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## Cultivar Test in South Dakota, 1988 Report: Alfalfa Yields

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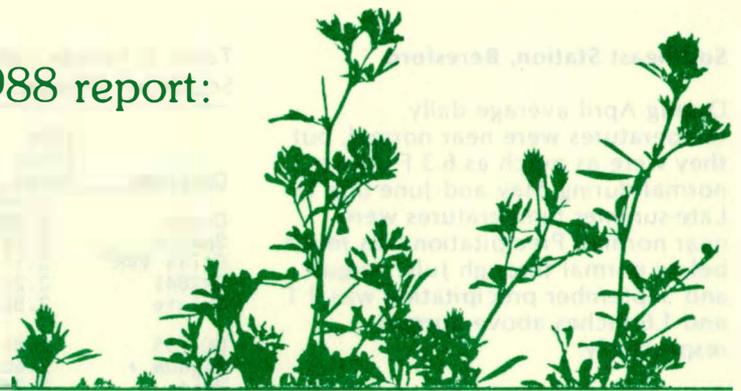
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## Cultivar tests in South Dakota, 1988 report:

# Alfalfa yields

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About 15 new alfalfa cultivars are released each year. Many of these cultivars are on the market, and you need to know their forage yields under South Dakota conditions before you can select one for your operation. Such yield information is given here for available cultivars and experimental lines at several locations in the state.

## Materials and methods

Experimental plots were established in 1986 and 1987 at the Southeast Research Station (Beresford) and the Central Crops and Soils Research Station (Highmore), and in 1987 and 1988 at the Northeast Research Station (Watertown) and the SDSU Research Station (Brookings). Tests were established on cooperators' land near Summit in 1986.

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 was 12 lb pure live seed (PLS) per acre. A preplant-incorporated herbicide (Eptam at 3 lb ai/A) and a fungicide (Ridomil at 1 lb ai/A) were used to help establishment.

The experimental design was a randomized complete block with four replicates. An experimental unit consisted of a 75-sq-ft (3 x 25 ft) plot. Plots were fertilized immediately after planting with 50 lb P<sub>2</sub>O<sub>5</sub>/A and in accordance with SDSU soil test results for growth periods after the seeding year. No insect problems were observed, so chemical pest control was not used.

Harvesting was by flail-type forage plot harvester; the harvest area was either 44 or 66 sq ft. Fresh herbage

weights were immediately obtained. Samples from half of the entries in each replicate were randomly taken, dried at 100 F for 72 hr 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, divided by harvest area to obtain forage DM production per unit area of harvest, and then converted into tons DM/A and analyzed by analysis of variance. DM yield differences among cultivars were tested by the least-significant-difference procedure (LSD). Relative performance among cultivars was calculated by dividing

average total seasonal yield over years by the mean forage yield of a given location.

Stage of maturity at harvest was recorded at Brookings. Ten shoots from each plot were randomly selected and rated according to the Kalu and Fick (1983, *Crop Science* 23:1167) mean-stage-by-count scheme (Table 1).

Experiments were harvested up to four times each year; however, growth conditions at some locations limited harvest frequencies. Seeding year harvests could not be obtained in 1987 at Highmore because of limited growth.

Table 1. Kalu and Fick Maturity Index.<sup>a</sup> Definition of stages of development for alfalfa.

Stage No.	Stage Name	Stage Definition
0	Early Vegetative	Stem length < 6 inches; no buds, flowers, or seed pods.
1	Mid-Vegetative	Stem length 6 to 12 inches; no flowers or seed pods.
2	Late-Vegetative	Stem length > 12 inches; no buds, flowers or seeds.
3	Early Bud	1 to 2 nodes with buds; no flowers or seed pods.
4	Late Bud	> 3 nodes with buds; no flowers or seed pods.
5	Early Flower	One node with one open flower (standard open) no seed pods.
6	Late Flower	> 2 nodes with open flowers; no seed pods.
7	Early Seed Pod	1 to 3 nodes with green seed pods.
8	Late Seed Pod	> 4 nodes with green seed pods.
9	Ripe Seed Pod	Nodes with mostly brown mature seed pods.

<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.

### Southeast Station, Beresford

During April average daily temperatures were near normal, but they were as much as 6.3 F above normal during May and June (Fig 1). Late-summer temperatures were near normal. Precipitation was much below normal through July. August and September precipitation was 2.1 and 1.6 inches above normal, respectively.

Three cuttings were taken from the 1986 and 1987 plantings. For the 1986 planting, the three-cut total yield in 1988 was approximately half of the 1987 total yield (Table 2). Three-year average yields ranged from 2.91 to 4.25 T/A, with some significant differences.

The wide range in yield marks the difference between hay- and pasture-type cultivars. Six of the 14 lowest yielding cultivars were pasture types.

Average yields from the second experiment ranged from 2.42 T/A for the first harvest to 0.36 T/A for the third harvest (Table 3). No significant cultivar differences were observed for either the 1988 three-cut total yield or 2-year average yield.

### SDSU, Brookings

Average daily temperatures were 5.7 and 6.9 F above normal during May and June (Fig 1) but were near normal during the mid- to late-summer season. Monthly precipitation was 40, 68, and 39% below normal during May, June, and July, respectively. Precipitation during September was over twice the normal value.

Two cuttings were obtained from the 1987 plantings. Average yield was 1.78 T/A for the first harvest but only 0.12 T/A for the second (Table 4). Two-year average yields ranged from 1.42 to 1.80 T/A, with no significant yield differences among the cultivars. Cultivars showed significant differences in maturity at first harvest, however (Table 5).

The most mature entries were at a late-bud stage, while the least mature entries were near the early-bud stage. This magnitude of

Table 2. Forage yield of 42 alfalfa cultivars planted May 5, 1986, at the Southeast Research Station, Beresford.

