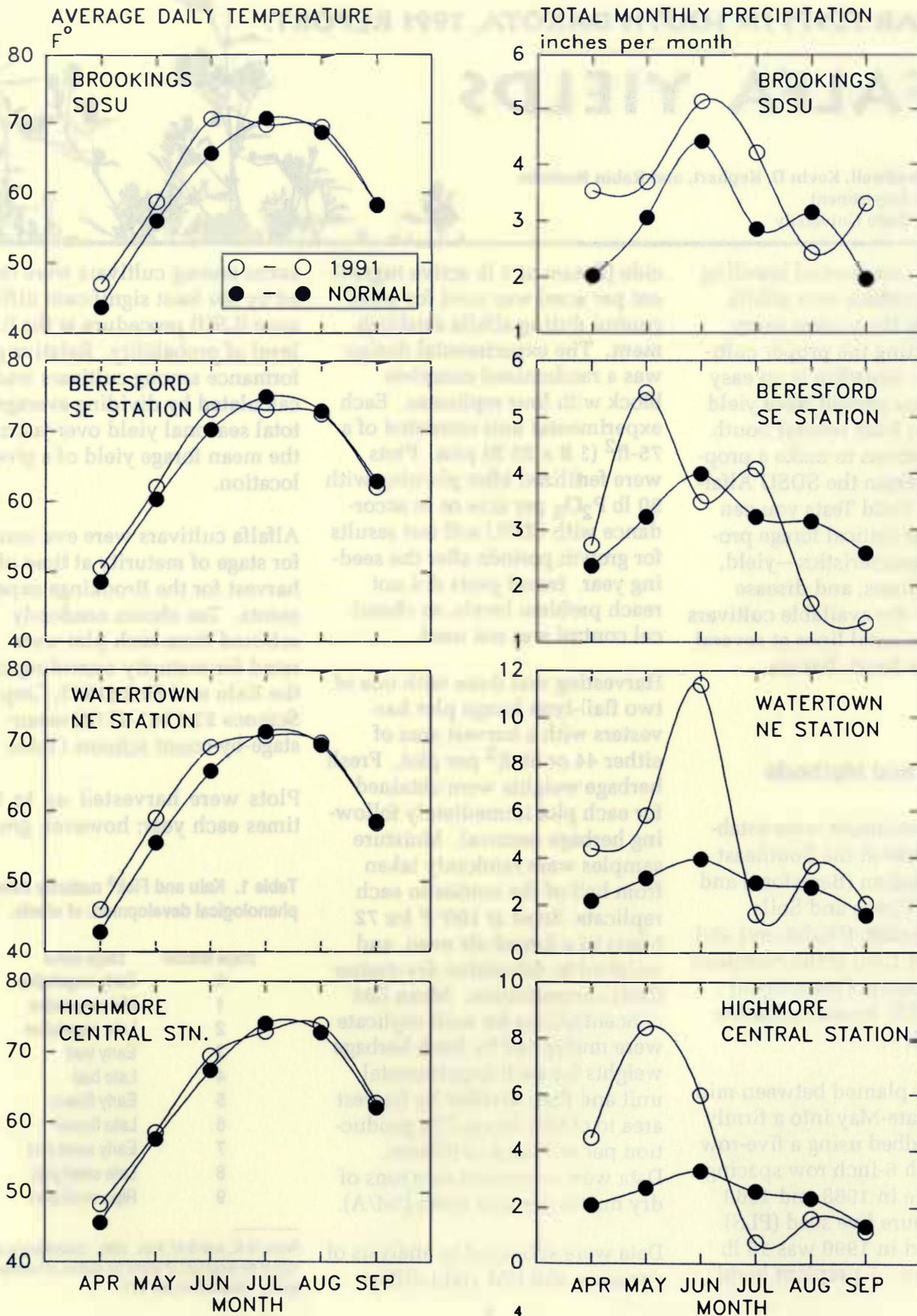
Plots were harvested up to four times each year; however, growth

**Table 1. Kalu and Fick<sup>a</sup> maturity index for phenological development of alfalfa.**

Stage number	Stage name
0	Early vegetative
1	Mid-vegetative
2	Late vegetative
3	Early bud
4	Late bud
5	Early flower
6	Late flower
7	Early seed pod
8	Late seed pod
9	Ripe seed pod

<sup>a</sup>Kalu, B.A., and G.W. Fick. 1983. Quantifying morphological development of alfalfa for studies of herbage quality. *Crop Sci.* 21:267-271.

**Fig 1. Average daily temperature and total monthly precipitation during the 1991 growing season for four alfalfa cultivar test locations in South Dakota.**



conditions at some locations often limited harvest frequencies.

### Southeast Research Station, Beresford, 1991 Results

Average daily temperatures were above normal during April, May, and June and were near normal throughout the remaining growing season (Fig 1). Precipitation was above normal in April, May, and July and below normal in June, August, and September. Beresford received only about 3 inches of precipitation during August and September, less than half the normal amount.

Three harvests were obtained from the 1989-planted plots. Average total DM yield was 4.19 T/A; no significant differences were detected among the 40 entries (Table 2).

Average yield for the first harvest was 2.10 T/A, the highest yield of the three 1991 harvests and probably due to above-normal precipitation during April and May. Average yields for the second and third harvests were 1.14 and 0.95 T/A, respectively, lower probably because of limited precipitation in June and July.

Next year's productivity will depend upon precipitation during winter and early spring. If adequate precipitation does not occur, alfalfa growth in the spring will be retarded, the first harvest may be delayed, and yields may be low.

Two-year average yield for this experiment was 4.33 T/A, with no significant differences among cultivars, despite a yield difference of 1.2 T/A between the top

**Table 2. Forage yield of 40 alfalfa cultivars planted April 20, 1989, at the Southeastern Research Station, Beresford, South Dakota.**

