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1991 Edition

VARIETAL TRIALS
OF SELECTED FARM CROPS

Forage Crops

Grain Crops

Oilseed Crops

Pulse Crops

Planting Rate & Date

Minnesota Agricultural Experiment Station — University of Minnesota

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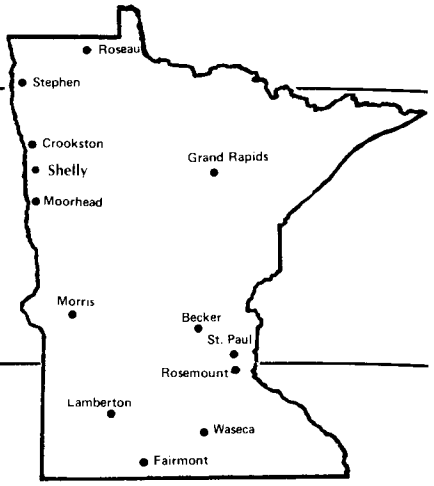
VARIETAL TRIALS
OF SELECTED FARM CROPS



Locations of varietal trials reported in this publication.

Successful crop production depends to a considerable extent on selecting the best varieties for a particular farm. For that reason, varieties are compared in trial plots on Minnesota Agricultural Experiment Station fields at St. Paul, Rosemount, Waseca, Lamberton, Morris, Crookston, Grand Rapids and Becker, and on farmers' fields. Important old varieties and new varieties are grown in replicated plots at each location. These plots are handled so that factors affecting yield and other characteristics are as nearly the same for all varieties at each location as is possible.

Minnesota Agricultural Experiment Station scientists are not currently conducting performance trials for 15 crops which were included in previous editions of this publication. For those who want the most recent reports of tests or additional production information, a contact address and/or alternate publication source is indicated under each crop heading.

Variety Classifications

Varieties of many of the evaluated crops are classed into four groups: "recommended varieties," "varieties not adequately tested," "other varieties," and "privately developed varieties." Some crops have further groupings within these categories. Varietal descriptions are alphabetical within groups.

The classifications of varieties as "recommended," "other" and "private" are determined each year by the Minnesota Agricultural Experiment Station crop variety review committee. A variety is usually not eligible for the "recommended" group unless it has been better than other varieties in important characteristics in three years of testing.

New varieties from other public experiment stations and private plant breeders, but not sufficiently evaluated here, are listed as "varieties not adequately tested." Available information is presented for these varieties, but no conclusions are drawn regarding their suitability for Minnesota conditions.

Varieties listed in the "other" category are usually inferior in one or more characteristics, as demonstrated in comparative tests. Varieties in the "private" category are good performing varieties, on which the experiment station makes no recommendations.

Seed of varieties in all three groups may be eligible for certification, and the use of certified seed is suggested. However, certification does not imply recommendation. Registered and certified seed of most varieties described in this report can be purchased from seed dealers or from growers listed in the *Minnesota Registered and Certified Seed Directory for 1991 Planting*. This publication can be obtained without charge from the Minnesota Crop Improvement Association, 1900 Hendon Avenue, St. Paul, MN 55108, or from county extension offices.

Interpreting the Tables

The LSD (Least Significant Difference) figures listed under the yield columns in the tables are statistical measures of variability within the trials. This statistic shows whether the difference between two yields is due to a genetic difference in the varieties or to other causes such as soil variability.

If the yield difference between two varieties equals or exceeds the LSD value listed at the bottom of a yield column, it can be properly concluded that the higher yielding variety was superior. If the difference is less, the yield difference was probably due to environmental rather than varietal differences.

These trials are not designed for comparisons between crop species, because the various crops are grown on different fields or with different management. Data should only be used to compare varieties within a table.

Relative maturities of varieties are indicated in the tables as date mature, heading, or blooming; days to mature, heading, or blooming; or moisture percentage at harvest.

Authors and Researchers

Authors of the crop sections are: D.H. Putnam, L.A. Field (amaranth, fieldpea, lupin, and canola-oilseed rape); D.K. Barnes, N.P. Martin and N.J. Ehlke (alfalfa, birdsfoot trefoil, orchardgrass, reed canarygrass, and timothy); D.C. Rasmusson (barley); D.D. Stuthman (oat); J.H. Orf (soybean); R.H. Busch (durum, hard red spring, and winter wheat); R. Porter (wild rice).

Information on the reaction of varieties to specific pathogens was largely provided by individuals of the Department of Plant Pathology: J.A. Thies (alfalfa); A.P. Roelfs (wheat); R.D. Wilcoxson (barley and oat); K.J. Leonard (oat); B.W. Kennedy, W. Stienstra and D.H. MacDonald (soybean); D.V. McVey (wheat).

Varietal trials at Waseca, Lamberton, Morris, Crookston-Stephen, and Grand Rapids was supervised by W.E. Lueschen, J.H. Ford, D.D. Warnes, J.V. Wiersma, and D.L. Rabas, respectively.

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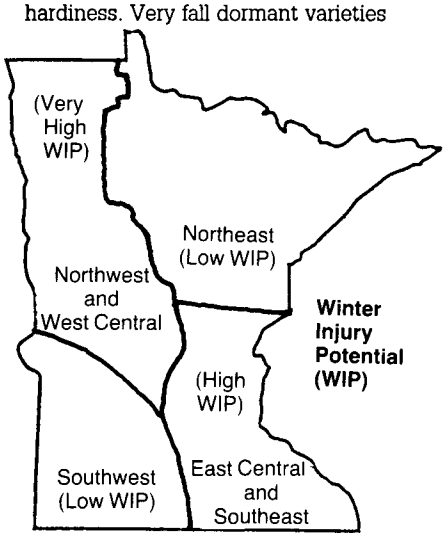
FORAGE CROPS

ALFALFA

Severe winters make winter hardiness a primary consideration in variety selection for most areas of Minnesota. The 1989-90 winter was very damaging to alfalfa stands over a wide area of the state. Nearly a million acres of alfalfa were severely damaged or killed. It confirmed previous observations about areas of the state most prone to winter injury (see accompanying map) and provided data about relative winter hardiness as measured by percent winter survival for most current varieties (Table 1).

The greatest winter hardiness is needed in the west central and northwest Minnesota area. Because of the high frequency of severe winters in this area only winter-hardy or very winter-hardy varieties should be selected. The east central and southeast area also experiences frequent severe winters. Winter-hardy varieties with high levels of disease resistances should be selected for this area. The southwest area seldom experiences severe winter injury because of dry soils, high soil potassium levels and neutral soil pH. The northeast area seldom experiences severe winter injury because of dependable snow cover. For these reasons both winter-hardy and moderately winter-hardy varieties have been profitable in those areas.

Varieties listed in tables 1 and 2 are ranked according to amount of fall growth, which is an indication of rate of growth after cutting and to a lesser degree winter hardiness. Very fall dormant varieties produce very little fall growth and are slow to recover after cutting. They usually are not high yielding, recover slowly for the second crop and produce only a small third crop because of early cessation of growth. Nevertheless, these varieties are very dependable in areas where frequent winter injury is expected and where soil moisture limits third crop yields. These varieties survived the 1989-90 winter with little injury.



Fall dormant varieties are adapted to all areas of the state. Forage yields vary among varieties in this group, primarily because of winter hardiness and disease resistance. Three or four years of consistent production can be expected from fall dormant varieties with high levels of winter hardiness.

Moderately fall dormant varieties produce good fall growth, are characterized by rapid recovery after harvest, and usually reach 1/10 bloom several days earlier than more dormant varieties. The general pattern of production for moderately dormant varieties under a four-harvest management has been to produce high yields during the first year after seeding, good yields--similar to winter-hardy, fall dormant varieties--for year two, and reduced yields in years three and four. Reduced yields in years three and four are usually associated with winter injury. The percent winter survival data in Table 1, and third and fourth year yields in Table 2, can help identify varieties that maintain high yields beyond the second year in areas that experience frequent winter injury.

Non-dormant varieties are characterized by extremely tall fall growth that continues until freeze-up. They produce yields similar to moderately dormant varieties during the summer, but produce more forage growth during the fall growth period. They will not survive most winters, and should only be grown for plow down in the seeding year.

The Minnesota Agricultural Experiment Station and USDA released non-dormant, nonwinter-hardy Nitro in 1986. Nitro is a special purpose alfalfa designed as a one year hay source and a fall plow down crop. It was selected in Minnesota for increased concentration of nitrogen in the roots and for larger roots in which to store nitrogen. Nitro is the first alfalfa variety with specialized nitrogen accumulation attributes.

Other nonwinter-hardy varieties which are not listed in the tables include Armona, Arroyo, Condor, CUF 101, DK 187, Florida 77, Granada, GT 13R Plus, Lew, Madera, Maricopa, Mecca, Moapa 69, Pierce, Rincon, Sundor, UC Cibola, WL 515, WL 516, WL 605, Yolo and 5929.

Disease Resistance and Stand Persistence

Alfalfa root and crown diseases occur in most Minnesota soils. The most important are bacterial wilt, Phytophthora root rot, Fusarium wilt, anthracnose and Verticillium wilt. Plant resistance is available for all five diseases. The variety resistance ratings for each disease are presented in table 1. Moderate resistance (MR) to a disease provides protection under most conditions. However, either resistance (R) or high resistance (HR) are required for protection under severe disease conditions.

Winter injury can be the result of a combination of injury from cold temperatures and from root and crown diseases. Under some conditions disease resistances can compensate for lesser levels of cold tolerance. All varieties can benefit from improved disease resistance. However, it is especially important for moderately fall dormant varieties to have at least R levels of disease resistance to stay productive for more than two years after the seeding year under intensive management (four cuts/season) in the east central and southeast area of Minnesota.

Bacterial Wilt—This disease is prevalent in most areas of the state. Susceptible varieties are poor risks and should not be grown. They generally show losses in stand by the end of the second year after seeding. In some cases where infection is severe, stand losses are often observed by the end of the first year after seeding. Stand reductions after winter are often due to a combination of wilt damage and winter injury.

Phytophthora Root Rot—This fungal disease is a major concern on poorly drained soils, especially in the east central and southeast area of the state. It can cause stand losses of seedlings, and can contribute to lower productivity in older stands if the soil remains wet for a week or more.

Fusarium Wilt—The fungus that causes Fusarium wilt is present in most soils. It contributes to stand decline mainly in combination with other disease organisms. Therefore, resistance to Fusarium wilt in addition to resistance to both bacterial wilt and Phytophthora root rot contributes to longer lived stands.

Anthracnose—This fungus disease was first found in Minnesota in 1978 and has become more prevalent each year in the east central and southeast area. It infects stems and crowns and kills susceptible plants. The disease is favored by hot, moist conditions, and will therefore be most frequently observed in southeast Minnesota.

Verticillium Wilt—This is a new, potentially destructive fungus disease that was first found in several eastern Minnesota fields in 1981. It has usually been found in two- or three-year-old fields. Its spread in the state has been slow. Planting resistant varieties helps ensure long-lived stands. Varieties having at least a low level of resistance are indicated in Table 2.

Table 1. Fall growth score, winterhardiness as indicated by percent stand survival after severe test winters, and disease resistance of alfalfa varieties eligible for certification and marketed in the Minnesota area.

Variety	Developer or Marketer[1]	Fall growth	Winter survival	Bacterial wilt	Phytophthora root rot	Fusarium wilt	Anthracnose	Verticillium wilt
		score[2]	%[3]			rating[4]		
Very Fall Dormant								
Spredor 2	Northrup King Co.[f]	7.5	60	HR	S	MR	S	--
Teton	S. Dakota Agr. Exp. Sta.[Nt]	7.4	--	LR	LR	MR	S	--
Travois	S. Dakota Agr. Exp. Sta.[Nd]	7.4	--	R	S	MR	S	--
Fall Dormant								
Wrangler	USDA & Nebraska Agr. Exp. Sta.[NZbdhinoqt]	7.0	71	R	R	R	LR	LR
Vernal	Wisconsin Agr. Exp. Sta. & USDA[HNTZbdhinoqt]	6.5	67	R	S	R	S	S
Baker	USDA & Nebraska Agr. Exp. Sta.[N]	6.5	53	R	S	R	LR	--
526	Pioneer Hi-Bred International, Inc.[J]	6.5	58	HR	LR	LR	LR	--
636	Garst Seed Co.[O]	6.3	25	HR	HR	R	MR	R
Clipper	Payco Seeds[g]	6.3	38	HR	R	HR	R	R
Envy	Gold Country Seed, Inc.[w]	6.3	49	HR	R	HR	HR	R
Profit	Peterson-Biddick Co.[h]	6.2	50	HR	R	HR	MR	R
Agate	USDA & Minnesota Agr. Exp. Sta.[NZdhioqt]	6.0	29	HR	R	HR	MR	--
Algonquin	Agr. Canada[o]	6.0	--	HR	S	S	--	--
Iroquois	Cornell University[Zhno]	6.0	--	HR	S	MR	S	S
Blazer	Cenex/Land O'Lakes[H]	5.9	--	HR	MR	MR	LR	LR
Renegade	Werner Farm Seeds[Pt]	5.9	31	R	MR	R	S	LR
629	Garst Seed Co.[O]	5.8	20	HR	HR	R	MR	MR
5262	Pioneer Hi-Bred International, Inc.[J]	5.7	60	HR	R	MR	--	LR
Thunder	ABI	5.7	57	R	R	HR	MR	--
WL 225	W-L Research, Inc.[Tg]	5.7	9	HR	R	HR	MR	R
Trident II	Cargill, Inc.[G]	5.6*	37	HR	R	HR	R	R
break-thru	Custom Farm Seed[J]	5.5	34	HR	MR	HR	MR	R
DK 122	DeKalb Plant Genetics[M]	5.5	--	HR	HR	R	HR	R
120	DeKalb-Plant Genetics[M]	5.5	43	HR	R	MR	LR	--
A-54	Ramy Seed Co.[n]	5.4	--	MR	LR	MR	--	--
Alpine	Bio Plant Research[D]	5.4*	16	HR	R	R	R	R
Ranger	USDA & Nebraska Agr. Exp. Sta.[HNZho]	5.4	57	MR	S	MR	S	S
Agressor	AgriPro[B]	5.3*	--	HR	HR	HR	HR	R
Dart	AgriPro[A]	5.3	25	HR	HR	R	R	R
Milkmaker	Lovelock Seed Co., Inc.[Xkv]	5.3	21	R	R	HR	MR	--
Arrow	NAPB[BZbpu]	5.2	37	HR	HR	HR	MR	R
Sparta	Cenex/Land O'Lakes[H]	5.2	31	R	MR	MR	S	R
GH715	J.C. Robinson Seed Co.[V]	5.1	44	HR	MR	R	MR	LR
Impact	Peterson Seed Co., Inc.[imv]	5.1	27	HR	HR	R	MR	R
Oneida	Cornell University[ht]	5.1	56	HR	HR	HR	S	--
Royalty	Cargill Seed Division[G]	5.1	--	HR	R	R	HR	R
Moderately Fall Dormant								
AF21	Asgrow Seed Co.[C]	5.0	24	HR	R	R	HR	R
Centurion	Blue Chip Quality Seed[F]	5.0	26	HR	HR	R	R	R
Ultra	SeedTec Int'l[A]	5.0	16	HR	R	HR	HR	R
BellRinger	Lovelock Seed Co., Inc.[Q]	4.9	24	R	LR	MR	LR	MR

Table 1 (Continued). Fall growth score, winterhardiness as indicated by percent stand survival after severe test winters, and disease resistance of alfalfa varieties eligible for certification and marketed in the Minnesota area.

Variety	Developer or Marketer[1]	Fall growth	Winter survival	Bacterial wilt	Phytophthora root rot	Fusarium wilt	Anthracnose	Verticillium wilt
		score[2]	%[3]			rating[4]		
Cutter	Payco Seeds[g]	4.9*	31	HR	HR	HR	R	R
Salute	United AgriSeeds, Inc.[Ys]	4.9	39	HR	R	R	MR	MR
98	L.L. Olds Seed Co.[b]	4.8	20	HR	H	HR	--	--
Husky	Plant Genetics[k]	4.8	35	R	MR	R	MR	S
Kingstar	Dahlgren & Co. Inc.[K]	4.8	19	R	R	HR	MR	R
Oneida VR	Cornell University[no]	4.8	24	R	MR	HR	MR	HR
Vernema	USDA & Washington Agr. Exp. Sta.[t]	4.8	13	MR	LR	R	LR	MR
VIP	SIGCO Research[p]	4.8	15	HR	R	HR	R	R
WL 317	W-L Research Inc.[Tg]	4.8	23	HR	R	HR	R	R
Apollo Supreme	ABI[BZb]	4.7	39	HR	R	HR	HR	R
Elevation	Jacques Seed Co.[U]	4.7	33	HR	R	R	R	MR
G7730	CIBA-GIEGY Seed Div.[Ih]	4.7	--	HR	HR	HR	LR	--
Magnum	Dairyland Seed Co., Inc.[L]	4.7	36	HR	S	R	MR	--
Perry	USDA & Nebraska Agr. Exp. Sta.[Z]	4.7	--	R	LR	R	LR	--
2833	CIBA-GEIGY Seed Div.[I]	4.6	48	HR	HR	R	HR	R
5432	Pioneer Hi-Bred International Inc.[J]	4.6	29	HR	MR	HR	--	R
Commandor	Northrup King Co.[f]	4.6	52	HR	R	R	HR	MR
Edge	Payco Seeds[g]	4.6	18	HR	R	R	HR	R
Endure	PAG Seeds[G]	4.6	31	R	MR	R	MR	R
Flint	Premium Seed Co., Inc.[v]	4.6	38	R	HR	R	HR	LR
Fortress	Northrup King Co.[f]	4.6	13	R	R	R	R	R
Jade	NC + Hybrids[De]	4.6*	39	HR	HR	HR	R	R
Recovery	George's Seeds, Inc.[Q]	4.6*	--	R	R	R	R	R
G2841	CIBA-GIEGY Seed Div.[I]	4.5	20	HR	R	HR	R	R
Apollo II	ABI[B]	4.5	23	R	HR	R	MR	MR
Chief	Jacques Seed Co.[U]	4.5	17	HR	HR	R	R	R
Duke	AgriPro[A]	4.5	--	R	HR	R	MR	--
DK 125	DeKalb Plant Genetics[M]	4.5	13	HR	R	R	HR	R
DK 135	DeKalb Plant Genetics[M]	4.5	28	MR	MR	R	MR	MR
GH737	J.C. Robinson Seed Co.[V]	4.5	27	HR	MR	HR	MR	R
Legend	Cenex/Land O'Lakes[H]	4.5	24	HR	R	HR	HR	R
Multi-plier	Jacques Seed Co.[U]	4.5	54	HR	R	HR	HR	R
Peak	Premium Seed Co., Inc.	4.5	32	HR	MR	MR	--	LR
Saranac	Cornell University[N]	4.5	20	R	S	R	S	S
Target II	Bio Plant Research[u]	4.5	--	HR	R	R	R	R
Trident	PAG Seeds[G]	4.5	--	R	HR	HR	MR	--
Ram Rod	Bio Plant Research[D]	4.5*	55	HR	R	R	MR	R
Voyager	Bio Plant Research[D]	4.5	31	HR	R	R	MR	MR
630	Garst Seed Co.[O]	4.5	28	HR	R	R	MR	MR
Bronco	Jung Farms' Inc.[W]	4.4	14	HR	HR	HR	HR	R
Allegiance	Keltgen Seed Co.[Ys]	4.4	34	HR	R	R	HR	R
Drummor	Northrup King Co.[f]	4.4	25	R	R	MR	MR	--
Dynasty	Dairyland Seed Co. Inc.[L]	4.4	19	HR	R	R	MR	R
Target	Ziller Seed Farm, Inc.[u]	4.4	24	HR	R	R	MR	MR
Vector	ProfiSeed, Inc.[m]	4.4	15	HR	MR	HR	R	MR
Verta +	NC + Hybrids[e]	4.4	29	HR	R	R	HR	R
5472	Pioneer Hi-Bred International Inc.[J]	4.4	--	HR	HR	MR	MR	MR
Aquarius	Lincoln Seed & Feed Co.[Z]	4.3	--	HR	S	R	HR	--
Premier	Dahlgren & Co., Inc.[K]	4.3	18	HR	R	HR	HR	R
Sure	Cenex/Land O'Lakes[H]	4.3	22	HR	R	HR	HR	R
Armor	ABI	4.2	46	R	R	R	MR	--
Crown	Paymaster Seeds[G]	4.2	15	R	R	R	HR	R
Crystal	Mike Brayton Seed[sc]	4.2*	--	HR	HR	HR	R	R
Echo	ProfiSeed, Inc.[m]	4.2	17	R	R	R	MR	R
Excalibur	Blue Chip Quality Seed[F]	4.2	15	R	LR	HR	MR	R
Good as Gold	Mike Brayton Seed[sc]	4.2*	--	HR	HR	HR	R	R
WL 320	W-L Research Inc.[g]	4.2	31	HR	R	HR	MR	MR
Anstar	NC + Hybrids	4.1	35	R	S	R	R	--
Crown II	Cargill Seed Div.[G]	4.1	48	HR	R	R	HR	R
Hi-Phy	Premium Seed Co., Inc.[v]	4.1	--	HR	HR	MR	--	--
Pro-Cut 2	L. Herried Seed, Inc.[a]	4.1	9	HR	HR	HR	R	R
Terminator	Ramy Seed Co.[n]	4.1	24	HR	MR	HR	R	R
Tomahawk	Jung Farms, Inc.[W]	4.1	--	R	R	R	HR	MR
Eagle	Asgrow Seed Co.[C]	4.0	26	HR	R	R	R	MR

Table 1 (Continued). Fall growth score, winterhardiness as indicated by percent stand survival after severe test winters, and disease resistance of alfalfa varieties eligible for certification and marketed in the Minnesota area.