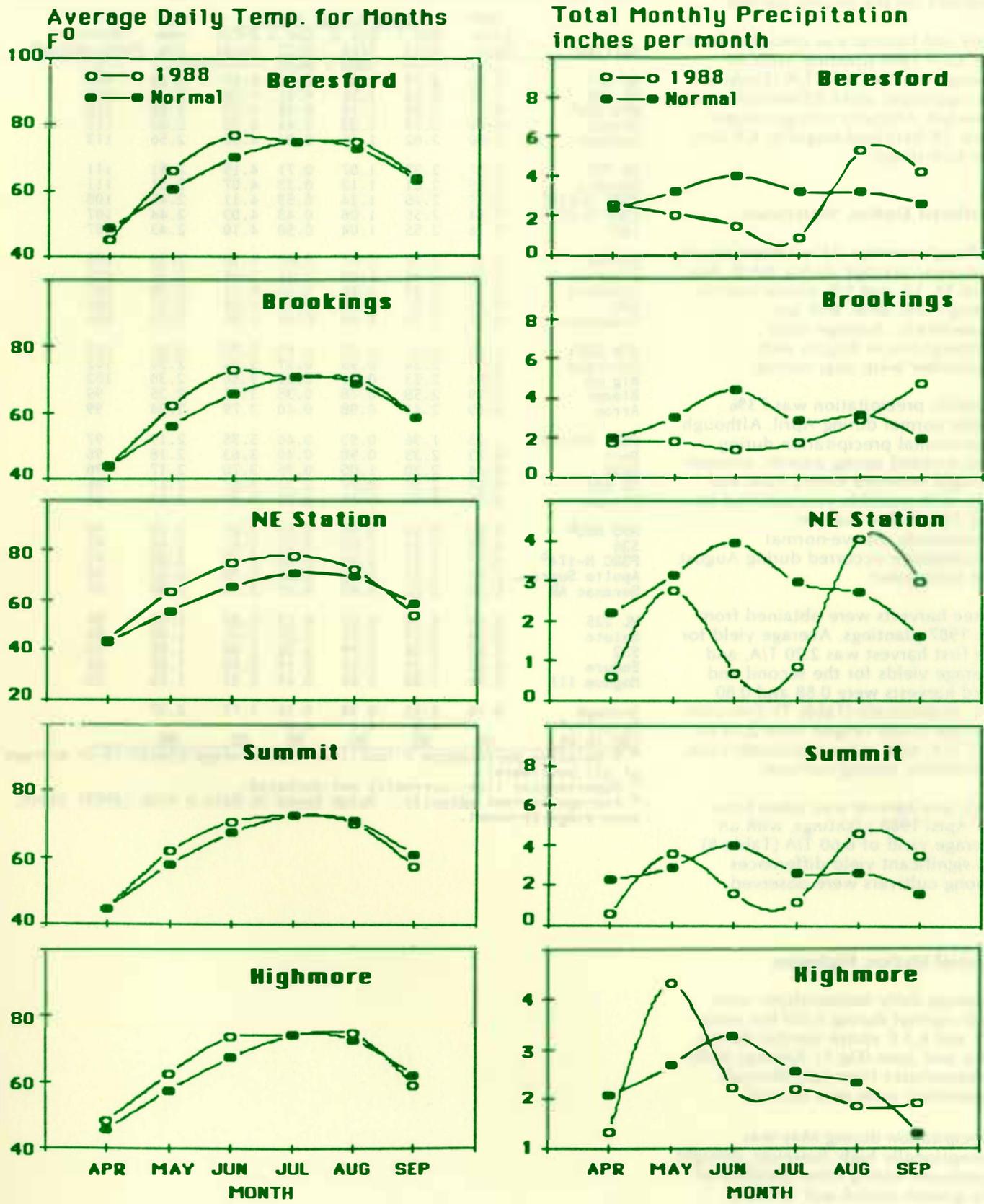
Cultivar	1986	1987	1988 Forage Yield				3 Year Avg	Relative Performance <sup>a</sup>
	2-cut Total	3-cut Total	Cut 1 6/14	Cut 2 7/14	Cut 3 8/23	3-Cut Total		
	tons / acre							
Crown	3.28	6.10	2.37	0.81	0.19	3.37	4.25	112
Sparta	2.76	6.66	2.37	0.73	0.12	3.22	4.21	111
F 144 VWR <sup>b</sup>	2.17	6.65	2.44	1.00	0.22	3.65	4.16	110
G-2841	2.21	6.64	2.62	0.83	0.18	3.62	4.16	110
Salute	2.81	6.45	2.27	0.75	0.16	3.17	4.14	110
DK 135	2.81	6.39	2.21	0.83	0.19	3.22	4.14	110
Magnum +	2.68	6.05	2.41	0.99	0.27	3.67	4.13	109
Dart	2.77	6.59	2.17	0.66	0.12	2.95	4.10	108
SX 217	2.55	6.25	2.52	0.80	0.13	3.45	4.08	108
Drumcor	2.73	5.89	2.35	1.04	0.20	3.58	4.07	108
Sure	2.44	6.72	2.20	0.60	0.14	2.93	4.03	107
Cimarron	2.41	6.46	2.28	0.73	0.16	3.17	4.01	106
Arrow	2.29	6.32	2.41	0.74	0.18	3.33	3.98	105
120	3.11	5.94	2.04	0.64	0.13	2.81	3.95	104
WL 320	2.28	6.04	2.34	0.96	0.22	3.51	3.94	104
AP 45	2.77	6.00	2.25	0.61	0.12	2.98	3.92	104
Summit	2.25	6.69	2.09	0.55	0.13	2.77	3.90	103
SX 424	2.92	6.15	1.87	0.60	0.17	2.63	3.90	103
526	2.63	5.91	2.31	0.68	0.11	3.10	3.88	103
WL 225	2.67	5.95	2.24	0.64	0.12	3.00	3.87	102
Surpass	2.52	6.02	2.11	0.69	0.18	2.97	3.84	102
Edge	2.46	5.90	2.13	0.74	0.14	3.02	3.79	100
GH-747	2.47	6.03	2.19	0.49	0.13	2.81	3.77	100
RS 7890 <sup>b</sup>	2.39	6.05	2.05	0.60	0.14	2.78	3.74	99
5432	2.93	5.81	1.58	0.56	0.15	2.29	3.68	97
LL3387 <sup>b</sup>	2.58	5.82	1.92	0.56	0.15	2.63	3.68	97
Dynasty	2.22	5.90	2.11	0.57	0.16	2.84	3.65	97
H 150R <sup>b</sup>	2.41	6.02	1.80	0.60	0.13	2.53	3.65	97
Old's "98"	2.19	5.92	2.20	0.52	0.13	2.85	3.65	97
532	2.04	6.18	2.00	0.56	0.11	2.66	3.63	96
Heinrich's	2.33	5.43	2.37	0.60	0.15	3.11	3.62	96
Champ	2.17	6.02	2.05	0.51	0.11	2.67	3.62	96
H-168 <sup>b</sup>	2.37	5.77	1.96	0.53	0.15	2.64	3.59	95
Eagle	2.50	5.73	1.88	0.54	0.11	2.53	3.59	95
Epic	2.18	5.58	2.17	0.60	0.17	2.94	3.57	94
Rambler	2.96	4.68	2.00	0.65	0.11	2.75	3.46	92
MTO S82 <sup>b</sup>	2.77	5.07	1.86	0.56	0.09	2.51	3.45	91
Rangelander	2.52	4.87	2.24	0.61	0.07	2.93	3.44	91
Vernal	2.10	5.52	1.75	0.30	0.12	2.17	3.26	86
MTO N82 <sup>b</sup>	1.93	4.96	2.18	0.52	0.09	2.79	3.23	85
Roamer	1.99	4.90	1.94	0.56	0.09	2.59	3.16	84
Drylander	1.80	4.70	1.86	0.32	0.05	2.23	2.91	77
Average	2.48	5.92	2.14	0.65	0.14	2.94	3.78	
Maturity <sup>c</sup>			4.1	5.0	4.7			
LSD(0.05)	0.55	0.77	NS	NS	0.08	NS	0.59	