Cultivar	1989	1990	1991			2-Year Avg. <sup>a</sup>	Relative Performance <sup>b</sup> — % —	
	1-Cut Total	3-Cut Total	Cut 1 6/3	Cut 2 7/1	Cut 3 8/6			
	tons DM/acre							
Centurion	1.31	4.76	2.40	1.46	1.29	5.15	4.96	114
Flint	1.30	4.80	2.25	1.37	1.28	4.90	4.85	112
Arrow	1.21	4.77	2.27	1.39	1.16	4.83	4.80	111
Sure	1.28	4.98	2.31	1.24	1.05	4.59	4.79	111
DK-125	1.42	4.75	2.25	1.22	1.13	4.60	4.68	108
Garst 636	1.19	4.76	2.20	1.26	1.04	4.50	4.63	107
SDHL1 <sup>c</sup>	0.94	4.70	2.24	1.18	1.04	4.45	4.58	106
DK-135	1.10	4.58	2.14	1.26	1.07	4.47	4.52	104
Multi-plier	1.25	4.78	2.08	1.17	1.02	4.27	4.52	104
FSRC 88S <sup>c</sup>	1.19	4.70	1.98	1.26	1.10	4.34	4.52	104
5262	1.08	4.50	2.06	1.31	1.17	4.53	4.51	104
Victory	1.22	4.47	2.18	1.26	1.10	4.53	4.50	104
Majestic	1.20	4.62	2.24	1.14	0.99	4.36	4.49	104
VIP	0.90	4.56	2.06	1.26	1.05	4.37	4.47	103
Action	1.19	4.56	2.26	1.12	0.89	4.27	4.42	102
Aggressor	1.08	4.52	2.14	1.20	0.95	4.29	4.41	102
526	1.06	4.60	2.13	1.12	0.90	4.14	4.37	101
VS-775 <sup>c</sup>	1.17	4.67	2.05	1.08	0.93	4.06	4.37	101
Garst 630	1.06	4.41	2.05	1.19	0.99	4.23	4.32	100
Vernal	1.07	4.54	2.06	1.08	0.94	4.08	4.31	99
WL 225	1.20	4.43	2.15	1.07	0.95	4.17	4.30	99
Saranac AR	1.14	4.38	2.18	1.11	0.91	4.20	4.29	99
Clipper	1.33	4.47	2.18	0.97	0.86	4.01	4.24	98
WL 317	1.19	4.37	2.06	1.12	0.92	4.09	4.23	98
Allegiance	0.88	4.27	2.05	1.18	0.94	4.17	4.22	97
Dart	1.19	4.52	2.11	1.02	0.78	3.91	4.21	97
Trident II	1.17	4.36	2.09	1.11	0.87	4.06	4.21	97
Chief	1.00	4.29	2.00	1.18	0.93	4.12	4.20	97
Apollo Supreme	0.93	4.24	2.11	1.12	0.91	4.14	4.19	97
5472	1.12	4.24	1.94	1.18	1.00	4.11	4.18	96
Legend	1.10	4.23	2.13	0.98	0.85	3.96	4.09	95
Pacesetter	1.22	4.49	2.02	0.90	0.77	3.68	4.08	94
Cimarron VR	1.02	4.24	2.06	1.04	0.82	3.92	4.08	94
Royalty	1.18	4.29	1.97	1.01	0.84	3.82	4.06	94
Dawn	1.07	4.26	1.94	1.04	0.82	3.80	4.03	93
WL 320	1.03	4.23	1.95	1.02	0.85	3.81	4.02	93
Ultra	1.07	4.11	2.06	0.97	0.77	3.79	3.95	91
H-174 <sup>c</sup>	1.06	4.02	1.80	1.08	0.88	3.76	3.89	90
SDHS6 <sup>c</sup>	1.04	4.16	1.98	0.91	0.71	3.60	3.88	90
Sabre	1.13	3.95	1.98	0.90	0.75	3.63	3.79	88
AVERAGE	1.13	4.46	2.10	1.14	0.95	4.19	4.33	
Maturity <sup>d</sup>			5.0	4.2	4.9			
LSD(0.05) <sup>e</sup>	NS	NS	NS	NS	NS	NS	NS	

<sup>a</sup> Two year average based on total yields for post-establishment years, 1990 and 1991.

<sup>b</sup> % Relative Performance = ratio of cultivar 2-yr average yield to 2-yr average yield of all cultivars.

<sup>c</sup> Experimental line, not currently marketed.

<sup>d</sup> Average harvest maturity. Value based on Kalu and Fick (1983) mean-stage-by-count index.

<sup>e</sup> NS= Means among cultivars not significantly different at the 0.05 level of probability.

**Table 3. Forage yield of 28 alfalfa cultivars planted April 20, 1988, at the SDSU Research Station, Brookings, South Dakota.**

Cultivar	1988	1989	1990	1991				3-Year Avg. <sup>a</sup>	Relative Performance <sup>b</sup> — % —	
	1-Cut Total	3-Cut Total	3-Cut Total	Cut 1 5/30	Cut 2 6/28	Cut 3 7/26	Cut 4 9/4			4-Cut Total
tons DM / acre										
526	0.76	3.58	4.19	1.91	1.36	1.34	1.06	5.66	4.48	106
Big 10	0.78	3.30	4.38	2.06	1.22	1.20	1.14	5.61	4.43	105
Vector	0.78	3.57	4.08	1.85	1.26	1.30	1.17	5.57	4.41	104
5432	0.87	3.36	4.24	2.00	1.25	1.27	1.07	5.58	4.39	104
Allegiance	0.66	3.04	4.05	2.04	1.38	1.41	1.15	5.97	4.35	103
Magnum +	0.68	3.44	4.13	1.77	1.23	1.42	1.05	5.47	4.35	103
5262	0.57	3.19	4.08	1.99	1.29	1.37	1.04	5.68	4.32	102
FSRC 87N3 <sup>c</sup>	0.77	3.30	4.02	1.88	1.26	1.31	1.18	5.64	4.32	102
Magnum III	0.72	3.07	4.12	1.88	1.36	1.32	1.19	5.74	4.31	102
Kingstar	0.76	3.12	4.06	1.88	1.37	1.38	1.13	5.76	4.31	102
Cimarron	0.87	3.32	4.18	1.85	1.23	1.22	1.10	5.41	4.30	102
FSRC 87M1 <sup>c</sup>	0.85	3.10	4.23	1.95	1.24	1.28	1.10	5.57	4.30	102
Arrow	0.74	2.94	4.16	2.01	1.41	1.36	0.99	5.77	4.29	101
SX 217	0.78	3.36	4.19	1.68	1.22	1.20	1.19	5.30	4.28	101
Vernal	0.78	3.28	4.36	1.75	1.24	1.11	1.09	5.19	4.27	101
AP 8620 <sup>c</sup>	0.70	3.24	4.14	1.90	1.32	1.19	0.96	5.38	4.25	101
Sure	0.72	3.27	4.22	1.84	1.14	1.26	0.98	5.22	4.24	100
120	0.72	3.27	4.20	1.88	1.29	1.13	0.91	5.21	4.23	100
Chief	0.79	3.08	4.09	1.88	1.27	1.27	1.04	5.46	4.21	100
Dart	0.69	3.13	3.94	1.91	1.23	1.25	1.04	5.43	4.16	98
FSRC 87N1 <sup>c</sup>	0.77	3.06	3.98	1.86	1.21	1.20	1.06	5.33	4.12	97
DK-125	0.85	2.76	4.15	1.94	1.24	1.18	1.06	5.41	4.11	97
AP 8631 <sup>c</sup>	0.68	2.79	3.92	1.84	1.38	1.35	0.98	5.53	4.08	96
WL 225	0.66	2.68	4.16	1.86	1.27	1.24	0.99	5.35	4.06	96
Premier	0.66	2.83	3.82	1.90	1.37	1.33	0.92	5.52	4.06	96
MTON82 <sup>c</sup>	0.75	3.56	4.35	1.53	1.01	0.84	0.76	4.13	4.01	95
WL 320	0.71	2.72	3.65	1.78	1.30	1.35	1.05	5.48	3.95	93
SX 424	0.62	2.48	3.82	1.89	1.26	1.27	1.09	5.49	3.93	93
AVERAGE	0.74	3.14	4.10	1.87	1.27	1.26	1.05	5.46	4.23	
LSD(0.05) <sup>d</sup>	NS	NS	NS	0.18	0.13	0.17	NS	0.49	NS	

