Extension Bulletin E-2787, New, May 2002

MICHIGAN STATE UNIVERSITY EXTENSION

Perennial Legume and Grass Forage Variety Selection for Michigan

Richard Leep, Timothy Dietz
and Doo-Hong Min
Department of Crop and Soil Sciences
Michigan State University

Introduction

Forage is defined as "edible parts of plants, other than separated grain, that can provide feed for animals, or that can be harvested for feeding." Over 2.5 million acres of Michigan farmland are dedicated to forage production. The total value of the forage harvested or grazed from this land is approximately $600 million. By acreage, forages are the No. 1 crop in the state. Perennial forage crops also help prevent soil erosion and protect water quality. In addition, forages create an appealing green landscape and open space across the state.

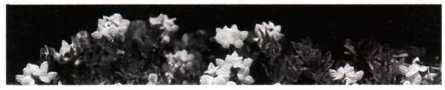
Many Michigan farmers are faced with equipment, land and labor costs that are increasing exponentially, while the value of the products sold off the farm gains slowly, holds steady or declines. Increasing the profit margin requires good management and improved varieties to increase yields.

Michigan State University has established more than 25 research trials in five locations across the state to evaluate management practices and varieties in an unbiased manner. Herbage yield, stand persistence and forage quality are the primary factors that are compared in these trials.

This publication summarizes performance data over the past several years for alfalfa, birdsfoot trefoil, clovers, forage chicory and cool-season grasses.

Evaluations of Alfalfa Varieties in Michigan

MSU has evaluated more than 90 commercially available alfalfa varieties in its variety trials since 1994. Plant breeders, developers and marketers submit both commercial and experimental alfalfa varieties to MSU for testing. Varieties in these trials are evaluated for herbage yield and stand



persistence for at least three years. Alfalfa variety trials have been established at East Lansing in southern lower Michigan, Lake City in central northern Michigan and Sandusky in the Thumb.

More than 95 percent of the varieties entered are evaluated at East Lansing. Trials at East Lansing are usually two to three times larger than trials at other sites in the state. Yield is expressed as a percentage of a check variety (Vernal) averaged over two or three years for 98 alfalfa varieties evaluated at East Lansing from 1994 to 1999 (Table 1). Lake City data from 1996 to 1999 are provided in Table 2.

Selecting an appropriate alfalfa variety for an environment requires careful consideration. Herbage yield and stand persistence of a variety are only a part of establishing and maintaining an alfalfa stand. Good management practices are also important. Establish good stands on adequately drained soils. Adjust soil pH a full year prior to seeding. Fertilize before seeding and amend annually with phosphorus and potassium as recommended by soil tests. The appropriate cutting management system depends on the location, yield goal, forage quality desired and desired stand life. Even the best alfalfa variety will not perform well under poor management.

Three cuttings per year:

Cutting three times per year is the best system in Michigan for long-term stands with good yields if alfalfa is fertilized adequately with potassium. Forage quality in a three-cut system should be adequate for beef cows, dairy replacement heifers and dry cows but may be too high in fiber (over 40 percent NDF) for high-producing dairy cows. Alfalfa stands intended for long-term use (greater than five years) should not be cut more than three times per year. Alfalfa stands in northern Michigan should not be cut more than three times per year.

Recommended dates of the third and final cutting are different for northern and southern Michigan. Cutting schedules and approximate stages of maturity with three cuttings are:

Southern lower and central Michigan:

1st cutting — June 1-5 (early bloom)
2nd cutting — July 10-20 (1/10 bloom)
3rd cutting — August 25-October 15 (1/10 to full bloom)

Upper Peninsula and northern lower Peninsula:

1st cutting — June 10-20 (late bud to early bloom)
2nd cutting — July 25-August 15 (1/10 to 1/5 bloom)
3rd cutting — September 30-October 15 (1/10 to full bloom)

Four cuttings per year:

Four cuttings per year are recommended for the highest yields of high quality alfalfa for three- to five-year stands in southern lower Michigan. Four cuttings will usually produce 15 percent higher yields than the standard three-cut system and higher forage quality. Best results are achieved with excellent drainage and high fertility (phosphorus and, especially, potassium). Four cuttings per year are not recommended for areas in northern lower Michigan (north of Clare) or the Upper Peninsula because of the shorter growing season. A four-cut harvest schedule in northern Michigan may result in lower yields, decreased stand life and increased weed invasion after the first year. A four-cut schedule in southern Michigan will result in forage quality of 20 percent crude protein, 30 percent acid detergent fiber and 40 percent neutral detergent fiber (20-30-40). Alfalfa with a nutritive value of 20-30-40 is ideal for high-producing dairy cows.

The cutting schedule for four cuts per year in southern Michigan (south of Clare) is:

1st cutting — late May-June 5 (late bud to very early bloom)
2nd cutting — July 5-15 (early bloom to 1/10 bloom)
3rd cutting — August 15-25 (early to 1/10 bloom)
4th cutting — mid- to late October (1/10 to full bloom; with little or no regrowth after cutting)

Selecting an Alfalfa Variety

For Short-term Stands — Up To Five Years

Most alfalfa stands in Michigan are left for three to four years. Varieties selected for short-term stands should be at least moderately winter hardy, high yielding, and resistant to bacterial wilt (BW) and anthracnose (AN). Resistance to Phytophthora root rot (PRR) is desirable when alfalfa is grown on fine-textured soils prone to waterlogging.

For Long-term Stands — Over Five Years

Winter hardiness is of primary importance for long-lived stands. Winter-hardy varieties may be slower to recover than moderately hardy varieties after a mid-September cutting. Compared with moderately hardy varieties, winter-hardy varieties may flower three to five days later in the first cutting. Winter-hardy varieties may be lower in yield than moderately hardy varieties in three- to five-year stands but are usually higher yielding after about five years, especially in northern Michigan.

Select high-yielding winter-hardy varieties resistant to PRR for long-lived stands. Varieties in dormancy groups 1 and 2 (see column FD in tables 1 and 2) are more likely than moderately hardy varieties (dormancy groups 3 and 4) to establish "permanent" cover. Varieties in groups 3 and 4 have yielded higher than Vernal with similar persistence in the three- to seven-year trials at Lake City or Chatham in northern Michigan. They are considered winter hardy enough for long-term stands because of good survival at these northern locations.

For Pastures

Alfalfa varieties used in pastures should be selected for long-lived stands with resistance to Phytophthora root rot. Allowing adequate rest periods of 30 to 35 days between grazing cycles will enhance longevity of alfalfa for pastures. In addition, allowing a rest period in the fall will allow the alfalfa crop to store needed carbohydrates and proteins for better winter survival. Several commercial varieties are being marketed with improved tolerance to grazing. Alfalfa-grass mixtures in pastures will usually result in better meat and milk gains than grass alone. The grass component will also reduce the risks of bloat in ruminant animals. Alfalfa will provide needed nitrogen for the grass through nitrogen fixation.

Winter Hardiness and Fall Dormancy Ratings

Fall dormancy ratings are determined by the amount of regrowth after a mid-September cutting. The **higher** the rating, the more regrowth and the **less** winter hardy the variety is. Non-hardy varieties used in the western United States have ratings of 5, 6 or 7. Non-hardy alfalfa varieties are usually not well adapted for Michigan, even for short-term stands.

Important Diseases in Michigan

With the exception of new hybrid varieties, most common alfalfa varieties consist of a population of plants that are genetically different from one another. Varieties are described according to the mean response of all plants, such as average yield, and as a frequency of certain types of plants, such as the percentage of plants resistant to some pest or disease. Thus, even in a "resistant" variety, only a portion of the plants will be resistant. Moderate resistance, for example, means that 15 to 30 percent of the plants are resistant but 70 to 85 percent are susceptible. Even a variety classified as resistant may suffer damage from a disease. Moderate resistance is generally considered adequate for good alfalfa production. Even resistant varieties, however, are susceptible to PRR or Pythium diseases in the seedling stage. Table 17 contains a table of disease resistance ratings for varieties evaluated for yield at MSU.

Bacterial wilt (BW). BW is present throughout Michigan. All of the named varieties sold in Michigan are adequately resistant to BW. "Common" alfalfa varieties sold by some seed companies are not recommended because the seed may have come from susceptible plants.

Phytophthora root rot (PRR). This fungus disease, first found in Michigan in 1972, is now one of the state's most important alfalfa diseases. PRR occurs on heavy or poorly drained soils. Alfalfa on any soil, however, when saturated during a rainy period of 7 to 10 days, may suffer severe injury, especially 1- to 2-month-old seedlings. Seed companies have been treating alfalfa seed with the fungicide *Apron* for several years. Seed treating with *Apron* may be helpful in improving stands of resistant varieties. Treating a susceptible variety, such as Vernal, is probably not helpful. Most of the highest yielding varieties entered in our tests were resistant to PRR.

Anthracnose (AN). This disease, first found in Michigan in 1976, is becoming more severe each year. It occurs during hot, moist summers and is most common in the southern third of lower Michigan. The fungus infects stems and crowns and may kill some plants. It is now recommended that only anthracnose-resistant varieties be planted in Michigan.

Verticillium wilt (VW). First detected in Michigan in 1982, VW has not increased in severity as expected. It is generally introduced with infected seed. It is usually not a problem until the third year and then primarily in the first cutting. Growing alfalfa for three to four years in rotation with corn will help break the disease cycle. Resistance to Verticillium wilt is recommended in alfalfa planted after alfalfa.

Important insects in Michigan

Two insects can significantly reduce yield in Michigan. The first is the alfalfa weevil, *Hypera postica*, which is more common in the first cutting. The adult is dark gray and approximately 0.2 inch long. It is the larva that causes crop damage. Larvae are pale green and very small in the first instar. They become darker green with a white stripe and prominent black head prior to pupation. The larvae are chewing insects that feed on interveinal tissue of the new growth. Control of this insect is usually attained through harvest, though insecticide treatments may be required in some years.