<sup>a</sup> % Relative performance = (cultivar 3-yr-average yield)/(3 yr average of all cultivars).

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

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

Fig 1. Average daily temperature and total monthly precipitation during the 1988 growing season for five alfalfa cultivar test locations in South Dakota.



difference may affect forage quality. No differences in maturity were detected for the second harvest.

Only one harvest was obtained from the April 1988 planting, with an average yield of 0.74 T/A (Table 6). No significant yield differences were detected. Maturity ratings ranged from 3.8 (late-bud stage) to 4.4 (very late-bud stage).

### Northeast Station, Watertown

Although average daily temperatures were near average during April, they were 14, 14, and 9% above normal during May, June, and July, respectively. Average daily temperatures in August and September were near normal.

Monthly precipitation was 73% below normal during April. Although near-normal precipitation during May assisted spring growth, extreme drought returned during June and July, with monthly precipitation 83 and 71% below normal, respectively. Above-normal precipitation occurred during August and September.

Three harvests were obtained from the 1987 plantings. Average yield for the first harvest was 2.20 T/A, and average yields for the second and third harvests were 0.88 and 0.80 T/A, respectively (Table 7). Two-year average yields ranged from 2.56 to 3.17 T/A, with some significant yield differences among cultivars.

Only one harvest was taken from the April 1988 plantings, with an average yield of 0.60 T/A (Table 8). No significant yield differences among cultivars were observed.

### Central Station, Highmore

Average daily temperatures were near normal during April but were 4.9 and 6.3 F above normal during May and June (Fig 1). Average daily temperatures from July through September were near normal.

Precipitation during May was exceptionally high; however, drought continued during other portions of the growth period and severely limited alfalfa growth.

Table 3. Forage yield of 35 alfalfa cultivars planted April 22, 1987, at the Southeast Research Station, Beresford.

Cultivar	1987 1-Cut Total	1988 Forage Yield				2 year Avg	Relative Performance <sup>a</sup>
		Cut 1 6/14	Cut 2 7/14	Cut 3 8/23	3-Cut Total		
	tons / acre					%	
SX 217	0.93	2.74	1.31	0.62	4.67	2.80	124
DK 135	1.03	2.64	1.31	0.41	4.36	2.70	119
MTO S82 <sup>b</sup>	0.77	2.99	1.18	0.43	4.59	2.68	118
Vernal	0.69	2.79	1.28	0.43	4.50	2.60	115
Saranac	0.80	2.82	1.16	0.34	4.32	2.56	113
GH 737	0.87	2.37	1.07	0.71	4.15	2.51	111
Dynasty	0.95	2.61	1.13	0.33	4.07	2.51	111
FSRC H-170 <sup>b</sup>	0.79	2.45	1.14	0.53	4.11	2.45	108
FSRC H-172 <sup>b</sup>	0.84	2.55	1.06	0.43	4.03	2.44	107
120	0.76	2.55	1.04	0.50	4.10	2.43	107
Mohawk	0.65	2.50	1.11	0.49	4.10	2.38	105
Cimarron	0.78	2.43	1.09	0.44	3.96	2.37	105
Iroquois	0.62	2.49	1.11	0.51	4.11	2.36	104
636	0.71	2.53	1.12	0.35	4.00	2.36	104
Commandor	0.77	2.50	1.00	0.45	3.94	2.36	104
XPH 2001	0.72	2.44	1.05	0.43	3.92	2.32	102
Fortress	0.97	2.34	0.93	0.37	3.64	2.30	102
Big 10	0.94	2.53	0.86	0.26	3.66	2.30	102
Blazer	0.79	2.58	0.78	0.35	3.71	2.25	99
Arrow	0.69	2.41	0.98	0.40	3.79	2.24	99
FSRC 1H-171 <sup>b</sup>	1.03	1.96	0.93	0.46	3.35	2.19	97
Dart	0.73	2.33	0.90	0.40	3.63	2.18	96
5432	0.64	2.30	1.05	0.35	3.70	2.17	96
SX 424	0.67	2.47	0.97	0.24	3.67	2.17	96
Clipper	0.71	2.40	0.91	0.27	3.58	2.14	94
MTO N82 <sup>b</sup>	0.52	2.61	0.92	0.15	3.68	2.10	93
526	0.59	2.34	1.03	0.23	3.61	2.10	93
FSRC H-174 <sup>b</sup>	0.77	2.21	0.93	0.24	3.38	2.08	92
Apollo Supreme	0.67	2.21	0.84	0.33	3.38	2.03	90
Saranac AR	0.65	2.21	0.82	0.27	3.30	1.98	87
WL 225	0.88	2.22	0.67	0.13	3.03	1.96	86
Salute	0.64	2.19	0.71	0.27	3.17	1.90	84
532	0.62	2.08	0.79	0.22	3.08	1.85	82
Endure	0.63	2.10	0.70	0.19	3.00	1.82	80
Magnum III	0.94	1.88	0.57	0.13	2.57	1.76	78
Average	0.76	2.42	0.98	0.36	3.77	2.27	
Maturity <sup>c</sup>		4.8	4.1	4.8			
LSD (0.05)	NS	NS	NS	NS	NS	NS	

<sup>a</sup> Relative performance = (cultivar 2-yr-average yield)/(2-yr average of all cultivars).