<sup>a</sup> Three year average based on post-establishment year yields, 1989, 1990, and 1991.  
<sup>b</sup> % Relative Performance = ratio of cultivar 3-yr average to 3-yr average of all cultivars.  
<sup>c</sup> Experimental line, not currently marketed.  
<sup>d</sup> NS = Means among cultivars not significantly different at the 0.05 level of probability.

and bottom cultivars. Apparently, environmental variation was large enough in this experiment to prevent detection of significant cultivar differences.

Another experiment of 36 cultivars was planted in 1991. Plots became well established because of above-normal precipitation during April and May. Plots were clipped on July 1 and August 6 to control weeds, but no yield data were taken from these clippings. After the last clipping, there was not enough regrowth to warrant another harvest in 1991.

### SDSU Research Station, Brookings, 1991 Results

Average daily temperatures were above normal during April, May, and June and near normal for the remainder of the growing season (Fig 1). Precipitation was above normal for every month during the growing season except for August, when precipitation was slightly below normal.

The 1988 planting produced four harvests with average total yield of 5.46 T/A. There were some significant cultivar differences (Table 3).

Yields in 1991 were over 1 T/A higher than those of 1990 and over 2 T/A higher than in 1989. This is probably because abundant rainfall permitted four harvests in 1991, compared to three harvests in both 1989 and 1990.

Three-year average yields ranged from 3.93 to 4.48 T/A with no significant cultivar differences. Cultivars showed significant dif-

ferences in maturity at the second and third harvests of 1991 (Table 4). No differences in maturity were detected for either the first or fourth harvest. The relevance of significant cultivar differences for maturity is probably greater for forage quality characteristics than for yield.

Three harvests were obtained from the 1990 planting. Three-cut average total yields ranged from 4.29 to 5.81 T/A (Table 5). This was the first full production year for this experiment.

There were significant cultivar differences for each cutting. This may be due to the fact that a third of the entries in this experiment were experimental lines, and, as shown in Table 5, there was a wider variation in productivity among these lines than among marketed varieties. As in the 1988 experiment, cultivars showed significant differences in maturity only for the second and third harvests (Table 6).

### Northeast Research Station, Watertown, 1991 Results

Average daily temperatures were above normal during April, May, and June and near normal during the remainder of the growing season (Fig 1). Precipitation was well above normal during April, May, and June, slightly below normal in July, and slightly above normal in August and September.

Four harvests were obtained from the study planted in 1988. Total seasonal yields ranged from 5.23 to 7.78 T/A (Table 7).

**Table 4. Maturity<sup>a</sup> of 28 cultivars planted April 20, 1988, at the SDSU Research Station, Brookings, South Dakota.**

Cultivar	1988		1989		1990			1991			
	Cut 1 7/12	Cut 1 6/6	Cut 2 7/16	Cut 3 8/23	Cut 1 6/5	Cut 2 7/13	Cut 3 8/29	Cut 1 5/28	Cut 2 6/27	Cut 3 7/25	Cut 4 9/4
526	3.93	3.50	4.95	4.03	3.15	5.05	5.00	3.48	3.43	3.80	4.45
5262	3.75	3.65	4.65	3.98	3.25	5.13	5.03	3.48	3.40	3.58	4.28
5432	4.05	3.58	4.98	4.08	3.33	5.23	4.95	3.55	3.55	3.65	4.50
Allegiance	4.05	3.63	4.88	4.03	3.38	5.23	5.13	3.65	3.65	3.60	4.55
AP 8631 <sup>b</sup>	4.43	3.45	4.73	3.98	3.20	5.65	5.03	3.58	3.65	3.63	4.38
AP 8620 <sup>b</sup>	4.00	3.73	4.53	4.03	3.45	5.23	4.93	3.55	3.53	3.58	4.53
Arrow	4.35	3.80	4.53	4.08	3.50	5.58	5.20	3.55	3.55	3.60	4.55
Big 10	4.30	3.78	4.70	3.98	3.25	5.15	4.93	3.45	3.55	3.65	4.48
Chief	3.93	3.53	4.85	3.98	3.18	5.18	5.10	3.55	3.55	3.73	4.53
Cimarron	4.05	3.95	4.78	4.03	3.30	5.18	5.10	3.38	3.45	3.60	4.48
Dart	4.20	3.30	4.73	4.03	3.28	5.23	5.25	3.55	3.45	3.65	4.58
120	4.00	3.48	4.78	4.05	3.03	5.30	5.00	3.55	3.30	3.55	4.35
DK-125	4.28	3.55	4.85	4.08	3.55	5.60	4.93	3.70	3.38	3.60	4.68
FSRC 87N1 <sup>b</sup>	4.30	3.80	4.83	4.05	3.43	5.28	4.88	3.55	3.25	3.55	4.65
FSRC 87N3 <sup>b</sup>	4.33	3.70	4.68	4.10	3.15	5.38	4.93	3.58	3.63	3.70	4.48
FSRC 87M1 <sup>b</sup>	4.18	3.45	4.65	4.08	3.18	5.25	4.93	3.28	3.50	3.45	4.53
Kingstar	4.18	3.55	4.68	3.98	3.43	4.93	4.80	3.38	3.23	3.45	4.55
Magnum III	4.35	3.50	4.78	4.03	3.10	5.03	4.93	3.68	3.30	3.55	4.45
Magnum +	3.93	3.85	4.70	4.03	3.08	4.85	4.90	3.43	3.43	3.63	4.43
MTO N82 <sup>b</sup>	3.98	3.75	4.53	3.83	3.23	4.98	4.55	3.43	3.10	3.18	4.23
Premier	3.95	3.50	4.53	4.08	3.13	5.33	4.98	3.38	3.20	3.60	4.45
Sure	4.23	3.85	4.60	4.03	3.30	5.43	5.08	3.70	3.35	3.58	4.40
SX 424	3.98	3.48	4.63	4.03	3.18	5.45	5.15	3.40	3.33	3.50	4.60
SX 217	4.13	3.35	4.70	4.03	3.05	5.28	4.95	3.53	3.18	3.63	4.50
Vector	4.28	3.75	5.03	4.10	3.45	5.18	4.98	3.68	3.53	3.70	4.53
Vernal	4.03	3.53	4.60	4.03	3.15	5.08	4.88	3.40	3.08	3.60	4.45
WL 320	4.10	3.38	4.55	4.05	3.03	5.05	5.05	3.73	3.53	3.45	4.40
WL 225	4.08	3.38	4.28	4.05	3.20	5.33	4.95	3.43	3.23	3.53	4.53
AVERAGE	4.12	3.60	4.70	4.03	3.25	5.23	4.98	3.52	3.40	3.58	4.48
LSD(0.05) <sup>c</sup>	0.3	0.4	0.4	NS	NS	NS	NS	NS	0.35	0.24	NS