Variety	Developer or Marketer[1]	Fall growth	Winter survival	Bacterial wilt	Phytophthora root rot	Fusarium wilt	Anthracnose	Verticillium wilt
		score[2]	%[3]			rating[4]		
Magnum Plus	Dairyland Seed Co., Inc.[L]	4.0	13	R	R	R	MR	LR
Magnum III	Dairyland Seed Co., Inc.[L]	4.0	17	HR	MR	R	MR	MR
Pro-Cut	L. Herried Seed, Inc.[a]	4.0	15	HR	R	HR	R	R
Empress	Blaney Seeds, Inc.[E]	3.9*	9	HR	HR	HR	R	R
Epic	Larry Peterson, Ltd.[Ym]	3.9	31	HR	R	R	S	--
G2852	CIBA-GEIEGY Seed Div.[I]	3.8	19	HR	R	R	HR	R
Cimarron	Great Plains Research[RX]	3.6	19	R	MR	HR	R	LR
Shenandoah	Great Plains Research[RX]	3.6	23	HR	LR	R	HR	--
Cimarron VR	Great Plains Research[RX]	3.2*	26	HR	R	R	HR	R
Non-Dormant								
Nitro	USDA & Minnesota Agr. Exp. Sta.[I]	2.4	--	S	R	HR	S	S

[1] 1991 seed sources are listed at the end of the forage crops section; [2] Based on fall growth in mid-October after cutting 1st week of September: 1 = tallest (tend to be least winterhardy), 9 = shortest, *Estimate not based on Univ. of Minnesota data; [3] Percent stand survival after severe test-winters, data are averages over tests based on percent of Vernal and adjusted to average Vernal stand (greater than 40% stand will provide profitable yields); [4] Resistance rating (percent resistant plants): HR = high resistance (51 +), R = resistant (31-50), MR = moderate resistance (16-30), LR = low resistance (6-15), and S = susceptible (0-5). Fall growth, winter survival, bacterial wilt, Phytophthora root rot, and Fusarium wilt evaluations were conducted by University of Minnesota. Anthracnose and Verticillium wilt values were published by the Certified Alfalfa Seed Council.

Table 2. Average yields of alfalfa varieties expressed as percentage of Vernal for all tests with one or more harvest years (1967-1990) in each of four climatological areas within Minnesota.

	Average yield for years 1-2 and 3-4 after seeding per test location										
	Rosemount & Waseca		Morris & Crookston		Lamberton		Grand Rapids		All locations		
Variety	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	Number tests
	% of Vernal										
Very Fall Dormant											
Spredor 2	93	85	96	104	—	—	94	94	94	92	5
Teton	—	—	102	98	—	—	—	—	102	98	1
Travois	—	—	94	90	—	—	—	—	94	90	1
Fall Dormant											
Wrangler	106	107	105	102	98	100	99	91	103	102	7
Vernal, tons/acre 15% M	5.19	4.57	4.23	3.94	4.34	4.17	3.95	3.56	4.78	4.38	54
Baker	100	103	100	102	107	103	72	85	98	100	15
526	106	114	107	113	104	108	114	95	107	111	8
636	110	106	102	104	100	107	102	102	107	106	6
Clipper	101	90	68	—	98	—	105	102	100	95	5
Envy	109	92	80	—	96	—	—	—	104	92	4
Profit	110	109	109	95	106	108	103	111	108	107	5
Agate	100	104	97	101	99	96	87	92	99	103	20
Algonquin	102	94	101	106	—	—	108	113	105	101	7
Iroquois	104	102	102	106	103	111	121	96	106	104	12
Blazer	108	113	95	105	102	—	101	104	104	110	10
Renegade	107	80	—	—	—	—	—	—	107	80	1
629	106	103	102	99	96	103	96	109	103	103	7
5262	105	—	102	—	95	—	—	—	102	—	4
Thunder	105	103	97	100	100	101	103	85	101	101	7
WL 225	102	80	57	—	95	—	104	107	99	91	5
Trident II	94	—	—	—	—	—	—	—	94	—	1
break-thru	100	82	63	—	93	—	—	—	97	82	5
DK 122	106	60	79	—	—	—	—	—	102	60	2
120	111	111	103	107	104	—	112	106	109	110	10
A-54	105	107	107	102	101	105	104	102	105	106	6
Alpine	110	104	56	—	—	—	—	—	92	104	2
Ranger	98	100	125	101	97	99	—	—	100	100	13
Agressor	82	—	—	—	—	—	—	—	82	—	1
Dart	111	106	106	109	108	110	108	108	110	107	6
Milkmaker	105	99	101	94	98	100	103	104	104	99	8

Table 2 (Continued). Average yields of alfalfa varieties expressed as percentage of Vernal for all tests with one or more harvest years (1967-1990) in each of four climatological areas within Minnesota.

Variety	Average yield for years 1-2 and 3-4 after seeding per test location										Number tests
	Rosemount & Waseca		Morris & Crookston		Lamberton		Grand Rapids		All locations		
	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	
	% of Vernal										
Arrow	108	103	97	95	108	114	109	103	107	104	6
Sparta	110	106	103	98	109	99	103	105	108	103	7
GH715	106	104	85	—	98	—	111	112	105	106	6
Impact	110	94	104	114	111	105	109	105	109	100	5
Oneida	105	106	102	111	93	97	105	108	103	107	10
Royalty	99	—	—	—	94	—	—	—	97	—	2
Moderately Fall Dormant											
AF21	101	88	47	—	93	—	—	—	96	88	4
Centurion	111	99	104	93	104	103	112	112	109	101	5
Ultra	102	61	46	—	102	—	113	111	101	83	5
BellRinger	107	98	93	99	103	105	112	118	105	101	6
Cutter	90	—	—	—	—	—	—	—	90	—	1
Salute	108	108	107	105	93	98	110	105	107	106	7
98	98	53	48	—	105	—	—	—	96	53	4
Husky	108	98	100	97	112	103	103	105	107	99	9
Kingstar	104	86	46	—	97	—	100	102	100	89	6
Oneida VR	101	106	70	—	99	—	103	103	100	105	5
Vernema	109	99	100	100	103	102	115	99	106	100	6
VIP	108	91	45	—	100	—	—	—	102	91	4
WL 317	109	93	61	—	98	—	—	—	101	93	3
Apollo Supreme	110	103	64	—	99	—	105	112	105	106	5
Elevation	109	112	106	106	111	95	110	95	109	107	7
G7730	103	106	105	109	98	101	98	103	103	106	8
Magnum	106	108	100	104	102	101	96	99	103	106	8
Perry	108	110	99	107	100	102	—	—	103	108	5
2833	99	—	63	—	99	—	—	—	93	—	3
5432	109	104	102	108	99	100	104	117	106	105	5
Commandor	109	105	91	94	102	99	102	103	105	103	6
Edge	108	94	98	102	104	103	110	101	106	97	5
Endure	107	110	104	107	100	112	110	94	106	102	7
Flint	104	104	61	—	101	—	—	—	101	104	5
Fortress	103	76	27	—	99	—	—	—	100	76	6
Jade	113	—	—	—	—	—	—	—	113	—	1
Recovery	97	54	—	—	—	—	—	—	97	54	1
G2841	96	56	37	—	99	—	—	—	93	56	4
Apollo II	103	93	103	96	103	95	103	84	103	94	8
Chief	101	82	53	—	98	—	107	104	100	87	6
Duke	104	101	103	104	98	98	106	82	103	100	7
DK 125	108	96	104	93	122	110	103	102	109	99	5
DK 135	105	94	97	107	101	100	102	85	101	98	7
GH 737	109	93	98	82	111	110	97	93	106	95	5
Legend	97	—	58	—	95	—	—	—	93	—	4
Multiplier	106	—	—	—	102	—	—	—	104	—	2
Peak	108	114	103	98	102	—	102	98	106	110	10
Saranac	103	98	103	109	102	101	96	109	103	100	27
Target II	104	84	—	—	—	—	—	—	104	84	1
Trident	106	111	96	99	103	—	98	96	102	105	8
Ram Rod	110	106	89	—	—	—	—	—	103	106	2
Voyager	113	101	104	118	102	108	106	119	109	107	5
630	110	110	102	98	107	110	99	112	108	109	7
Bronco	107	—	28	—	96	—	—	—	90	—	3
Allegiance	94	—	71	—	100	—	—	—	93	—	4
Drummor	101	90	101	89	107	105	99	87	101	91	8
Dynasty	109	97	101	84	98	94	103	113	105	96	5
Target	107	106	107	101	103	107	99	99	106	105	7
Vector	106	109	46	—	94	—	—	—	101	109	4
Verta +	106	97	98	93	94	96	104	96	103	96	5
5472	—	—	80	—	—	—	—	—	80	—	1
Aquarius	99	90	100	92	—	—	—	—	99	92	5
Premier	94	—	45	—	93	—	—	—	88	—	4

Table 2 (Continued). Average yields of alfalfa varieties expressed as percentage of Vernal for all tests with one or more harvest years (1967-1990) in each of four climato'ogical areas within Minnesota.

Variety	Average yield for years 1-2 and 3-4 after seeding per test location										Number tests
	Rosemount & Waseca		Morris & Crookston		Lamberton		Grand Rapids		All locations		
	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	
	% of Vernal										
Sure	110	99	98	106	101	100	100	107	105	101	5
Armor	106	102	101	109	100	102	113	108	105	104	8
Crown	110	102	94	101	121	111	110	105	109	104	5
Crystal	108	—	—	—	—	—	—	—	108	—	1
Echo	93	—	40	—	92	—	—	—	85	—	3
Excalibur	101	86	100	94	111	110	108	81	103	91	6
Good as Gold	—	—	—	—	—	—	—	—	—	—	—
WL 320	109	110	106	100	108	107	112	102	108	106	6
Anstar	108	96	98	98	101	95	105	113	105	98	5
Crown II	104	—	64	—	98	—	—	—	96	—	3
Hi-Phy	110	126	100	100	103	—	99	102	105	112	7
Pro-Cut 2	100	—	36	—	107	—	—	—	93	—	3
Terminator	105	99	46	—	98	—	—	—	100	99	4
Tomahawk	111	98	106	102	115	114	106	109	110	103	5
Eagle	103	79	107	95	114	104	109	82	106	86	7
Magnum Plus	107	115	95	103	100	—	103	109	103	110	6
Magnum III	110	99	104	106	111	110	103	108	108	103	5
Pro-Cut	102	64	48	—	97	—	—	—	97	64	4
Empress	104	—	—	—	—	—	—	—	104	—	1
Epic	104	108	105	103	99	105	108	90	104	106	10
G2852	105	89	109	92	103	100	107	105	106	93	6
Cimarron	104	87	93	98	118	113	108	80	103	93	6
Shenandoah	104	86	106	96	92	96	115	93	104	90	6
Cimarron VR	84	—	—	—	—	—	—	—	84	—	1
Non-Dormant											
Nitro	—	—	—	—	—	—	—	—	—	—	—

BIRDSFOOT TREFOIL

Birdsfoot trefoil is an excellent nonbloating pasture legume which can also be harvested for hay and silage. It grows under a wide range of soil conditions, and persists longer and performs better than other legumes under poor soil conditions such as low fertility, acidity and poor drainage. It is persistent when grown with Kentucky bluegrass and timothy.

Varieties were established in pure stands in August 1989 at Rosemount and Grand Rapids. Severe winter injury at Grand Rapids destroyed the trial at that location. First harvest yield data collected at Rosemount shows the effect of winter injury on the performance of birdsfoot trefoil.

Winter-hardy varieties such as Carroll, Norcen and WIT-II produced the highest yields in 1990. Norcen was released in 1983 by the agricultural experiment stations of Minnesota and six other states and has performed exceptionally well in grazing trials.

Seed sources of the varieties sold in Minnesota are listed in Crop News No. 42 (Revised), January 1991, prepared by Neal P. Martin, Extension Agronomist-Forages.

Table 3. Winter injury score, percent groundcover and dry matter yield of birdsfoot trefoil varieties seeded in 1989 at Rosemount, MN.

Variety	Winter injury	Ground cover	Forage Yields		
			6/18	8/14	Total
	score[1]	%	tons dm/A		
Bonnie	3.2	45	1.5	2.4	3.9
Carroll	1.0	98	2.8	2.8	5.6
Dawn	3.0	45	2.2	2.8	5.0
Empire	3.7	35	1.9	2.7	4.6
Fergus	1.5	94	2.3	2.6	4.9
GA-1	5.0	01	NH[2]	NH	NH
Leo	2.7	68	1.9	2.5	4.4
MU-81	3.7	49	1.7	2.3	4.0
Norcen	1.5	90	2.4	2.8	5.2
WIT-II	1.0	86	2.6	3.0	5.6
LSD 5%	1.0	23	0.6	0.4	0.8

[1]Score: 1 = no injury to 5 = dead on 18 May 1990; [2]NH: not harvested.

BROMEGRASS

Bromegrass is generally grown for hay in mixture with alfalfa, or is used as pasture in mixture with other grasses and legumes. Varieties are classed as southern, intermediate or northern types. Southern type varieties may not be higher yielding, but are generally less susceptible to leaf diseases and earlier in maturity than northern types. Varieties presently being sold in Minnesota are of the southern type. All varieties are winter-hardy. Some stand losses may occur when bromegrass is managed under three- and four-cut alfalfa harvest systems.

Minnesota Agriculture Experiment Station scientists are not currently conducting performance trials of bromegrass. If you want information from a recent report of tests of this crop, contact Extension Agronomy, 411 Borlaug Hall, 1991 Buford Circle, University of Minnesota, St. Paul, MN 55108.

Seed sources for the varieties sold in Minnesota are listed in Crop News No. 42 (revised), January 1991, prepared by Neal P. Martin, Extension Agronomist-forages.

ORCHARDGRASS

Orchardgrass is often used in hay and pasture mixes with other grasses and legumes because it establishes rapidly and recovers quickly after grazing or harvesting. It's major limitation is a lack of winter hardiness, but it can persist and remain productive in areas with reliable snow cover.

Orchardgrass varieties were established in pure stand in August, 1989 at Rosemount, Grand Rapids and Morris. Severe winter injury at Morris destroyed the trial at that location. Few differences were observed for forage yield at the remaining locations. Varieties which showed significant winter injury in May, 1990 produced adequate forage yields during the 1990 growing season.

Seed sources of the varieties sold in Minnesota are listed in Crop News No. 42 (Revised), January 1991, prepared by Neal P. Martin, Extension Agronomist-Forages.

Table 4. Winter injury score and dry matter yield of orchardgrass varieties seeded in 1989 at two locations.

Variety	Winter Injury		Forage Yield		
	Grand Rapids	Rosemount	Grand Rapids	Rosemount	Average
	score[1]		Tons DM/A		
81-1	3.0	4.0	4.9	4.9	4.9
888	2.3	3.8	4.6	5.4	5.0
8SM	2.4	3.8	4.6	5.2	4.9
Ambassador	2.6	1.8	4.6	5.4	5.0
Crown	2.4	1.5	4.6	5.1	4.9
Dawn	2.3	2.0	4.7	5.5	5.1
Justus	2.8	2.8	4.5	5.2	4.9
Napier	2.4	2.0	5.0	5.0	5.0
Orbit	2.5	2.3	4.3	5.0	4.7
Orion	2.6	1.0	4.8	5.8	5.3
Potomic	2.0	1.5	4.4	5.2	4.8
Sterling	2.1	2.3	4.1	5.4	4.8
LSD 5%	0.6	0.8	NS	0.5	0.4

[1]Score: 1 = no injury to 5 = dead; scored in May, 1990.

RED CLOVER

Red clover can be seeded in pure stands or with timothy for use as hay or silage. It is more easily established in pasture renovation than either alfalfa or trefoil. Historically, the winter-hardy red clover varieties have not persisted beyond two crop years because they are suseptible to crown rot. Most varieties currently sold in Minnesota can persist for three years if there is good winter snow cover.

Minnesota Agriculture Experiment Station scientists are not currently conducting performance trials of red clover. If you want information from a recent report of tests of this crop, contact Extension Agronomy, 411 Borlaug Hall, 1991 Buford Circle, University of Minnesota, St. Paul, MN 55108.

Seed sources for the varieties sold in Minnesota are listed in Crop News No. 42 (revised), January 1991, prepared by Neal P. Martin, Extension Agronomist-forages.

REED CANARYGRASS

Reed canarygrass is adapted throughout Minnesota for use as hay, pasture and silage. It is one of the best grass species for poorly drained soils and tolerates flooding better than other cool season grasses. The species utilizes nitrogen efficiently and is adapted to liquid manure application. Seedling vigor is not as good as other commonly used forage grasses.

Prior to 1985, common reed canarygrass had been described as being less palatable than most other grass species seeded for hay and pasture. Cattle produced well on the grass if it was grazed when it was between 6 and 24 inches tall.

The latest development in reed canarygrass breeding has been the release of varieties low in indole alkaloid concentration. Hay should be harvested between heading and early bloom because quality declines with maturity. In grazing trials, lambs and steers gained more weight and sheep has less diarrhea on low alkaloid varieties than on common reed canarygrass.

Reed canarygrass trials were established

in pure stands in 1989 at Morris and Rosemount. Available varieties are winter-hardy and persistent in Minnesota. Palaton and Venture are the two low alkaloid varieties currently on the market in Minnesota and both produced high forage yields in 1990.

Seed sources of the varieties sold in Minnesota are listed in Crop News No. 42 (Revised), January 1991, prepared by Neal P. Martin, Extension Agronomist-Forages.

Table 5. Dry matter yields of reed canarygrass varieties seeded in 1989 at two locations.

Variety	Morris	Rosemount	Average
		tons dm/A	
MN-76	5.1	7.4	6.2
Palaton	5.1	8.8	7.0
Rise	5.4	7.5	6.5
Vantage	5.7	8.3	7.0
Venture	6.0	9.2	7.6
LSD 5%	0.9	1.2	0.8

Low alkaloid varieties of reed canarygrass are clearly more palatable to livestock, which consistently graze them shorter than the older varieties untouched in this photo.

TALL FESCUE

Tall fescue is a bunchgrass and may be planted in mixtures with other grasses and legumes. It establishes rapidly, withstands trampling, tolerates summer drought and produces fall season pasture when other grasses have become dormant. Animal performance is better when the variety grown is endophyte-free. Tall fescue is subject to winter injury, but may remain productive in areas with reliable snow cover.

Minnesota Agriculture Experiment Station scientists are not currently conducting performance trials of tall fescue. If you want information from a recent report of tests of this crop, contact Extension Agronomy, 411 Borlaug Hall, 1991 Buford Circle, University of Minnesota, St. Paul, MN 55108.

Seed sources for the varieties sold in Minnesota are listed in Crop News No. 42 (revised), January 1991, prepared by Neal P. Martin, Extension Agronomist-forages.

TIMOTHY

Timothy is adapted throughout Minnesota for use in hay and pasture mixes. When timothy is the major component in hay, its stage of maturity affects both yield and quality. Harvesting timothy at early heading is the preferred time. Timothy produces the majority of it's forage at the first harvest.

Timothy varieties differ in maturity so care should be taken in choosing varieties that fit the management requirements of the crop and mixture. Early varieties are best adapted to a three-cut system with alfalfa. Varieties that are intermediate to late maturing should not be harvested more than twice during the growing season. Therefore, timothy is compatible with red clover and birdsfoot trefoil in mixtures for hay production.

Varieties were established in pure stands in August, 1989 at Grand Rapids and Rosemount. Early maturing varieties had

greater forage production than the late maturing varieties at both locations.

Seed sources of the varieties sold in Minnesota are listed in Crop News No. 42 (Revised), January 1991, prepared by Neal P. Martin, Extension Agronomist-Forages.

Table 6. Dry matter yields of timothy varieties seeded in 1989 at two locations.