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

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

Two harvests were obtained from the 1986 plantings and three harvests were made in both 1986 and 1987 (Table 9). Average yields for the first and second harvests were 0.86 and 0.20 T/A, respectively. Three-year average yields ranged from 1.62 to 2.36 T/A, with some significant differences among cultivars. These yield differences occurred because both hay- and pasture-type alfalfa cultivars were included in the experiment. Five of the 10 lowest yielding cultivars were pasture-types.

Two harvests were also obtained from the 1987 plantings. Average yields for the first and second harvests were 1.44 and 0.30 T/A, respectively (Table 10). Two-year average yields ranged from 1.24 to 2.23 T/A with no significant differences among cultivars.

Two 1985 plantings were not harvested because of lack of growth. The alfalfas seemed to be particularly affected by the drought. The average yield for first-harvest growth of a nearby alfalfa seeding-rate study was 0.7 T/A.

#### Summit

Early summer average daily temperatures were slightly above normal; late summer temperatures were near normal (Fig 1). The monthly precipitation pattern was very erratic during 1988. May precipitation was near normal; but April, June, and July precipitation, respectively, was 73, 59, and 54% below normal. Above-normal precipitation occurred during August and September.

Three harvests were obtained from this 1986 planting (Table 11). Average total yield for the three harvests in 1988 was 1.16 T/A, approximately a third of the 1987 average total yield. In 1988, second-harvest yields were extremely low, averaging 0.04 T/A. Three-year average yields ranged from 1.79 to 2.47 T/A with some significant differences in yield among cultivars. The wide range of yield performance related to hay- and pasture-type cultivars being in the same experiment. Five of the 10 lowest yielding cultivars were pasture types.

Table 4. Forage yield of 34 alfalfa cultivars planted April 22, 1987, at the SDSU Research Station, Brookings.

Cultivar	1987	1988 Forage Yield			2-Year Avg	Relative Performance <sup>a</sup>
	1-Cut Total	Cut 1 6/6	Cut 2 7/25	2-Cut Total		
		tons / acre				%
Ultra	1.58	1.87	0.15	2.03	1.80	109
Emerald	1.51	1.96	0.13	2.08	1.80	109
MTO S82 <sup>b</sup>	1.50	1.92	0.08	1.99	1.74	106
Dart	1.43	1.90	0.13	2.04	1.74	105
636	1.30	2.02	0.14	2.15	1.72	105
Endure	1.41	1.94	0.11	2.05	1.73	105
Summit	1.43	1.85	0.17	2.02	1.72	104
Saranac	1.39	1.93	0.11	2.05	1.72	104
Saranac AR	1.36	1.90	0.15	2.05	1.70	103
Mohawk	1.50	1.81	0.10	1.91	1.70	103
DK 135	1.49	1.75	0.12	1.88	1.68	102
Sure	1.45	1.77	0.13	1.90	1.68	101
Vernal	1.20	2.02	0.12	2.14	1.67	101
Cimarron	1.33	1.88	0.13	2.00	1.66	101
8016 PCA3	1.40	1.81	0.11	1.92	1.66	101
Commandor	1.49	1.71	0.11	1.82	1.66	100
Blazer	1.48	1.68	0.12	1.80	1.64	100
SX 217	1.36	1.77	0.15	1.92	1.64	100
DS 701	1.44	1.69	0.15	1.84	1.64	99
Target II	1.44	1.70	0.14	1.84	1.64	99
Apollo Supreme	1.39	1.76	0.11	1.87	1.63	99
SX 424	1.39	1.77	0.11	1.87	1.63	99
Arrow	1.39	1.76	0.11	1.87	1.63	99
120	1.38	1.76	0.12	1.88	1.63	99
GH-747	1.35	1.75	0.15	1.90	1.62	98
Big 10	1.32	1.82	0.11	1.93	1.62	98
MTO N82 <sup>b</sup>	1.56	1.60	0.09	1.68	1.62	98
RS 7890 <sup>b</sup>	1.45	1.65	0.14	1.79	1.62	98
WL 225	1.42	1.69	0.07	1.76	1.59	97
Clipper	1.28	1.78	0.11	1.89	1.58	96
Fortress	1.37	1.69	0.11	1.80	1.58	96
Iroquois	1.31	1.54	0.12	1.65	1.48	90
526	1.19	1.61	0.11	1.72	1.46	88
532	1.27	1.49	0.08	1.58	1.42	86
Average	1.40	1.78	0.12	1.90	1.65	
LSD (0.05)	NS	NS	0.05	NS	NS	

<sup>a</sup> % Relative performance = (cultivar 2-yr-average yield)/(2-yr average of all cultivars).

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

Table 5. Maturity ratings<sup>a</sup> of 34 alfalfa cultivars planted April 22, 1987, at the SDSU Research Station, Brookings.

Cultivar	1987	1988	
	Cut 1 7/22	Cut 1 6/6	Cut 2 7/25
8016 PCa3	3.3	3.7	4.4
Apollo Supreme	3.7	3.4	4.1
Arrov	3.9	3.5	4.3
Big 10	3.6	3.9	5.0
Blazer	3.6	3.2	4.5
Cimarron	3.5	3.7	4.4
Commandor	3.6	3.2	4.3
120	3.4	3.5	4.1
DK 135	3.6	3.5	4.6
DS 701	3.3	3.7	4.1
Target II	3.7	3.5	4.8
Dart	3.5	3.6	4.6
Emerald	3.3	3.9	4.9
Endure	3.5	3.4	4.2
Fortress	3.7	3.5	4.6
636	3.6	3.6	4.8
CH-747	3.5	3.7	4.5
Iroquois	3.5	3.6	4.5
MTO N82	3.7	3.9	4.3
MTO S82	3.5	4.0	4.4
Mohawk	3.4	3.7	4.8
Clipper	3.2	3.7	4.4
526	3.5	3.4	4.5
532	3.1	3.3	4.5
RS 7890	3.3	3.8	4.4
SX 217	3.7	3.5	4.5
SX 424	3.5	3.4	5.1
Saranac	3.4	3.5	4.6
Saranac AR	3.6	3.7	4.8
Summit	3.6	3.5	4.7
Sure	3.8	3.5	4.5
Ultra	3.7	3.7	4.7
Vernal	3.4	3.7	4.5
WL 225	3.5	3.4	4.1
Average	3.5	3.6	4.5
LSD (0.05)	NS	0.4	NS

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

Table 6. Maturity<sup>a</sup> and yield of 28 alfalfa cultivars planted April 20, 1988, at the SDSU Research Station, Brookings.