Potato leafhopper (PLH), *Empoasca fabae*, can greatly reduce alfalfa yields as well as forage quality and poses the greatest threat to second and third cuttings. Additional information about this pest is provided in the following pages.

Stem/bulb nematode, *Ditylenchus dipsaci*, is less common than these others, but it can potentially reduce older alfalfa stands. Stem nematode is a microscopic pest that occurs in the soil. Symptoms of nematode damage include stunted plants and clublike stems. Crop rotation is the best method for managing stem nematode.

Statistics Explained

The statistic that may be most useful is the average or mean. Comparing selected cultivars to the mean is a simple way to determine which is the best, though experimental error needs to be considered. The least significant difference (LSD) is the minimum value between means for a real difference to exist. This value is determined by observing the error between replications. The coefficient of variation (CV percent) may also be useful in determining the precision of a trial. The greater the variation within the trial, the higher the CV percent.

Table 1. Yield of alfalfa varieties expressed as a percentage of Vernal at East Lansing.

Variety	*Marketer*	*FD**	*Seeding year/% of Vernal*					
			1994	*1995*	*1996*	*1997*	*1998*	*1999*
			3-yr. average					*2-yr. average*
620	Garst, AgriPro Seed, Interstate Seed	2	112	116	-	-	-	-
ABT 205	LaCrosse Forage and Turf Seed	2	-	-	108	-	-	-
Columbia 2000	LG Seed, LaCrosse Forage and Turf Seed, Kaltenberg Seed Farms	2	-	-	113	-	-	-
Dividend	Agway/Allied Seed	2	-	-	114	-	-	-
DK 122	Monsanto	2	101	-	-	-	-	-
DK 124	Monsanto	2	-	-	-	-	118	-
Evolution	Mycogen	2	103	-	-	-	-	-
Iroquois	Public	2	-	-	105	102	-	-
Mariner	Allied Seed	2	-	117	-	-	-	-
Oneida	Public	2	-	-	108	106	-	-
Pioneer var. 5262	Pioneer Hi-Bred	2	-	111	-	-	-	-
Quantum	Renk Seed	2	100	-	-	-	-	-
Sterling	Cargill	2	100	115	-	-	-	-
Vernal	Public	2	100	100	100	100	100	100
Viking I	Syngenta	2	104	-	-	-	-	-
WL 232 HQ	FS Growmark, L.L. Olds Seed	2	-	-	-	-	115	-
WL 252 HQ	FS Growmark, L.L. Olds Seed	2	103	-	-	-	-	-
645	Garst	3	108	-	-	-	-	-
6420	Garst	3	-	-	-	-	-	132
9326	LG Seeds	3	-	-	112	-	-	-
9701	Geertson Seed	3	-	-	-	-	-	134
A 395	MBS	3	-	-	-	-	126	-
Abound	Monsanto	3	-	-	-	-	-	120
Ameriguard 302+Z	America's Alfalfa	3	-	-	-	-	-	94
Ciba 2444	Syngenta	3	-	-	-	114	-	-
Ciba 2888	Syngenta	3	-	110	117	-	-	-
Demand	Agripro	3	101	-	-	-	-	-
DK 127	Monsanto	3	108	116	114	109	-	-
DK 134	Monsanto	3	-	-	-	-	106	122
Forecast 3001	Dairyland	3	-	-	-	-	-	141

*FD = fall dormancy.

Table 1. Yield of alfalfa varieties expressed as a percentage of Vernal at East Lansing (cont).

Variety	*Marketer*	*FD**	*Seeding year/% of Vernal*					
			1994	*1995*	*1996*	*1997*	*1998*	*1999*
			3-yr. average					*2-yr. average*
FQ 314	Cargill Seeds	3	-	-	-	-	124	-
FQ 315	Cargill Seeds	3	-	-	119	-	-	126
GH 788	Golden Harvest Seed	3	-	-	120	-	-	-
GH 794	Golden Harvest Seed	3	95	-	-	-	-	-
GH 797	Golden Harvest Seed	3	-	112	-	-	113	-
Green Field	Beck's	3	104	-	-	-	127	-
Imperial	ABI Alfalfa	3	-	-	117	-	-	-
Innovator + Z	America's Alfalfa, Frontiersmen	3	108	116	-	-	-	-
Magnum III WET	Dairyland Seed	3	-	108	-	-	-	-
Mainstay	Ag Venture	3	-	-	-	-	126	-
Max 329	SeedMart	3	-	-	113	-	-	-
Nemesis	Renk Seed	3	-	-	-	110	-	-
Pioneer var. 5312	Pioneer	3	-	115	-	114	-	116
Pioneer var. 53Q60	Pioneer	3	-	-	-	-	140	131
Pioneer var. 53V63	Pioneer	3	-	-	-	-	103	-
Pointer	Dahlco Seed	3	-	-	-	-	-	134
Rainier	Syngenta	3	-	-	110	-	-	-
Spirit	MBS	3	-	-	-	-	121	-
Stampede	Agway/Allied Seed	3	-	113	-	-	-	-
Synergy	Crow's Hybrid	3	-	-	-	-	115	-
Target II+	Producers Hybrid	3	-	-	-	-	124	-
TMF Multiplier II	Mycogen Seed	3	-	-	107	-	-	-
Total + Z	America's Alfalfa, Frontiersmen	3	95	-	-	-	-	-
Vitro	North-Gro Seed, M&M Biotechnologies	3	-	-	117	-	-	-
Webfoot MPR	Great Lakes Hybrid	3	-	-	110	-	-	-
Wintergreen	Renk Seed	3	-	-	115	-	-	-
WL 325 HQ	FS Growmark, L.L. Olds Seed	3	108	-	111	-	133	-
405	LaCrosse Forage and Turf Seed	4	-	113	-	-	-	-
630	Garst	4	110	-	119	-	-	-
631	Garst	4	105	114	-	114	-	119

*FD = fall dormancy.

Table 1. Yield of alfalfa varieties expressed as a percentage of Vernal at East Lansing (cont).

Variety	*Marketer*	*FD**	*Seeding year/% of Vernal*					
			1994	*1995*	*1996*	*1997*	*1998*	*1999*
			3-yr. average					*2-yr. average*
9429	LG Seeds	4	-	-	121	-	-	-
Ace	UAP Seeds, Ottilie Seeds	4	-	-	112	-	-	-
Affinity+Z	America's Alfalfa, Frontiersmen	4	-	-	112	-	117	-
Alpha 2001	Great Lakes Hybrid	4	-	110	-	-	-	-
Amerigraze 401+Z	America's Alfalfa, Frontiersmen	4	-	-	109	-	-	-
Apollo Supreme	America's Alfalfa, Frontiersmen	4	102	-	-	-	-	-
Aspen	Brown Seed Farms	4	-	-	-	108	-	-
Award	Monsanto	4	-	-	110	-	-	118
Awesome	LG Seeds	4	-	-	-	-	-	116
Big Horn	Cargill Seeds	4	117	-	-	-	-	-
Choice	FFR Cooperative	4	-	113	116	111	112	-
Cimarron 3i	Great Plains Research	4	-	-	-	111	-	-
Depend +EV	Agripro Seeds	4	-	-	114	-	-	-
DK 133	Monsanto	4	106	-	114	-	-	-
DK 140	Monsanto	4	-	-	-	113	135	132
DK 141	Monsanto	4	-	-	118	110	120	114
Emperor	ABI Alfalfa	4	-	-	-	-	125	-
Enhancer	BPR	4	-	-	-	-	-	130
Excalibur	Allied Seed	4	-	-	111	-	-	-
Forecast 1001	Dairyland	4	-	-	-	-	-	132
Gem	FFR Cooperative	4	-	-	111	111	-	-
Geneva	Syngenta	4	-	-	-	-	124	-
Magnum IV	Dairyland Seed	4	111	110	-	-	-	-
Magnum V	Dairyland Seed	4	-	-	-	-	136	114
Ovation	LG Seeds	4	105	109	-	-	-	-
Pioneer var. 5454	Pioneer	4	-	120	117	116	-	-
Pioneer var. 54V54	Pioneer	4	-	-	-	-	-	135
Platinum	Midwest Seed Genetics	4	-	-	-	-	-	121
Pristine	Trelay	4	-	-	-	-	123	-
Radiant	AMPAC seed, CISCO	4	-	-	-	112	-	-

*FD = fall dormancy.

Table 1. Yield of alfalfa varieties expressed as a percentage of Vernal at East Lansing (cont).

Variety	*Marketer*	*FD**	*Seeding year/% of Vernal*					
			1994	*1995*	*1996*	*1997*	*1998*	*1999*
			3-yr. average					*2-yr. average*
Rocket	FFR Cooperative	4	-	-	-	-	-	138
Rushmore	Syngenta	4	103	-	-	-	-	-
Saranac	Public	4	-	-	108	-	89	-
Target II	Producers Hybrid Wilken Bio.	4	-	-	119	-	-	-
WinterGold	Renk Seed	4	-	-	117	-	-	130
WL 323	FS Growmark, L.L. Olds Seed	4	-	112	-	-	-	-
WL 326 GZ	FS Growmark, L.L. Olds Seed	4	-	-	115	-	-	-
WL 327	WL Research	4	-	-	-	-	-	132
Ave. yield of Vernal (DM tons/acre)			6.01	6.29	6.89	5.17	4.46	5.57

*FD = fall dormancy.

Table 2. Yield of alfalfa varieties expressed as a percentage of Vernal at Lake City.