<sup>a</sup> Kalu and Fick (1983) index, mean-stage-by-count.

<sup>b</sup> Experimental line, not currently marketed.

<sup>c</sup> NS = Means among cultivars not significantly different at the 0.05 level of probability.

**Table 5. Forage yield of 32 alfalfa cultivars planted April 24, 1990, at the SDSU Research Station, Brookings, South Dakota.**

Cultivar	1990	1991			3-Cut Total	Relative Performance <sup>a</sup> — % —
	Cut 1 9/5	Cut 1 6/6	Cut 2 7/3	Cut 3 7/31		
	tons DM / acre					
VS-888 <sup>b</sup>	1.24	3.15	1.49	1.17	5.81	113
G-2833	1.38	3.19	1.33	1.00	5.52	107
8837N <sup>a</sup>	1.15	3.02	1.42	1.08	5.51	107
Garst 630	1.29	2.83	1.45	1.22	5.50	107
Multi-plier	1.29	3.13	1.34	0.99	5.46	106
DK-122	1.25	2.99	1.39	1.07	5.45	106
VIP	1.27	2.97	1.35	1.09	5.40	105
Centurion	1.39	2.97	1.39	1.03	5.39	105
Crown II	1.37	2.89	1.40	1.06	5.36	104
5262	1.17	2.76	1.46	1.13	5.36	104
5364	1.20	2.98	1.35	0.97	5.30	103
Flint	1.32	2.70	1.45	1.15	5.29	103
8941N <sup>b</sup>	1.19	2.84	1.37	1.02	5.23	102
H 174 <sup>b</sup>	1.20	2.86	1.34	1.02	5.21	101
8832N <sup>b</sup>	1.19	2.75	1.42	1.05	5.21	101
Garst 645	1.17	2.72	1.42	1.05	5.20	101
Allegiance	1.16	2.73	1.40	1.07	5.19	101
SX 217	1.23	2.79	1.32	1.04	5.15	100
MultiKing 1	1.23	2.89	1.33	0.93	5.14	100
Aggressor	1.24	2.76	1.39	0.99	5.14	100
Dawn	1.18	2.85	1.34	0.93	5.1	99
MN GRN-14 <sup>b</sup>	1.09	2.76	1.37	0.94	5.08	99
120	1.35	2.93	1.29	0.84	5.07	99
G-2841	1.35	2.78	1.33	0.93	5.04	98
H 154 <sup>b</sup>	1.25	2.57	1.35	1.12	5.04	98
Vernal	1.33	2.72	1.32	0.88	4.92	96
WL 317	1.17	2.72	1.22	0.93	4.87	95
WL 225	1.24	2.71	1.24	0.89	4.84	94
MTO S82 <sup>b</sup>	1.32	2.83	1.06	0.73	4.62	90
SDHS6 <sup>b</sup>	1.25	2.74	1.11	0.65	4.50	88
AFYF 88 <sup>b</sup>	1.06	2.56	1.07	0.69	4.32	84
SDHL1 <sup>b</sup>	1.25	2.62	1.10	0.57	4.29	83
AVERAGE	1.24	2.83	1.33	0.97	5.14	
LSD(0.05)	0.16	0.26	0.12	0.17	0.39	

<sup>a</sup> % Relative Performance = ratio of cultivar 1991 yield to 1991 yield of all cultivars.

<sup>b</sup> Experimental line, not currently marketed.

**Table 6. Maturity<sup>a</sup> of 32 cultivars planted April 24, 1990, at the SDSU Research Station, Brookings, South Dakota.**

Cultivar	1990	1991		
	Cut 1 9/5	Cut 1 5/31	Cut 2 7/2	Cut 3 7/31
	index			
5262	3.25	3.30	4.10	3.53
5364	3.98	3.40	4.08	3.58
8832N <sup>b</sup>	3.83	3.18	4.23	3.60
8837N <sup>b</sup>	3.85	3.23	4.10	3.50
8941N <sup>b</sup>	3.95	3.35	3.98	3.58
AFYF 88 <sup>b</sup>	3.03	3.35	3.68	3.15
Aggressor	3.75	3.43	4.10	3.70
Allegiance	3.58	3.28	4.38	3.73
Centurion	4.13	3.55	4.38	3.40
Crown II	3.73	3.65	4.05	3.55
Dawn	3.90	3.40	4.05	3.55
DK-122	3.68	3.48	3.98	3.60
120	3.63	3.10	4.00	3.53
Flint	3.65	3.20	4.18	3.50
G-2833	3.90	3.50	4.20	3.43
G-2841	4.05	3.48	4.25	3.48
Garst 645	3.93	3.25	4.28	3.78
Garst 630	3.88	3.63	3.95	3.48
H 154 <sup>b</sup>	3.68	3.08	3.98	3.60
H 174 <sup>b</sup>	3.85	3.23	4.05	3.58
MN GRN-14 <sup>b</sup>	3.50	3.45	4.25	3.60
MTO S82 <sup>b</sup>	3.18	3.48	3.65	3.03
Multi-plier	3.73	3.28	4.03	3.53
MultiKing 1	4.00	3.33	4.30	3.80
SDHL1 <sup>b</sup>	3.30	3.18	3.98	3.25
SDHS6 <sup>b</sup>	3.15	3.10	3.83	3.05
SX 217	3.78	3.35	3.85	3.60
Vernal	3.38	3.35	4.15	3.38
VIP	3.75	3.43	3.83	3.55
VS-888 <sup>b</sup>	4.15	3.50	4.30	3.58
WL 225	3.40	3.20	4.23	3.45
WL 317	3.70	3.35	4.23	3.53
AVERAGE	3.69	3.34	4.08	3.50
LSD(0.05) <sup>c</sup>	0.50	NS	0.28	0.24

<sup>a</sup> Kalu and Fick (1983) index, mean-stage-by-count

<sup>b</sup> Experimental line, not currently marketed.