Cultivar	Maturity	1988	Relative
		Cut 1 7/12 tons / acre	Performance <sup>b</sup> - % -
5432	4.1	0.87	118
Cimarron	4.1	0.87	117
DK 125	4.3	0.85	115
FSRC 87MI <sup>c</sup>	4.2	0.85	115
Chief	3.9	0.79	107
SX 217	4.1	0.78	106
Vector	4.3	0.78	105
Big 10	4.3	0.78	105
Vernal	4.0	0.78	105
FSRC 87N3	4.3	0.77	105
FSRC 87NI <sup>c</sup>	4.3	0.77	104
Kingstar	4.2	0.76	103
526	3.9	0.76	103
MTO N82 <sup>c</sup>	4.0	0.75	102
Arrov	4.4	0.74	100
Magnum III	4.4	0.72	98
Sure	4.2	0.72	98
120	4.0	0.72	97
WL 320	4.1	0.71	96
AP 8620 <sup>c</sup>	4.0	0.70	95
Dart	4.2	0.69	93
Magnum +	3.9	0.68	92
AP 8631 <sup>c</sup>	4.4	0.68	92
Allegiance	4.1	0.66	90
WL 225	4.1	0.66	89
Premier	4.0	0.66	89
SX 424	4.0	0.62	84
XAF62 <sup>c</sup>	3.8	0.57	77
Average	4.1	0.74	
LSD (0.05)	0.3	NS	

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

<sup>b</sup> % Relative performance = (cultivar average yield) / (average of all cultivars).

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

## Discussion

The drought produced such uncontrollable variation in forage yields that no cultivars consistently stood out as superior to others. Other crops in South Dakota—small grains, soybeans, and corn—had similar variations in yield.

The 1988 drought brought questions about alfalfa stand persistence. Alfalfa originates from the arid climate of Persia, is well adapted to dry conditions, and is usually able to survive a drought. Whether or not a stand is reduced by drought depends upon both subsoil moisture and management of the stand during the fall, winter, and spring following the drought.

As shown in Fig 1, Beresford, Watertown, and Summit locations received above-normal precipitation during August and September. This moisture aided plant preparation for the winter period. Alfalfa stands may have a good chance of producing near-normal forage yields in 1989.

Brookings and Highmore received above-normal precipitation only during September. Production will depend more on winter and spring precipitation, especially at Highmore. If this precipitation does not occur, alfalfa growth in the spring will be retarded, the first harvest may be delayed, and yields may be low.

Poor fall cutting management also threatens stand longevity. Producers should fall-cut after a hard frost when there is little chance for regrowth. Not harvesting in the fall will permit stubble to catch any snow that may fall. Snow insulates the crown and provides moisture for plant growth the following spring.

## Cultivar selection

Before planting a new alfalfa cultivar, examine the test information on all possible choices, emphasizing the major characteristics: yield, fall dormancy, disease resistance, and cost per unit of pure live seed (PLS).

## Yield:

The yield information represents seeding year, 2-, and 3-year

Table 7. Forage yield of 31 alfalfa cultivars planted April 25, 1987, at the Northeast Research Station, Watertown.

Cultivar	1987 1-Cut Total	1988 Forage Yield				3-Cut Total	2 Year Avg	Relative Performance <sup>a</sup> %
		Cut 1 6/13	Cut 2 7/26	Cut 3 8/31	tons / acre			
120	2.00	2.44	1.04	0.86	4.34	3.17	111	
WL 225	2.11	2.40	0.95	0.86	4.21	3.16	111	
Dart	1.93	2.43	0.97	0.88	4.28	3.10	109	
Fortress	1.87	2.43	0.99	0.90	4.31	3.09	109	
Cimarron	1.95	2.29	1.00	0.89	4.18	3.06	108	
SX 217	2.05	2.09	1.05	0.90	4.04	3.04	107	
MTO S82 <sup>b</sup>	1.91	2.51	0.94	0.70	4.15	3.03	106	
Clipper	2.03	2.34	0.85	0.84	4.02	3.02	106	
532	1.77	2.38	0.92	0.86	4.16	2.96	104	
Magnum III	1.86	2.07	0.95	0.90	3.92	2.89	102	
526	1.66	2.37	0.91	0.82	4.10	2.88	101	
Iroquois	1.84	2.15	0.87	0.84	3.86	2.85	100	
Blazer	1.82	2.26	0.87	0.73	3.86	2.84	100	
Big 10	1.74	2.12	0.92	0.88	3.92	2.83	99	
Endure	1.81	2.15	0.91	0.77	3.83	2.82	99	
Mohawk	1.68	2.24	0.92	0.78	3.94	2.81	99	
Dynasty	1.82	2.13	0.81	0.82	3.76	2.79	98	
Cim 2000C <sup>b</sup>	1.79	2.14	0.82	0.82	3.78	2.78	98	
SX 424	1.65	2.07	0.91	0.90	3.88	2.76	97	
Arrow	1.65	2.15	0.86	0.85	3.87	2.76	97	
XPH 2001	1.69	2.02	0.95	0.86	3.82	2.76	97	
DK 135	1.81	2.18	0.79	0.72	3.69	2.75	97	
Eagle	1.72	2.06	0.86	0.86	3.78	2.75	97	
Apollo Supreme	1.81	2.18	0.78	0.70	3.66	2.74	96	
5432	1.72	1.98	0.89	0.86	3.73	2.72	96	
Saranac AR	1.78	2.03	0.83	0.75	3.61	2.70	95	
Vernal	1.83	2.05	0.78	0.71	3.55	2.69	95	
Commandor	1.80	1.96	0.82	0.79	3.56	2.68	94	
636	1.73	2.09	0.81	0.68	3.57	2.65	93	
Saranac	1.60	2.11	0.80	0.67	3.57	2.58	91	
MTO N82 <sup>b</sup>	1.78	2.32	0.54	0.47	3.33	2.56	90	
Average	1.81	2.20	0.88	0.80	3.88	2.85		
Maturity <sup>c</sup>		5.6	7.4	4.3				
LSD (0.05)	NS	0.33	0.21	0.17	NS	0.37		

<sup>a</sup> % Relative performance = (cultivar 2-yr-average yield)/(2-yr average of all cultivars).