Variety	*Marketer*	*FD**	*Seeding year/% of Vernal*			
			1996	*1997*	*1998*	*1999*
			3-yr. average			*2-yr. average*
8920 MF	Pickseed Canada	2	96	-	-	-
Avalanche +Z	America's Alfalfa	2	104	-	-	-
Defiant	Agripro Seeds	2	97	-	-	-
Dividend	Allied Seed	2	96	-	-	-
DK 122	Dekalb	2	96	-	-	-
DK 124	Dekalb	2	-	-	93	-
Evolution	AgriPro	2	101	103	-	-
Garst 620	Garst	2	103	104	-	-
Iroquois	public	2	97	-	-	-
Oneida	public	2	107	-	-	-
Sterling	Cargill	2	96	-	-	-
TMF 421	Mycogen	2	-	-	101	-
Webfoot	Great Lakes	2	104	-	-	-
2888	Mycogen	3	99	-	-	-
Abound	Asgrow	3	-	-	-	101
DK 127	Dekalb	3	103	95	-	-
DK 134	Dekalb	3	-	-	100	85
FQ 315	Cargill	3	-	-	-	97
Garst 645	Garst	3	101	-	-	-
GH 797	Golden Harvest	3	-	105	-	-
Innovator +Z	America's Alfalfa	3	-	95	-	-
Magnum III Wet	Dairyland	3	103	-	-	-
Mainstay	AgVenture	3	-	-	105	-
Oneida VR	NY AES	3	-	-	-	85
Pioneer 5312	Pioneer	3	-	100	-	91
Pioneer 53Q60	Pioneer	3	-	-	-	102
Rainier	Syngenta	3	95	-	-	-
Saranac	Public	3	100	94	105	91

*FD = fall dormancy.

Table 2. Yield of alfalfa varieties expressed as a percentage of Vernal at Lake City (cont).

Variety	*Marketer*	*FD**	*Seeding year/% of Vernal*			
			1996	*1997*	*1998*	*1999*
			3-yr. average			*2-yr. average*
TMF Multiplier II	MBS, Inc	3	103	-	-	-
Aspen	Brown Seeds	4	-	94	-	-
Award	Asgrow	4	-	-	-	90
Columbia 2000	Allied Seed	4	96	-	-	-
DK 133	Dekalb	4	104	-	-	-
DK 140	Dekalb	4	-	98	104	101
DK 141	Dekalb	4	-	98	107	104
Garst 630	Garst	4	101	-	-	-
Garst 631	Garst	4	103	-	-	-
Geneva	Syngenta	4	-	-	99	-
Magnum IV	Dairyland	4	103	-	-	-
Magnum V	Dairyland	4	-	-	107	-
Pioneer 5454	Pioneer	4	101	98	-	-
Pionner 54V54	Pioneer	4	-	-	-	103
Pristine	Trelay	4	-	-	100	-
Webfoot MPR	Great Lakes	4	96	-	-	-
Vernal (DM/tons/acre)		2	3.24	2.41	2.33	1.93

*FD = fall dormancy

Evaluation of Alfalfa Varieties Resistant to Potato Leafhopper

Potato leafhopper (PLH) reduces alfalfa yield each year in Michigan. It is currently the most damaging insect to alfalfa production in Michigan. Carried north by air currents, this pest rains down on alfalfa fields in mid- to late June. It damages alfalfa by injecting a piercing mouthpart (stylet) into the stems and petioles. The insertion of the stylet and subsequent injection of toxic saliva result in a decreased flow of nutrients and eventually stunting. "Hopperburn" is the term used for the yellowing that occurs from leafhopper damage. Yield can be reduced greatly when sufficient numbers of PLH are present. (For information on insecticide control of potato leafhopper in alfalfa, consult your local Extension office.)

In 1997, several alfalfa seed marketers released "potato leafhopper-resistant" alfalfa varieties. The resistance levels of varieties released in 1997 varied greatly, but most were under 25 percent. Even alfalfa varieties resistant to potato leafhopper may benefit from insecticide applications, especially in the establishment year. Research is being conducted in other states to determine new economic thresholds for determining when to apply insecticides. Many of these varieties (commercial and experimental) were entered into variety trials established in East Lansing in 1997 and at Kellogg Biological Station (KBS) in 1998 and 1999. Since 1997, several varieties of alfalfa with increased resistance to potato leafhopper have been released. Varieties with increased resistance were established in 1998-99 trials at KBS. Yield data from that trial are presented in tables 3 and 4. No insecticide was applied to these trials. The potato leafhopper-resistant alfalfa trial established in East Lansing in 1997 compares eight PLH-resistant varieties with four non-resistant check varieties under spray and no-spray management. Yields from this trial are reported in Table 5.

Table 3. Yield of PLH-resistant alfalfa varieties at KBS (seeded 1998).

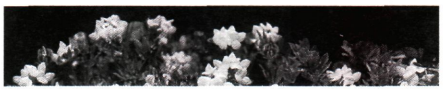
Cultivar	22-May	26-Jun	01-Aug	01-Oct	2001 total	2000 total	1999 total	3-year total
	Dry hay tons/acre							
DK 131 HG	2.24	1.27	1.31	1.20	6.02	6.28	6.24	18.55
TMF 4355 LH	2.26	1.26	1.26	1.23	6.01	6.56	5.97	18.54
DK 121 HG	2.17	1.18	1.05	1.19	5.60	6.19	6.00	17.79
Pioneer 53V63	2.19	1.18	0.94	1.10	5.41	6.11	5.75	17.27
ABT 227 LH	2.14	1.10	0.72	1.15	5.11	6.17	5.59	16.87
Vernal	2.05	1.06	0.73	1.11	4.95	5.78	5.72	16.42
Clean Sweep 1000	2.13	0.84	0.68	1.21	4.86	6.06	5.19	16.11
Mean	2.18	1.16	1.00	1.20	5.52	6.22	5.82	17.50
CV (%)	5	13	14	7	6	5	11	5
5% LSD	0.12	0.16	0.15	0.09	0.36	0.39	0.79	1.16

Table 4. Yield of PLH-resistant alfalfa varieties at KBS (seeded 1999).

Cultivar	22-May	26-Jun	01-Aug	01-Oct	2001 total	2000 total	2-yr total
	Dry hay tons/acre						
DK 131 HG	2.22	1.02	0.96	1.42	5.63	6.33	11.96
4r37	2.32	1.05	0.97	1.45	5.80	6.15	11.94
Pioneer 53V63	2.25	1.10	0.86	1.30	5.51	6.11	11.63
Garst 6310	2.32	0.90	0.88	1.41	5.50	6.02	11.53
Pioneer 5312	2.43	1.05	0.74	1.30	5.52	5.90	11.42
Cimarron SR	2.12	1.03	0.59	1.56	5.30	5.80	11.10
Oneida	2.48	0.95	0.61	1.24	5.29	5.78	11.07
Vernal	2.48	1.00	0.63	1.33	5.44	5.53	10.97
Mean	2.33	1.01	0.78	1.38	5.50	5.95	11.45
CV (%)	9	13	20	13	8	8	7
LSD (5%)	0.28	0.18	0.20	0.22	NS	0.58	NS

Table 5. Yield of potato leafhopper-resistant alfalfa varieties at East Lansing (seeded 1997).

	2000 total		1999 total		1998 total		3-year total	
	Untrt	Trt	Untrt	Trt	Untrt	Trt	Untrt	Trt
	Tons of dry hay/acre							
Rhino	5.08	5.55	5.73	6.08	6.77	6.79	17.57	18.42
5347 LH	4.86	5.14	5.30	5.90	6.45	6.40	16.60	17.45
Clean Sweep 1000	4.66	5.11	5.39	5.43	6.51	6.34	16.55	16.88
Arrest	4.86	5.24	4.98	5.62	6.54	6.51	16.39	17.32
Interceptor	4.75	5.01	5.02	5.62	6.27	6.23	16.04	16.86
Safegaurd	4.55	5.18	4.93	5.71	6.29	6.49	15.80	17.37
Ameriguard 301	4.66	5.04	4.93	6.09	6.02	6.77	15.62	17.90
DK 121 HG	4.46	5.14	5.04	5.49	5.75	6.26	15.25	16.88
8-variety average	**4.74**	**5.18**	**5.17**	**5.74**	**6.32**	**6.47**	**16.23**	**17.39**
Magnum III WET	5.45	5.65	5.65	6.15	6.39	6.41	17.48	18.20
Innovator + Z	5.28	5.54	5.52	6.10	6.28	6.79	17.42	18.42
Pioneer 5454	5.25	5.68	5.44	5.96	6.29	6.53	16.98	18.17
Vernal	5.06	5.35	4.98	5.26	6.34	5.94	16.38	16.56
4-variety average	**5.26**	**5.56**	**5.40**	**5.87**	**6.33**	**6.42**	**17.07**	**17.84**



Birdsfoot trefoil

Birdsfoot trefoil (*Lotus corniculatus* L.) is a legume used for pasture and hay production that will grow in a wide variety of soil conditions. Birdsfoot trefoil may be the best forage species to use in pastures with poorly drained clay soils. The shallow, branching root system makes it less drought tolerant than alfalfa. Allowing birdsfoot trefoil to set seed will permit new seedlings to establish and thus extend trefoil persistence beyond 3 years. Bloat is not a problem for livestock grazing birdsfoot trefoil, perhaps because of the presence of tannin compounds that reduce foaming in the rumen.

Table 6. East Lansing birdsfoot trefoil variety trial, seeded in 1998.