<sup>c</sup> NS = Means among cultivars not significantly different at the 0.05 level of probability.

Above normal precipitation throughout most of the growing season permitted one more harvest than is usually obtained at the Northeast station. Average yields in 1991 were about one to two times greater than those in either 1989 or 1990.

Three-year average yields ranged from 3.72 T/A for 'Premier' to 5.15 T/A for '5262'. Yield differences among cultivars may be due to plant mortality that occurred during the winter of 1989-90. Results from visual ratings in April 1990 indicated that there were significant differences in winter damage among the cultivars. These differences in winter damage translated into significant cultivar differences for yield in 1990 and probably in 1991. Most of the cultivars that had relatively low yields in 1990 remained low in 1991.

Results from the 1988 study are particularly valuable to producers concerned about selecting cultivars that are persistent and high yielding under adverse weather conditions. The conditions present during winter of 1989-90 do not occur often. Information obtained during severe winters indicate that some cultivars tolerate these conditions better than others.

An experiment of 36 cultivars was planted in 1990. Four cuttings were obtained during 1991 (Table 8) with average total yield of 7.19 T/A, the highest average yield reported at this station in several years. Above normal precipitation in the fall of 1991 replenished the soil moisture reserve. If normal precipitation occurs during winter and spring it is hoped that this test will con-

**Table 7. Forage yield of 28 alfalfa cultivars planted April 28, 1988 at the Northeastern Research Station, Watertown, South Dakota.**

Cultivar	1988	1989	1990	1991					3-Year Avg. <sup>a</sup>	Relative Performance <sup>b</sup> - % -
	1-Cut Total	3-Cut Total	3-Cut Total	Cut 1 6/10	Cut 2 7/10	Cut 3 8/12	Cut 4 10/1	4-Cut Total		
tons DM/acre										
5262	0.52	3.87	3.81	3.51	1.45	1.45	1.38	7.78	5.15	118
526	0.56	3.66	3.94	3.47	1.35	1.48	1.36	7.65	5.08	116
Big 10	0.76	4.45	3.71	3.25	1.09	1.24	1.15	6.73	4.96	113
Vernal	0.77	4.00	3.87	3.21	1.28	1.28	1.23	6.99	4.95	113
MTO N82 <sup>c</sup>	0.54	3.73	4.33	2.99	1.09	1.06	0.70	5.84	4.63	106
86639 <sup>c</sup>	0.53	3.54	3.63	3.23	1.18	1.17	1.14	6.71	4.63	106
120	0.71	3.81	3.45	3.09	1.01	1.29	1.09	6.47	4.58	105
5432	0.49	3.91	3.11	2.95	1.24	1.25	1.29	6.72	4.58	105
AP 8620 <sup>c</sup>	0.67	3.86	3.29	2.84	1.13	1.32	1.12	6.40	4.51	103
AP 8631 <sup>c</sup>	0.55	3.84	3.13	2.80	1.16	1.30	1.17	6.42	4.46	102
Magnum +	0.52	3.92	3.21	2.76	1.04	1.25	1.15	6.20	4.44	101
Dart	0.54	3.55	3.10	3.14	1.06	1.25	1.22	6.66	4.44	101
Arrow	0.57	3.94	3.09	2.94	1.03	1.18	1.13	6.27	4.43	101
SX 424	0.62	3.75	3.00	2.85	1.01	1.27	1.20	6.33	4.36	100
DK-125	0.67	4.12	2.95	2.58	0.98	1.19	1.16	5.91	4.33	99
FSRC 87M1 <sup>c</sup>	0.67	3.60	3.01	2.84	1.06	1.26	1.14	6.30	4.30	98
Magnum III	0.57	4.00	3.04	2.52	1.01	1.19	1.14	5.87	4.30	98
FSRC 87N3 <sup>c</sup>	0.57	3.86	2.98	2.69	1.02	1.23	1.11	6.06	4.30	98
Vector	0.62	4.06	2.83	2.50	1.04	1.13	1.08	5.74	4.21	96
FSRC 87N1 <sup>c</sup>	0.70	3.88	3.00	2.55	0.94	1.16	1.10	5.75	4.21	96
Chief	0.58	4.15	2.64	2.79	0.84	1.03	1.05	5.70	4.17	95
Sure	0.61	3.81	2.83	2.50	0.87	1.17	1.05	5.59	4.08	93
WL 225	0.47	3.41	2.79	2.66	1.00	1.19	1.12	5.98	4.06	93
SX 217	0.60	3.39	2.76	2.53	0.97	1.18	1.11	5.80	3.98	91
Kingstar	0.58	3.53	2.81	2.50	0.86	1.19	0.99	5.54	3.96	90
WL 320	0.53	3.62	2.55	2.48	0.90	1.19	1.08	5.64	3.94	90
Cimarron	0.67	3.56	2.71	2.28	0.91	1.16	1.19	5.54	3.94	90
Premier	0.57	3.46	2.48	2.31	0.87	1.09	0.97	5.23	3.72	85
AVERAGE	0.60	3.80	3.15	2.81	1.05	1.22	1.13	6.21	4.38	
Maturity <sup>d</sup>				4.6	4.1	4.3	4.7			
LSD(0.05) <sup>e</sup>	NS	NS	0.41	0.45	0.14	0.14	0.20	0.75	0.47	

<sup>a</sup> Three year average based on post-establishment year yields, 1989, 1990, and 1991.

<sup>b</sup> % Relative Performance = ratio of cultivar 3-yr average to 3-yr average of all cultivars.

<sup>c</sup> Experimental line, not currently marketed.

<sup>d</sup> Average harvest maturity. Value based on Kalu and Fick (1983) mean-stage-by-count index.

<sup>e</sup> NS = Means among cultivars not significantly different at the 0.05 level of probability.