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

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

averages. Generally, yield data representing several years of production are the most meaningful. Use data from the test locations that most nearly resemble your farm in terms of growing conditions.

To measure significant differences in yield 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 are approximately equal in yielding ability. In some cases an LSD value is not presented; the designation NS (non-significant) indicates that significant yield differences among the cultivars were not detected.

#### Fall Dormancy:

Fall dormancy ratings (Table 12) range from values of 1 (early dormancy) to 8 (non-dormant). Fall dormancy is closely related to winterhardiness. Severe winters in South Dakota necessitate that winterhardiness be a major consideration in cultivar selection.

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

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

Cultivars with a rating of 3 to 4 are winterhardy to moderately winterhardy, and at least 3 to 4 years of excellent production can be expected. 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 indicate a cultivar's potential to perform when

Table 8. Forage yield of 28 alfalfa cultivars planted April 28, 1988, at the Northeast Research Station, Watertown.

Cultivar	1988	Relative Performance <sup>a</sup>
	Cut 1 7/26 tons / acre	
Vernal	0.77	129
Big 10	0.76	127
120	0.71	118
FSRC 87N1 <sup>b</sup>	0.70	117
AP 8620 <sup>b</sup>	0.67	112
FSRC 87M1 <sup>b</sup>	0.67	112
DK 125	0.67	112
Cimarron	0.67	111
Vector	0.62	104
SX 424	0.62	103
Sure	0.61	102
SX 217	0.60	100
Kingstar	0.58	97
Chief	0.58	96
Arrow	0.57	96
Magnum 111	0.57	96
FSRC 87N3 <sup>b</sup>	0.57	95
Premier	0.57	94
526	0.56	94
AP 8631 <sup>b</sup>	0.55	92
Dart	0.54	90
MTO N82 <sup>b</sup>	0.54	90
WL 320	0.53	89
86639 <sup>b</sup>	0.53	88
XAF62 <sup>b</sup>	0.52	88
Magnum +	0.52	87
5432	0.49	82
WL 225	0.47	79
Average	0.60	
Maturity <sup>c</sup>	4.0	
LSD (0.05)	NS	

<sup>a</sup> Relative performance = (cultivar average yield)/(average yield of all cultivars).

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

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

specific diseases are present. Major alfalfa diseases in South Dakota are bacterial wilt and Phytophthora root rot.

Bacterial wilt infection generally begins in the spring or early summer of the third production year, entering plants through 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 pronounced moisture stress. Symptoms include yellow leaves, stunted growth, and a yellow to brown discoloration of the root tissue beneath the outermost layer. Many bacteria-resistant cultivars are available.

Phytophthora root rot is a fungal disease which may occur in poorly drained soils during excessive precipitation or irrigation. Symptoms include deteriorated root or crown tissue in areas where you see the stands are thinning. Wilting, yellowing, and lack of vigorous growth are also frequently observed. This disease is sometimes involved in damping off of alfalfa seedlings.

Verticillium wilt is a fungal disease which will first wilt upper leaves temporarily on warm days at pre-bud to floral stages of maturity. After a yellow color develops on the leaf tips, the leaves die and drop off. Eventually, the stems die as well. Yellow to brown discoloration is usually found 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.

Other diseases, such as anthracnose, leaf spots, Fusarium wilt, and other root and crown rots, may be problems at a particular site. For each of these diseases, the only practical way to minimize economic loss is to use disease resistant cultivars. Disease resistance ratings for the tested cultivars are given in Table 12.

#### Pasture-type cultivars:

Pasture-type cultivars are less erect, slower to recover after cutting, and

Table 9. Forage yield of 24 alfalfa cultivars planted April 10, 1986, at the Central Crops and Soils Research Station, Highmore.

Cultivar	1986	1987	1988 Forage Yield			3 Year Avg Performance <sup>a</sup>	Relative Performance <sup>a</sup>
	3-Cut Total	3-Cut Total	Cut 1 6/20	Cut 2 8/11	2-Cut Total		
	----- tons / acre -----						
5432	2.67	3.33	0.88	0.22	1.09	2.36	114
526	2.50	3.20	0.90	0.21	1.11	2.27	110
Edge	2.37	3.34	0.86	0.22	1.08	2.26	110
Drummor	2.37	3.27	0.85	0.21	1.06	2.23	108
AP 45	2.37	3.21	0.85	0.21	1.06	2.21	107
Cimarron	2.83	2.77	0.81	0.21	1.02	2.21	107
Crown	2.60	2.99	0.79	0.18	0.97	2.19	106
Dart	2.45	3.08	0.79	0.25	1.03	2.19	106
532	2.50	3.02	0.82	0.21	1.04	2.19	106
Surpass	2.24	3.19	0.82	0.26	1.08	2.17	105
120	2.35	2.98	0.80	0.22	1.02	2.12	103
SX 217	2.49	2.86	0.78	0.21	0.99	2.11	102
Epic	2.46	2.84	0.81	0.21	1.01	2.10	102
Arrow	2.11	2.93	0.79	0.18	0.96	2.00	97
Heinrich's	1.90	2.84	0.98	0.21	1.19	1.98	96
Vernal	2.26	2.76	0.73	0.18	0.90	1.97	96
SX 424	2.30	2.62	0.76	0.17	0.93	1.95	94
MTO S82 <sup>b</sup>	2.25	2.62	0.84	0.14	0.98	1.95	94
Roamer	1.77	2.70	1.09	0.27	1.36	1.94	94
WL 225	2.21	2.66	0.74	0.15	0.89	1.92	93
Rangelander	1.83	2.68	0.98	0.23	1.21	1.91	92
MTO N82 <sup>b</sup>	1.96	2.64	0.89	0.14	1.02	1.87	91
Rambler	1.88	2.44	1.04	0.20	1.25	1.86	90
Drylander	1.63	2.11	0.98	0.14	1.12	1.62	78
Average	2.26	2.88	0.86	0.20	1.06	2.06	
Maturity <sup>c</sup>			4.8	6.7			
LSD (0.05)	0.34	0.63	NS	NS	NS	0.33	

<sup>a</sup> % Relative performance = (cultivar 3-yr-average yield)/(3-yr average of all cultivars).