Cultivar	Cut 1	Cut 2	2001 total	2000 total	1999 total	3-year total
			Tons of dry hay/acre			
Maitland	2.31	1.66	3.95	5.94	4.74	14.64
Empire	1.95	1.67	3.63	5.82	5.05	14.50
AU Dewey	2.20	1.28	3.49	5.97	4.35	13.81
Viking	2.23	1.49	3.72	5.80	4.27	13.77
Dawn	1.93	1.33	3.26	5.78	4.65	13.69
Georgia I	2.45	1.28	3.74	5.76	4.19	13.68
Langible	1.89	1.48	3.35	5.45	4.88	13.68
Norcen	1.88	1.47	3.34	5.49	4.49	13.32
Marabel	1.65	1.44	3.10	5.49	4.33	12.92
Leo	1.76	1.19	2.95	5.31	4.22	12.48
Witt	1.94	1.03	2.97	5.23	4.27	12.47
Steadfast	1.70	0.98	2.68	5.69	3.25	11.63
Average	1.99	1.35	3.35	5.65	4.39	13.38
CV%						7
LSD (0.05)						1.12

A birdsfoot trefoil variety trial was established in East Lansing in 1998. Twelve varieties are being evaluated for yield (Table 6) and stand persistence. The variety Steadfast was bred for rhizome development. Birdsfoot trefoil will produce 60 percent of the yield of alfalfa in central Michigan; in northern Michigan, it yields 75 percent of alfalfa. In grazing trials comparing birdsfoot trefoil/bromegrass and alfalfa/bromegrass mixtures, there were no significant differences in animal weight gain over a three-year grazing trial at Lake City, Mich. In another grazing trial at the Kellogg Biological Station comparing birdsfoot trefoil/perennial ryegrass with alfalfa/perennial ryegrass, the alfalfa/perennial ryegrass resulted in greater animal weight gains per acre per year than birdsfoot trefoil/perennial ryegrass.

More information about growing birdsfoot trefoil may be obtained through your county Extension office. Ask for bulletin E-1745 or NCR 474.

Kura Clover, Ladino Clover, Red Clover and Legume Mixtures

Evaluations of red clover, kura clover, and mixtures of ladino, birdsfoot trefoil and alsike clovers were initiated in 1995 to evaluate the legumes for herbage yield, stand persistence and palatability

Table 7. Lake City birdsfoot trefoil variety trial, seeded 1999.

Cultivar	08-Jun	17-Jul	2001 total	2000 total	2-year total
			Dry hay tons/acre		
Bright	1.99	1.07	3.06	3.78	6.84
Dawn	1.98	1.10	3.07	3.64	6.70
MSP 3262	1.75	0.94	2.69	3.74	6.43
Viking	1.82	1.15	2.97	3.48	6.43
Witt	1.84	0.93	2.77	3.65	6.43
MSP 3249	1.74	0.99	2.73	3.65	6.38
Norcen	1.84	0.92	2.77	3.48	6.25
MSP 3261	1.75	0.92	2.67	3.55	6.22
Leo	1.60	0.99	2.58	3.57	6.16
MSP 3264	1.56	1.01	2.57	3.56	6.13
Mirabel	1.66	0.92	2.58	3.45	6.02
MSP 3263	1.57	0.86	2.43	3.43	5.86
Mean	1.76	0.99	2.74	3.58	6.32
CV%					6
LSD (0.05)					0.44

under grazing conditions. The trials were planted at the Upper Peninsula Experiment Station, Chatham, Mich. In spring 1995, five varieties of red clover, mixtures of ladino plus birdsfoot trefoil, ladino plus birdsfoot trefoil plus red clover plus alsike, and ladino plus alsike plus red clover were seeded. In addition, a mixture of birdsfoot trefoil plus kura clover was compared with pure kura clover. The legumes were pure seedings without a grass. A grass/birdsfoot trefoil variety trial was used to supply grass, which prevented cattle from getting bloat from grazing pure legumes. The border of the trial was seeded with birdsfoot trefoil. Forage yield samples from within each plot were taken using a small quadrant (1/4-meter) prior to grazing. One sample was used to determine pregrazing yields; another yield sample was taken after grazing to determine amount of forage rejected by the animals. Holstein cows were used to graze the plots. The plots were grazed one replication at a time using an electric polywire break fence. The rest periods between grazing events were approximately 30 to 35 days. Kura clover is the only legume remaining after six years of grazing in this trial.

Red clover (*Trifolium pratense* L.) is a biennial or short-lived perennial that is well adapted to soils that are not adequately drained. In Michigan, red clover is often frost seeded into wheat stubble as a plow-down and may be grazed or harvested for silage. Red clover is also frost seeded into pastures for improved growth and production. Two to three hay crops per year are the norm for the medium red (early-flowering) type. Mammoth red (late-flowering) is also grown but usually produces only one cutting in Michigan. Red clover data are presented in Table 8.

Table 8. East Lansing red clover variety trial, seeded in July 2001.

Cultivar	Cut 1	Cut 2	2001 total
	Tons dry hay/acre		
Emarwan	1.24	1.83	3.08
Tyrant	1.27	1.72	2.99
Cinnamon	1.18	1.78	2.97
Royal Red	1.36	1.48	2.84
Arlington	1.10	1.57	2.67
Concorde	1.05	1.56	2.60
Common	0.84	1.63	2.47
Marathon	1.18	1.25	2.43
Average	1.13	1.57	2.68
CV%			13
LSD (0.05)			0.46

Kura clover (*Trifolium ambiguum* Bieb.) is a rhizomatous, long-lived, perennial clover that has poor seedling vigor and grows slowly during the establishment year. It tolerates high soil moisture and low fertility levels, but during periods of drought kura clover will become dormant. Good stand persistence due to rhizomes (belowground vegetative shoots that give rise to new plants) makes this a desirable species for intensive grazing, but it must be in a grass mix to reduce bloating. A trial was established in Lake City in 1999 as a grazing trial with kura clover in a co-culture with seven grass species. Data from three grazing events in 2001 are presented in Table 9. In East Lansing, a standard variety trial (mechanically harvested) was seeded in 1999 to measure the yield of kura clover alone (Table 10). The East Lansing trial includes two varieties of birdsfoot trefoil (Steadfast, Norcen) and one mixture of alfalfa, birdsfoot trefoil and kura clover (Multigrazer 700) for comparison.

Ladino clover (*Trifolium repens* var. *giganteum* L.) is a large-type white clover with the greatest yields of all white clovers. Ladino clover is best suited for well drained clay and loam soils. Stolons (aboveground vegetative shoots that give rise to new plants) emanate from the crown of newly

Table 9. Yield of kura/grass presented and percentage (% R) of forage remaining after grazing (2001) at Lake City, Mich.

	14 May		21 June		17 July	
Species	**t ha^{-1}***	**% R**	**t ha^{-1}**	**% R**	**t ha^{-1}**	**% R**
BR†	1.9	28	1.1	27	0.7	4
KB	1.6	30	1.4	34	0.7	1
OR	1.9	72	1.1	54	1.3	7
PR	1.2	33	1.3	32	0.7	3
RC	1.9	53	1.6	48	1.0	11
TF	1.4	25	1.9	39	0.8	5
TIM	1.4	25	1.7	30	0.6	3

† BR = bromegrass, KB = Kentucky bluegrass, OR = orchardgrass, PR = perennial ryegrass, RC = reed canarygrass, TF = tall fescue and TIM = timothy

* Tons per hectare

Table 10. Yields of kura clover, birdsfoot trefoil and mixtures at East Lansing, seeded in 1999.

Cultivar	07-May	23-Jul	2001 total	2000 total	2-year total
Norcen*	1.83	1.49	3.32	5.48	8.80
Multigrazer 700**	2.18	1.23	3.41	5.34	8.75
Cossack	1.85	1.13	2.98	5.06	8.03
Steadfast*	1.91	1.19	1.97	5.91	7.88
MSP 3210	2.24	0.92	3.15	4.68	7.83
MSP 3267	1.89	0.97	2.86	4.80	7.66
MSP 3265	1.80	0.86	2.66	4.32	6.98
MSP 3280	1.91	0.80	2.70	4.22	6.92
MSP 3286	1.92	0.86	2.78	4.05	6.83
MSP 3269	1.65	0.80	2.45	4.28	6.74
Rhizo	1.48	0.84	2.32	3.72	6.03
MSP 3256	1.36	0.69	2.05	3.94	5.99
MSP 3270	1.45	0.80	2.25	3.41	5.66
Average	1.82	1.00	2.81	4.55	7.36
CV%					16
LSD (0.05)					1.45

* Birdsfoot trefoil

** Mixture of alfalfa, birdsfoot trefoil, kura

established ladino clover seedlings to form a carpet that makes it ideal for heavily grazed pastures. Ladino, like other types of white clover, has high bloat potential and should be grown with grasses. Rotational grazing with moderate nitrogen applications allows ladino clover to persist well in grass pastures.

Alsike clover (*Trifolium hybridum* L.) is a short-lived perennial species that prefers cool, wet conditions and survives in soils with low fertility. The fine stems of alsike clover make it susceptible to lodging. Grass species with strong stems are usually grown with alsike clover to reduce bloat and lodging. Alsike clover is grown in Michigan in both pasture and hay production systems.

The results of the grazing trial are grouped into three tables according to species. Table 11 gives the intake yields of red clover varieties tested. There was no significant difference in yield between clover varieties in the seeding year and the second year of production. In 1997, Marathon red clover resulted in the largest yield, 2.42 tons/acre higher than common red clover. This is probably due to a better growth in the third year because of less root rot in this variety than in other varieties.

Table 11. Red clover yields (dry matter yield, tons/acre) at Chatham, Mich., seeded in 1995.

Variety	1995	1996	1997	1998	1999	Total
MARATHON	0.49	2.16	5.10	1.18	1.09	8.94
RED LINE	0.43	2.30	3.82	1.49	0.85	8.03
ARLINGTON	0.90	2.26	2.44	0.95	0.07	6.54
ASTRID	0.77	2.10	2.46	0.70	0.12	6.02
COMMON	0.57	2.06	2.71	0.48	0.07	5.82
Average	0.63	2.18	3.31	0.96	0.44	7.04

The results of mixtures of ladino white clover and other clovers are given in Table 12. When red clover was added to the mixtures, the yield increased approximately 1/2 ton per acre regardless of the mixture. This indicates the competitive nature of red clover. The comparison of Rhizo kura clover and the mixture of Rhizo and birdsfoot trefoil are given in Table 13.

There were no differences in yield between the mixture of birdsfoot trefoil/kura clover and kura clover alone. The kura clover plots were always the first to be selected by the animals, followed by ladino and red clovers.

Table 12. White clover yields (dry matter yield, tons/acre) at Chatham, Mich., seeded in 1995.