**Table 8. Forage yield of 36 alfalfa cultivars planted May 4, 1990, at the Northeastern Research Station, Watertown, South Dakota.**

Cultivar	1990		1991				Relative Performance <sup>a</sup> — % —
	Cut 1	Cut 1	Cut 2	Cut 3	Cut 4	4-Cut	
	7/27	6/10	7/10	8/12	10/1	Total	
tons DM/ acre							
VS-888 <sup>b</sup>	1.66	3.73	1.35	1.39	1.25	7.71	107
Multi-plier	1.67	3.54	1.32	1.42	1.41	7.68	107
Centurion	1.59	3.51	1.31	1.42	1.36	7.60	106
Garst 630	1.52	3.40	1.32	1.48	1.36	7.56	105
Dawn	1.56	3.33	1.27	1.48	1.46	7.54	105
G-2833	1.59	3.51	1.29	1.39	1.31	7.50	104
VIP	1.66	3.38	1.28	1.43	1.39	7.47	104
G-2841	1.63	3.50	1.29	1.42	1.24	7.44	104
H 174 <sup>b</sup>	1.48	3.15	1.33	1.51	1.45	7.44	103
DK-122	1.59	3.32	1.38	1.42	1.31	7.42	103
MultiKing 1	1.64	3.37	1.28	1.39	1.36	7.40	103
5364	1.58	3.41	1.30	1.40	1.28	7.39	103
Crown II	1.63	3.42	1.26	1.37	1.29	7.33	102
8837N <sup>b</sup>	1.53	3.26	1.28	1.41	1.37	7.33	102
5262	1.49	3.28	1.32	1.41	1.29	7.30	101
SX 217	1.58	3.09	1.34	1.48	1.38	7.29	101
Garst 645	1.65	3.20	1.30	1.42	1.32	7.24	101
8941N <sup>b</sup>	1.57	3.31	1.28	1.35	1.30	7.24	101
WL 225	1.52	3.23	1.31	1.39	1.31	7.23	101
120	1.54	3.50	1.23	1.34	1.17	7.23	101
Baker	1.58	3.50	1.22	1.24	1.26	7.22	100
Perry	1.55	3.33	1.23	1.35	1.30	7.20	100
Allegiance	1.47	3.17	1.42	1.40	1.19	7.18	100
Saranac AR	1.42	3.25	1.25	1.39	1.27	7.16	100
Aggressor	1.46	3.14	1.25	1.43	1.31	7.13	99
MN GRN-14 <sup>b</sup>	1.42	3.21	1.34	1.40	1.17	7.11	99
H 154 <sup>b</sup>	1.55	2.84	1.32	1.48	1.45	7.09	99
Wrangler	1.53	3.33	1.26	1.26	1.20	7.04	98
8832N <sup>b</sup>	1.49	2.99	1.30	1.38	1.35	7.02	98
WL 317	1.45	3.13	1.27	1.40	1.20	6.99	97
Flint	1.63	3.15	1.22	1.31	1.25	6.92	96
Vernal	1.54	3.29	1.21	1.21	1.07	6.77	94
SDHL1 <sup>b</sup>	1.51	3.14	1.22	1.20	1.07	6.63	92
SDHS6 <sup>b</sup>	1.63	3.37	1.14	1.10	0.94	6.55	91
MTO S82 <sup>b</sup>	1.50	3.18	1.12	1.15	0.96	6.40	89
AFYF 88 <sup>b</sup>	1.59	3.20	0.97	0.99	0.79	5.95	83
AVERAGE	1.56	3.30	1.27	1.36	1.26	7.19	
Maturity <sup>c</sup>	4.1	4.7	4.0	3.6	2.9		
LSD(0.05) <sup>d</sup>	NS	0.28	0.15	0.13	0.23	0.57	

<sup>a</sup> % Relative Performance = ratio of cultivar 1991 yield to 1991 yield of all cultivars.

<sup>b</sup> Experimental line, not currently marketed.

<sup>c</sup> Average harvest maturity. Value based on Kalu and Fick (1983) mean-stage-by-count index.

<sup>d</sup> NS = Means among cultivars not significantly different at the 0.05 level of probability.

tinue to be highly productive in 1992.

### Central Research Station, Highmore, 1991 Results

Average daily temperatures were near normal throughout the growing season (Fig 1). Precipitation was two to four times above normal during April through June. During July, however, Highmore received less than one inch of precipitation. In August and September precipitation was slightly below normal.

Three harvests were obtained from the 1989 planting. Average three-cut total yields ranged from 4.99 to 8.11 T/A (Table 9). Yields from the first cutting were especially high due to the above normal precipitation. Conditions were too wet to allow harvesting at the appropriate maturity stage, so the high yields could also be attributed to harvesting at an advanced maturity stage.

Total average yields in 1991 were about 2.5 T/A higher than those of 1990. Yields in 1991 were the highest recorded in several years at this station. Two-year average yields ranged from 3.48 to 5.47 T/A, with some significant cultivar differences.

Another experiment was planted in 1991. Plots were seeded in late April, but they did not become successfully established due to the above normal precipitation. Some of the plots were completely destroyed by standing water, and other plots suffered severe damage. The exper-

iment was reseeded in mid-August and became successfully established during August and September.

## Discussion

For most locations, average daily temperatures were above normal during April, May, and June and were near normal throughout the remainder of the growing season (Fig 1). Each location received above-normal precipitation from April through June.

For Watertown and Highmore, precipitation during July was below normal, but, fortunately, near normal precipitation was received at these locations in the late summer. Brookings received timely rainfall throughout the growing season, and the above-normal precipitation that fell in September allowed soil moisture supplies to be above normal entering the winter months.

The only location that was lacking in late-summer precipitation was Beresford. Soil moisture supplies were diminished for this location as it entered the winter months. This means that at Beresford, alfalfa production in 1992 will be dependent upon winter and spring precipitation.