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

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

more winterhardy than most hay-type alfalfas.

They are also generally less productive under optimum growth conditions; however, they often withstand moisture and temperature stresses better than hay-type alfalfas because of their high degree of fall dormancy. Pasture-type cultivars frequently have broad, deep-set crowns and spreading root systems which make them more tolerant of grazing than hay-type cultivars.

### Conclusions

A single characteristic, such as high yield, will make no one alfalfa cultivar superior to another. Although yield serves as a good measure of economic production, characteristics associated with stand longevity, stress, and disease tolerance 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. It is related to stand longevity in stressful environments. Multiple disease resistance benefits stand longevity and yield. Seed cost per unit PLS is the final consideration.

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Table 10. Forage yield of 24 alfalfa cultivars planted April 27, 1987, at the Central Crops and Soils Research Station, Highmore.

Cultivar	1988 Forage Yield			Relative Performance <sup>a</sup>
	Cut 1 6/20	Cut 2 8/9	2-Cut Total	
	tons / acre			- % -
Mohawk	1.75	0.48	2.23	128
Saranac	1.72	0.49	2.21	127
Saranac AR	1.63	0.55	2.18	125
636	1.58	0.49	2.08	119
Iroquois	1.61	0.33	1.94	112
120	1.54	0.35	1.89	109
Big 10	1.48	0.39	1.87	108
Vernal	1.54	0.31	1.85	106
8016 PCa3	1.48	0.33	1.81	104
Magnum III	1.44	0.34	1.79	103
526	1.52	0.22	1.74	100
DK 135	1.40	0.30	1.70	98
MTO N82 <sup>b</sup>	1.51	0.19	1.70	98
Cimarron	1.36	0.30	1.65	95
MTO S82 <sup>b</sup>	1.53	0.12	1.65	95
Emerald	1.34	0.28	1.61	93
SX 424	1.25	0.35	1.61	92
Blazer	1.35	0.24	1.59	91
Eagle	1.34	0.22	1.56	90
WL 225	1.27	0.22	1.50	86
532	1.28	0.20	1.48	85
Clipper	1.30	0.14	1.44	83
Dynasty	1.28	0.14	1.42	82
SX 217	1.08	0.16	1.24	71
Average	1.44	0.30	1.74	
Maturity <sup>c</sup>	4.7	7.7		
LSD (0.05)	0.35	NS	NS	

<sup>a</sup> \* Relative performance = cultivar total yield / (average-total yield of all cultivars).

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

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

Table 11. Forage yield of 27 alfalfa cultivars planted May 22, 1986, at Summit.

Cultivar	1986	1987	1988 Forage Yield				3 Year Avg	Relative Performance <sup>a</sup>
	2-Cut Total	3-Cut Total	Cut 1 6/13	Cut 2 8/1	Cut 3 9/3	3-Cut Total		
	----- tons / acre -----							
120	2.38	3.77	0.98	0.03	0.24	1.25	2.47	111
Cimarron	2.41	3.76	0.87	0.06	0.25	1.19	2.45	111
Magnum +	2.36	3.67	0.94	0.07	0.29	1.29	2.44	110
Dart	2.45	3.55	0.91	0.03	0.26	1.20	2.40	108
Dynasty	2.36	3.59	0.88	0.06	0.29	1.23	2.39	108
DS 647 <sup>b</sup>	2.44	3.49	0.84	0.04	0.28	1.16	2.36	107
DS 646 <sup>b</sup>	2.18	3.73	0.82	0.05	0.23	1.10	2.34	105
5432	1.84	3.91	0.88	0.05	0.30	1.23	2.33	105
AP 45	2.12	3.65	0.83	0.03	0.27	1.13	2.30	104
Crown	2.21	3.47	0.85	0.05	0.27	1.16	2.28	103
Arrov	2.16	3.38	0.96	0.03	0.24	1.23	2.26	102
Drummor	2.10	3.50	0.88	0.06	0.22	1.16	2.25	102
MTO S82 <sup>b</sup>	2.08	3.41	1.01	0.03	0.17	1.22	2.24	101
Surpass	2.24	3.38	0.72	0.03	0.26	1.02	2.21	100
SX 217	2.08	3.43	0.76	0.05	0.23	1.04	2.18	99
Vernal	1.95	3.49	0.83	0.04	0.23	1.10	2.18	98
526	2.09	3.32	0.82	0.03	0.21	1.06	2.16	97
532	2.05	3.26	0.84	0.03	0.27	1.14	2.15	97
Rangelander	1.85	3.35	1.00	0.03	0.19	1.22	2.14	97
Epic	2.06	3.19	0.82	0.05	0.31	1.17	2.14	97
SX 424	2.08	3.16	0.89	0.04	0.24	1.17	2.14	96
Edge	2.18	3.10	0.83	0.05	0.23	1.11	2.13	96
Heinrich's	1.82	3.25	1.04	0.04	0.18	1.25	2.11	95
MTO N82 <sup>b</sup>	2.20	3.04	0.88	0.02	0.14	1.04	2.09	94
Roamer	2.00	2.87	0.89	0.02	0.13	1.04	1.97	89
Drylander	1.58	3.04	1.09	0.02	0.10	1.21	1.94	88
Rambler	1.56	2.69	0.99	0.03	0.09	1.11	1.79	81
Average	2.10	3.39	0.89	0.04	0.23	1.16	2.21	
Maturity <sup>c</sup>			5.3	6.2	4.1			
LSD (0.05)	NS	0.45	NS	0.02	0.07	NS	0.31	

<sup>a</sup> % Relative performance = (cultivar 3-yr-average yield)/(3-yr average of all cultivars).