Variety	1995	1996	1997	1998	1999	Total
ladino + birdsfoot trefoil	0.91	1.95	2.23	0.43	0.42	5.52
ladino + alsike + r. clover	0.90	1.82	3.35	0.82	0.20	6.90
ladino + b. trefoil + r. clover + alsike	0.73	2.08	2.76	0.52	0.30	6.08
Average	0.85	1.95	2.78	0.59	0.31	6.16

Table 13. Kura clover yields (dry matter yield, tons/acre) Chatham, Mich., seeded in 1995.

	1995	1996	1997	1998	1999	Total
RHIZO	0.57	1.81	2.91	0.60	0.97	5.89
RHIZO + BFT	0.83	1.47	3.07	1.10	1.04	6.47
Average	0.70	1.64	2.99	0.85	1.01	6.18

Forage Chicory

Forage chicory (*Cichorium intybus* L.) is a perennial broadleaf that has good seedling vigor when established in moderately drained soils with a pH of 5.5 or greater. Chicory is an herb that closely resembles dandelion and develops a taproot that sustains lush green growth in times of drought and is best suited for grazing situations. The nutritive value of properly managed chicory is similar to that of alfalfa.

Two forage chicory varieties were evaluated in a grazing trial at the Upper Peninsula Experiment Station in Chatham, Mich., from 1996 to 2000. The trial was established in May 1995. Each plot consisted of a 3- by 25-foot area seeded with a Carter forage planter, which plants five rows 6 inches apart. The chicory was planted either with Alfagraze alfalfa or in a monoculture. Puna chicory has been sold for several years. Lacerta has been available in limited supplies for approximately three years. Forage yield samples from within each plot were taken using a small quadrant (2.7 square feet) prior to grazing. The sample was used to determine pregrazing yields. Another yield sample was taken after grazing to determine the amount of forage rejected by the animals. Holstein cows were used to graze the plots.

The plots were grazed one replication at a time using an electric polywire break fence. The rest periods between grazing events were approximately 30 to 35 days. The yield results are given in Table 14. When either of the chicory varieties was grown in a binary mixture of alfalfa, the yield increased by an average of 1.46 tons dry matter per acre over three years. Puna chicory yields were higher than Lacerta chicory when grown either in binary mixtures or as a monoculture. Visual observations taken in the fall of 1998 showed approximately 35 percent more Puna chicory plants than Lacerta chicory plants. This would indicate that Puna chicory is more persistent under the conditions at this experimental location. The yield of chicory or chicory-alfalfa mixtures was much lower than that of red clover or alfalfa varieties evaluated in the same experimental location.

The chicory bolted (flowers appeared) within a few weeks of the first grazing cycle each year of the trial. This would be somewhat challenging for producers to manage unless they were on a very short grazing cycle.

Cool-season Grasses

Evaluations of perennial cool-season grass species and varieties were initiated during 2000 in an attempt to evaluate grasses for herbage yield, stand persistence and palatability. During the summer of 2000, 20 varieties of six species of cool-season

Table 14. Chicory yields for Chatham, Mich., seeded in May 1995.

Treatment	1996	1997	1998	1999	2000	Total
	dry matter yield (tons/acre)					
Puna & alfalfa	1.92	1.06	1.70	2.98	1.48	9.14
Puna	1.45	0.88	2.07	2.08	1.87	8.35
Lacerta & alfalfa	1.88	0.77	1.63	1.31	1.59	7.18
Lacerta	1.59	0.42	1.09	1.32	0.71	5.13
Average	1.71	0.78	1.62	1.92	1.41	

grasses were seeded at Lake City and East Lansing experiment stations. Each of the grasses (i.e., smooth bromegrass [20 pounds/acre], orchardgrass [15 pounds/acre], timothy [8 pounds/ acre], perennial ryegrass [30 pounds/acre] and tall fescue [15 pounds/acre]) were seeded in small plots (Lake City: 6 by 25 feet; East Lansing: 3 by 25 feet) using four replications. To test palatability and persistence, a Simmental beef herd was used for grazing at Lake City. Each plot was rated visually to determine amount of residue left after grazing. Rest periods were usually 30 to 35 days but varied from year to year and between grazing events, depending on forage regrowth rates. Results from this trial are shown in tables 15 and 16. The following paragraphs provide a summary of the species evaluated.

Orchardgrass (*Dactylis glomerata* L.) is a high-yielding perennial bunchgrass that grows rapidly in the early spring and, once established, will outcompete most other forage species in lower Michigan. Soils with moderately poor drainage are ideal for this species, though it grows on a wide range of soil types. Tillering occurs throughout the growing season, enabling quick regrowth following harvest. Orchardgrass has similar nutritive characteristics to timothy and smooth bromegrass and should be harvested during the vegetative stages of growth prior to heading. Alfalfa and orchardgrass are often grown together in Michigan. Late-maturing varieties of orchardgrass are preferred in mixes with alfalfa.

Perennial ryegrass (*Lolium perenne* L.) is a bunchgrass high in forage quality but somewhat lower in total yield. Perennial ryegrass will persist under intensive rotational grazing situations. It is susceptible to injury when grazed as frozen forage. This species is not as winter hardy as other cool-season grasses, but because of its high forage quality, many farmers are using it in their pasture mixes. Soils that are high in fertility and moderately well drained are ideal for this species. Hot and dry conditions will cause perennial ryegrass to go dormant. Supplemental irrigation can increase perennial ryegrass yields.

Kentucky bluegrass (*Poa pratensis* L.) is a highly palatable perennial cool-season grass with good winter hardiness. It is a sod-forming, rhizomatous, low-yielding, cool-season pasture grass with excellent quality. It tolerates somewhat poorly drained soils, requires a medium soil fertility and soil pH of 5.8 to 6.5. Because of its shallow root system, it often flourishes in early spring, followed by dormancy in the summer months. It is often referred to as "June grass" because of the above seasonal growth characteristic.

Tall fescue (*Festuca arundinacea* L.) is a sod-forming grass that is renowned for fall growth. Tall fescue persists on many soil types and may produce short rhizomes and tillering when grazed frequently. It has a high relative nutritive value when closely grazed. All varieties tested were endophyte-free. Tall fescue persists under heavy traffic from vehicles or animals.

Festulolium (*Festulolium braunii*, K.A.) is a cross between meadow fescue and either perennial ryegrass or Italian ryegrass. This cross combines the persistence of fescue with the palatability of ryegrass. Legume/festulolium compatibility studies are underway in four locations across the state.

Timothy (*Phluem pratense* L.) is a bunchgrass that forms an open sod and persists well under high-moisture conditions. It is best known for its winter hardiness and ability to survive when covered by ice. Timothy should be grown with a legume such as alfalfa, red clover or birdsfoot trefoil. Because long rest periods between harvest and grazing are required for timothy to rebuild carbohydrate reserves, it is more adaptable to a two-cut harvest system.

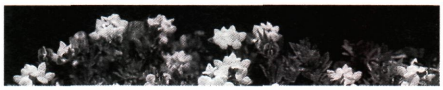


Table 15. East Lansing grass variety trial, seeded 2000.

Species			04-May	30-May	28-Jun	23-Jul	02-Nov	2001
Marketer	Cultivar	04-May	Cut 1	Cut 2	Cut 3	Cut 4	Cut 5	total
		% ground cover			Dry hay tons/acre			
Festulolium								
DLF-Jenks	Perun	100	2.24	1.85	2.11	0.82	1.07	8.08
DLF-Jenks	Hykor	100	2.22	1.17	1.51	1.08	1.58	7.56
Turf-Seed, Inc.	Spring Green	95	1.97	1.66	1.59	0.50	0.73	6.43
	LSD (0.05)							1.03
Ky. bluegrass								
Turf-Seed, Inc.	Lato	45	0.36	0.72	0.65	0.42	0.72	2.86
	Ginger	38	0.25	0.39	0.57	0.27	0.50	1.98
	LSD (0.05)							0.43
Mixture								
AMPAC	Renovator	73	0.70	1.33	1.17	0.47	0.56	4.23
Orchardgrass								
	Potomac	100	1.92	1.11	1.16	0.85	1.23	6.26
Turf-Seed, Inc.	Megabite	100	2.00	0.91	0.94	0.75	0.68	5.28
Turf-Seed, Inc.	Elsie	100	1.58	1.06	0.99	0.75	1.15	5.52
DLF-Jenks	Aramis	87.5	0.82	1.09	1.00	0.67	1.30	4.88
	LSD (0.05)							0.44
Perennial rye								
Michigan State Seed	Elgon	100	1.19	1.91	1.08	0.51	0.74	5.47
Barenbrug USA	Mara	100	1.43	1.44	1.19	0.40	0.51	4.98
Michigan State Seed	Herbie	100	1.10	1.70	0.91	0.50	0.63	4.84
	LSD (0.05)							0.47
Tall fescue								
DLF-Jenks	Kora	100	2.36	1.24	1.56	0.88	1.30	7.33
AMPAC/Parsons	Kokanne	100	2.13	1.43	1.35	0.86	1.31	7.08
Pickseed	Festival	98	2.20	1.11	1.44	0.86	1.67	7.28
Michigan State Seed	Fawn	98	2.22	0.95	1.30	0.95	1.02	6.43
Barenbrug USA	Barolex	98	1.82	1.30	1.20	0.64	1.05	5.99
	LSD (0.05)							1.01
Timothy								
AMPAC/Parsons	Tuukka	98	1.39	1.60	.	1.52	0.70	5.22
Michigan State Seed	Climax	76	1.09	1.67	.	1.34	0.52	4.63
	LSD (0.05)							0.51
	GRAND MEAN	**88**	**1.60**	**1.27**	**1.20**	**0.76**	**0.99**	**5.76**
	CV%	**9**						**16**
	LSD (0.05)	**11.2**						**1.14**

Comments: Below normal precipitation occurred in summer 2001.

Table 16. Lake City grass variety trial, seeded 2000.