Variety	Grand Rapids	Rosemount	Average
	tons dm/A		
Early maturity			
Chazy	4.0	3.8	3.9
Tupper	4.0	3.6	3.8
Intermediate maturity			
Comtal	3.6	3.5	3.5
Climax	3.6	2.9	3.2
Goliath	3.3	3.7	3.5
Late maturity			
Champlain	3.2	3.1	3.2
Heidemij	2.7	2.6	2.6
LSD 5%	0.4	0.8	0.8

1991 FORAGE SEED SOURCES

A. AgriPro, 824 2nd St. South, P.O. Box 250, Brookings, SD 57006;
B. Americas Alfalfas Distributors, 6700 Antioch, Shawnee Mission, KS 66201;
C. Asgrow Seed Co., 7000 Portage Rd., Kalamazoo, MI 49001;
D. Bio Plant Research, P.O. Box 300, Camp Point, IL 62320;
E. Blaney Seeds, Inc., 2160 Industrial Drive, Madison, WI 53713;
F. Blue Chip Quality Seed, Abbottsford, WI 54405;
G. Cargill Seed Div., P.O. Box 5645, Mpls., MN 55440;
H. Cenex/Land O'Lakes, Station 680, P.O. Box 64089, St. Paul, MN 55164-0089;
I. CIBA-GIEGY Seed Div., P.O. Box 18300, Greensboro, NC 27407;
J. Custom Farm Seed, Box 160, Momence, IL 60954
K. Dahlgren & Co., Inc., 1220 Sunflower Street, Crookston, MN 56716;
L. Dairyland Seed Co., Inc., R.R. #1, P.O. Box 129, Clinton, WI 53525;
M. DeKalb-Plant Genetics, 3100 Sycamore Rd., DeKalb, IL 60115;
N. Discount Farm Center, Inc., P.O. Box 84, Watertown, SD 57201;
O. Garst Seed Co., P.O. Box 300, Coon Rapids, IA 50058;
P. Geertson Seed Farms, 1665 Burroughs Rd. Adrain, Oregon 97901;
Q. George's Seeds, Inc., P.O. Box 155, Prescott, WI 54021;
R. Great Plains Research Co, Inc., 3624 Kildaire Farm Rd., Apex, NC 29502;
S. International Seeds Inc., P.O. Box 168, Halsy, Oregon 97348;
T. Interstate Seed Co., 1214 Prairie Parkway, West Fargo, ND 58078;
U. Jacques Seed Co., 720 St. Croix, Prescott, WI 54021;
V. J.C. Robinson Seed Co. (Golden Harvest), 100 J.C. Robinson Blvd., Waterloo, NE 68069;
W. Jung Farms Inc., 335 South High Street, Randolph, WI 53957;
X. Kaltenberg Seed Farms, Inc., P.O. Box 278, Waunakee, WI 53597;
Y. Keltgen Seed Co., Box A, Olivia, MN 56277;
Z. Lincoln Seed, Inc., 211 Pearl St., P.O Box 2803, Sioux City, IA 51106;
a. L. Herried Seed, Inc., P.O. Box 216, Prescott, WI 54021;
b. L.L. Olds Seed Co., Box 7790, 2901 Packers Ave., Madison, WI 53707-7790;
c. Mike Brayton Seeds, P.O. Box 308, Ames, IA 50010;
d. Mohn Seed Co., Rt. 1, Box 152, Cottonwood, MN 56229;
e. NC+ Hybrids, P.O. Box 4408, Lincoln, NE 68504;
f. Northrup King Co., P.O. Box 959, 7500 Olson Memorial Hwy., Golden Valley, MN 55400;
g. Payco Seeds, P.O. Box 70, Dassel, MN 55325;
h. Peterson-Biddick Co., Box 190, 102 Aldrich S.E., Wadena, MN 56482;
i. Peterson Seed Co., Inc., P.O. Box 346, Savage, MN 55378;
j. Pioneer Hi-Bred Int'l, Inc., P.O. Box 287, 7305 N.W. 62nd Ave., Johnston, IA 50131;
k. Plant Genetics, Inc., 1541 Berne Road, Fridley, MN 55241;
m. ProfiSeed, Inc., Rt. 2, Hampton, IA 50441;
n. Ramy Seed Company, 1329 N. Riverfront Drive, Mankato, MN 56001;
o. Seedsman, P.O. Box 542, St. Peter, MN 56082;
p. SIGCO Research, P.O. Box 289, Breckenridge, MN 56520;
q. The Sexauer Co., P.O. Box 58, Brookings, SD 57006;
r. Top Farm Hybrids, Inc., Box 850, Cokato, MN 55321;
s. United Agriseeds, Inc., P.O. Box 4011, Champaign, IL 61824;
t. Werner Farm Seeds, 3104 Millersburg Blvd., Dundas, MN 55019;
u. Ziller Seed Farms, Inc., R.R.1, Box 122, Bird Island, MN 55310;
v. Premium Seed Co., Inc., 7800 E. State Hwy 101, Shakopee, MN 55379;
w. Gold Country Co., Inc., Rt. 1, Box 111, Plato, MN 55370.

GRAIN CROPS

AMARANTH

Amaranth is a high protein grain crop grown for human food. First used by the Aztec and Mayan civilizations, amaranth is currently grown in China, India, Africa and on both American continents. Interest in this crop in Minnesota has increased in recent years.

Amaranth has large seed heads which can be yellow, green, brown, red, or maroon in color. Plants range from three to nine feet tall, and produce very small, lens shaped seeds. It is a drought tolerant crop which grows best in warm, dry weather. It is widely adapted to many locations in the Midwest.

The crop is planted in late May or early June. Cultivation of wide rows is required in the absence of approved herbicides. Seed yields of 300 to 2,055 pounds per acre (hand harvested) have been reported in Minnesota. A killing frost followed by a week of drying weather is required before harvest can be accomplished by combine.

A constraint to successfully growing amaranth is finding markets. Amaranth should not be grown without first identifying a market and establishing a contract for the grain. Amaranth is used in various flour based products. The grain can also be popped like popcorn or flaked like oatmeal. More than 40 products containing amaranth are currently on the market.

Production information is provided in the Amaranth chapter in the *Alternative Field Crops Manual*. Contact your county extension agent or the Center for Alternative Plant and Animal Products, 340 Alderman Hall, University of Minnesota, St. Paul, MN 55108 for details about this publication. Additional information is provided in the "Amaranth Grain Production Guide" available from the American Amaranth Institute, Box 216, Bricelyn, MN 56097 (cost: $5).

Table 7. Seed yield and characteristics of amaranth, 1990

	Seed Yield										
Line	Grand Rapids	Lamberton	Rosemount	St. Paul	Overall Avg.[1]	Protein[2]	Planting to 90% bloom[4]	Plant height[5]	Lodging[5]	Seed weight[2]	Test weight[7]
	lbs/a					%[3]	days	inches	score[6]	1,000s/lb.	lbs/bu
Amont	1171	1064	1018	1970	—	14.1	74	78	9	673	58
A200D	—	—	729	—	—	—	—	—	—	709	—
D136	—	956	893	1498	—	—	79	64	1	797	60
K266	—	1072	1299	2055	1379	15.4	77	73	9	966	58
K283	—	444	679	1329	905	15.1	70	69	3	708	57
K343	1326	629	910	1634	1115	15.8	72	69	5	713	60
K432	1397	735	1117	1550	1209	17.2	66	49	3	849	58
LSD 5%	198	393	193	306	287						

[1]Rosemount 1988, Grand Rapids, Lamberton, Rosemount and St. Paul 1990; [2]Rosemount; [3]Oven dry basis; [4]Lamberton and Rosemount; [5]Lamberton, Rosemount and St. Paul; [6]1 = no lodging, 10 = severe lodging; [7]St. Paul.

ANNUAL CANARYGRASS

Annual Canarygrass or canaryseed is a grain crop with production practices and a life cycle similar to that of spring wheat or oat. The plant is grown on large acreage in the Middle East, Europe, and Argentina, with some production in the northern Red River Valley of Minnesota, and the western provinces of Canada.

Production in the U.S. developed after World War II in Minnesota and North Dakota, and shifted in Manitoba and later Saskatchewan. In 1987, over 180,000 acres of canarygrass were produced in Canada. Less than 3,000 acres annually have been planted in Minnesota and North Dakota in recent years. It is grown under contract as a specialty crop, used primarily as birdfeed. The largest users are Japan and other countries of East Asia and Europe.

Minnesota Agriculture Experiment Station scientists are not currently conducting performance trials of annual canarygrass. If you want information from a recent report of tests of this crop, contact Extension Agronomy, 411 Borlaug Hall, 1991 Buford Circle, University of Minnesota, St. Paul, MN 55108.

Additional production information is provided in the annual canarygrass chapter in *Alternative Field Crops Manual*. Contact your county extension agent or The Center for Alternative Plant & Animal Products, 340 Alderman Hall, University of Minnesota, St. Paul, MN 55108, for details about this publication.

BARLEY

Recommended Public Varieties

Morex—Medium yield. Early. Medium lodging resistance. Kernel plumpness intermediate. Six-rowed, semi-smooth awn, short rachilla hairs, colorless aleurone. Awns may drop off as crop approaches maturity. Threshes easily. Classified as a malting variety by AMBA. Moderately resistant to spot blotch. Susceptible to loose smut. Developed by Minnesota Agricultural Experiment Station from cross of Cree and Bonanza. Released 1978.

Robust—High yield. Medium maturity. Superior to Morex in lodging resistance and kernel plumpness. Six-rowed, semi-smooth awn, short rachilla hairs, colorless aleurone. Classified as a malting variety by AMBA. Resistant to spot blotch. Susceptible to loose smut. Developed by Minnesota Agricultural Experiment Station from cross of Morex and Manker. Released 1983. Seed sale regulated by U.S. Variety Protection Act.

Excel—High yield. Medium maturity. Similar to Robust in lodging resistance. Kernel plumpness lower than Robust. Six-rowed, semi-smooth awn, colorless aleurone. Has long rachilla hairs so grain can be distinguished from grain of Robust and Morex. Classified as a malting variety by AMBA. Resistant to spot blotch. Susceptible to loose smut. Developed by Minnesota Agricultural Experiment Station from cross involving Robust, Manker, and a sisterline of Morex. Released 1990. Variety protection pending.

Other Public Varieties

Azure—High yield. Medium maturity. Six-rowed, semi-smooth awn, long rachilla hairs, blue aleurone. Classified as a malting variety by AMBA. Resistant to spot blotch. Yielded similar to Robust in Minnesota trials. Not recommended because of limited demand for blue aleurone malting variety in Minnesota. Developed by North Dakota Agricultural Experiment Station from a cross involving Bonanza, Nordic, and ND B130. Released 1982.

Table 8. Yields of barley varieties 1986-1990

Variety	Location: Crookston 5[1]	Morris 5	Stephen 2	St. Paul 3	15 trial average
	bu/A				
Morex	81	72	65	69	73
Robust	87	76	58	75	77
Excel	90	73	74	74	79
B1602	84	71	65	73	75
B1603	85	69	58	72	73
LSD 5%	6	5	11	8	3

[1]Number of trials.

Table 9. Characteristics of barley varieties, 1986-90

Variety	Heading 12[1]	Height 12	Lodging 4	Plump kernels 13	Stem rust 1	Net blotch 5
	date	inches	%	%	%	score[2]
Morex	6-22	32	43	63	32	3.4
Robust	6-24	32	32	72	32	2.4
Excel	6-24	30	32	55	18	2.0
B1602	6-24	27	31	64	32	2.7
B1603	6-22	31	37	62	40	2.7

[1]Number of trials; [2]low rating is best.

Bowman—Medium yield. Medium maturity. Very good kernel plumpness. Medium lodging resistance. Two-rowed, smooth awns, long rachilla hairs, and colorless aleurone. Not approved for malting by AMBA. Limited demand for two-rowed malting type in Minnesota. Similar to Robust in resistance to leaf diseases. Susceptible to loose smut. Developed by North Dakota Agricultural Experiment Station from cross involving several parents. Released 1984.

Hazen—High yield. Medium maturity. Good kernel plumpness and good lodging resistance. Six-rowed, semi-smooth awn, long rachilla hairs, colorless aleurone. Not approved for malting by AMBA. Resistant to spot blotch. Susceptible to loose smut. Developed by North Dakota Agricultural Experiment Station from a cross involving Glenn, Nordic, Dickson, Trophy and Azure. Released 1984.

Privately Developed Varieties

B1602—High yield. Medium maturity and kernel plumpness. Good lodging resistance. Six-rowed, rough awn, long rachilla hairs, colorless aleurone. Resistant to spot blotch. Classified as a malting variety by Anheuser Busch Inc., but not by AMBA. Is only grown under contract. Developed and marketed by Busch Agricultural Resources Inc. Parents include Bumper and Morex.

B1603—Medium yield and lodging resistance in limited testing by Minnesota Agricultural Experiment Station. Six-rowed, rough awn, long rachilla hairs, colorless aleurone. Resistant to spot blotch. Classified as a malting variety by Anheuser Busch Inc., but not by AMBA. Is only grown under contract. Developed and marketed by Busch Agricultural Resources Inc. Parents include Morex and Glenn.

BUCKWHEAT

Buckwheat is a nutritionally excellent grain. USDA-ARS analyses indicate that the grain has an amino acid composition nutritionally superior to most cereals, including oats.

Minnesota Agriculture Experiment Station scientists are not currently conducting performance trials of buckwheat. If you want information from a recent report of tests of this crop, contact Extension Agronomy, 411 Borlaug Hall, 1991 Buford Circle, University of Minnesota, St. Paul, MN 55108.

Additional production information is provided in the Buckwheat chapter in *Alternative Field Crops Manual*. Contact your county extension agent or The Center for Alternative Plant & Animal Products, 340 Alderman Hall, University of Minnesota, St. Paul, MN 55108, for details about this publication.

CORN

The Minnesota Agricultural Experiment Station conducts research in corn breeding. This includes the development of inbred lines which are used as parents of hybrids. Private companies may use these inbreds to produce the hybrid seed corn they develop for farmers.

Hundreds of corn hybrids are registered for sale in Minnesota by private companies. Information on the performance of these closed-pedigree or private hybrids is available from the companies selling them.

GRAIN SORGHUM

Farmers on the hot, dry plains from Texas to South Dakota grow and use grain sorghum like Corn Belt farmers use corn. Large acreage is also grown in Africa and Asia in areas where the climate is too hot and dry for corn. Acreage in the U.S. has ranged from 15 to 18 million per year. Renewed interest occurs with every hotter and drier than normal growing season.

Sorghum is a food grain for humans, but in the U.S. is primarily used as feed for livestock. Feed value is similar to corn. Grain sorghum may also be used as whole-plant silage, however, sweet sorghum was specifically developed as a silage crop. Sweet sorghum produces much higher forage yields than grain sorghum, but feed quality will likely be lower because there is no grain. Some growers plant grain sorghum with soybeans to produce a higher protein silage.

Minnesota Agriculture Experiment Station scientists are not currently conducting performance trials of grain sorghum. If you want information from a recent report of tests of this crop, contact Extension Agronomy, 411 Borlaug Hall, 1991 Buford Circle, University of Minnesota, St. Paul, MN 55108.

Additional production information is provided in the grain sorghum chapter in *Alternative Field Crops Manual*. Contact your county extension agent or The Center for Alternative Plant & Animal Products, 340 Alderman Hall, University of Minnesota, St. Paul, MN 55108, for details about this publication.

MILLET

Millet is among the oldest of cultivated crops. The name is applied to various grass crops whose seeds are harvested for food or feed. Five species have commercial value.

Foxtail millet (*Setaria italica* L.) is primarily grown for hay or silage or as a short season emergence hay crop. In the U.S. it is grown principally in the Dakotas, Colorado and Nebraska.

Proso millet (*Panicum miliaceum* L.) is a component of grain mixes for many birds and as a feed for cattle, sheep, hogs and poultry. It is similar to oats and barley in nutritional value and is grown principally in the Dakotas, Colorado and Nebraska.

Barnyard or Japanese millet (*Echinochloa frumentaceae* L.), is a domesticated relative of the barnyard grass weed. In the U.S. it is grown primarily as a forage.

Browntop millet (*Panicum ramosum*) is grown in southeastern U.S. for hay or pasture, and as game preserve bird feed plantings.

Pearl or cattail millet (*Pennisetum glaucum*) is primarily grown in southern U.S. as a temporary pasture.

Minnesota Agriculture Experiment Station scientists are not currently conducting performance trials of millet. If you want information from a recent report of tests of this crop, contact Extension Agronomy, 411 Borlaug Hall, 1991 Buford Circle, University of Minnesota, St. Paul, MN 55108.

Additional production information is provided in the millet chapter in *Alternative Field Crops Manual*. Contact your county extension agent or The Center for Alternative Plant & Animal Products, 340 Alderman Hall, University of Minnesota, St. Paul, MN 55108, for details about this publication.

OAT

Recommended Varieties

Don—Early, very high yield, short, fair lodging resistance, very high test weight, high groat percent, low protein percent, white seed. Resistant to crown rust and smut. Selected at the Illinois Agricultural Experiment Station. Released 1985.

Hazel—Medium maturity, high yield, short, very good lodging resistance, high test weight, very high groat percent, medium protein percent, ivory seed. Resistant to crown rust, susceptible to smut, tolerant to red leaf. Selected at the Illinois Agricultural Experiment Station from a cross involving Clintford and Portal. Released 1985. Because of smut susceptibility, plant only treated seed.

Premier—Medium maturity and yield, short, fair lodging resistance, very high test weight and high groat percentage, medium protein percent, yellow seed. Susceptible to rust, resistant to smut, some tolerance to red

leaf. Selected at the Minnesota Agricultural Experiment Station from a cross between Noble and an unreleased Wisconsin line. Released 1990. Plant Variety Protection will be applied for.

Starter—Early, medium yield, short, good lodging resistance, high test weight and groat percent, medium protein percent, yellow seed. Susceptible to crown rust, resistant to smut, some tolerance to red leaf. Selected at the Minnesota Agricultural Experiment Station from a cross involving Noble and a Dal derivative. Released 1986. Seed sale regulated by U.S. Variety Protection Act.

Steele—Late, medium yield, tall, fair lodging resistance, medium test weight and groat and protein percents, white seed. Some resistance to crown rust and smut, some tolerance to red leaf. Selected at North Dakota Agricultural Experiment Station from a cross between a Dal derivative and Noble. Released 1984.

Valley—Late, very high yield, short, good lodging resistance, high test weight and groat percent, medium protein percent, ivory seed. Some resistance to crown rust, susceptible to smut. Some tolerance to red leaf. Selected at the North Dakota Agricultural Experiment Station. Released 1988. Because of smut susceptibility, plant only treated seed.

Varieties Not Adequately Tested

Dane—Early, very high yield, short, good lodging resistance, very high test weight and groat percentage, yellow seed. Resistant to crown rust, moderately susceptible to smut and susceptible to red leaf. Selected at the Wisconsin Agricultural Experiment Station. Released 1990. Available only under a license/fee collection agreement.

Ensiler—Late, tall, poor grain but excellent forage yields, poor lodging resistance. Resistant to crown rust and smut, some tolerance to red leaf. Selected at the Wisconsin Agricultural Experiment Station from a cross involving Lodi and Otee. Released 1990. Available only under a license/fee collection agreement.

Settler—Medium-late maturity, high yield, medium height, poor lodging resistance, medium test weight and groat and protein percents, white seed. Some resistance to crown rust and smut and some tolerance to red leaf. Selected at the South Dakota Agricultural Experiment Station from a cross involving Benson and Noble. Released 1989.

Other Varieties

Hamilton—Early-medium maturity, medium yield, short, good lodging resistance, medium test weight and groat and protein percents, yellow seed. Susceptible to crown rust and smut. Selected at the Iowa Agricultural Experiment Station. Released 1988. Because of smut susceptibility, plant only treated seed.

Horicon—Medium maturity, high yield, medium height, very good lodging resistance, medium test weight, high groat percent, medium protein percent, tan seed. Resistant to crown rust, susceptible to smut, some tolerance to red leaf. Selected at the Wisconsin Agricultural Experiment Station from a complex cross. Released 1989. Available only under a license/fee collection agreement. Because of smut susceptibility, plant only treated seed.

Hytest—Medium maturity, low yield, tall, poor lodging resistance, very high test weight, high groat percent, medium protein percent, cream color seed. Susceptible to crown rust and red leaf, resistant to smut. Selected at the South Dakota Experiment Station from a cross involving Dal, Nodaway 70 and Moore. Released 1986.

Moore—Late, medium yield, tall, fair lodging resistance, medium test weight and groat and protein percents, white seed. Some resistance to crown rust and smut. Selected at Minnesota Agricultural Experiment Station from a cross between Lodi and Mn 65B 1286. Released 1979.

Newdak—Medium maturity, high yield, short, fair lodging resistance, medium-poor test weight and groat percentage, white seed. Moderately susceptible to rust, susceptible to smut, good tolerance to red leaf. Selected at North Dakota Agricultural Experiment Station. Released 1990. Because of smut susceptibility, plant only treated seed.

Noble—Early-medium maturity, medium yield and height, good lodging resistance, medium test weight and groat and protein percents, yellow seed. Susceptible to crown rust, resistant to smut, some tolerance to red leaf. Selected at Purdue Agricultural Experiment Station. Released 1973. Seed sale regulated by U.S. Variety Protection Act.

Ogle—Medium maturity, high yield, medium height, good lodging resistance, medium test weight, high groat percent, low protein percent, yellow seed. Susceptible to crown rust and smut, tolerant to red leaf. Selected at Illinois Agricultural Experiment Station from a cross of Brave, Tyler and Egdolon. Released 1981. Because of smut susceptibility, plant only treated seed.

Preston—Early, medium yield, short, fair lodging resistance, high test weight, medium groat percent, very high protein percent, ivory seed. Some resistance to crown rust, resistant to smut, some tolerance to red leaf. Selected at Minnesota Agricultural Experiment Station from a cross between Dal and Otee. Released 1982.

Rodney—Late, medium yield, tall, poor lodging resistance, medium test weight, white seed. Some resistance to crown rust, susceptible to smut. Selected by Agriculture Canada, Winnipeg. Licensed in 1952. Because of smut susceptibility, plant only treated seed.

Sandy—Late, low yield, tall, fair lodging resistance, high test weight, medium groat and protein percents, cream color seed. Susceptible to crown rust, smut, and red leaf. Selected at the South Dakota Experiment Station from a cross involving Dal, Nodaway 70 and Moore. Released in 1986. Because of smut susceptibility, plant only treated seed.

Trucker—Late, low yield, medium height, good lodging resistance, medium test weight and groat percent, high protein percent, white seed. Susceptible to crown rust and red leaf, some resistance to smut. Selected at the South Dakota Agricultural Experiment Station from a cross involving Dal, Nodaway 70 and Moore. Released 1988.

Table 10. Yield of oat varieties, 1988-90

Variety	Rosemount	Waseca	Lamberton	Morris	Crookston[1]	Grand Rapids	6 loc.ave.	Roseau
	bu/A							
Starter	73	69	50	81	91	59	69	65
Dane[2]	101	85	68	74	83	68	80	—
Don	96	80	62	85	91	72	80	69
Hazel	87	84	61	81	101	70	80	88
Premier	76	77	62	87	94	64	76	—
Settler[2]	74	75	67	90	96	70	79	—
Newdak	84	77	63	85	103	80	81	—
Steele	72	65	49	72	91	72	69	97
Valley	86	77	57	95	110	79	82	107
LSD 5%	7.2	7.9	6.8	6.2	11.9	7.7	3.3	12.2

[1]1989-90 data; [2]1990 data only.

Table 11. Characteristics of oat varieties, 1988-90

Variety	Heading	Height	Lodging	Test weight	Groat	Reaction to Disease		
						Rust	Smut	BYDV
	date	inches	score[1]	lbs/bu	%	rating[2]		
Starter	17	31	1.4	38.4	72.8	S	HR	6.0
Dane[3]	18	33	1.1	39.3	75.4	R	MS	7.0
Don	19	30	1.2	38.5	72.6	R	R	8.0
Hazel	20	30	1.1	37.6	74.5	R	S	4.0
Premier	21	32	1.3	38.5	72.9	S	HR	5.0
Settler[3]	22	34	1.6	35.3	70.5	MR	MS	5.0
Newdak	22	33	1.3	35.2	71.8	MS[4]	S	3.0
Steele	23	36	1.3	35.6	71.6	MR[4]	MS	4.5
Valley	24	32	1.3	37.1	72.0	MR[4]	MS	4.5

[1]1 = erect, 5 = flat; [2]R = resistant, MR = moderately resistant, MS = moderately susceptible, S = susceptible; 1 resistant -9 dead, rated by Kolb and Hewings, Univ. of Ill.; [3]1990 data only; [4]susceptible to new race.