Improper fall harvest management also threatens stand longevity. Producers that wish to harvest all possible forage should harvest after a hard frost when there is little chance for regrowth. Avoiding harvest in the fall will permit stubble to catch snow. Snow insulates the crown and provides moisture for

**Table 9. Forage yield of 36 alfalfa cultivars planted May 11, 1989, at the Central Crops and Soils Research Station, Highmore, South Dakota.**

Cultivar	1990	1991			3-Cut Total	2-Year Avg. <sup>a</sup>	Relative Performance <sup>b</sup> — % —
	3-Cut Total	Cut 1 6/18	Cut 2 7/17	Cut 3 8/22			
	tons DM/acre						
Flint	4.02	4.14	2.20	1.77	8.11	5.47	124
Chief	4.03	3.93	2.14	1.90	7.96	5.45	123
Ultra	4.06	4.15	1.96	1.52	7.63	5.33	120
Sure	3.70	4.14	1.53	1.58	7.25	5.05	114
Victory	3.76	4.17	1.74	0.81	6.72	4.98	112
WL 225	3.53	3.96	1.83	1.39	7.18	4.90	111
Pacesetter	3.43	4.17	2.06	1.42	7.64	4.89	110
VS-775 <sup>c</sup>	3.49	4.33	1.78	1.15	7.26	4.88	110
Garst 630	3.83	3.97	1.47	1.01	6.45	4.88	110
Action	3.62	4.15	1.63	0.95	6.73	4.83	109
Apollo Supreme	3.59	3.94	1.65	1.06	6.65	4.81	109
Legend	3.44	4.31	1.56	1.17	7.03	4.73	107
Centurion	3.44	4.01	1.47	1.00	6.48	4.69	106
Sabre	3.40	4.14	1.45	0.99	6.58	4.66	105
Multi-plier	3.21	4.05	1.73	1.02	6.80	4.56	103
Clipper	3.12	4.05	1.69	1.18	6.92	4.53	102
WL 317	3.36	4.12	1.42	0.85	6.38	4.48	101
Dawn	3.35	3.82	1.39	0.90	6.11	4.47	101
5472	3.31	3.63	1.42	0.76	5.80	4.27	96
Majestic	3.20	3.75	1.33	0.81	5.88	4.25	96
Royalty	3.29	3.78	1.24	0.67	5.69	4.24	96
Aggressor	3.13	3.71	1.43	0.80	5.94	4.20	95
VIP	3.33	3.70	1.20	0.53	5.43	4.19	95
Saranac AR	3.26	3.41	1.44	0.81	5.66	4.13	93
Trident II	2.92	3.74	1.34	0.71	5.79	4.11	93
H-174 <sup>c</sup>	3.06	3.62	1.38	0.64	5.64	4.07	92
Arrow	2.87	3.67	1.38	0.62	5.67	3.99	90
5262	2.77	3.79	1.08	0.84	5.71	3.97	90
526	2.92	3.99	1.15	0.45	5.59	3.96	89
Garst 636	2.91	3.94	1.06	0.48	5.48	3.92	89
SDHL1 <sup>c</sup>	2.80	3.99	1.09	0.66	5.74	3.91	88
Vernal	2.87	3.58	1.31	0.67	5.56	3.86	87
SDHS6 <sup>c</sup>	2.85	3.87	1.00	0.44	5.31	3.85	87
Dart	2.83	3.34	1.01	0.65	4.99	3.74	84
Cimarron VR	2.71	3.55	1.09	0.51	5.16	3.67	83
FSRC 88S <sup>c</sup>	2.50	3.28	1.26	0.50	5.05	3.48	79
AVERAGE	3.28	3.89	1.47	0.92	6.28	4.43	
Maturity <sup>d</sup>		5.8	4.5	5.5			
LSD(0.05)	0.90	0.59	0.70	0.84	1.96 <sup>e</sup>	1.48 <sup>e</sup>	

a Two year average based on total yields for post-establishment years, 1990 and 1991.

b % Relative Performance = ratio of cultivar 2-yr average yield to 2-yr average yield of all cultivars.

c Experimental line, not currently marketed.

d Average harvest maturity. Value based on Kalu and Fick (1983) mean-stage-by-count index.

e Significant at the 0.07 level of probability.

plant growth the following spring.

## Cultivar Selection

The “right” decision is difficult to make when you are selecting an alfalfa cultivar. When evaluating alfalfa cultivar test information, examine several plant characteristics before reaching a decision. Major characteristics include yield, fall dormancy, disease resistance, and cost per unit of pure live seed.

## Yield

Yield information presented in this and other reports represents seeding-year or post-seeding-year averages. Generally, yield data for several years of production are the most meaningful.

Use data from test locations that most nearly resemble growing conditions on your farm. Yield performance information will be much more reliable.

To measure significant yield differences between cultivars, a statistical measure known as the least significant difference (LSD) is used. If the difference in yield between any two cultivars equals or exceeds the LSD value, the higher yielding cultivar is significantly higher in yield and should be favored. If the yield difference is less than the LSD value, the two cultivars do not significantly differ, and both cultivars are approximately equal in yielding ability.

In some cases an LSD value is not presented and the designation NS

(non-significant) indicates significant yield differences among the cultivars were not detected.

## Fall Dormancy

Fall dormancy ratings (Appendix) range from values of 1 (early dormancy) to 9 (non-dormant). Fall dormancy is thought to be related to winterhardiness. The severe winters of South Dakota require that you take winterhardiness into consideration in selecting a cultivar.

Cultivars with a fall dormancy ratings of 1 or 2 generally are very winterhardy and should persist under South Dakota conditions. Forage yield under optimum conditions may be lower for these cultivars, however, than for less dormant types.

Consequently, very winterhardy cultivars should be used if stand longevity is of primary concern.

Cultivars with a rating of 3 to 4 are winterhardy to moderately winterhardy, and you can expect at least 3 to 4 years of excellent production.

Cultivars with ratings of 5 to 8 are generally not winterhardy enough to survive several South Dakota winters. These cultivars may be used as annual forages.

## Disease Resistance

Disease resistance ratings (Appendix) are important indicators of a cultivar’s potential to perform in situations where specific diseases may be limiting to production. Major diseases that may affect the productivity of

alfalfa in South Dakota include bacterial wilt, Phytophthora root rot, and Verticillium wilt. Resistance characteristics to these diseases should be considered when choosing a cultivar.

Bacterial wilt is generally not observed until after the second production year. Infection occurs in spring or early summer via cracks and wounds in the roots and crowns. Eventually, the water conducting tissues of the roots become plugged, causing the top growth to wilt, especially during periods of moisture stress. Symptoms include yellow leaves, stunted growth, and a yellow to brown discoloration of the root tissue beneath the outer layer. Many cultivars are resistant to bacterial wilt, and you can avoid the disease by using these cultivars.

Phytophthora root rot is a fungal disease which occurs in wet, poorly drained soils after excessive precipitation or irrigation. Symptoms include deteriorated root or crown tissue in areas where the stand is thinning. Top growth symptoms generally include wilting, yellowing, and lack of vigorous growth. Early symptoms of this disease sometimes resemble damping-off of alfalfa seedlings.