Species	Cultivar	10-May % ground cover	10-May Graze 1	08-Jun Graze 2	17-Jul Graze 3	01-Oct Graze 4	2001 total	Graze 1	Graze 2	Graze 4
			Dry hay tons/acre					Palatability 1 to 5*		
Festulolium										
DLF-Jenks	Perun	100	0.80	1.01	0.84	1.33	3.98	4.1	4.8	4.8
DLF-Jenks	Hykor	83	0.93	0.77	0.75	1.60	4.09	2.1	2	3.3
Turf-Seed, Inc.	Spring Green	93	1.03	1.18	0.69	0.90	3.86	4	4	4.8
	LSD (0.05)	15	NS	0.28	NS	0.68	NS			
Ky. bluegrass										
Turf-Seed, Inc.	Lato	27	0.69	0.17	0.36	0.77	2.00	1	2.3	5
	Ginger	10	0.73	0.33	0.22	0.60	1.89	1	3	5
	LSD (0.05)	NS	NS	NS	NS	NS	NS			
Mixture										
AMPAC	Renovator	50	0.74	0.97	0.56	0.99	3.26	3.6	2.8	5
Orchardgrass										
	Potomac	100	1.16	1.35	0.57	1.36	3.90	2	3	2.5
Turf-Seed, Inc.	Megabite	100	1.13	0.67	0.68	1.76	4.26	2.8	3.8	3.8
Turf-Seed, Inc.	Elsie	100	0.89	0.69	0.67	1.35	3.60	2.8	3.3	3.5
DLF-Jenks	Aramis	93	0.94	0.64	0.58	1.56	3.73	2.8	3.5	3
	LSD (0.05)	NS	0.20	NS	NS	0.40	0.65			
Perennial rye										
Michigan State Seed	Elgon	100	0.76	1.20	0.74	1.26	3.95	3.6	4.5	4.5
Barenbrug USA	Mara	100	0.93	1.38	0.81	1.39	4.51	3.1	4.3	4.8
Michigan State Seed	Herbie	93	0.66	1.17	0.67	1.07	3.57	4.3	4.5	5
	LSD (0.05)	NS	NS	NS	NS	0.65	0.82			
Tall fescue										
DLF-Jenks	Kora	80	1.03	0.75	0.68	1.95	4.42	2	2.3	3.5
AMPAC/Parsons	Kokanne	80	1.03	0.77	0.61	1.68	4.10	2.3	2.3	2.8
Pickseed	Festival	80	0.99	0.74	0.69	1.45	3.86	2	3.3	3.3
Michigan State Seed	Fawn	50	0.91	0.44	0.50	1.10	2.97	2.1	2.5	3.5
Barenbrug USA	Barolex	87	0.75	0.81	0.53	1.36	3.47	2.6	2.5	3.8
	LSD (0.05)	6.5	NS	0.17	0.17	0.56	0.86			
Timothy										
AMPAC/Parsons	Tuukka	70	0.99	0.81	0.31	0.97	3.07	4.3	4	5
Michigan State Seed	Climax	70	0.64	0.66	0.42	1.13	2.84	3.9	3.5	5
	LSD (0.05)	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**			
	GRAND MEAN		**0.89**	**0.77**	**0.59**	**1.26**	**3.51**	**2.7**	**3.3**	**4.1**
	CV%		**24**	**21**	**24**	**25**	**13**	**21**	**27**	**22**
	LSD (0.05)	**15**	**0.27**	**0.2**	**0.17**	**0.39**	**0.58**	**0.8**	**1.24**	**1.3**

Comments: Below normal precipitation occurred in summer 2001.
*Palatability is determined by visual observation following grazing (5 is the most palatable).

Table 17. Disease resistance ratings* for alfalfa cultivars in MSU variety trials (BW = bacterial wilt, PRR = Phytophthora root rot, AN = anthracnose, VW = Verticillium wilt, FW = Fusarium wilt).

Variety	BW	PRR	AN	VW	FW
2444	HR	HR	HR	R	HR
2833	HR	HR	HR	R	HR
2888	HR	HR	HR	R	HR
2980	HR	HR	R	R	R
3324	HR	HR	HR	R	HR
9323	HR	HR	R	R	HR
9326	HR	HR	R	R	HR
9429	R	HR	HR	R	HR
9701	R	HR	R	R	HR
A 295	HR	HR	R	R	HR
A 395	HR	HR	HR	R	HR
Abound	HR	HR	HR	HR	HR
ABT 205	HR	HR	HR	R	HR
ABT 227 LH	HR	HR	HR	R	HR
ABT 350	HR	HR	HR	HR	HR
ABT 400 SCL	HR	HR	HR	HR	HR
ABT 405	HR	HR	R	HR	HR
Accolade	R	R	R	HR	R
Ace	HR	HR	HR	R	HR
Achieva	R	HR	HR	R	HR
Action	R	R	HR	MR	R
AF 21	HR	R	HR	R	R
Affinity + Z	HR	HR	HR	HR	HR
Aggressor	HR	HR	HR	R	HR
Agriboss	HR	HR	HR	MR	HR
Alfagraze	MR	LR	MR	-	R
Allegiance	R	R	HR	R	R
Allegro	HR	HR	HR	R	HR
Alpha 2001	HR	HR	HR	HR	HR

Table 17 (cont.). Disease resistance ratings* for alfalfa cultivars in MSU variety trials (BW = bacterial wilt, PRR = Phytophthora root rot, AN = anthracnose, VW = Verticillium wilt, FW = Fusarium wilt).

Variety	BW	PRR	AN	VW	FW
Amerigraze 401+Z	HR	HR	HR	R	HR
Ameriguard 301	HR	HR	HR	R	HR
Ameriguard 302+Z	HR	HR	HR	HR	HR
Apollo Supreme	HR	R	HR	R	HR
Applause	HR	R	HR	R	HR
Arrow	HR	HR	MR	R	HR
Aspen	HR	HR	HR	R	HR
Asset	HR	HR	R	R	R
Attainer	HR	HR	HR	HR	HR
Avalanche +Z	HR	HR	HR	HR	HR
Award	HR	HR	HR	HR	HR
Awesome	HR	HR	HR	HR	HR
Belmont	HR	HR	HR	HR	HR
Benchmark	HR	HR	HR	R	HR
BH 330	HR	HR	HR	R	HR
Big Horn	HR	HR	HR	R	HR
Blazer XL	R	HR	HR	R	HR
Bolt ML	R	HR	HR	HR	R
Break Thru	HR	HR	MR	R	HR
Bronco	HR	HR	MR	R	HR
Callahan 501	R	R	R	R	R
Centurion	HR	R	R	R	R
Chief	HR	HR	R	R	R
Choice	HR	HR	R	HR	R
Cimarron	HR	MR	R	LR	HR
Cimarron 3i	HR	HR	HR	R	HR
Cimarron SR	HR	HR	HR	HR	HR
Cimarron VR	HR	MR	HR	R	HR
Class	R	MR	-	MR	HR

* See page 28 for description of disease ratings.

Table 17 (cont.). Disease resistance ratings* for alfalfa cultivars in MSU variety trials (BW = bacterial wilt, PRR = Phytophthora root rot, AN = anthracnose, VW = Verticillium wilt, FW = Fusarium wilt).

Variety	BW	PRR	AN	VW	FW
Clipper	HR	R	R	R	HR
Clean Sweep 1000	HR	HR	HR	R	HR
Columbia 2000	R	MR	MR	MR	R
Columbo	R	R	R	HR	-
Crown II	HR	HR	HR	R	HR
Crystal	HR	HR	R	R	HR
Cut `N' Graze	HR	R	MR	LR	HR
Dart	HR	HR	R	R	HR
Dawn	R	R	R	R	HR
Defiant	HR	HR	HR	HR	HR
Demand	HR	HR	HR	R	HR
Depend +EV	HR	HR	HR	HR	HR
Dividend	HR	HR	HR	R	HR
DK 120	HR	R	LR	-	R
DK 121 HG	HR	HR	HR	R	HR
DK 122	HR	HR	HR	R	R
DK 124	HR	HR	HR	HR	HR
DK 125	HR	R	HR	R	R
DK 127	HR	HR	HR	R	HR
DK 131 HG	HR	HR	HR	HR	HR
DK 133	HR	HR	HR	R	HR
DK 134	HR	HR	HR	HR	HR
DK 140	HR	HR	HR	R	HR
DK 141	HR	HR	HR	HR	HR
Dominator	HR	HR	HR	R	HR
Dynasty	HR	R	MR	R	R
Echo	R	R	MR	R	R
Emerald	R	R	MR	MR	R
Emperor	HR	HR	HR	HR	HR

Table 17 (cont.). Disease resistance ratings* for alfalfa cultivars in MSU variety trials (BW = bacterial wilt, PRR = Phytophthora root rot, AN = anthracnose, VW = Verticillium wilt, FW = Fusarium wilt).

Variety	BW	PRR	AN	VW	FW
Empress	HR	HR	R	R	HR
Encore	HR	HR	HR	R	HR
Enhancer	HR	HR	R	R	HR
Enterprise	HR	HR	R	R	HR
Envy	R	-	-	MR	-
Evolution	HR	HR	HR	R	HR
Excalibur	R	LR	MR	R	HR
Excalibur II	HR	HR	HR	R	HR
Feast	HR	HR	HR	R	HR
Flagship 75	HR	HR	R	R	HR
Flint	R	R	HR	LR	HR
Forecast 1000	HR	HR	R	R	HR
Forecast 1001	HR	HR	R	R	HR
Forecast 3000	HR	R	R	R	HR
Forecast 3001	HR	HR	R	R	HR
Forerunner	HR	HR	HR	HR	HR
Fortress	R	HR	R	R	R
FQ 314	HR	HR	HR	HR	HR
FQ 315	HR	HR	HR	R	HR
G 2841	HR	R	HR	R	HR
G 2852	HR	R	HR	R	R
Garst 620	HR	HR	HR	R	R
Garst 630	HR	R	MR	MR	R
Garst 631	HR	HR	R	R	R
Garst 636	HR	R	MR	R	R
Garst 645	HR	HR	HR	R	R
Garst 6310	HR	HR	HR	HR	HR
Garst 6420	HR	HR	HR	HR	HR
Gem	HR	HR	HR	R	HR

* See page 28 for description of disease ratings.