DURUM WHEAT

Publicly developed varieties are classed as "Recommended," "Not Adequately Tested" or "Other," and listed within classes in maturity order. Privately developed varieties are listed and described in maturity order.

Recommended Publicly Developed Varieties

Monroe—Awned, early, medium height, fair lodging resistance. Resistant to stem rust and moderately resistant to leaf rust. High yield, medium test weight, high seed weight. Superior quality for export market. Released by North Dakota Agricultural Experiment Station in 1985.

Renville—Awned, midseason to late, fair lodging resistance. Resistant to stem rust and moderately resistant to leaf rust. High yield and test weight, and medium kernel weight. Superior quality for export market. Released by North Dakota Agricultural Experiment Station in 1988.

Cando—Awned, midseason to late, semidwarf, good lodging resistance.Resistant to stem rust . Susceptible to leaf rust. Medium yield and test weight, low seed weight. Satisfactory quality. Better adapted to northern Minnesota. Released by North Dakota Agricultural Experiment Station 1975.

Other Public Varieties

Medora—Awned, early, medium height, fair lodging resistance. Resistant to stem rust and moderately resistant to leaf rust. High yield and test weight, medium seed weight. Released by Agriculture Canada, Winnipeg, in 1980.

Table 12. Characteristics and yields of durum wheat varieties, 1988-89

Variety	Heading	Height	Lodging	Rust reaction		Seeds	Test weight	Yield			
				leaf	stem			Morris	Crookston	Stephen	Average
	date	inches	score[1]	rating[2]		no./lb	lbs/bu	bu/A			
PUBLICLY DEVELOPED VARIETIES											
Monroe	6-23	35	2.9	MR	R	10,200	61.1	35	42	51	43
Renville	6-26	36	2.8	MR	R	11,200	61.1	34	45	49	43
Cando	6-26	30	1.3	S	R	13,300	60.3	26	38	53	39
Medora	6-25	38	3.0	MR	R	11,500	61.7	38	43	49	43
Vic	6-25	36	2.8	MS	R	10,700	61.8	35	41	50	42
Lloyd	6-27	30	1.7	MS	R	11,200	58.7	23	41	57	41
Mindum	6-28	41	3.3	MS	S	11,500	61.7	26	38	35	33
PRIVATELY DEVELOPED VARIETIES											
Fjord	6-25	35	3.0	MR	R	11,100	62.3	34	37	50	40
Stockholm	6-26	30	2.0	MS	R	11,600	60.7	23	41	53	39
Laker	6-26	33	1.9	MR	R	11,100	60.7	29	39	55	40
LSD 5%								9	5	—	6

[1]1 = erect, 9 = flat; [2]Reaction to prevalent races: R = resistent, MR = moderately resistant, MS = moderately susceptible, S = susceptible.

Vic—Awned, midseason, medium height, fair lodging resistance. Resistant to stem rust. Moderately susceptible to leaf rust. High yield, test weight and seed weight. Superior quality for export market. Released by North Dakota Agricultural Experiment Station 1979.

Lloyd—Awned, midseason to late, semidwarf, good lodging resistance. Resistant to stem rust and moderately susceptible to leaf rust. Susceptible to glume blatch. High yield, low test weight and low seed weight. Superior quality for export market. Better adapted to northern Minnesota. Released by North Dakota Agricultural Experiment Station in 1983.

Mindum—Awned, late, tall, poor lodging resistance. Susceptible to stem rust and moderately susceptible to leaf rust. Low yield, high test weight, medium seed weight. Satisfactory quality. A durum type selected from a bread wheat field. Released by Minnesota Agricultural Experiment Station in 1917.

Privately Developed Varieties

Fjord—Awned, early, medium height, good lodging resistance. Resistant to stem rust and moderately resistant to leaf rust. High yield, medium test weight and seed weight. Released by Agripro in 1987. Seed sale regulated by the U.S. Variety Protection Act.

Stockholm—Awned, midseason, semidwarf, good lodging resistance. Resistant to stem rust and moderately susceptible to leaf rust. High yield, medium test weight and seed weight. Released by Agripro in 1987. Seed sale regulated by the U.S. Variety Protection Act.

Laker—Awned, midseason to late, semidwarf, good lodging resistance. Resistant to stem rust and moderately resistant to leaf rust. Medium yield, test weight, and seed weight. Released by Western Plant Breeders in 1984. Seed sale regulated by the U.S. Variety Protection Act.

HARD RED SPRING WHEAT

Publicly developed varieties are classed as "Recommended," "Not Adequately Tested" or "Other," and listed within classes in maturity order. Privately developed varieties are listed and described in maturity order.

Recommended Publicly Developed Varieties

Butte 86—Awned, early, medium height. Resistant to stem and leaf rust. Moderately tolerant of loose smut. Moderately susceptible to tan spot, black chaff, and lodging. High yield and test weight. Medium protein percent. Satisfactory milling and baking characteristics. Released by North Dakota Agricultural Experiment Station in 1986.

Grandin—Awned, early, semidwarf. Resistant to stem rust and moderately resistant to leaf rust. Moderately tolerant to loose smut. High yield and test weight. High protein percent. Satisfactory milling and baking. Released by North Dakota Agricultural Experiment Station in 1989.

Prospect—Awned, midseason, semidwarf. Moderately susceptible to stem and moderately resistant to leaf rust. Tolerant to loose smut. Medium lodging resistance. Moderately susceptible to leaf spotting diseases. High yield and test weight. Low to medium percent protein. Satisfactory milling. Released by South Dakota Agricultural Experiment Station in 1988.

Minnpro—Awned, midseason, semidwarf. Resistant to stem and leaf rust. Moderately susceptible to loose smut. High yield and very high protein percent. Low test weight. Satisfactory milling and baking characteristics. Best adapted to northern Minnesota. Released by Minnesota Agricultural Experiment Station and USDA-ARS in 1989. Variety protection pending.

Marshall, a widely grown hard red spring wheat, has improved characteristics—height and disease resistance—in contrast with heirloom varieties such as Thatcher and Marquis which were popular in the 1930s.

Stoa—Awned, midseason, medium height. Resistant to stem and moderately resistant to leaf rust. Moderately tolerant of loose smut and ergot. Medium lodging resistance. Very high yield and medium test weight. Medium protein percent. Satisfactory milling and baking. Released by North Dakota Agricultural Experiment Station in 1984.

Wheaton—Awned, midseason, semidwarf. Resistant to stem and leaf rust. Moderately tolerant of loose smut and ergot. Medium lodging resistance. Very high yield. Low test weight. Low protein percent. Satisfactory milling. Released by Minnesota Agricultural Experiment Station and USDA-ARS in 1983.

Vance—Awned, midseason, semidwarf. Resistant to stem and leaf rust. Tolerant to loose smut. High yield and medium test weight. Medium protein percent. Satisfactory milling and baking characteristics. Best adapted to northern Minnesota. Released by Minnesota Agricultural Experiment Station and USDA-ARS in 1989. Variety protection pending.

Marshall—Awned, midseason, semidwarf. Resistant to stem rust and moderately resistant to leaf rust. Moderately tolerant of loose smut and ergot. Good lodging resistance. High yield and high test weight. Low to medium protein percent. Satisfactory milling. Low bake absorption. Released by Minnesota Agricultural Experiment Station and USDA-ARS in 1982. Seed sale regulated by U.S. Variety Protection Act.

Table 13. Yields of hard red spring wheat varieties, 1988-90

Variety	Crookston	Stephen	Roseau[2]	Northern average	St. Paul	Morris[3]	Lamberton	Waseca[3]	Southern average	State average
					bu/A					
PUBLICLY DEVELOPED VARIETIES										
Butte 86	45	57	59	53	45	35	38	33	39	45
Grandin	41	61	51	51	44	33	39	36	39	44
Prospect	40	59	53	50	41	31	42	38	39	44
Minnpro	43	59	61	54	39	26	33	33	34	43
Stoa	44	58	60	53	43	34	44	39	41	46
Wheaton	42	61	53	52	38	35	42	35	39	45
Marshall	42	61	49	51	41	29	38	33	35	42
Vance	44	60	53	52	39	30	33	31	34	42
Shield	43	46	57	48	45	31	50	40	42	45
Sharp[1]	42	54	55	50	44	34	38	36	38	44
Guard	43	53	49	48	39	29	42	33	37	42
Len	43	57	53	51	37	25	33	29	32	40
Amidon	44	56	54	51	35	32	34	35	34	41
Gus	45	57	60	54	42	34	40	36	38	45
Chris	32	35	39	35	29	26	30	33	29	32
PRIVATELY DEVELOPED VARIETIES										
2375	44	57	63	54	44	34	46	39	42	47
Fjeld	44	64	52	53	40	34	43	37	39	45
W2501	43	61	55	53	42	37	42	36	40	45
Bergen[1]	43	63	53	53	39	34	42	33	37	44
Celtic	42	59	53	51	41	29	36	36	36	43
Telemark	43	61	42	50	35	28	37	38	35	41
2369	44	58	53	51	39	28	37	34	35	42
Nordic	48	63	52	55	36	32	34	37	35	44
Norseman	44	59	57	53	40	27	35	31	34	43
Tammy	47	61	54	54	39	25	37	33	35	43
LSD 5%	7	10	10	5	7	7	8	—	4	3

[1]1989-90. Data adjusted to 3-year average; [2]1989-90 data; [3]1988-89 data.

Table 14. Characteristics of hard red spring wheat varieties, 1988-90

Variety	Heading	Height	Lodging	Rust reaction leaf	Rust reaction stem	Seeds	Test weight	Wheat protein	Milling baking quality
	date	inches	score[1]	rating[2]		no./lb	lbs/bu	%[3]	rating
PUBLICLY DEVELOPED VARIETIES									
Butte 86	6-18	33	3.7	MR	R	13,800	59.9	15.0	Medium-High
Grandin	6-19	32	2.5	MR	R	14,200	59.4	15.3	High
Prospect	6-20	32	2.4	MR	MS	14,100	59.5	14.7	Medium-Low
Minnpro	6-20	32	3.0	R	R	13,400	57.2	16.3	High-Medium
Stoa	6-21	35	3.9	R	R	14,700	59.3	14.6	Medium-High
Wheaton	6-21	31	2.4	R	R	14,000	57.4	14.3	Low-Medium
Vance	6-22	31	2.4	R	R	14,200	58.0	14.9	Medium-High
Marshall	6-23	31	1.8	MR	R	16,200	58.4	14.4	Medium-Low
Shield	6-17	34	3.7	MR	MS	13,600	58.9	14.6	Medium
Sharp[4]	6-18	33	4.2	MR	R	13,500	60.0	15.0	Medium
Guard	6-19	30	3.1	R	MR	14,600	59.1	14.5	Medium-Low
Len	6-21	32	2.4	MS	R	14,600	58.9	15.6	High-Medium
Amidon	6-22	37	3.9	R	R	15,000	59.3	15.0	High-Medium
Chris	6-22	35	4.8	MR	R	16,000	58.4	15.8	High
Gus[4]	6-23	33	3.5	R	R	15,800	58.9	15.7	High
PRIVATELY DEVELOPED VARIETIES									
2375	6-19	32	4.1	MR	R	13,800	60.0	15.2	Medium
Fjeld	6-20	31	2.9	MR	R	14,000	58.4	13.8	Low-Medium
W2501	6-20	31	2.0	R	R	15,200	56.4	14.3	Low-Medium
Bergen[4]	6-21	31	2.1	R	R	14,200	58.4	14.5	Medium
Celtic	6-21	32	2.5	R	R	13,500	58.6	15.0	Medium
Telemark	6-21	29	1.3	R	R	14,400	57.4	15.2	Medium-High
2369	6-21	31	2.8	MS	MR	13,600	59.3	15.0	Low-Medium
Nordic	6-22	32	2.8	MS	R	12,600	59.5	13.6	Low
Norseman	6-23	29	2.0	R	R,S	13,800	57.5	15.0	Medium-Low
Tammy	6-23	31	2.7	MS	S	12,700	58.4	15.0	Medium-Low

[1]1 = erect, 9 = flat; [2]Reaction to prevalent races: R = resistant, MR = moderately resistant, MS = moderately susceptible, S = susceptible; [3]12 percent moisture; [4]two year data.

Public Varieties Not Adequately Tested

Sharp—Awned, early, medium height. Resistant to stem rust and moderately resistant to leaf rust. High yield and test weight. Medium protein percent. Higher potential for lodging. Satisfactory milling and baking. Released by South Dakota Agricultural Experiment Station in 1990.

Gus—Awned, midseason, semidwarf. Resistant to stem rust and leaf rust. High yield and test weight. High protein percent. Higher potential for lodging. Satisfactory milling and baking. Released by South Dakota Agricultural Experiment Station in 1990.

Other Public Varieties

Shield—Awned, early, medium height. Moderately susceptible to stem rust and resistant to leaf rust. Tolerant of loose smut. High yield. Medium test weight. Resistant to hessian fly. Medium protein percent. Susceptible to shattering and moderately susceptible to lodging. Satisfactory milling and baking characteristics. Released by South Dakota Agricultural Experiment Station in 1987.

Guard—Awned, early, semidwarf. Resistant to leaf rust and moderately resistant to stem rust. Moderately susceptible to tan spot. Moderately tolerant of loose smut and ergot. Medium lodging resistance. Resistant to hessian fly. High yield and test weight. Medium protein percent. susceptible to shattering. Satisfactory milling and baking. Released by South Dakota Agricultural Experiment Station in 1983. Seed sale regulated by U.S. Variety Protection Act.

Amidon—Awned, midseason, medium height. Resistant to stem and leaf rust. Moderately tolerant of loose smut. Medium yield and high test weight. Tolerant to sawfly. Medium percent protein. High potential for lodging, Satisfactory milling baking. Suggested for western North Dakota. Released by North Dakota Agricultural Experiment Station in 1988.

Chris—Awnless, midseason, medium height. Resistant to stem rust and moderately resistant to leaf rust. Tolerant of ergot and moderately tolerant of loose smut. Low yield and medium test weight. High protein percent. Susceptible to lodging. Satisfactory milling and baking. Released by Minnesota Agricultural Experiment Station and USDA-ARS in 1965.

Len—Awned, midseason, semidwarf. Resistant to stem rust and moderately resistant to leaf rust. Moderately tolerant of loose smut and ergot. Moderately susceptible to tan spot. Good lodging resistance. Moderately susceptible to shattering. Medium yield and test weight. High protein percent. Satisfactory milling and baking. Released by North Dakota Agricultural Experiment Station in 1979.

Privately Developed Varieties

2375—Awned, midseason to early, medium height. Resistant to stem rust and moderately resistant to leaf rust. Tolerant to loose smut. Very high yield and test weight. Medium to high protein percent. Moderately susceptible to lodging. Satisfactory milling and baking characteristics. Released by Pioneer Hi-Bred in 1988. Seed sale regulated by U.S. Variety Protection Act.

Fjeld—Awned, midseason, semidwarf. Resistant to stem rust and moderately susceptible to leaf rust. Moderately tolerant of loose smut. High yield and medium test weight. Low protein percent. Satisfactory milling characteristics. Lower flour water absorption. Released by AgriPro in 1989. Seed sale regulated by U.S. Variety Protection Act.

W2501—Awned, midseason, semidwarf. Resistant to stem and leaf rust. Medium lodging resistance. High yield. Low test weight and protein percent. Satisfactory milling. Sold by Busch Agricultural Research. Seed sale regulated by U.S. Variety Protection Act.

Bergen—Awned, midseason, semidwarf. Resistant to stem and leaf rust. High yield and medium test weight. Low to medium protein percent. Satisfactory milling and baking. Released by Agripro in 1990. Seed sale regulated by U.S. Variety Protection Act.

Celtic—Awned, midseason, semidwarf. Resistant to stem and leaf rust. Moderately tolerant of loose smut. High yield and test weight. Medium protein percent. Satisfactory milling and baking. First marketed by AgriPro in 1985. Seed sale regulated by the U.S. Variety Protection Act.

Telemark—Awned, midseason, semidwarf. Resistant to stem rust and to leaf rust. Moderately tolerant of loose smut. Medium to high yield and test weight. Medium protein percent. Satisfactory quality. First marketed by Agripro in 1986. Seed sale regulated by the U.S. Variety Protection Act.

2369—Awned, midseason, semidwarf. Moderately resistant to stem rust and moderately susceptible to leaf rust. Tolerant to loose smut. High yield and high test weight. Low to medium protein percent. Medium lodging resistance. Released by Pioneer Hi-Bred in 1983. Seed sale regulated by U.S. Variety Protection Act.

Nordic—Awned, midseason, semidwarf. Resistant to stem rust and moderately susceptible to leaf rust. Moderately tolerant of loose smut. Very high yield and test weight. Low protein percent. First marketed by Agripro in 1986. Seed sale regulated by the U.S. Variety Protection Act.

Norseman—Awned, midseason, semidwarf. Mixed resistant-susceptible to stem rust, and resistant to leaf rust. Good lodging resistance. Moderately susceptible to loose smut. High yield and low test weight. Low to medium protein percent. Low bake absorption. First marketed by Agripro in 1984. Seed sale regulated by U.S. Variety Protection Act.

Tammy—Awned, midseason semidwarf. Moderately susceptible to leaf rust and susceptible to stem rust. Moderately tolerant of loose smut. High yield and low test weight. Medium protein percent. First sold by World Seeds, Inc. in 1985. Seed sale regulated by the U.S. VarietyProtection Act.

WINTER WHEAT

Publicly developed varieties are listed within classes in maturity order. Privately developed varieties are listed in maturity order after a minimum of two years testing. Cultural practices have a major effect on winter survival of all winter wheats. Planting into a firm seedbed with at least some stubble remaining to retain snow cover can reduce winterkill.

Recommended Publicly Developed Varieties

Roughrider—Awned, tall, medium maturity, fair lodging resistance. Winter-hardy. Susceptible to leaf rust but resistant to stem rust. High yield and test weight. Satisfactory quality. Released by the North Dakota Agricultural Experiment Station in 1975.

Seward—Awned, tall, late, fair lodging resistance. Winter-hardy. Moderately susceptible to leaf rust and resistant to stem rust. Very high yield and medium to low test weight. Low protein percent. Satisfactory quality. Released by the North Dakota Agricultural Experiment Station in 1987.

Public Varieties Not Adequately Tested

Arapahoe—Awned, semidwarf, early, good lodging resistance. Moderately winter-hardy. Moderately resistant to leaf rust and resistant to stem rust. High yield and test weight. Released by Nebraska Agricultural Experiment Station and the USDA-ARS in 1988. Seed sale regulated by U.S. Variety Protection Act.

Other Public Varieties

Siouxland—Awned, very early, medium height with medium lodging resistance. Winter hardiness is not satisfactory. Moderately resistant to leaf and resistant to stem rust. High yield and medium test weight. Released by Nebraska Agricultural Experiment Station and USDA-ARS in 1984. Seed sale regulated by U.S. Variety Protection Act.

Agassiz—Awned, tall, medium maturity, fair lodging resistance. Winter-hardy. Susceptible to leaf rust and resistant to stem rust. Medium yield and test weight. Satisfactory quality. Released by North Dakota Agricultural Experiment Station in 1983.

Brule—Awned, early, semidwarf, good lodging resistance. Moderately winter-hardy. Moderately susceptible to leaf rust and resistant to stem rust. Very high yield and medium test weight. Satisfactory quality. Released by Nebraska Agricultural Experiment Station and USDA-ARS in 1982. Seed sale regulated by U.S. Variety Protection Act.

Rose—Awned, medium height, medium maturity, good lodging resistance. Moderately winter-hardy. Moderately susceptible to leaf rust andmoderately resistant to stem rust. High yield and test weight. Satisfactory quality. Released by South Dakota Agricultural Experiment Station in 1981.

Minter—Awned, late, tall, poor lodging resistance. Winter-hardy. Moderately susceptible to leaf and resistant to stem rust. Medium yield and high test weight. Satisfactory quality. Released by the Minnesota Agricultural Experiment Station and USDA-ARS in 1949.

Privately Developed Varieties

Thunderbird—Awned, early, semidwarf, good lodging resistance. Winter hardiness is not satisfactory. Moderately resistant to leaf rust and moderately susceptible to stem rust. High yield and test weight. Sold by Agripro in 1986. Seed sale regulated by U.S. Variety Protection Act.

Bighorn—Awned, early, semidwarf, good lodging resistance. Moderately winter-hardy. Susceptible to leaf and stem rust. High yield and low test weight. Satisfactory quality. Sold by SeedTec in 1984. Seed sale regulated by U.S. Variety Protection Act.

Abilene—Awned, semidwarf, early, good lodging resistance. Moderately winter-hardy. Moderately resistant to leaf rust and resistant to stem rust. High yield and test weight. Satisfactory quality. Released by Agripro in 1987. Seed sale regulated by U.S. Variety Protection Act.