Verticillium wilt is a fungal disease which produces initial symptoms of temporary wilting of upper leaves on warm days at pre-bud to floral stages of maturity. Affected leaves will generally turn yellow and then drop off. Eventually, the stems die as well. Yellow to brown discoloration is usually present in the woody cylinder of the tap root. Verticillium wilt has not yet

been documented in South Dakota; however, it has been observed in several surrounding states and its appearance in South Dakota is expected. Planting a resistant cultivar is the most effective control.

Other diseases, such as anthracnose, leaf spots, Fusarium wilt, and other root and crown rots may be problems at a particular site. In these situations, you should consider using cultivars with resistance to a particular disease, if possible. For many diseases, the only practical means of minimizing economic loss is to use resistant cultivars.

Reduced stress from use of multiple disease-resistant cultivars can result in long-term increases in yield and quality.

### Conclusions

No single characteristic, even yield, will make an alfalfa cultivar or small group of cultivars consistently superior to any others; several characteristics must be evaluated together.

Although yield from 1- to 3 year-old stands serves as a good measure of economic production, stand longevity, and tolerance to

stress and disease are also important.

Yield response data collected over several years and locations may be useful indicators of stress tolerance, longevity, and economic production. Fall dormancy has a significant influence upon winterhardiness, stress tolerance, and yield potential and is related to stand longevity in stressful environments. Multiple disease resistance also benefits stand longevity and yield. Finally, seed cost per unit PLS should also be considered when selecting alfalfa cultivars.

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**Appendix. Listing of alfalfa cultivars, developers, suppliers, and agronomic characteristics<sup>a</sup>.**

Developer/ Supplier	Cultivar	Disease & Insect Resistance <sup>c</sup>						
		FD <sup>b</sup>	BW	VW	FW	An	PRR	PA
ABI Alfalfa	Aggressor	4	HR	R	HR	HR	HR	HR
	Apollo Supreme	4	HR	R	HR	HR	R	HR
	Arrow	3	HR	R	HR	MR	HR	R
AgriPro Seeds	Dart	3	HR	R	HR	R	HR	R
	Dawn	3	HR	R	HR	R	HR	— <sup>d</sup>
Allied Seed	Centurion	3	HR	R	R	R	R	R
	Majestic	3	R	HR	HR	HR	MR	—
	Sabre	4	HR	HR	HR	HR	HR	—
Brown's Seed Farms	Pacesetter	2	HR	R	HR	HR	HR	R
Cargill	Crown II	3	HR	R	HR	HR	HR	R
	Royalty	3	HR	R	HR	HR	HR	R
	Trident II	3	HR	R	R	R	HR	MR
Cenex/Land O'Lakes	Legend	4	HR	R	HR	HR	HR	R
	Sure	3	HR	R	HR	HR	R	HR
Dahlgren	Kingstar	3	R	R	HR	MR	R	MR
	Premier	4	HR	R	HR	HR	HR	HR
Dairyland Research Intl.	Magnum III	4	R	MR	R	MR	R	—
	Magnum +	4	R	LR	R	MR	R	—
Dekalb Plant Genetics	120	3	HR	—	R	LR	R	R
	DK 122	2	HR	R	R	HR	HR	R
	DK 125	3	HR	R	R	HR	R	R
	DK 135	4	R	MR	R	MR	MR	R
Funk Brand Seeds	G-2833	3	HR	R	HR	HR	HR	R
	G-2841	3	HR	R	R	R	R	R
Garst Seed	630	4	HR	MR	R	MR	R	—
	636	2	HR	R	R	MR	R	R
	645	3	HR	R	R	HR	HR	R
Great Lakes Hybrids	Big 10	3	HR	—	HR	R	R	R
Great Plains Research	Cimarron	4	HR	LR	HR	R	MR	R
	Cimarron VR	5	HR	R	HR	HR	R	HR
Hyttest Seeds	Victory	3	HR	R	HR	HR	MR	—
Jacques Seed	Multi-plier	3	HR	R	HR	HR	HR	R
	Chief	4	HR	R	R	R	HR	R

Developer/ Supplier	Cultivar	Disease & Insect Resistance <sup>c</sup>						
		FD <sup>b</sup>	BW	VW	FW	An	PRR	PA
L. Peterson Ltd.	Vector	4	R	MR	HR	R	R	R
New York Agric. Exp. Stn.	Saranac Ar	4	MR	—	R	HR	—	—
Northrup King	MultiKing 1	3	HR	R	HR	R	R	MR
Payco Seeds/ Interstate	Clipper	2	HR	R	HR	R	R	R
	WL 225	2	HR	R	HR	MR	HR	R
	WL 317	3	HR	R	HR	R	HR	HR
	WL 320	4	R	MR	HR	MR	R	MR
Pioneer Hi-Bred Int'l	526	2	HR	—	MR	—	LR	R
	5262	2	HR	LR	MR	—	R	R
	5364	4	R	MR	R	MR	MR	HR
	5432	4	HR	R	HR	—	MR	R
	5472	4	HR	MR	HR	MR	MR	HR
Plant Genetics	Flint	4	R	LR	HR	HR	R	MR
Public Cultivars, South Dakota Crop Improvemt. Association	Baker	2	HR	—	R	LR	—	HR
	Perry	3	R	—	R	LR	MR	—
	Wrangler	2	R	LR	R	LR	HR	HR
Research Seeds	VIP	3	HR	R	R	R	R	HR
	Action	4	R	MR	R	HR	R	R
SeedTec	Ultra	3	HR	R	HR	HR	R	R
Sexauer	SX 217	4	R	—	HR	MR	MR	—
	SX 424	5	MR	—	R	R	R	—
United AgriSeeds	Allegiance	3	R	R	R	HR	R	R
Wisc. Agric. Exp. Stn./USDA	Vernal	2	R	—	MR	—	—	—

<sup>a</sup> Ratings obtained from: (1) Alfalfa Varieties, 1991 Edition, Alfalfa Variety Characterization. Certified Alfalfa Seed Council, Davis, CA 95617-1017. (2) Alfalfa marketers.

<sup>b</sup> FD = Fall Dormancy Index, 1 = greatest fall dormancy; 9 = absence of fall dormancy.

<sup>c</sup> Refer to pest resistance rating below:

BW = Bacterial Wilt  
 VW = Verticillium wilt  
 FW = Fusarium wilt  
 An = Anthracnose  
 PRR = Phytophthora Root Rot  
 PA = Pea Aphid

Pest Resistance Rating	
% Resistant plants	Resistance class
0-5%	Susceptible (S)
6-14%	Low Resistance (RS)
15-30%	Moderate Resistance (MR)
31-50%	Resistance (R)
> 50%	High Resistance (HR)

<sup>d</sup> Blank spaces indicate cultivar is susceptible or has not been adequately tested.