Table 17 (cont.). Disease resistance ratings* for alfalfa cultivars in MSU variety trials (BW = bacterial wilt, PRR = Phytophthora root rot, AN = anthracnose, VW = Verticillium wilt, FW = Fusarium wilt).

Variety	BW	PRR	AN	VW	FW
Genesis	HR	HR	HR	R	HR
Geneva	HR	HR	HR	HR	HR
GH 737	R	HR	MR	R	R
GH 755	HR	HR	HR	R	HR
GH 777	HR	HR	R	R	HR
GH 787	HR	HR	HR	R	R
GH 788	HR	HR	HR	R	HR
GH 794	HR	HR	HR	R	HR
GH 797	HR	HR	HR	HR	HR
Gourmet Hay	HR	R	HR	R	HR
Green Field	HR	HR	HR	R	HR
Haygrazer	HR	R	R	R	HR
Haymark	R	R	HR	-	HR
Homestead	HR	HR	HR	R	R
Husky	R	MR	MR	-	R
HYGain	HR	HR	R	R	HR
Hyland	HR	HR	R	R	HR
Impact	HR	R	MR	R	HR
Imperial	HR	HR	HR	R	HR
Innovator +Z	HR	HR	HR	R	HR
Iroquois	HR	-	-	-	-
Jade	HR	HR	R	R	HR
Key	HR	HR	HR	HR	HR
Laser	HR	HR	R	R	HR
Legacy	HR	HR	R	R	HR
Legend	HR	R	HR	R	HR
LegenDairy	HR	HR	HR	HR	HR
MagnaGraze	HR	HR	R	R	HR
Magnum III	R	R	MR	MR	R

Table 17 (cont.). Disease resistance ratings* for alfalfa cultivars in MSU variety trials (BW = bacterial wilt, PRR = Phytophthora root rot, AN = anthracnose, VW = Verticillium wilt, FW = Fusarium wilt).

Variety	BW	PRR	AN	VW	FW
Magnum III WET	R	R	MR	MR	R
Magnum IV	HR	HR	R	R	HR
Magnum V	HR	HR	R	R	HR
Mainstay	HR	HR	HR	HR	HR
Majestic	HR	R	HR	HR	-
Mariner	R	HR	MR	MR	HR
Max 329	HR	HR	HR	HR	HR
Medallion	HR	R	R	R	-
Milkmaker	R	MR	MR	-	HR
Mohawk	HR	-	HR	-	MR
Multi-Gem	HR	R	R	R	R
MultiKing 1	HR	HR	HR	R	-
Multiplier	HR	HR	HR	R	-
MultiQueen	HR	HR	HR	R	HR
Multistar	HR	HR	HR	R	HR
Nemesis	R	HR	HR	HR	HR
Nordic	HR	HR	R	R	R
Oneida	HR	HR	-	-	R
Oneida VR	R	MR	MR	HR	HR
Ovation	HR	HR	HR	HR	HR
Pacesetter	HR	HR	HR	R	R
Paramount	HR	HR	HR	R	HR
Patriot	R	R	R	R	R
Pioneer var. 5151	R	-	-	-	R
Pioneer var. 5246	HR	HR	R	HR	HR
Pioneer var. 5262	HR	R	-	LR	MR
Pioneer var. 5312	HR	HR	HR	HR	HR
Pioneer var. 5364	R	MR	MR	MR	R
Pioneer var. 5373	HR	MR	HR	R	HR

* See page 28 for description of disease ratings.

Table 17 (cont.). Disease resistance ratings* for alfalfa cultivars in MSU variety trials (BW = bacterial wilt, PRR = Phytophthora root rot, AN = anthracnose, VW = Verticillium wilt, FW = Fusarium wilt).

Variety	BW	PRR	AN	VW	FW
Pioneer var. 53Q60	HR	HR	HR	R	HR
Pioneer var. 53V63	HR	HR	HR	HR	HR
Pioneer var. 5432	HR	MR	-	R	HR
Pioneer var. 5454	R	HR	HR	MR	HR
Pioneer var. 5472	HR	MR	MR	MR	HR
Pioneer var. 54V54	HR	HR	HR	HR	HR
Platinum	HR	HR	HR	HR	HR
Pointer	HR	HR	HR	R	HR
Precedent	HR	HR	R	R	HR
Prism	HR	HR	HR	R	R
Pristine	HR	HR	HR	R	R
Pro-Cut	HR	HR	R	R	HR
Pro-Cut 2	HR	HR	R	R	R
Profit	HR	R	MR	R	HR
Promise	HR	HR	HR	R	HR
Proof	HR	HR	HR	R	HR
Quantum	HR	HR	HR	HR	HR
Quest	HR	HR	R	R	HR
Radiant	HR	HR	HR	HR	HR
Rainier	HR	HR	HR	R	HR
Ram Rod	R	R	MR	R	R
Recovery	R	R	R	R	R
Resistar	R	HR	R	HR	HR
RFV 2000	HR	HR	HR	R	HR
Rocket	HR	HR	HR	HR	HR
Rushmore	HR	HR	HR	R	HR
Sabre	HR	R	HR	HR	-
Salute	HR	R	MR	MR	R
Saranac	R	-	-	-	-

Table 17 (cont.). Disease resistance ratings* for alfalfa cultivars in MSU variety trials (BW = bacterial wilt, PRR = Phytophthora root rot, AN = anthracnose, VW = Verticillium wilt, FW = Fusarium wilt).

Variety	BW	PRR	AN	VW	FW
Shield	HR	R	HR	R	R
Spredor 3	HR	MR	R	MR	MR
Spirit	HR	HR	R	R	HR
Stampede	HR	HR	R	R	HR
Sterling	HR	HR	HR	R	HR
Stine 9227	HR	HR	HR	R	HR
SuperCuts	HR	HR	HR	HR	HR
Sure	HR	R	HR	R	HR
Surpass	HR	R	MR	R	HR
Synergy	HR	HR	HR	R	HR
Target II	HR	HR	MR	MR	R
Target II+	HR	HR	R	R	HR
Terminator	HR	R	R	MR	-
Thrive	HR	HR	HR	R	HR
Thunder	R	R	MR	-	HR
TMF 421	HR	HR	HR	HR	R
TMF 4355 LH	HR	HR	HR	R	HR
TMF Generation	HR	HR	HR	HR	HR
TMF Multiplier II	HR	HR	HR	HR	HR
Total +Z	HR	HR	HR	R	HR
Trident	R	HR	MR	-	HR
Trident II	HR	HR	R	R	R
Ultimate	HR	R	HR	R	-
Ultimate	HR	R	HR	R	R
Ultra	HR	R	HR	R	HR
Ultraleaf 87	HR	HR	HR	R	HR
Vector	R	R	R	MR	HR
Venture	HR	HR	R	R	HR
Vernal	R	-	-	-	MR

* See page 28 for description of disease ratings.

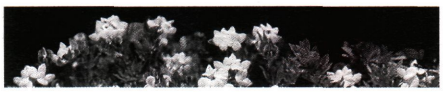
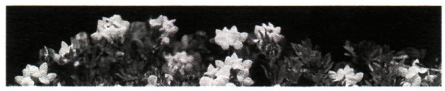


Table 17 (cont.). Disease resistance ratings* for alfalfa cultivars in MSU variety trials (BW = bacterial wilt, PRR = Phytophthora root rot, AN = anthracnose, VW = Verticillium wilt, FW = Fusarium wilt).

Variety	BW	PRR	AN	VW	FW
Vernema	MR	LR	LR	MR	-
Viking I	R	R	R	HR	HR
VIP	HR	R	R	R	R
Vitro	HR	HR	HR	R	HR
Voyager II	HR	HR	R	R	HR
Webfoot	R	R	LR	-	MR
Webfoot MPR	HR	HR	HR	R	HR
WinterGold	HR	HR	HR	HR	HR
Wintergreen	HR	HR	R	R	HR
WL 225	HR	HR	MR	R	HR
WL 232 HQ	HR	HR	HR	HR	HR
WL 252 HQ	HR	HR	HR	R	HR
WL 317	HR	HR	R	R	HR
WL 320	R	R	MR	MR	HR
WL 322 HQ	R	R	MR	R	-
WL 323	HR	HR	HR	R	HR
WL 324	HR	HR	HR	R	HR
WL 325 HQ	HR	HR	HR	R	HR
WL 326 GZ	HR	HR	HR	R	HR
WL 327	HR	HR	HR	R	HR
WL 332 SR	HR	HR	HR	R	HR
Wrangler	R	HR	LR	LR	R
Zenith	HR	HR	HR	R	-

***Descriptions of Disease Ratings**

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



Seed Marketers

Advanta Seeds Pacific
33725 Columbus St., SE
Albany, OR 97321
(800) 288-7333

Agrecol
1984 Berlin Rd.
Sun Prairie, WI 53590
(608) 825-9765

AgriPro Seeds
P.O. Box 2962
Shawnee Mission, KS 66201
(913) 384-4940

AgVenture, Inc.
207 N 7th St.
Kentland, IN 47951
(888) 999-0859

Allied Seed Cooperative
P.O. Box 945
Angola, IN 46703
(800) 813-5025

America's Alfalfa
6700 Antioch
Merriam, KS 66304
(800) 873-3230

AMPAC Seed Co. and their distributers
1-877-778-7880
www.ampacseed.com
info@ampacseed.com