Table 15. Yield and characteristics of winter wheat varieties, 1988-90

Variety	Heading	Height	Winter survival	Lodging	Rust reaction		Test weight	Protein	Yield				
					leaf	stem			Rose-mount	Mor-ris	Crook-ston[5]	Ros-eau[5]	Avg.
	date	inches	%[1]	score[2]	rating[3]		lbs/bu	%[4]	bu/A				
PUBLICLY DEVELOPED VARIETIES													
Roughrider	6-11	36	59	2.1	S	R	58.8	13.8	33	35	39	34	35
Seward	6-12	36	57	1.9	MR	R	56.9	12.3	39	37	41	52	41
Thunderbird	6-6	31	48	1.1	MR	MS	57.7	13.2	36	29	17	23	28
Siouxland	6-6	33	52	2.3	MS	R	57.2	12.9	41	32	32	46	38
Brule	6-9	34	54	1.5	MS	R	56.8	12.8	35	32	29	21	30
Arapahoe[6]	6-9	32	56	2.3	R	R	58.0	13.0	34	39	42	28	36
Rose	6-10	34	53	1.3	S-MS	MR	58.3	13.3	34	29	36	29	32
Agassiz	6-13	39	59	2.4	S	R	57.8	13.2	27	32	34	42	33
PRIVATELY DEVELOPED VARIETIES													
Abilene[6]	6-9	32	54	2.9	MS	MR	58.3	13.9	28	36	40	35	34
Bighorn	6-10	33	57	1.7	S	S	55.6	13.1	33	30	22	35	30
Minter	6-14	39	60	3.4	MS	R	57.8	13.5	24	30	33	36	30
LSD 5%									—	8	—	14	7

[1]Includes two locations not harvested because of severe winter-kill. [2]1 = erect, 9 = flat. [3]R = resistant, MR = moderately resistant, MS = moderately susceptible, S = susceptible. [4]12% moisture. [5]1988 and 1989 data. [6]1989 and 1990 data, yields adjusted.

WILD RICE

Cultivated wild rice is grown on 20,000 acres in Minnesota. Most is produced from varieties with nonshattering tendency, but some fields are still planted to shattering types. No recommendations regarding specific varieties are made.

Because of the likelihood of preharvest losses due to high winds, storms, blackbird damage, and killing frost before varietal maturity, growers should favor early to medium maturing varieties. All varieties shatter to some extent and are lodging and disease susceptible.

Varieties

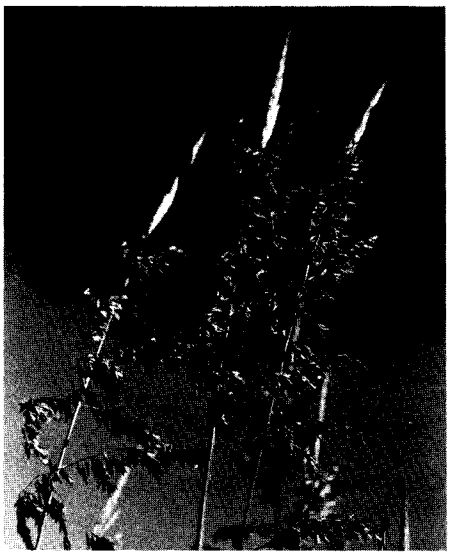
K2—Medium height, early to medium maturity, medium to high yield. Developed by Kosbau Bros. in 1972.

M3—Medium height, medium to late maturity, high yield. Diverse in plant and panicle type. Developed by Manomin Development Co. in 1974.

Meter—Short height, very early maturity, low to medium yield. Large seed size. Reduced foliage in the canopy compared to other varieties. Released by the Minnesota Agricultural Experiment Station in 1985.

Netum—Medium height, early maturity, low to medium yield. Released by the Minnesota Agricultural Experiment Station in 1978.

Voyager—Short to medium height, early maturity, medium to high yield. Should equal or exceed K2 in yield and mature a few days earlier. Released by the Minnesota Agricultural Experiment Station in 1983.



Seed heads of wild rice tend to shatter, but research has created several varieties more suited to cultivation. The "foliage" are actually the male pollen producing florets.

Table 16. Yield and characteristics of wild rice varieties.

Variety	Yield			Shattering		Harvest	Height	Seeds
	1981-1886	1989[1]	1990[1]	1989[1]	1990[1]	1981-1986	1981-1988	
	lbs/A[2]			%[3]		date	inches	no./lb[4]
K2	1578	1083	796	37	59	8-23	72	7300
M3	1613	649	720	55	59	8-27	74	9460
Meter	1078	1070	—	21	—	8-2	53	6880
Netum	1497	728	—	27	—	8-17	68	8300
Voyager	1500	1082	—	31	—	8-18	66	8600
LSD 5%	156	292	315	9	7	—	4	—

[1]1990 data was from Grand Rapids; 1989 data was from Grand Rapids and Gully (on-farm); [2]Green weight of harvested grain adjusted to 40% moisture; [3]Shattering expressed as percent of total possible yield, or the sum of harvested and shattered seed; [4]Seeds per pound based on wet, stored seed. Seed size will vary from year to year and seed-lot to seed-lot.

WINTER RYE

Rye is believed to have originated in southern Europe and nearby parts of Asia. Rye was a weed widely distributed in wheat and barley fields in southern Asia. It apparently had coevolved with wheat and barley until its value as a crop was recognized.

Rye was brought to the western hemisphere by English and Dutch settlers. The average production in the United States in 1987-89 was about 15.9 million bushels on about 2.3 million acres. Leading states in rye production are South Dakota, Georgia, Nebraska, North Dakota, and Minnesota. In 1989 there were 32,000 acres harvested in Minnesota.

Less than half the rye grown in the U.S. is harvested for grain. The remainder is used as pasture, hay, or a cover crop. About half of the rye harvested for grain is used for livestock feed or exported, and the remainder is used for alcoholic beverages, food, and seed.

Minnesota Agriculture Experiment Station scientists are not currently conducting performance trials of rye. If you want information from a recent report of tests of this crop, contact Extension Agronomy, 411 Borlaug Hall, 1991 Buford Circle, University of Minnesota, St. Paul, MN 55108.

Additional production information is provided in the rye chapter in *Alternative Field Crops Manual.* Contact your county extension agent or The Center for Alternative Plant & Animal Products, 340 Alderman Hall, University of Minnesota, St. Paul, MN 55108, for details about this publication.

OILSEED CROPS

FLAX

Common flax was one of the first domesticated crops. It is thought to have originated in the Mediterranean region of Europe. In the United States, early colonists grew small fields of flax for home use. Commercial production of fiber flax began in 1753. During the 1940s fiber flax production in the U.S. dropped to nearly zero.

The current major fiber flax producing countries are the Soviet Union, Poland, and France. States having the largest seed flax acreage are North Dakota, South Dakota, and Minnesota. Since 1943, Minnesota flax acreage has declined from 16 million to only 15,000 in 1988. Minnesota flax acreage is concentrated in the northwestern area, but flax has been grown successfully in nearly all counties.

Minnesota Agriculture Experiment Station scientists are not currently conducting performance trials of flax. If you want information from a recent report of tests of this crop, contact Extension Agronomy, 411 Borlaug Hall, 1991 Buford Circle, University of Minnesota, St. Paul,MN 55108.

Additional production information is provided in the flax chapter in *Alternative Field Crops Manual.* Contact your county extension agent or The Center for Alternative Plant & Animal Products, 340 Alderman Hall, University of Minnesota, St. Paul, MN 55108, for details about this publication.

CANOLA AND OILSEED RAPE

Canola and oilseed rape are used for oil extraction and protein feed. Most of the spring canola acreage is currently grown in Canada, but canola and oilseed rape are occasionally produced in northwestern Minnesota when market prices are high.

The first canola variety was licensed in 1974. It was developed from oilseed rape by Canadian plant breeders. Canola seed oil contains less than 2 percent erucic acid compared with 20 to 40 percent in oilseed rape. The meal remaining after oil extraction from canola also contains less than 0.1 percent of glucosinolate (sulfur-containing compounds) compared with about 1 percent in rapeseed meal. Canola is also referred to as double low or 00 rapeseed.

High levels of erucic acid in food oils are hazardous to health, and high levels of glucosinolates are detrimental in livestock feeds. Consequently, canola is rapidly replacing oilseed rape for food oil and livestock feed.

Oilseed rape's high level of erucic acid is needed for certain industrial purposes. Canadian plant breeders have developed oilseed rape varieties with oil containing over 40 percent erucic acid. These varieties are grown under contract so that they cannot be marketed as canola.

The canola variety descriptions that follow are for spring sown types. Winter canola has also been evaluated by University of Minnesota researchers at locations throughout the state. In 1989, trials at five out of six locations were completely winterkilled. Further evaluation is required to assess the potential of this crop in Minnesota.

Production information is provided in the Canola chapter in *Alternative Field Crops Manual.* Contact your county extension agent or the Center for Alternative Plant and Animal Products, 340 Alderman Hall, University of Minnesota, St. Paul, MN 55108 for details about this publication.

Spring Canola Varieties *(Brassica napus)*

A112—Developed by Ameri-Can Pedigreed Seed Co., Memphis, TN, and distributed by Terra International, Sioux City, IA. Limited availability.

A114—Developed by Ameri-Can Pedigreed Seed Co., Memphis, TN, and distributed by Terra International, Sioux City, IA. Limited availability.

Bounty—Developed by Weibulls, AB, Landskrona, Sweden. Distributed by Allelix Crop Technologies, Inc., Clarksville, TN. Limited availability.

Celebra—Developed by Svalof, AB, Sweden. Distributed by Bonis and Company Ltd., Lindsay, Ontario, Canada.

Delta—Developed by Weibulls, AB, Landskrona, Sweden. Distributed by Allelix Crop Technologies, Inc., Clarksville, TN. Limited availability.

Global—Developed by Svalof, AB, Sweden. Distributed by Bonis and Co., Lindsay, Ontario, Canada and Can Am Seed Co., Grand Forks, ND.

Hyola 40—Hybrid developed by Garst Seed Co., Winnipeg and marketed in U.S. by Garst Seed Co., Lakeville, MN. Limited availability.

Hyola 41—Hybrid developed by Garst Seed Co., Winnipeg and marketed in U.S. by Garst Seed Co., Lakeville, MN. Seed not currently available.

Legend—Variety of Svalof, AB, Sweden. Distributed by Bonis and Co., Lindsay, Ontario, Canada and by Interstate Seed Co., West Fargo, ND.

OAC Triton—Tolerant of triazine herbicides (Sencor, Lexone, Atrazine, etc.). Originated at University of Guelph, Ontario, Canada. Licensed 1984.

OAC Triumph—Tolerant of triazine herbicides (Sencor, Lexone, Atrazine, etc). Originated at University of Guelph, Ontario, Canada.

Pactol—Developed by Semences Cargill, France and distributed by Cargill Hybrid Seeds, Minneapolis, MN. Plant Variety Protected. Released 1986.

Stallion—Tolerant of triazine herbicides (Sencor, Lexone, Atrazine, etc). Variety of Svalof, AB, Sweden. Distributed by Bonis and Co., Lindsay, Ontario, Canada.

Topas—Reported to have moderate resistance to Sclerotinia. Developed by Svalof, AB, Sweden. Distributed by Bonis and Company Ltd., Lindsay, Ontario, Canada and Can Am Seed Co., Inc., Grand Forks, ND.

Tribute—Tolerant of triazine herbicides (Sencor, Lexone, Atrazine, etc.). Better oil quality than OAC Triton. Originated by Agriculture Canada, Saskatoon and University of Guelph, Ontario, Canada. Licensed 1985.

Vanguard—Variety of Svalof, AB, Sweden. Distributed by Bonis and Co., Lindsay, Ontario, Canada.

Westar—Originated by Agriculture Canada, Saskatoon, Canada. Licensed 1982. Certified seed production limited to Canada.

Table 17. Seed yield of spring canola (Brassica napus) varieties

Variety	Crookston[1] 1990	Morris 1990	Roseau 1990	Avg. 1990	Avg. 1989-1990
	lbs/A				
A112	1240	2282	2278	1933	—
A114	1165	2867	2458	2163	—
Bounty	1749	2300	1926	1992	1755
Celebra	1689	2842	1963	2165	1793
Delta	1832	1933	2391	2052	1868
Global[2]	2048	2805	2659	2504	1776
Hyola 40	1670	2475	2217	2121	1843
Hyola 41	1546	2132	1993	1890	—
Legend	1890	2266	1870	2009	1838
OAC Triton[2]	1394	1521	1129	1348	1102
OAC Triumph	1351	2063	1838	1751	1315
Pactol	2246	2599	1837	2227	—
Stallion	1328	2183	1610	1707	1351
Topas[2]	1714	2578	1990	2094	1716
Vanguard	1746	2439	2124	2103	—
Westar[2]	1918	2262	2031	2070	1722
LSD 5%	463	618	642	580	510

[1]Hail damage at maturity reduced yields across all varieties by an estimated 40%; [2]Long term averages (10 location/year) for Global, OAC Triton, Topas and Westar are 1594, 987, 1461 and 1637 lbs/a respectively.

Table 18. Characteristics of spring canola (Brassica napus) varieties[1]

Variety	Oil 1990	Oil 1989-1990	Test weight	Seed weight	Planting to 50% bloom	Planting to maturity	Lodging	Plant height
	%[2]		lbs/bu	1,000s/lb	days		score[3]	inches
A112	36	—	54	153	58	102	4	47
A114	36	—	52	152	60	101	2	47
Bounty	37	37	52	149	54	102	7	48
Celebra	37	38	50	141	55	101	4	51
Delta	35	36	52	153	56	102	6	51
Global	37	37	49	128	56	104	7	50
Hyola 40	37	38	51	137	53	98	4	47
Hyola 41	37	—	50	155	52	95	6	43
Legend	37	38	49	133	54	100	6	52
OAC Triton	35	35	49	131	56	103	8	47
OAC Triumph	35	35	50	149	56	103	6	49
Pactol	39	—	50	148	56	100	5	45
Stallion	36	36	50	137	56	103	7	50
Topas	37	37	50	152	56	102	3	51
Vanguard	37	—	50	139	54	101	6	47
Westar	38	38	50	114	54	100	7	48

[1]Crookston, Morris and Roseau 1990; [2]10% moisture basis; [3]1 = no lodging, 10 = severe lodging.

Spring Canola Variety *(Brassica Campestris)*

Tobin—Originated by Agriculture Canada, Saskatoon, Canada. Licensed 1981. Certified seed production limited to Canada.

Oilseed Rape Variety *(Brassica Napus)*

Reston—Over 40 percent erucic acid in oil and less than 0.1 percent glucosinolate in meal. Originated by University of Manitoba, Canada. Licensed 1982.

Oilseed Rape Variety *(Brassica Campestris)*

R-500—Over 50 percent erucic acid in oil and very high glucosinolate in meal. Originated by Agriculture Canada, Saskatoon, Canada. Licensed 1975.

MUSTARD

During the Middle Ages seeds from the cultivated mustard crop *(Brassica spp.)* provided special oils for flavoring European foods. It is still used widely as a source of oil and for table mustard preparations. It is a contract specialty crop grown in rotation with small grains (wheat, oats, barley).

Minnesota acreage in 1963 was around 25,000 acres, mostly grown under contract in the northwest part of the state. Present Minnesota mustard acreage is unknown, but Canada, Denmark and the United Kingdom are now large producers.

Three types of mustard can be grown in Minnesota: yellow, oriental *(Brassica hirta)* and brown *(Brassica juncea)*. Only the yellow mild table mustard type has high yield in the state. The other types are grown on fewer acres, for specialty hot mustard products.

Minnesota Agriculture Experiment Station scientists are not currently conducting performance trials of mustard. If you want information from a recent report of tests of this crop, contact Extension Agronomy, 411 Borlaug Hall, 1991 Buford Circle, University of Minnesota, St. Paul, MN 55108.

SOYBEAN

Many soybean varieties are available in Minnesota, developed by public and/or private organizations. The important characteristics of these soybean varieties are presented in this section's tables.

Tables 20 to 25 deal with varieties developed by publicly supported institutions and are considered for recommendation by the Minnesota Agricultural Experiment Station.

Tables 26 to 28 show performance characteristics of privately developed varieties as well as several public varieties. These tests were conducted at various locations in the northern, central and southern zones (see map). Specific test locations for each zone are indicated in each table. Becker was the only irrigated test location. All tests were planted between May 5 and May 25 unless otherwise indicated. Row spacings vary in some tables. The Moorhead test location was not harvested in 1988 due to severe hail damage.

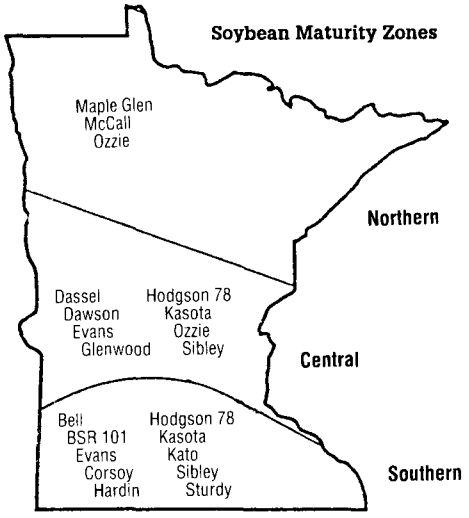
Major factors to be considered in selecting varieties are listed below:

Maturity—Soybeans are sensitive to day length, so date of maturity is affected by production zone latitude. Because of this, each soybean variety has a narrow range of adaptation. Varieties that mature before the fall killing frost should be selected to obtain high yield and quality. A soybean variety is considered mature when 95 percent of the pods have reached their mature color. Harvesting would normally be done one to two weeks after this stage is reached, depending on drying conditions. The accompanying map relates production zones to recommended varieties discussed in text and tables.

Yield—Varieties are arranged in the tables in order of increasing maturity. Later maturing varieties are normally expected to have higher yield potential than earlier maturing varieties. Compare yields by looking within a maturity range of about 5 days. Yield comparisons are more reliable if data is available for several years. Data from different tables should not be compared. All yield data reported in these tables were obtained from replicated tests harvested with a plot combine.

The LSD figures at the bottom of table yield columns are measures of variability within the trials. If the yield difference between two varieties within a column exceeds this LSD value one can assume that the higher yielding variety was truly superior. A 20 percent level of significance is used in the tables. This means that 80 percent of the time yield differences exceeding the LSD value are real differences, the remaining 20 percent of the time the differences are due to chance.

Row Spacing—Research over many years and at many locations has shown that yields from narrow rows (10 inches to 18 inches) are higher than wide rows (20 inches to 40 inches). These row width yield differences for the two early planting dates at Waseca and Lamberton have not been as pronounced in most recent years of testing. Although



rankings of varieties can change with row spacing, top performers in a wide spacing should be among the top performers in a narrow spacing.

Plant Height and Lodging—These measurements indicate stem strength and standability of varieties and relate somewhat to ease of combining. Actual height and lodging scores are influenced by environ-

Table 19. Genes for resistance to races of Phytophthora root rot

Gene	Races																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Rps1	■	■								■	■		■	■	■	■	■	■						■	
Rps1-6	■		■	■	■	■	■	■	■				■	■		■	■	■			■	■			
Rps1-c	■	■	■			■	■	■	■	■	■		■		■	■	■						■	■	
Rps1-k	■	■	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■				■		■	
Rps3	■	■	■	■	■			■		■	■		■	■		■							■		■
Rps4	■	■	■	■						■		■		■		■		■	■	■	■				■
Rps6	■	■	■	■						■		■				■		■	■	■	■				■

mental conditions, so values may vary from year to year. Use these values by comparing scores of newer varieties to scores of a familiar variety.

Chlorosis—The score is a measure of how much leaf yellowing occurred in variety tests conducted in 1990 on a high lime (high pH) soil near Lamberton. It indicates how well a variety will perform on such soils. *For some varieties the symptoms were not as severe as previously observed. These 1990 scores may not be indicative of some varieties' responses to high pH soils.*

Phytophthora—Phytophthora root rot can cause significant yield losses when susceptible varieties are planted in poorly drained fields. There are several races of this fungus and it is important to know which are present in a field. Several genes can be incorporated into varieties to provide complete resistance to specific races.

Some information refers to "tolerance" or "field resistance" which is not race-specific and should not be confused with race specific resistance. Reliable tests for tolerance have not yet been developed. The genes present were determined based on data from greenhouse plants grown by scientists in the University of Minnesota Department of Plant Pathology, and on information supplied by the companies.

Soybean Cyst Nematode--SCN was first identified in Minnesota in 1978 and is now known to occur in 23 counties. Areas infested and numbers of nematodes both appear to be increasing. When SCN numbers are high, significant yield losses can occur. Several races of SCN are known to occur in Minnesota, however, Race 3 appears to be the predominant one. Planting resistant varieties and rotations to non-host crops assists in managing nematode populations.

Additional details on the soybean cyst nematode and management of infested fields can be found in the publication *The Soybean Cyst Nematode* (AG-FO-3935, 1990, Minnesota Extension Service, University of Minnesota). It is available from County Extension offices or the Distribution Center, 3 Coffey Hall, 1420 Eckles Ave., University of Minnesota, St. Paul, MN 55108.

Brown Stem Rot—Brown stem rot is a fungal disease that can cause yield losses in certain situations. The disease occurs most frequently when soybeans follow soybeans but can occur where soybeans are planted every other year. Resistant varieties, or longer rotations out of soybeans, assist in management of this disease.

Protein and Oil--Protein and oil values are determined using near infrared reflectance analysis. Protein and oil values are expressed on a 13 percent moisture basis. This formula converts the protein and oil value to another moisture basis:

$$\frac{\text{100-desired moisture}}{87} \times \text{protein or oil value given in the table}$$

The value of a bushel of soybeans based on its oil and protein content can be calculated by:

$$APV = 60\,[Po\,(X) + \frac{Pm\,(Y)}{.44}]$$

Where:

APV = Approximate value of a bushel of soybeans
Po = soybean oil price (in $ per pound)
Pm = price of 44% meal (in $ per pound)*
X = oil content at 13% moisture (in decimals)
Y = protein content at 13% moisture (in decimals)

And:

$$\frac{\text{* price of meal (\$/ton)}}{2{,}000} = \text{\$/pound}$$

Corsoy 79—Southern zone. Very good yield. *Rps1-c gene for phytophthora resistance.* Poor chlorosis ratings, somewhat lodging susceptible. Developed by Illinois Agricultural Experiment Station. Released 1979.