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

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

Table 12. Listing of alfalfa cultivars, developers, suppliers, and characteristics.<sup>ab</sup>

Developer/Supplier	Cultivar	FDC	BW	WFP	And	PRR	SAAD	PAD	BAAD	SND	RND
Agriculture Canada Research Station	Drylander	1	MR	—	MR	S	S	—	—	—	—
	Heinrich's Rambler										
	Rangelander										
	Roamer										
AgriPro	AP 45 Dart	3	HR	R	HR	R	HR	—	—	—	
Arrow Seed Company, Inc.	Emerald	4	R	MR	R	MR	R	LR	R	—	
Asgrow Seed Company	Eagle XPH 2001	4	HR	MR	R	R	MR	R	R	LR	
Cargill, Inc.	Endure	3	R	R	R	MR	R	LR	—	—	
Cenex/Land O'Lakes	Surpass	3	HR	R	HR	MR	R	—	—	—	
	Sure	3	HR	R	HR	HR	R	LR	HR	—	
	Sparta	3	R	R	MR	—	MR	—	R	—	
	Blazer	3	HR	LR	R	LR	MR	—	HR	—	
Dahlgren & Company, Inc.	Kingstar	3	R	R	HR	MR	R	R	MR	—	
	Premier	4	R	R	HR	R	HR	MR	HR	—	
Dairyland Research Int'l.	Magnum III	4	R	MR	R	MR	R	MR	—	—	
	DS 701										
	Target II	4	HR	R	HR	R	R	R	—	—	
	Dynasty	4	HR	R	R	MR	R	R	—	—	
Dekalb-Pfizer Genetics	Magnum +	4	R	LR	R	MR	R	LR	—	—	
	DK 135	4	R	MR	R	MR	MR	MR	R	LR	
	DK 120	3	HR	—	R	LR	R	—	R	—	
DK 125	3	HR	R	R	HR	R	MR	R	—	—	
Funk Seeds International	G-2841	3	HR	R	R	R	R	HR	R	—	
Garst Seed Company	636	2	HR	R	R	MR	R	—	—	—	
Golden Harvest	GH-747										
Great Lakes Hybrids	Big 10	3	HR	—	HR	R	R	LR	R	—	
Great Plains Research	Cimarron	4	HR	LR	HR	R	MR	HR	R	—	
Jacques	Chief	4	HR	R	R	R	HR	R	R	—	

Table 12. Continued  
Developer/Supplier

Developer/Supplier	Cultivar	FD <sup>c</sup>	BW <sup>d</sup>	VW <sup>d</sup>	FW <sup>d</sup>	An <sup>d</sup>	PRR <sup>d</sup>	SAA <sup>d</sup>	PA <sup>d</sup>	BAA <sup>d</sup>	SN <sup>d</sup>	RKN <sup>d</sup>
J.C. Robinson Seed Company	GH 737	4	R	R	R	MR	HR	R	R	--	MR	--
L. L. Olds Seed Co.	Old's "98"	3	HR	R	R	HR	R	R	R	--	--	--
L. Peterson Ltd.	Vector	4	R	MR	HR	R	R	R	R	LR	R	--
Michigan Agric. Exp. Stn.	8016 PCa3											
NAPB	Arrow	3	HR	R	HR	MR	HR	--	--	--	--	--
	Apollo Supreme	4	HR	R	HR	HR	R	--	--	--	--	--
New York Agric. Exp. Stn.	Iroquois	2	R	--	--	--	--	--	--	--	--	--
	Saranac	4	R	--	--	--	--	--	--	--	--	--
	Saranac Ar	4	MR	--	--	--	--	--	--	--	--	--
	Mohawk	2	HR	--	MR	HR	--	--	--	--	--	--
The New Northrup King	Commandor	4	R	MR	R	HR	R	LR	--	--	MR	--
	Drumcor	4	R	--	MR	MR	R	HR	--	--	MR	--
	Summit	4	R	R	R	HR	R	MR	R	--	--	--
	Fortress	4	R	R	R	R	HR	HR	R	--	HR	--
Payco / Interstate	Edge	4	R	R	R	HR	R	R	R	--	--	--
	Clipper	2	HR	R	HR	R	R	--	--	--	--	--
Paymaster	Crown	3	R	R	R	HR	R	MR	R	--	R	--
Pioneer Hi-Bred Int'l.	526	2	HR	--	MR	--	LR	HR	R	--	--	--
	532	3	HR	--	R	LR	LR	HR	R	--	--	--
	5432	4	HR	R	HR	--	MR	HR	R	--	--	--
Research Seeds, Inc.	Epic	4	R	--	MR	--	R	--	HR	--	HR	--
	Champ	3	HR	MR	R	S	MR	S	HR	--	HR	--
SeedTec	Ultra	3	HR	R	HR	HR	R	LR	R	--	--	--
Sexauer Company	SX 217	4	R	--	HR	MR	MR	HR	--	--	R	MR
	SX 424	3	MR	--	R	R	R	HR	--	--	--	--
United AgriSeeds, Inc.	Salute	4	HR	MR	R	MR	R	LR	--	--	--	--
	Alliegance	4	HR	MR	HR	R	R	LR	MR	--	R	--
Wisconsin Agric. Exp. Stn. /USDA	Vernal	2	R	--	MR	--	--	--	--	--	--	MR
W-L Research, Inc.	WL 225	2	HR	R	HR	MR	MR	HR	R	R	--	MR
	WL 320	5	R	MR	HR	MR	R	R	MR	MR	MR	--

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

<sup>b</sup>Ratings have been obtained from: 1987 alfalfa varieties. Certified Alfalfa Seed Council, Inc., Davis, CA; 1987 varietal trials of forage crops. University of Minn. Rpt. no. 24.; Alfalfa varieties for '88. 1987. Hay and Forage Grower. 2(6):5-7.; and Seed companies list new alfalfa varieties. 1988. Hay and Forage Grower. 3(8):11. Webb Publishing Co St. Paul, MN.

<sup>c</sup>FD = Fall Dormancy Index, 1 = greatest fall dormancy; 8 = absence of fall dormancy.

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

BW = Bacterial Wilt  
VW = Verticillium wilt  
FW = Fusarium wilt  
An = Anthracnose  
PRR = Phytophthora Root Rot  
SAA = Spotted Alfalfa Aphid  
PA = Pea Aphid  
BAA = Blue Alfalfa Aphid  
SN = Stem Nematode  
RKN = Root Knot Nematode

Pest Resistance % Resistance 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)

Brandnames are given for reader convenience and do not constitute an endorsement nor discrimination against those not mentioned. Cultivars, whether public or private, are not endorsed by their inclusion in this publication.

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