Andrews Seed Co.
580 S. Oregon St.
Ontario, OR 97914
(541) 889-9109

Arrow Seed Co.
126 N. 10th St.
Broken Bow, NE 68822
(800) 622-4727

Asgrow Seed Co.
2605 E. Kilgore Rd.
Kalamazoo, MI 49001
(616) 384-5510

B & A Sales
P.O. Box 386
Columbus, WI 53925
(920) 623-2529

Barenbrug USA
John Thyssen
PO Box 239
Tangent, OR 97389
(541) 926-5801
jthyssen@barusa.com

B&M Seed
Alma, MI
(517) 463-2846

Bedford Farm Supply
NW Michigan
(231) 823-2620
acbeddford@net-port.com

Bio-Plant Research
P.O. Box 320
Camp Point, IL 62320
(800) 593-7708

Blue Chip Quality Seeds
P.O. Box 11
Abbottsford, WI 54405
(715) 223-2389

Brian Martindale
Athens, MI
(616) 729-4349

Brown Seed Farms
P.O. Box 7
Bay City, WI 54723
(715) 594-3003

Brunner Seed Farm
W 3850 US Hwy 10
Durand, WI 54736
(715) 672-5887

Cargill Seeds
P.O. Box 5645
Minneapolis, MN 55440
(612) 742-6726

Cascade International Seed Co.
8483 W. Stayton Rd.
Aumsville, OR 97325
(503) 749-1822
cmiebach@grass-seed.com

Cole Growers' Service
537 Atlas Ave.
Madison, WI 53714
(800) 362-8049

Croplan Genetics
P.O. Box 64089,
MS 680
St. Paul, MN 55164
(800) 232-3639 ext. 5492

Crow's Hybrid
Box 306
Milford, IL 60953
(815) 889-4151

Dairyland Seed Co.
P.O. Box 958
West Bend, WI 53095
(800) 676-2237

Dekalb Genetics Corp.
3100 Sycamore Rd.
Dekalb, IL 60115
(815) 758-3461

DLF-Jenks USA
Chad Hale
260 Ferry Street SW,- 202
Albany, Oregon 97330
Phone: (541) 812-0217
chad@dlfusa.com

Domestic Seed & Supply
P.O. Box 466
Madison, SD 57042
(605) 256-6529

E.F. Burlingham & Sons
P.O. Box 217
Forest Grove, OR 97116
(503) 357-2141

Fontanelle Hybrids
Rt. 1, Box 18
Nickerson, NE 68044
(402) 721-1410

Fred Gutwein & Sons
Rt. 1, Box 40
Francesville, IN 47946
(219) 567-9141

Frontier Seed Service
301 East Graham
Kentland, IN 57951
(219) 474-6001

Seed Marketers (cont.)

FS Growmark
P.O. Box 2500
Bloomington, IL 61702
(309) 557-6400

Garst Seed Co.
9877 Britton
Laingsburg, MI 48848
(517) 651-2218

Geertson Seed Farm
1665 Burroughs Rd.
Adrian, OR 97901
(800) 843-0390

Golden Harvest Seed, Inc.
220 N. Eldorado Rd., Ste. E
Bloomington, IL 61704
(800) 610-7333

Grassland West
P.O. Box 489
1392 Port Dr.
Clarkston, WA 99403
(509) 758-9100

Great Lakes Hybrids
P.O. Box 637
9915 West M-21
Ovid, MI 48866
(517) 834-2251

Great Plains Seed Co.
3924 Kildaire Farm Rd.
Apex, NC 27502
(800) 874-7945

Hansmeier & Son, Inc.
P.O. Box 136
Bristol, SD 57219
(605) 492-3611

Heritage Seed
324 Main St.
Crawford, NE 69339
(308) 665-1672

Hoegemeyer
1755 Hoegemeyer Rd.
Hooper, NE 68031
(402) 654-3399

International Seeds, Inc.
P.O. Box 168
Halsey, OR 97348
(541) 369-2251

Ioka Farms, Inc.
Rob Duerst
(503)873-4464 or
13512 Doerfler Rd. SE

Silverton, OR 97381
www.iokafarms.com
iokafarms@aol.com

Jacklin Seed Co.
West 5300 Riverbend Ave.
Post Falls, ID 83854-9499
(208) 773-7581

Jung Seed Genetics
335 S. High St.
Randolph, WI 53956
(800) 242-1855

Kaltenberg Seed Farms
P.O. Box 278
Waunakee, WI 53597
(800) 383-3276

Keltgen Seed
2220 W. Lincoln
Olivia, MN 56277
(612) 523-1331

LaCrosse Seed Co.
2615 Commerce St.
Lacrosse, WI 54601
(608) 781-7333

Lemke Seed Farms
10220 N. Grandville Rd.
Mequon, WI 53092
(414) 242-2647

LG Seeds, Inc.
P.O. Box 216
Prescott, WI 54021
(715) 262-5552

L.L. Olds Seed Co.
2901 Packers Ave.
Madison, WI 53704
(608) 249-9291

Lynks Seed Co.
P.O. Box 637
Marshalltown, IA 50158
(515) 752-4626

Mallard Seed Co., Inc.
311 West Broadway
Plainview, MN 55964
(507) 534-2300

MBS
225 W. 1st St.
Story City, IA 50248
(800) 247-3967

McDonald Ag. Corp.
P.O. Box 828
McMinnville, OR 97128
(503) 472-5158

Midwest Seed Genetics
P.O. Box 518
Carroll, IA 51401
(800) 369-8218

Michigan State Seed
717 N Clinton St
Grand Ledge, MI 48837
Phone: 800-647-8873
fsiemon@seedsolutions.com

Modern Forage Systems
3770 Aldergrove Rd.
Ferndale, WA 98248
(360) 366-4345

Mycogen Seed
1340 Corporate Ctr.
St. Paul, MN 55121
(800) 692-6436

Nevill Supply
DLF-Jenks
Don Nevill
8415 S. Eberhart Ave.
Clare, MI 48617
(989) 386-4522

North-Gro Seeds
613 N. Randolph St.
Cuba City, WI 53807
(800) 207-3337

Syngenta
P.O. Box 959
Golden Valley, MN 55440
(612) 593-7333

Olsen-Fennell Seed, Inc.
P.O. Box 15028
Salem, OR 97309
(503) 371-2940

Seed Marketers (cont.)

Oseco, Inc.
RR 2
Brampton, Ontario
L6V 1A1
(905) 846-5080

Ottilie Seed
Hwy. 14 N, Box 52
Marshalltown, IA 50158
(515) 753-5561

Patriot Seeds
512 Water St., Box 456
Warren, IL 61087
(815) 745-2774

Pennington Seed
P.O. Box 386
Lebanon, OR 97355
(541) 451-5261

Peterson Seed Co.
P.O. Box 346
Savage, MN 55378
(612) 445-2606

Pickseed West, Inc.
30190 Hwy 34 SW
Albany, OR 97321
(541) 967-0123
www.pickseed.com
dfloydswres@proaxis.com

Pioneer Hi-Bred
Mideast Sales Region
210 Westfield Dr
Archbold, OH 43502-9991

Plains Group
101 E. 4th St.
Greely, CO 80631
(970) 330-2291

Producers Hybrids
Box C
Battle Creek, NE 68715
(402) 675-2975

Proprietary Seeds, Inc.
2882 Howell Prairie Rd. N.
Salem, OR 97305
(503) 585-7033

Quist Farms
McBain
(231) 825-2614

Ray Brothers Seed
11140 Chicken Dinner Rd.
Caldwell, ID 83605
(800) 657-1060

Renk Seed Co.
6800 Wilburn
Sun Prairie, WI 53590
(608) 837-7351

Roberts Seed Co.
P.O. Box 206
Tangent, OR 97389
(541) 926-8891

Raymond Oates & Sons
Waldron, MI

Royster-Clark
70 North Market Street
Mt. Sterling, OH 43143
740-869-2181

Royal Seeds
2882 Howell Prairie Rd., NE
Salem, OR 97305
(503) 585-7033

SeCan Association
200-57 Euriga Dr.
Nepean, Ontario K2E 8B2
(613) 225-6891

Sharp Bros. Seed Co.
P.O. Box 140
Healy, KS 67850
(316) 398-2231

Smith Seed Services
David Keister
PO Box 288
Halsey, OR 97348
(541) 369-2831

Spangler Seeds
803 W. Racine
Jefferson, WI 53549
(920) 674-4606

Specialty Seeds
26787 Hillhaven Dr.
Cold Spring, MN 56320
(800) 685-4521

Top Farm Hybrids, Inc.
P.O. Box 850
Cokato, MN 55321
(800) 782-4416

Trelay Farms
Rt. 1
Livingston, WI 53554
(608) 943-6363

Tri-State Seed & Ag., Inc.
P.O. Box 354
Sleepy Eye, MN 56085
(507) 794-3078

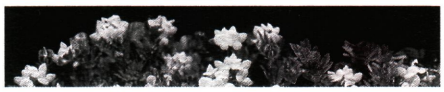
Turf – Seed, Inc.
Crystal Fricker
PO Box 250
Hubbard, OR 97032
(503) 651-2130
crystal@turf-seed.com

Turf Merchants
33390 Tangent Loop
Tangent, OR 97389
(541) 926-8649

UAP Great Lakes
221 W. Lake Lansing Rd.
Suite 102
East Lansing, MI 48823
517-333-8788

Van der Have Oregon
P.O. Box 1496
Albany, OR 97321
(541) 967-8923

Wensman Seed Co.
102 Aldrich Ave. SE
Box 190
Wadena, MN 56482
(800) 456-4894



Seed Marketers (cont.)

Western Productions
P.O. Box 491
Woodburn, OR 97071
(503) 982-8655

Wilco Farmers
P.O. Box 319
1125 Wilco Rd.
Stayton, OR 97383
(503) 769-7171

Willamette Seed &
Grain Co.
P.O. Box 791
Albany, OR 97321
(541) 926-2728

WL Research
PO Box 8112
Madison, WI 53708
(800) 406-7662

Wyffels Hybrids
P.O. Box 246
Atkinson, IL 61235

New 5:02 - 2M - KMF - BRD, Price $2.80, for sale only.