Dassel—Central zone. Yield similar to Evans. Good lodging resistance. *Rps6 gene for resistance to phytophthora.* Highly susceptibleto herbicide metribuzin. Developed by Minnesota Agricultural Experiment Station. Released 1986. Seed sale regulated by U.S. Variety Protection Act.

Dawson—Central zone. Very good tolerance to iron chlorosis on high lime soils. Higher yielding than Swift. Good lodging resistance. *Rps1 gene for resistance to phytophthora but quite susceptible to race 3 of phytophthora.* Developed by Minnesota Agricultural Experiment Station. Released 1983. Seed sale regulated by U.S. Variety Protection Act.

Evans—Central zone. *Rps1 gene for resistance to phytophthora.* Good for late season plantings in southern zone. Developed by Minnesota Agricultural Experiment Station. Released 1974. Seed sale regulated by U.S. Variety Protection Act.

Jim Orf, soybean breeder, evaluates thousands of plots every year across Minnesota, testing new "advanced" lines for yield, maturity and other important characteristics.

Recommended Public Varieties

BSR 101—Southern zone. Similar in maturity to Corsoy 79. High yield potential, moderate resistance to brown stem rot. Acceptable iron chlorosis score. *Rps1 gene for resistance to phytophthora.* Developed by Iowa Agricultural Experiment Station. Released 1985.

Bell—Southern zone. Several days later than Hardin in maturity. *Resistant to race 3 and race 14 (formerly reported as race 4) of the Soybean Cyst Nematode.* Recommended as part of a management package for producers with a soybean cyst nematode problem. Fair yield potential. Susceptible to phytophthora. Released by Illinois Agricultural Experiment Station in 1989. Seed sale regulated by U.S. Variety Protection Act.

Glenwood—Central zone. One to two days later than Evans. High yield. Good lodging resistance. Outstanding protein level. *Rps1 gene for resistance to phytophthora.* Developed by Minnesota Agricultural Experiment Station. Released 1987. Seed sale regulated by U.S. Variety Protection Act.

Hardin—Southern zone. Earlier than Corsoy. Good yield performance. *Rps1 gene for resistance to phytophthora.* Developed by Iowa Agricultural Experiment Station. Released 1980. Seed sale regulated by U.S. Variety Protection Act.

Hodgson 78—Central and southern zones. Similar to Hodgson, except *Rps1 gene for resistance to phytophthora.* Developed by Minnesota Agricultural Experiment Station.

Released 1978. Seed sale regulated by U.S. Variety Protection Act.

Kasota—Central and southern zones. Slightly later than Hodgson 78 in maturity. Very good yield potential. High protein level. Good lodging resistance. *Rps1c gene for resistance to phytophthora.* Developed by Minnesota Agricultural Experiment Station. Released 1990. Seed sale regulated by U.S. Variety Protection Act.

Kato—Central and southern zones. Maturity similar to Sibley. Outstanding protein level. Very good lodging resistance. Good iron chlorosis resistance. *Rps1 gene for resistance to phytophthora.* Developed by Minnesota Agricultural Experiment Station. Released 1989. Seed sale regulated by U.S. Variety Protection Act.

Maple Glen—Northern zone. Matures about six days later than McCall but earlier than Ozzie. Very good yield potential. Susceptible to phytophthora. Developed by Agriculture Canada, Ottawa. Licensed 1987.

McCall—Northern zone. High yield. Tall. Good lodging resistance in its maturity class. Susceptible to phytophthora. Developed by Minnesota Agricultural Experiment Station. Released 1978.

Ozzie—Northern and central zones. High yield. Good lodging resistance for its maturity. *Rps1 gene for resistance to Phytophthora.*Developed by Minnesota Agricultural Experiment Station. Released 1983. Seed sale regulated by U.S. Variety Protection Act.

Sibley—Central and southern zones. One day later than Hodgson 78. Higher yielding and higher protein and oil than Hodgson 78. *Rps1 gene for resistance to phytophthora.* Developed by Minnesota Agricultural Experiment Station. Released 1986. Seed sale regulated by U.S. Variety Protection Act.

Sturdy—Southern zone. Matures later than Hardin but earlier than Corsoy 79. High yield potential. Good lodging resistance and iron chlorosis resistance. *Rps1 gene for resistance to phytophthora.* Developed by Minnesota Agricultural Experiment Station. Released 1989. Seed sale regulated by U.S. Variety Protection Act.

Weber 84—Southern zone. Similar to Weber except *Rps1 gene for resistance to phytophthora.* Developed by Iowa Agricultural Experiment Station. Released 1984.

Public Varieties Not Adequately Tested

Archer—Similar in maturity to BSR 101 and Corsoy 79. Yield, brown stem rot resistance and iron chlorosis resistance similar to BSR 101. *Rsp1k and Rps6 genes for resistance to phytophthora.* Released by Iowa Agricultural Experiment Station in 1989. Seed Sale regulated by U.S. Variety Protection Act.

Other Public Varieties

Hodgson—Largely superseded by phytophthora-resistant Hodgson 78. Developed by Minnesota Agricultural Experiment Station. Released 1974. Seed sale regulated by U.S. Variety Protection Act.

Maple Arrow—Matures about six days later than McCall. *Rps6 gene for resistance to phytophthora.* Developed by Agriculture Canada, Ottawa. Licensed 1976.

Maple Donovan—Central zone. Slightly later than Evans in maturity. *Rps1 and Rps4 genes for resistance to phytophthora.* Developed by Agriculture Canada, Ottawa. Licensed 1986.

Simpson—Central and southern zones. High yield. Good lodging resistance. *Rps1 gene for resistance to phytophthora.* Developed by Minnesota Agricultural Experiment Station. Released 1982. Seed sale regulated by U.S. Variety Protection Act.

Swift—Very good tolerance to iron chlorosis on high lime soils. Susceptible to phytophthora. Developed by Minnesota Agricultural Experiment Station. Released 1972.

Table 20. Yields of publicly developed soybean varieties in northern zone, 1986-90

Variety	Crookston	Grand Rapids	Moorhead[1]	Roseau
		bu/A		
McCall	23	33	32	37
Chico	—	—	30	—
Maple Arrow	21	—	26	—
Ozzie	24	—	34	—
Evans	26	—	33	—
Proto	—	—	26[2]	—
Dawson	24[2]	—	39	—
Dassel	—	—	34	—
Glenwood	—	—	36	—
Maple Donovan	27	—	34	—
Simpson	—	—	35	—
LSD 20%	2		2	

[1]1986-87, 89-90; [2]1987-90.

Table 21. Yields of publicly developed soybean varieties in 10 inch and 30 inch spacings, and three planting dates at Morris, 1986-87, 89-90.

	mid-May planting		late-May planting		mid-June planting	
Variety	10 inch	30 inch	10 inch	30 inch	10 inch	30 inch
			bu/A			
McCall	--	--	36	32	31	27
Ozzie	43	36	42	36	30	29
Evans	46	38	43	39	33	33
Dawson	--	--	42	42	32	33
Hodgson 78	46	43	--	--	--	--
LSD 20%	2	2	2	2	2	2

Table 22. Yields of publicly developed soybean varieties in central zone, 1986-90

Variety	Rosemount 10-inch	Morris 10-inch	Becker 30-inch	Average
		bu/A		
McCall	37	30	--	34
Ozzie	41	35	48	41
Evans	38	37	46	40
Dawson	42	42	47	44
Dassel	42	37	48	42
Glenwood	40	41	48	43
Simpson	44	38	47	43
Hodgson 78	46	42	50	46
LSD 20%	2	2	2	1

Table 23. Yields of publicly developed soybean varieties in 10 inch and 30 inch spacings and 5 planting dates at Waseca and Lamberton, 1986-87, 89-90.

Variety	early-May planting		mid-May planting		late-May planting		mid-June planting		late-June planting	
	10-inch	30-inch	10-inch	30-inch	10-inch	30-inch	10-inch	30-inch	10-inch	30-inch
	bu/A									
Evans	---	---	---	---	---	---	39	39	33	31
Sibley	48	47	49	49	48	46	43	42	34	33
Hardin	50	52	53	53	53	51	47	44	33	30
Corsoy 79	52	51	55	52	50	47	---	---	---	---
BSR 101	51	54	53	52	49	48	---	---	---	---
LSD 20%	2	2	2	2	2	2	2	2	2	2

Weber—Similar to Corsoy 79 in yield and lodging. Good tolerance to high lime soils. Susceptible to phytophthora rot. Developed by Iowa Agricultural Experiment Station. Released 1979. Seed sale regulated by U.S. Variety Protection Act.

Special Purpose Varieties

Chico—Small-seeded variety for specialty markets. Matures slightly earlier than Clay. Seed weight about 5 grams per 100 seeds less than Clay. Yields less than Clay. *Rps1 gene for resistance to phytophthora.* Developed by Minnesota Agricultural Experiment Station. Released 1983.

Grande—Relatively large seeded variety for specialty markets. Three to four days later than Evans. Seed weight about 6 grams per 100 seeds greater than Evans. Yields less than Evans. Developed by Minnesota Agricultural Experiment Station. Released 1976.

Minnatto—Small seeded variety for specialty markets. Matures slightly later than Evans. Seed weight about 4 grams per 100 seeds less than Chico. Similar in yield to Chico. *Rps1 gene for phytophthora resistance.* Developed by Minnesota Agricultural Experiment Station. Released 1989. Seed sale regulated by U.S. Variety Protection Act. (Contact Sigco Sun Products, Inc., Breckenridge, MN, for seed information.)

Proto—Very high protein variety for specialty markets. Maturity similar to Evans. Protein content 3 to 5 percent higher than other varieties. Yields less than Evans. Susceptible to phytophthora. Developed by Minnesota Agricultural Experiment Station. Released 1989.

Vinton 81—Large seeded special purpose variety. Maturity similar to Hardin. Seed weight 6 to 8 grams per 100 seeds greater than Hardin. *Rps1 gene for resistance to phytophthora.* Developed by Iowa Agricultural Experiment Station. Released 1981.

Table 24. Yields of publicly developed soybean varieties in southern zone, 1986-90

Variety	Waseca and Lamberton		Fairmont mid-May planting 30-inch	Waseca mid-May planting 10-inch	Lamberton mid-May planting 10-inch	Average mid-May planting
	mid-May planting	mid-June planting				
	bu/A					
McCall	—	36	—	—	—	—
Ozzie	41	43	43	40	42	42
Evans	42	43	42	40	44	42
Dawson	47	46	44	47	47	46
Glenwood	46	44[1]	46[1]	46	46	46
Dassel	47	44[1]	44	48	46	46
Simpson	49	43	45	51	46	47
Kato	50	46[3]	51	51	48	50
Hodgson 78	50	45	45	52	47	48
Sibley	52	46	46	51	52	50
Kasota[3]	53	47	48	52	51	50
Hardin	55	48	47	53	57	52
Weber 84	54	48	50	56	51	52
Sturdy	56	47[2]	49	57	56	54
BSR 101	51	44	56	52	50	53
Corsoy 79	53	44	44	53	52	50
LSD 20%	2	2	2	2	2	1

[1]1987-90 data; adjusted to 5 year; [2]1988-90 data; adjusted to 5 year average; [3]1989-90 data; adjusted to 5 year average.

Privately Developed Varieties

Private companies entering varieties in the 1990 Minnesota tests, and brand names:

AgriPro, Route 2, Hwy 30 East, Ames, IA 50010 (AP);
Asgrow Seed Company, P.O. Box 7570, Des Moines, IA 50322 (Asgrow);
Atlas S-Brand Seed Company, Rt. 1, Box 149, Harlan, IA 51537 (Atlas S-Brand);
Cargill Incorporated, Cargill Office Center, P.O. Box 9300, Minneapolis, MN 55440 (Cargill);
Cenex/Land O'Lakes, 2827 8th Avenue South, Fort Dodge, IA 50501 (C/LOL);
CIBA GEIGY Seed Division, P.O. Box 18300, Greensboro, NC 22419 (Funk's G Brand);
Custom Farm Seed, P.O. Box 160, Momence, IL 60954 (CFS);
Dahlgren & Company, Inc., 1220 Sunflower Street, Crookston, MN 56716 (Dahlgren);
Dairyland Seed Co., Inc., P.O. Box 958, 3570 Hwy. H., West Bend, WI 53095 (DSR);
DeKalb Plant Genetics, 3100 Sycamore Road, DeKalb, IL 60115 (DeKalb);
Dennis Ewing Farm Seed, Rt. 4, Ames, IA 50010 (Yield King);
Domestic Seed & Supply, Inc., Box 466, 306 S. Washington, Madison, SD 57042 (Mustang);
Edward J. Funk & Sons, Inc., 601 Funk Parkway, Kentland, IN 47951(Super Crost);
Ehrich Seed Farms, RR 1, Elmore, MN 56027 (Ehrich);
Gold Country Seed, Inc., Rte 1, Box 111, Plato, MN 55370 (GCS);
Hy-Vigor Seeds, Inc., R.R. 1, Paullina, IA 51046 (Hy-Vigor);
Interstate Seed Company, Box 338, 1215 Prairie Parkway, West Fargo, ND 58078 (IS);
Jacques Seed Company, 720 St. Croix St., Prescott, WI 54021 (Jacques);
J.C. Robinson Seed Co., The, 100 J.C. Robinson Boulevard, Waterloo, NE 68069-0301 (Golden Harvest);
Kaltenberg Seed Farms, Inc., 5506 Hwy. A., P.O. Box 278, Waunakee, WI 53597 (Kaltenberg);
Kruger Seed Company, Hwy 20 East, Box A, Dike, IA 50624 (Kruger);
Latham Brothers Farms, Rt. 1, Box 12, Alexander, IA 50420 (Latham);

Lundquist Seed, Inc., 15 N. 10th St., Wheaton, MN 56296 (LS);
Midwest Oilseeds, Inc., Route 3, Box 204, Adel, IA 50003 (MO);
Northrup King, 7500 Olson Memorial Highway, Minneapolis, MN 55427 (NK);
Pioneer Hi-Bred Int'l, Inc., 130 SE Willmar Ave., Willmar, MN 56201, (Pioneer);
Prairie Brand Seed, Inc., Rte. 1, Box 201, Gowrie, IA 50543 (Prairie Brand);
ProfiSeed, Inc., Route 2, Hampton, IA 50441 (Profiseed);
Rossbach Lakeside Seeds, Route 1, Box 70, Hanska, MN 56041 (Lakeside);
Sand Seed Service, Inc., P.O. Box 648, Marcus, IA 51035 (SOI);
Sansgaard Seed Farms, Inc., RR 1, Box 76, Story City, IA 50248 (Sansgaard);

Table 25. Characteristics of publicly developed soybean varieties, 1990

Variety	Mature: mid-May Planting	Mature: mid-June Planting	Lodging	Height	Phytophthora	Protein	Oil	Chlorosis
	----------date----------		score[1]	inches	gene	%[2]	%[2]	score[1]
Northern Zone (Crookston and Moorhead)								
McCall	8-31	--	1.0	19	S	35.8	16.7	2.0
Chico	9-4	--	1.0	18	Rps1	36.7	16.3	1.5
Maple Arrow	9-4	--	1.0	22	Rps1	37.6	15.8	2.0
Ozzie	9-5	--	1.0	23	Rps1	35.8	16.8	1.0
Proto	9-5	--	1.0	20	S	39.4	14.3	1.0
Maple Donovan	9-7	--	1.0	21	Rps1 + Rps4	37.0	16.0	2.0
Evans	9-9	--	1.0	22	Rps1	36.3	16.5	2.0
Glenwood	9-11	--	1.0	20	Rps1	37.3	15.9	2.5
Dawson	9-11	--	1.0	23	Rps1	36.2	16.5	1.0
Minnatto	9-12	--	1.0	21	Rps1	37.8	15.5	1.0
Simpson	9-13	--	1.0	20	Rps1	37.1	15.8	2.5
Dassel	9-13	--	1.0	21	Rps6	36.5	16.3	1.0
Central Zone (Morris and Rosemount)								
McCall	9-3	--	1.5	25	S	34.3	17.8	2.0
Chico	9-3	--	2.0	31	Rps1	35.5	17.0	1.5
Ozzie	9-9	--	1.5	34	Rps1	35.7	16.9	1.0
Evans	9-12	--	2.0	38	Rps1	35.7	17.0	2.0
Glenwood	9-12	--	1.8	32	Rps1	35.8	16.8	2.5
Proto	9-12	--	2.0	29	S	38.4	15.0	1.0
Dawson	9-13	--	2.0	36	Rps1	34.5	17.5	1.0
Simpson	9-13	--	1.8	33	Rps1	34.9	17.4	2.5
Swift	9-13	--	2.8	39	S	34.0	18.0	2.0
Maple Donovan	9-13	--	1.8	35	Rps1 + Rps4	35.3	17.2	2.0
Dassel	9-14	--	1.3	34	Rps6	36.0	16.8	1.0
Kato	9-19	--	1.8	40	Rps1	37.6	15.6	2.5
Hodgson 78	9-20	--	2.0	39	Rps1	34.7	17.7	2.5
Sibley	9-20	--	2.3	37	Rps1	35.4	17.1	1.0
Kasota	9-20	--	2.4	34	Rps1-c	37.7	15.9	1.5
Weber 84	9-20	--	3.0	38	Rps1	34.8	17.5	2.0
Hardin	9-20	--	2.5	39	Rps1	34.7	17.5	2.5
Sturdy	9-22	--	2.0	40	Rps1	35.8	16.5	1.0
Corsoy 79	9-22	--	2.5	41	Rps1-c	36.1	16.6	2.0
Southern Zone (Lamberton and Waseca)								
McCall	9-1	9-23	1.5	27	S	35.3	17.0	2.0
Ozzie	9-6	9-25	1.3	32	Rps1	37.0	16.0	1.0
Evans	9-7	9-26	2.0	36	Rps1	35.7	16.9	2.0
Proto	9-7	--	1.5	28	S	38.7	14.6	1.0
Glenwood	9-7	9-28	1.3	32	Rps1	36.5	16.4	2.5
Dawson	9-8	9-28	2.5	35	Rps1	34.6	17.5	1.0
Simpson	9-8	9-26	1.8	32	Rps1	35.1	17.2	2.5
Swift	9-9	--	3.0	38	S	33.6	18.0	2.0
Dassel	9-10	10-1	1.3	31	Rps6	36.3	16.4	1.0
Kato	9-18	10-4	2.0	38	Rps1	38.3	15.0	2.5
Hodgson 78	9-20	10-3	2.5	37	Rps1	35.8	16.8	2.5
Sibley	9-22	10-4	3.0	40	Rps1	36.1	16.5	1.0
Kasota	9-23	10-4	1.8	39	Rps1-c	37.6	15.7	1.5
Hardin	9-23	10-6	3.0	39	Rps1	35.4	17.0	2.5
Weber 84	9-25	10-4	3.0	42	Rps1	36.3	16.5	2.0
Corsoy 79	9-26	10-6	3.3	43	Rps1-c	36.5	16.4	2.0
Bell	9-26	--	4.0	35	S	37.6	15.7	1.5
Sturdy	9-27	10-6	3.0	40	Rps1	36.2	16.5	1.0
BSR 101	9-25	10-6	2.5	39	Rps1	34.6	17.7	2.0
Archer	9-25	--	2.0	40	Rps1k + Rps6	34.3	17.7	2.0

[1]1 = excellent, 5 = very poor; [2]13% moisture.

Sexauer Company, The, P.O. Box 58, Brookings, SD 57006-0058 (Sexauer);
Sigco Research, Box 289, Breckenridge, MN 56520 (Sigco);
Star Brand Seed, Marcus, IA 51035 (Star);
Stine Seed Farm, Inc., Route 3, Box 204, Adel, IA 50003 (Stine);
Terra International, Inc., 950 South Broadway, Lima, OH 45804 (Terra);
Thompson Agronomics, Inc., Route 1, Leland, IA 50453 (Thompson);
Thompson Seeds, Inc., Route 1, Leland, IA 50453 (Thompson);
Willette Seed Farm, Inc., Delavan, MN 56023 (Willette Seed Farm);
Wilson Hybrids, Inc., P.O. Box 391, Harlan, IA 51537 (Wilson Blend);
Ziller Seed Company, Route 1, Box 122, Bird Island, MN 55310 (Ziller).

Table 26. Yields and characteristics of public and private soybean varieties, northern zone, 1990 (Crookston, Moorhead, Shelly)

Brand or Originator	Variety	Matures	Yield 1988-1989[2]	Yield 1989-1990[2]	Yield 1990	Phytophthora gene[3]	Chlorosis score[4]	Protein 1988-1990	Protein 1989-1990	Protein 1990	Oil 1988-1990	Oil 1989-1990	Oil 1990
		date	bu/A	bu/A	bu/A			%[5]	%[5]	%[5]	%[5]	%[5]	%[5]
Agric. Canada	Maple Belle	8-31	—	18	23	Rps1	1.0	—	36.3	35.9	—	17.2	16.8
Minn. A.E.S.	McCall	8-31	18	20	23	S	1.5	36.6	35.2	35.1	18.7	18.0	17.3
Agric. Canada	Maple Ridge	8-31	17	18	22	S	1.0	36.3	35.6	35.5	18.9	17.8	17.2
Sigco	KG20	8-31	18	18	22	S	1.5	36.7	35.6	35.9	18.4	17.5	16.5
GCS	Arco	9-2	—	18	22	S	1.5	—	35.0	34.6	—	18.0	17.4
Dahlgren	D3888	9-2	—	18	22	S	1.5	—	35.2	35.7	—	18.0	17.1
NK	S00-88	9-2	—	17	22	S	2.0	—	36.1	34.8	—	17.0	17.5
Dairyland	DSR-045	9-3	—	—	26	S	4.5	—	—	35.4	—	—	17.0
Univ. of Guelph	OAC Scorpio	9-3	—	21	25	S	3.0	—	34.6	34.7	—	18.2	17.6
Dahlgren	KG-40	9-3	18	19	22	S	1.5	37.2	35.8	35.4	18.0	17.3	17.1
Jacques	011[1]	9-3	19	19	21	S	4.5	36.3	35.2	35.1	18.7	17.8	17.3
Univ. of Guelph	Bicentennial	9-3	16	16	19	Rps6	2.5	38.5	37.2	36.5	17.1	16.3	16.5
Jacques	033	9-4	—	—	24	S	1.5	—	—	35.1	—	—	17.3
Agric. Canada	Maple Glen	9-4	19	20	23	S	2.0	36.8	35.3	34.9	18.5	17.8	17.6
Agric. Canada	Maple Arrow	9-4	13	13	16	Rps1	2.0	37.4	36.6	35.5	17.5	16.6	17.1
IS	604	9-5	17	18	20	S	2.0	35.7	34.2	34.4	19.2	18.6	17.8
Minn. A.E.S.	Ozzie	9-6	18	19	24	Rps1	1.0	37.9	36.4	36.0	17.3	16.8	16.8
Sigco	49	9-6	—	—	24	S	2.5	—	—	34.2	—	—	17.9
Univ. of Guelph	OAC Libra	9-6	—	20	21	S	2.0	—	34.4	34.5	—	18.6	17.8
Stine	0510	9-6	19	19	21	S	1.0	35.7	34.2	34.4	19.1	18.6	17.6
Agric. Canada	Maple Donovan	9-7	22	22	27	Rps1+4	2.0	37.3	35.6	35.4	17.9	17.4	17.1
Pioneer	9061	9-8	21	22	27	Rps1	2.5	36.1	34.8	34.8	18.8	18.2	17.5
I.S.	529	9-8	—	20	24	S	2.0	—	34.0	34.0	—	18.8	18.0
Minn. A.E.S.	Glenwood	9-9	—	—	24	Rps1	2.5	—	—	35.7	—	—	16.8
Minn. A.E.S.	Dawson	9-11	22	22	26	Rps1	1.5	36.7	35.2	35.3	18.4	17.8	17.2
Minn. A.E.S.	Evans	9-12	20	20	27	Rps1	1.5	36.8	35.6	35.7	18.4	17.6	17.1
Golden Harvest	X075	9-12	—	—	26	S	1.5	—	—	35.7	—	—	17.0
AgriPro	AP0919	9-13	—	—	26	S	2.0	—	—	35.9	—	—	16.8
Univ. of Guelph	OAC Pisces	9-13	—	21	24	S	3.0	—	35.4	35.7	—	17.8	16.9
I.S.	546	9-14	23	22	28	Rps1	2.5	37.5	36.4	36.2	17.8	17.0	16.7
Dairyland	DSR-070	9-14	22	21	26	S	2.0	37.8	36.4	36.1	17.5	16.8	16.6
AgriPro	AP1347	9-18	—	—	28	S	2.0	—	—	34.6	—	—	17.6
LSD 20%			2	2	2								

[1]Blend (information furnished by originator); [2]Morris 1988, Shelly 1989 and 1990 test; [3]Specific genes noted; S = susceptible; [4]1 = excellent, 5 = very poor, see text for additional explanation; [5]13% moisture.

Table 27. Yields and characteristics of public and private soybean varieties, central zone, 1990 (Becker, Morris, Rosemount)

Brand or Originator	Variety	Matures	Yield 1988-1989	Yield 1989-1990	Yield 1990	Phytophthora gene[2]	Chlorosis score[4]	Protein 1988-1990	Protein 1989-1990	Protein 1990	Oil 1988-1990	Oil 1989-1990	Oil 1990
		date	bu/A	bu/A	bu/A			%[5]	%[5]	%[5]	%[5]	%[5]	%[5]
Minn. A.E.S.	Ozzie	9-11	38	39	39	Rps1	1.0	37.0	36.7	36.9	18.3	17.0	16.4
Pioneer	9061	9-13	—	—	42	Rps1	2.5	—	—	34.7	—	—	17.6
Pioneer	9091	9-13	42	43	42	S	1.0	36.9	36.2	36.3	18.5	17.0	16.8
GCS	Baker	9-13	—	—	37	S	2.0	—	—	37.5	—	—	15.9
Minn. A.E.S.	Glenwood	9-13	38	38	37	Rps1	2.5	37.6	36.5	36.7	18.0	17.1	16.4
Minn. A.E.S.	Evans	9-13	37	39	36	Rps1	1.5	37.1	36.0	36.2	18.0	17.6	16.8
Minn. A.E.S.	Dassel	9-14	39	42	40	Rps6	1.0	37.1	36.8	37.0	18.2	16.8	16.2
Jacques	J-080	9-14	42	42	39	S	3.0	35.1	34.1	33.8	19.8	18.9	18.2
Cargill Inc	097	9-14	—	—	38	Rps1	1.5	—	—	36.4	—	—	16.7
Minn. A.E.S.	Dawson	9-14	40	40	35	Rps1	1.5	35.6	35.0	34.9	19.3	18.2	17.5
Univ. of Guelph	OAC Eclipse	9-14	—	—	34	S	2.5	—	—	36.1	—	—	16.9

Table 27 (Continued). Yields and characteristics of public and private soybean varieties, central zone, 1990 (Becker, Morris, Rosemount)

Brand or Originator	Variety	Matures	Yield 1988-1989	Yield 1989-1990	Yield 1990	Phytophthora gene[2]	Chlorosis score[4]	Protein 1988-1990	Protein 1989-1990	Protein 1990	Oil 1988-1990	Oil 1989-1990	Oil 1990
		date	bu/A					%[5]			%[5]		
NK	S07-80	9-15	—	43	38	S	2.5	—	35.2	35.6	—	18.3	17.3
Univ. of Guelph	OAC Musca	9-15	—	37	35	S	2.0	—	34.1	34.3	—	19.0	17.9
Dairyland	DST0903	9-16	—	—	41	S	1.0	—	—	36.8	—	—	16.4
Ziller Seed Co.	BT 1790	9-16	46	48	41	Rps1-c	2.0	36.0	35.4	35.9	19.3	18.1	17.1
Dahlgren	KG60	9-16	—	—	30	Rps1-c	2.0	—	—	36.2	—	—	16.7
Sigco	80	9-17	42	43	41	Rps1	2.0	37.7	37.0	37.4	17.6	17.0	16.1
Asgrow	A0949	9-17	43	44	41	Rps1-c	1.5	37.4	36.6	37.0	18.3	17.1	16.3
NK	X8909	9-17	—	43	40	Rps1	2.0	—	36.4	36.8	—	17.2	16.4
DeKalb	CX096	9-17	40	41	40	Rps1	1.5	37.6	37.0	37.6	18.0	16.8	15.8
Jacques	J-121	9-17	—	—	38	S	2.0	—	—	36.7	—	—	16.5
Minn. A.E.S.	Simpson	9-17	39	39	36	Rps1	1.5	36.5	35.8	36.0	18.8	17.7	16.9
Pioneer	9111	9-18	45	46	42	S	2.0	37.5	36.8	37.4	18.1	17.0	16.1
Ziller	BT 1422	9-18	—	44	42	S	1.5	—	36.0	36.8	—	17.8	16.5
Thompson	T-3100	9-18	43	43	40	S	3.5	36.9	36.2	36.9	18.7	17.6	16.5
Univ. of Guelph	OAC Dorado	9-19	—	43	40	S	2.0	—	35.1	35.9	—	18.3	17.0
Sigco	HP71	9-19	—	—	39	Rps1	2.0	—	—	38.5	—	—	15.4
NK	B117	9-19	44	43	39	S	2.0	36.7	36.0	36.5	18.8	17.6	16.7
Univ. of Guelph	OAC Aries	9-19	—	—	38	S	2.0	—	—	35.2	—	—	17.3
Dairyland	DSR-122	9-19	—	42	37	S	2.5	—	36.8	37.3	—	17.0	16.0
NK	X90-12	9-20	—	—	43	S	2.0	—	—	35.8	—	—	17.1
SuperCrost	SC134	9-20	—	—	41	S	2.0	—	—	36.6	—	—	16.5
LS	Brandt	9-20	—	—	40	S	1.5	—	—	36.4	—	—	16.6
Dahlgren	D3050	9-21	—	—	44	S	2.0	—	—	35.9	—	—	16.9
DeKalb	CX 117	9-21	45	47	43	S	2.0	36.0	35.4	35.7	19.2	18.0	17.1
Stine	0965[1]	9-21	—	—	41	Rps1	2.5	—	—	36.0	—	—	16.8
Dairyland	DSR-135	9-21	42	42	39	Rps1	2.0	36.7	36.2	36.4	18.3	17.8	16.9
Sexauer	SX 1000	9-21	—	—	39	M[3]	2.0	—	—	36.9	—	—	16.4
Kaltenberg	KB098	9-21	42	43	38	S	2.0	36.7	36.1	36.2	18.6	17.4	16.7
Agripro	AP1776	9-22	46	48	48	Rps1	2.5	34.6	33.7	34.5	20.4	19.3	17.9
MO	MW Oil 1910	9-22	44	46	45	Rps1-c	4.5	36.7	36.5	36.6	18.4	17.0	16.5
MO	MW Oil 1820	9-22	47	48	45	S	2.0	36.3	36.4	36.8	18.6	17.2	16.4
Kaltenberg	KB117	9-22	47	49	45	S	2.0	37.2	36.6	37.1	18.2	17.1	16.2
SOI	195	9-22	45	47	44	S	1.5	36.9	36.4	36.3	18.3	34.4	16.7
Minn. A.E.S.	Kato	9-22	42	43	43	Rps1	1.0	40.0	38.8	39.1	16.6	15.3	14.8
Atlas S-Brand	B115[1]	9-22	—	46	42	M[3]	1.5	36.6	—	37.5	—	17.1	15.9
Thompson	T-18	9-23	44	45	43	S	2.0	36.8	36.3	36.3	18.6	17.4	16.9
GCS	Courtland	9-23	—	46	43	M[3]	1.5	—	36.9	37.6	—	17.1	16.0
Thompson	EX 802	9-23	—	—	42	S	4.5	—	—	37.3	—	—	16.1
Dairyland	DSR-128	9-23	43	44	40	Rps1-c	2.0	36.2	35.8	36.6	19.1	17.8	16.6
CFS	CFS 158	9-24	43	45	44	S	2.0	36.0	35.8	35.5	19.1	17.8	17.2
C/LOL	L1880	9-24	—	—	43	S	2.0	—	—	35.7	—	—	17.0
Minn. A.E.S.	Hodgson 78	9-24	44	45	41	Rps1	2.0	35.9	35.4	35.8	19.3	18.0	17.0
Minn. A.E.S.	Kasota	9-24	—	—	40	Rps1-c	1.5	—	—	37.7	—	—	15.9
C/LOL	L1700[1]	9-25	—	—	43	S	2.5	—	—	35.2	—	—	17.4
Cargill	155	9-25	—	—	43	Rps1-c	2.5	—	—	35.4	—	—	17.3
Stine	1070	9-25	46	46	42	S	1.5	37.0	36.6	36.8	18.4	17.0	16.4
Funks G-Brand	G-3185	9-25	—	45	42	S	1.5	—	35.6	35.4	—	17.8	17.5
DeKalb	CX 187	9-25	43	45	42	S	2.0	35.8	35.4	35.5	19.2	17.9	17.2
MO	EX 1210	9-25	—	—	41	S	2.5	—	—	37.7	—	—	15.9
Dahlgren	D3131	9-25	—	—	39	S	2.0	—	—	36.6	—	—	16.5
Minn. A.E.S.	Sibley	9-25	42	43	38	Rps1	2.0	36.8	36.4	37.1	18.6	17.2	16.2
STAR	EXP 8916	9-26	—	47	44	S	2.0	—	36.8	37.2	—	17.1	16.1
CFS	E90-137	9-26	—	—	43	S	1.5	—	—	37.1	—	—	16.2
STAR	EXP-9015	9-26	—	—	43	S	2.0	—	—	36.8	—	—	16.3
Golden Harvest	H1150	9-26	—	—	41	S	2.0	—	—	36.8	—	—	16.4
Sexauer	SX 1005	9-26	—	—	41	Rsp1-c	1.5	—	—	35.2	—	—	17.3
Funks G-Brand	G-3197	9-27	45	47	42	S	2.0	36.2	35.4	35.7	19.0	18.0	17.1
Super Crost	SC 192	9-27	—	—	41	S	2.0	—	—	36.6	—	—	16.5
AgriPro	AP 1989	9-27	45	43	39	Rps1-c	2.0	34.3	33.8	34.2	20.4	19.1	17.9
DeKalb	CX210	9-29	—	—	42	S	2.5	—	—	35.3	—	—	17.3
Kaltenberg	KB125	9-29	—	—	40	Rps1	2.0	—	—	35.9	—	—	16.9
LSD 20%			2	3	3								

[1]Blend (information furnished by originator); [2]Specific genes noted, S = Susceptible; [3]Mixture of Rps1 and susceptible, see text for additional explanation; [4]1 = excellent, 5 = very poor; [5]13% moisture.

Table 28. Yields and characteristics of public and private soybean varieties, southern zone, 1990 (Fairmont, Lamberton, Waseca)

Brand or Originator	Variety	Matures	Yield 1988-1989	Yield 1989-1990	Yield 1990	Phytophthora gene[2]	Chlorosis score[4]	Protein 1988-1990	Protein 1989-1990	Protein 1990	Oil 1988-1990	Oil 1989-1990	Oil 1990
		date	bu/A	bu/A	bu/A			%[5]	%[5]	%[5]	%[5]	%[5]	%[5]
Mustang	M-1140	9-16	—	—	60	S	2.0	—	—	36.9	—	—	16.5
Minn. A.E.S.	Kato	9-16	—	48	54	Rps1	1.0	—	37.4	37.7	—	16.5	15.9
PB	181	9-18	—	54	59	S	3.0	—	35.7	36.5	—	17.8	16.6
Terra	Flag +[1]	9-18	45	52	56	S	2.0	36.0	35.4	35.9	19.2	18.0	17.1
Ziller	BT 2877	9-18	—	51	54	Rps1-c	2.0	—	35.0	35.1	—	18.2	17.5
Pioneer	9161	9-19	50	54	62	S	2.0	35.8	35.0	35.3	19.4	18.2	17.4
Pioneer	9162	9-19	—	—	62	S	1.5	—	—	34.7	—	—	17.8
Ehrich	E-1686[1]	9-19	—	—	62	S	2.5	—	—	35.6	—	—	17.3
Pioneer	9171	9-19	—	—	60	S	2.0	—	—	33.8	—	—	16.1
Minn. A.E.S.	Kasota	9-19	—	—	56	Rps1-c	1.5	—	—	37.9	—	—	15.9
Dairyland	DSR-170	9-20	—	50	56	S	1.5	—	35.2	35.6	—	18.2	17.3
Thompson	T-3175	9-20	—	51	54	S	2.5	—	34.9	35.7	—	18.5	17.2
Minn. A.E.S.	Hodgson 78	9-20	42	50	53	Rps1	2.0	35.2	34.4	34.5	19.8	18.8	17.9
Yield King	K-1818	9-21	—	—	65	S	3.5	—	—	34.7	—	—	17.9
Stine	1065[1]	9-21	—	56	62	S	2.0	—	35.2	36.1	—	18.2	16.9
PS	1130	9-21	—	—	61	S	3.5	—	—	36.5	—	—	16.8
Minn. A.E.S.	Sibley	9-21	45	52	60	Rps1	2.0	35.7	34.8	35.0	19.5	19.4	17.6
Pioneer	9181	9-21	45	52	60	Rps1-c	2.5	36.2	35.1	34.9	19.1	18.2	17.8
Wilson Blend	1880[1]	9-21	47	54	60	M[3]	3.5	35.9	35.4	36.4	19.4	18.0	16.7
Terra	Exp 175 +[1]	9-21	—	—	60	S	2.0	—	—	36.2	—	—	16.9
C/LOL	L1991	9-21	—	—	60	S	1.0	—	—	35.9	—	—	17.0
Thompson	T-3187[1]	9-21	—	54	60	S	3.5	—	35.2	35.9	—	18.1	17.0
Golden Harvest	H-1150	9-21	—	—	59	S	2.0	—	—	35.6	—	—	17.3
Funks G-Brand	G-3185	9-21	—	—	58	S	1.5	—	—	35.3	—	—	17.3
Thompson	EX 757	9-22	—	—	66	S	2.0	—	—	36.3	—	—	16.9
Atlas S-Brand	S170	9-22	—	56	64	S	2.0	—	35.2	36.1	—	18.1	16.9
Latham	2008[1]	9-22	45	56	64	S	2.0	35.7	35.0	35.5	19.5	18.3	17.3
Asgrow	A1929	9-22	—	56	63	Rps1-k	2.0	—	34.3	34.9	—	18.8	17.6
Hy-Vigor	EX 2029[1]	9-22	—	—	63	Rps1	2.5	—	—	35.3	—	—	17.4
AgriPro	AP 1989	9-22	48	57	63	Rps1-c	2.0	33.9	33.0	33.0	20.7	19.8	18.8
LS	Russell	9-22	—	—	62	S	1.0	—	—	36.4	—	—	16.6
Sansgaard	S1924	9-22	—	54	62	S	2.5	—	35.4	36.1	—	18.0	17.0
Star	Exp 8819	9-22	47	56	62	S	3.0	36.5	35.8	36.3	18.9	17.8	16.8
Ziller	Exp 723	9-22	—	—	62	S	2.0	—	—	35.1	—	—	17.6
Kaltenberg	KB 180	9-22	—	—	62	S	1.0	—	—	35.8	—	—	17.0
Super Crost	SC192	9-22	—	—	62	S	2.0	—	—	36.8	—	—	16.5
Sigco	94	9-22	—	55	62	S	2.0	—	36.0	36.5	—	17.4	16.6
PS	1850	9-22	—	—	62	S	1.0	—	—	36.1	—	—	17.0
Atlas S-Brand	A190	9-22	—	—	61	S	2.5	—	—	34.4	—	—	17.9
Terra	Runner III +[1]	9-22	46	54	61	S	3.0	35.7	34.9	35.8	19.6	18.6	17.3
PS	2198	9-22	44	53	61	S	2.5	35.7	34.8	35.5	19.6	18.6	17.4
Mustang	M-1150	9-22	—	—	60	S	2.0	—	—	36.1	—	—	16.9
GCS	Bancroft	9-22	—	—	60	Rps1-c	3.0	—	—	36.2	—	—	16.9
PB	195	9-22	—	—	60	S	2.5	—	—	36.2	—	—	16.9
Hy-Vigor	Row-99	9-22	—	—	59	S	2.0	—	—	35.8	—	—	17.1
NK	S 17-18	9-22	—	51	56	Rps1	2.5	—	35.0	36.0	—	18.4	17.0
Kaltenberg	KB220	9-23	—	—	71	S	2.0	—	—	36.0	—	—	16.9
Thompson	T-3190	9-23	—	—	69	S	3.0	—	—	36.3	—	—	16.8
Kruger	K2121	9-23	—	—	68	S	1.5	—	—	36.3	—	—	16.7
Mustang	M-1200	9-23	—	—	67	S	2.0	—	—	36.0	—	—	17.2
Super Crost	D200	9-23	47	54	64	S	2.0	36.1	35.6	36.1	19.2	18.0	17.0
Funks G-Brand	G-3197	9-23	44	55	63	S	2.0	35.5	34.7	35.7	19.7	18.6	17.2
NK	S 19-90	9-23	—	55	62	Rps1-c	2.5	—	34.8	35.7	—	18.6	17.1
Ziller	BT 2585	9-23	—	54	61	S	2.0	—	35.5	36.1	—	18.0	16.9
AgriPro	AP 2040	9-23	—	—	60	Rps1	2.0	—	—	35.5	—	—	17.2
CPS	158	9-23	44	52	60	S	2.0	36.1	35.4	35.5	19.2	17.9	17.2
Latham	Ex 250	9-23	—	—	60	S	1.0	—	—	36.1	—	—	16.9
Jacques	J-245	9-23	—	54	59	S	1.5	—	35.6	36.6	—	17.8	16.6
Sexauer	SX 1095	9-23	—	—	59	Rps1-c	2.5	—	—	35.8	—	—	17.2
GCS	Prosper	9-23	—	54	59	Rps1	1.5	—	36.4	37.0	—	17.2	16.4
LS	Judson	9-23	—	—	59	S	3.0	—	—	35.0	—	—	17.6
Iowa A.E.S.	Weber 84	9-23	43	48	58	Rps1	2.0	35.5	34.6	35.2	19.7	18.6	17.4
Super Crost	EX02001	9-23	—	—	58	S	2.0	—	—	33.9	—	—	18.3
PB	225	9-24	—	—	70	S	2.0	—	—	36.4	—	—	16.8
Ehrich	E-298	9-24	—	—	68	S	2.0	—	—	36.4	—	—	16.9

Table 28 (Continued). Yields and characteristics of public and private soybean varieties, southern zone, 1990 (Fairmont, Lamberton, Waseca)

Brand or Originator	Variety	Matures	Yield 1988-1989	Yield 1989-1990	Yield 1990	Phytophthora	Chlorosis	Protein 1988-1990	Protein 1989-1990	Protein 1990	Oil 1988-1990	Oil 1989-1990	Oil 1990
		date	bu/A			gene[2]	score[4]	%			%		
MO	2220	9-24	—	—	66	S	2.0	—	—	35.3	—	—	17.4
GCS	Wilmont	9-24	—	—	66	Rps1	3.5	—	—	35.6	—	—	17.4
SOI	285	9-24	50	58	66	S	2.0	36.4	35.2	35.5	19.1	18.2	17.4
Yield King	K-2030	9-24	—	—	65	Rps1	2.0	—	—	35.4	—	—	17.3
Dairyland	DSR-206	9-24	—	56	63	S	2.0	—	35.5	35.8	—	18.0	17.2
Cargill	207	9-24	—	—	63	Rps1-c	2.0	—	—	35.6	—	—	17.4
Atlas S-Brand	S40C	9-24	52	58	62	S	1.0	35.5	35.2	35.3	19.6	18.2	17.5
Atlas S-Brand	B225[1]	9-24	—	58	62	S	2.5	—	34.8	35.6	—	18.5	17.2
Kruger	K2424	9-24	—	61	62	S	2.5	—	37.2	37.8	—	16.6	15.9
NK	S 20-26	9-24	—	55	61	Rps1-c	2.5	—	35.6	36.1	—	17.8	16.8
Thompson	T-11	9-24	45	54	60	S	2.5	35.6	35.1	36.3	19.7	18.4	16.9
Iowa A.E.S.	Hardin	9-24	46	53	60	Rps1	2.5	36.2	35.2	36.1	19.2	18.2	16.9
Sexauer	SX1085	9-24	—	—	60	Rps1	2.5	—	—	35.0	—	—	17.5
Illinois A.E.S.	Corsoy 79	9-24	47	52	60	Rps1-c	3.0	36.1	35.3	36.2	19.2	18.2	16.9
Asgrow	A2234	9-24	48	55	59	Rps1-k	1.5	36.4	35.6	35.3	19.1	18.0	17.5
Kaltenberg	KB125	9-24	—	—	58	Rps1	2.0	—	—	35.4	—	—	17.3
SOI	Exp 9024	9-25	—	—	69	S	2.5	—	—	36.2	—	—	17.0
Dahlgren	D3223	9-25	—	—	68	S	2.0	—	—	36.2	—	—	16.9
Atlas S-Brand	A211	9-25	—	—	67	S	2.0	—	—	36.1	—	—	17.0
SOI	296	9-25	—	60	67	S	2.0	—	35.4	35.6	—	18.0	17.2
Yield King	D-212A[1]	9-25	—	—	66	S	2.0	—	—	35.4	—	—	17.4
Sansgaard	S2062	9-25	—	58	66	S	1.5	—	35.9	36.1	—	17.6	17.0
Super Crost	Ex02302	9-25	—	—	66	S	3.5	—	—	36.5	—	—	16.6
Star	Exp 8923	9-25	—	58	66	S	2.0	—	34.0	34.6	—	19.0	17.9
CFS	E90-137	9-25	—	—	65	S	1.5	—	—	36.5	—	—	16.7
Kruger	D-202[1]	9-25	—	—	64	S	2.0	—	—	35.7	—	—	17.3
DeKalb	CX210	9-25	—	—	64	S	2.5	—	—	34.6	—	—	17.9
Sexauer	SX 1090	9-25	47	55	64	Rps1	1.5	38.5	37.3	37.8	17.9	16.6	16.0
Iowa A.E.S.	BSR101	9-25	47	57	63	Rps1	2.0	35.1	34.3	34.4	19.9	18.9	18.0
Jacques	J-181[1]	9-25	48	57	63	S	2.0	35.7	34.2	34.8	20.0	19.0	17.7
LS	Action	9-25	—	54	63	Rps1	4.0	—	35.0	35.5	—	18.3	17.2
Dairyland	DSR-196	9-25	—	56	62	S	2.0	—	36.0	36.7	—	17.6	16.6
Lakeside	Lakeside 109[1]	9-25	—	—	62	Rps1	2.5	—	—	36.2	—	—	16.8
MO	1095[1]	9-25	—	56	62	S	2.0	—	35.6	36.3	—	18.0	16.9
NK	X 90-20	9-25	—	—	61	Rps1-c	2.0	—	—	35.7	—	—	17.0
Golden Harvest	X229	9-25	—	—	61	S	2.0	—	—	36.2	—	—	16.8
SOI	198	9-25	—	54	61	S	2.5	—	33.6	34.2	—	19.4	18.1
Dairyland	DSR-208	9-25	—	—	60	S	1.5	—	—	36.7	—	—	16.7
Stine	2840	9-25	—	—	60	S	2.0	—	—	36.3	—	—	16.9
C/LOL	L2121	9-25	—	—	60	S	3.0	—	—	34.4	—	—	17.9
Latham	550CN	9-25	—	—	55	S	2.0	—	—	36.8	—	—	16.5
Dahlgren	KG81	9-25	—	—	53	Rps1-c	2.5	—	—	35.1	—	—	17.6
Yield King	K-2525	9-26	—	—	69	S	4.0	—	—	35.6	—	—	17.3
Asgrow	A2396	9-26	—	—	66	Rps1	1.5	—	—	34.9	—	—	17.6
Latham	440	9-26	—	—	63	S	3.0	—	—	34.5	—	—	17.9
Willette Seed	Prescott 110[1]	9-26	—	—	63	Rps1	1.0	—	—	35.3	—	—	17.5
Sansgaard	Exp 2047	9-26	—	—	63	S	2.5	—	—	35.3	—	—	17.4
Star	Exp 9020	9-26	—	—	63	S	2.0	—	—	36.3	—	—	16.9
DeKalb	CX 264	9-26	48	56	63	S	2.0	36.8	35.4	35.7	18.7	18.0	17.3
Latham	401[1]	9-26	48	55	62	S	2.0	36.1	35.2	35.5	19.1	18.0	17.2
AgriPro	AP 2324	9-26	—	—	62	Rps1	2.0	—	—	35.4	—	—	17.5
Thompson	T-30P[1]	9-26	49	56	62	S	2.0	36.6	35.8	37.0	18.9	17.8	16.5
GCS	Hartland	9-26	—	53	61	Rps1-c	3.5	—	37.0	36.6	—	16.7	16.7
DeKalb	CX 259	9-26	—	57	60	S	2.5	—	34.9	35.7	—	18.6	17.3
Jacques	J-231	9-26	48	53	60	Rps1	2.5	36.2	35.2	35.4	19.1	18.2	17.4
CFS	213	9-26	47	53	59	S	3.0	37.0	35.6	36.2	19.0	17.9	17.0
DeKalb	CX 174	9-26	46	53	58	S	1.0	36.3	35.4	35.6	19.1	18.0	17.2
Hy-Vigor	C19HV	9-26	—	—	55	Rps1-c	2.5	—	—	36.3	—	—	16.6
Illinois A.E.S.	Bell	9-26	—	—	54		2.0	—	—	37.3	—	—	16.2
Thompson	T-3250	9-27	—	—	65	S	2.5	—	—	36.0	—	—	17.1
Sansgaard	Exp 2025	9-27	—	—	63	S	3.5	—	—	36.9	—	—	16.5
PS	1152	9-27	49	57	62	S	2.0	36.7	35.6	36.3	18.9	18.0	16.9
Stine	2935CN[1]	9-27	—	—	61	S	2.0	—	—	36.8	—	—	16.6
Latham	650	9-27	46	54	60	S	1.5	36.4	35.5	35.8	19.0	17.8	17.1

Table 28 (Continued). Yields and characteristics of public and private soybean varieties, southern zone, 1990 (Fairmont, Lamberton, Waseca)

Brand or Originator	Variety	Matures	Yield 1988-1989	Yield 1989-1990	Yield 1990	Phytophthora	Chlorosis	Protein 1988-1990	Protein 1989-1990	Protein 1990	Oil 1988-1990	Oil 1989-1990	Oil 1990
		date	bu/A	bu/A	bu/A	gene[2]	score[4]	%[5]	%[5]	%[5]	%[5]	%[5]	%[5]
Minn. A.E.S.	Sturdy	9-27	—	53	60	Rps1	2.0	—	35.2	35.4	—	18.2	17.4
Stine	2915[1]	9-28	—	58	65	S	2.0	—	34.6	35.3	—	18.8	17.6
PB	223	9-28	—	—	65	S	2.0	—	—	35.7	—	—	17.2
Kruger	D-249[1]	9-28	—	—	63	S	2.0	—	—	35.4	—	—	17.4
Mustang	M-1210	9-28	—	—	63	Rps1	2.0	—	—	35.7	—	—	17.3
Asgrow	A2543	9-28	—	55	61	Rps1-k	1.5	—	37.5	37.2	—	16.3	16.3
MO	2030	9-28	—	—	60	S	2.0	—	—	33.1	—	—	19.0
Thompson	T-3215CN	9-28	—	—	53	S	2.5	—	—	37.0	—	—	16.5
Hy-Vigor	3228-A	9-30	—	—	64	S	3.5	—	—	36.0	—	—	16.8
LSD 20%			2	3	3								

[1]Blend (information supplied by originator); [2]Specific genes noted, S = susceptible; [3]Mixture of Rps1 and susceptible; [4]1 = excellent, 5 = poor, see text for additional explanation; [5]13% moisture; [7]1988 planting omission, 1987 and 1989 data only.

SUNFLOWER

Sunflower originated in North America. It was probably first introduced to Europe through Spain, and spread through Europe as a curiosity until it reached Russia where it was readily adapted. Selection for high oil in Russia began in 1860.

High oil lines from Russia, reintroduced into the U.S. after World War II, rekindled interest in the crop. Production rose dramatically in the Great Plains states to meet markets for sunflower oil, birdseed and human snack foods. Production in the 1980s has declined because of low prices, and disease, insect and bird problems. Sunflower acreage is moving westward into dryer regions, but 85 percent of the North American sunflower seed is still produced in North and South Dakota and Minnesota.

Minnesota Agriculture Experiment Station scientists are not currently conducting performance trials of sunflower. If you want information from a recent report of tests of this crop, contact Extension Agronomy, 411 Borlaug Hall, 1991 Buford Circle, University of Minnesota, St. Paul, MN 55108.

Additional production information is provided in the sunflower chapter in *Alternative Field Crops Manual.* Contact your county extension agent or The Center for Alternative Plant & Animal Products, 340 Alderman Hall, University of Minnesota, St. Paul, MN 55108, for details about this publication.

PULSE CROPS

ADZUKI

Adzuki is the sixth largest crop in Japan. The bean is prized for its red color, delicate flavor and the characteristic grainy texture of pastes made from it. It has been produced in Minnesota in recent years under contract for export to Japan and for use in special ethnic or health food products in the U.S.

Minnesota Agriculture Experiment Station scientists are not currently conducting performance trials of adzuki. If you want information from a recent report of tests of this crop, contact Extension Agronomy, 411 Borlaug Hall, 1991 Buford Circle, University of Minnesota, St. Paul, MN 55108.

Additional production information is provided in the adzuki chapter in *Alternative Field Crops Manual.* Contact your county extension agent or The Center for Alternative Plant & Animal Products, 340 Alderman Hall, University of Minnesota, St. Paul, MN 55108, for details about this publication.

FIELDBEAN

In tons of crop produced per year, the fieldbean is the world's third most important legume. Acreage in the U.S. is concentrated in Michigan, North Dakota, Minnesota, Idaho, Colorado, and Nebraska. Grower interest is largely determined by both prices and proximity of buying stations or processers.

Minnesota Agriculture Experiment Station scientists are not currently conducting performance trials of fieldbean. If you want information from a recent report of tests of this crop, contact Extension Agronomy, 411 Borlaug Hall, 1991 Buford Circle, University of Minnesota, St. Paul, MN 55108.

Additional production information is provided in the fieldbean chapter in *Alternative Field Crops Manual.* Contact your county extension agent or The Center for Alternative Plant & Animal Products, 340 Alderman Hall, University of Minnesota, St. Paul, MN 55108, for details about this publication.

FIELDPEA

Fieldpea is usually combine harvested as mature, dry seed. The seed is sold for use in soup and pigeon feed, or fed on the farm to sheep, hogs or cattle. As a forage or feed grain crop, fieldpea is usually sown in mixture with oat.

Varieties with cream-colored seed are most commonly grown. Buyers in Minnesota have not encouraged production of green varieties because of bleaching that occurs at harvest time.

Miranda and Trapper produce seed of satisfactory cooking quality. Other varieties have not been tested for culinary quality, but may be used as a protein concentrate feed for livestock. Trapper and Procon are also useful as forage crops and may be grown alone or in mixture with small grains for silage, or fed as grain.

Stand establishment is sometimes a problem due to general susceptibility of plants to seedling diseases, and to variability in seed quality. Seed quality may be responsible for differences in stand which affect seed yield.

Varieties

Bellevue—Medium maturity. Medium vine length. Medium size, cream-colored seed with smooth seed coat. Susceptible to Ascochyta and Septoria leaf blotch. Developed by Agriculture Canada. Distributed by SeCan Association, Canada.

Helka—Early maturity. Medium vine length. Semi-leafless, bush-type growth habit. Green-seeded variety. Resistant to Ascochyta, Fusarium and BYMV. Developed by Hankkija, Finland. Distributed by NorFarm Seeds, Roseau, MN.

Impala—Medium to early maturity. Cream-colored seed. Leafless. Resistant to Ascochyta Race C. Developed by Cebeco-Handelsraade (Netherlands). Distributed by International Seeds, Halsey, OR.

Kimo—Early-mid maturity. Short vine length. Green medium-large seed. Semi-leafless. Developed by Hankkija, Finland. Distributed by NorFarm Seeds, Roseau, MN.

Maxi—Medium maturity. Short vine length. Large bluish-green seed. Released by Cebeco-Handelsraade (Netherlands). Distributed by International Seeds, Halsey, OR. Seed sale regulated by U.S. Variety Protection Act.

Miranda—Very early. Very short. Very large cream colored seed. Released by Cebeco-Handelsraade (Netherlands). Distributed by International Seeds, Halsey, OR. Seed sale regulated by U.S. Variety Protection Act.

Procon—Very early. Short vined but not dwarf. Large cream colored seed for protein concentrate in livestock rations. Released by Minnesota Agricultural Experiment Station in 1986.

Renata—Medium maturity. Large cream colored seed. Semi-leafless. Highly resistant to Fusarium wilt. Resistant to Ascochyta Race C and Downey Mildew. Released by Cebeco-Handelsraade (Netherlands). Distributed by International Seeds, Halsey, OR.

Solara—Medium maturity. Short. Very large bluish seed. Semi-leafless. Resistant to Fusarium wilt and Ascochyta Race C.

Developed by Cebeco-Handelsraade (Netherlands). Distributed by International Seeds, Halsey, OR.

Tipu—Medium maturity. Long vined. Medium size cream colored seed. Semi-leafless plant type with normal stipules and leaflets reduced to tendrils. Released by Agriculture Canada, Morden. Licensed 1985. Production of certified seed limited to Canada.

Titan—Medium maturity. Large yellow seed. Long vined. Distributed by SeCan Association, Canada.

Trapper—Late maturity. Long vined. Small cream colored seed. Suitable for birdfeed markets that require small, "yellow" seed. Released by Agriculture Canada, Morden. Licensed 1970.

Table 29. Seed yield and characteristics of fieldpea varieties.

	Seed Yield				Stand						
	1990				1990						
Variety	Grand Rapids	Roseau	1989 Roseau	Overall average	Grand Rapids	Roseau	Planting to Bloom[1]	Planting to Maturity[1]	Plant Height[2]	Seed Weight[1]	Seed Protein[3]
	lbs/A				%		days		in.	no./lb.	%[4]
Bellevue	3119	2116	1771	2335	85	45	61	107	27	2627	25
Helka	2378	1804	2223	2135	89	50	57	90	21	2114	22
Impala	—	—	1744	—	—	—	—	—	—	—	—
Kimo	2017	3097	2409	2508	89	65	57	91	21	1915	22
Maxi	2335	1398	—	—	83	53	63	95	18	1436	—
Miranda	1830	2012	1060	1634	73	58	57	91	17	1297	24
Procon	1736	2309	1585	1877	63	65	58	89	20	1602	24
Renata	—	—	1204	—	—	—	—	—	—	—	—
Solara	2495	2663	1472	2210	88	48	57	90	20	1481	23
Tipu	1744	2188	1529	1820	74	38	60	91	33	1923	23
Titan	2611	2546	1037	2065	75	50	60	101	32	1704	23
Trapper	2326	2074	1106	1835	84	60	60	101	30	3472	26
LSD 5%	379	733	430	537							

[1]Roseau 1989-90, Grand Rapids 1990; [2]Grand Rapids and Roseau 1990; [3]Grand Rapids 1990, Roseau 1989; [4]10% moisture basis.

LENTIL

Lentil, a cool season annual grain legume has received little research attention to improve yield or quality. It grows well in limited rainfall areas. Lentil protein content ranges from 22 to 35 percent. It supplements cereal grain diets, or can be used as a green manure crop.

Minnesota Agriculture Experiment Station scientists are not currently conducting performance trials of lentil. If you want information from a recent report of tests of this crop, contact Extension Agronomy, 411 Borlaug Hall, 1991 Buford Circle, University of Minnesota, St. Paul, MN 55108.

Additional production information is provided in the lentil chapter in *Alternative Field Crops Manual*. Contact your county extension agent or The Center for Alternative Plant & Animal Products, 340 Alderman Hall, University of Minnesota, St. Paul, MN 55108, for details about this publication.

LUPIN

Lupin is a cool season grain legume suited to well drained, coarsely textured, neutral to acidic soils. They are tolerant of early season frosts. Flowers are susceptible to high temperatures, which cause blasting and reduce seed yields. For these reasons, lupin is well adapted in the central and northern portions of Minnesota on sandy, acidic soils. Crop failures or low yields have occurred at Waseca, Lamberton, Crookston and St. Paul on heavier, alkaline soils.

The crop should be planted from early to mid-April and should be ready to harvest in August to September. Lupin is easily direct combined because of their upright habit. Yields up to 4,400 lbs/acre have been produced in Minnesota.

Lupin utilization includes direct feeding to poultry and other livestock, as well as markets for human food products. Swine may

Table 30. Characteristics of lupin varieties

Variety	Planting to 90% bloom[1]	Planting to maturity[1]	Lodging[2]	Plant height[1]	Seed weight[1]	Seed protein[4]
	days		score[3]	inches	no./lb.	%[5]
Blanca 101	58	119	2.1	33	1553	33
Gela x 243	59	119	2.2	32	1495	32
Horizont	58	120	2.0	33	1457	34
Kiev[6]	59	113	3.2	28	1768	33
L 2019 N[7]	64	122	2.5	31	1501	32
L 2085 N	59	117	2.1	30	1864	33
Primorski	58	116	2.9	29	1731	34
Strain 21	60	120	2.1	31	1477	34
Ultra	60	117	2.1	30	1564	32
46-10	59	119	2.1	33	1452	34
47-5	58	123	1.5	34	1415	34

[1] Becker, Rosemount and Staples 1989-1990; [2]Becker, Rosemount and Staples 1989-1990, Grand Rapids 1989; [3]1 = no lodging, 10 = severe lodging; [4]Becker, Grand Rapids, Rosemount and Staples 1989-1990; [5]10% moisture basis; [6]Becker and Staples 1989-1990, Grand Rapids and Rosemount 1990; [7]Staples 1989-1990, Becker, Grand Rapids and Rosemount 1989.

Table 31. Seed yield of lupin varieties

Variety	Becker		Grand Rapids		Rosemount		Staples		Overall average[1]
	1990	1987-1990	1990	1988-1990	1990	1987-1990	1990	1988-1990	
	lbs/A								
Blanca 101	2708	1737	3739	2274	3807	1855	2400	2300	1984
Gela x 243	2240	1692	3667	2148	3536	1889	2371	2064	1926
Horizont	2878	1837	3580	1982	3786	1861	2860	2154	1943
Kiev	—	1127	—	822	—	1123	2492	2141	—
L 2019 N	2470	—	3725	—	3334	—	2357	—	—
L 2085 N	2555	—	3840	—	3504	—	2553	—	—
Primorski	2669	1632	3768	2062	3488	1861	2348	1929	1853
Strain 21	2492	1676	3566	2115	3497	1797	2694	2258	1929
Ultra	2543	1644	3725	2015	3854	1669	3178	2238	1858
46-10	2671	1666	3629	2063	3875	1809	2753	2162	1898
47-5	2519	1796	3269	1794	3478	1762	2964	2199	1872
LSD 5%	401	430	512	515	605	398	520	527	463

[1]Becker and Rosemount 1987-90, Grand Rapids and Staples 1989-90

be sensitive to low levels of alkaloid in Lupin; seed should be tested before being used as feed. In Minnesota lupin is processed into flour, pasta and hulls for dietary fiber. Lupin should not be produced until potential markets or uses are first identified.

Production information is provided in the Lupin chapter in *Alternative Field Crops Manual.* Contact your county extension agent or the Center for Alternative Plant and Animal Products, 340 Alderman Hall, University of Minnesota, St. Paul, MN 55108 for details about this publication.

Potential Seed Sources

Wolf River Valley Seeds, N2976 County M, White Lake, WI 54491 (47-5, 46-10, Primorski, Ultra);

Lupin-Triticale Enterprises, P.O. Box 187, Perham, MN 56573 (Ultra, Primorski, Strain 21);

Resource Seeds, Inc. P.O. Box 1319, Gilroy, CA 95021 (L2019N, L2085N).

PLANTING RATE AND DATE FOR VARIETIES EVALUATED

Rates are based on normal seedbeds and on normal size, good quality seed Rates used will vary greatly depending on seed cost, desired stand, expected mortality, emerging ability, seed weight, seed germination, seedbed condition, depth of planting, and planting equipment

Crop	Bushel weight (pounds)[1]	Seeds/pound (number)	Rate/acre (pounds)	Rate (seeds)	Date
Barley	48	14,300	85	28/sqare foot	Early spring
Forage Grasses (perennial)	If mixed with legume, sow at time indicated for the legume				
Orchardgrass in mixtures	14	653,000	2	30/square foot	Early spring or summer
Reed canarygrass alone	46	526,000	7	85/square foot	Early spring or summer
in mixtures			5	60/square foot	
Timothy in mixtures	45	1234,000	3	85/square foot	Early spring or summer
Forage Legumes (perennial)					
Alfalfa alone	60	199,000	11	50/square foot	Early spring to August 10
with grass			7	32/square foot	
Birdsfoot trefoil alone	60	372,000	7	60/square foot	Early spring or summer
with grass			4	34/square foot	
Oat	32	16,200	80	28/square foot	Early spring
Soybean 10-inch rows	60	2,800	56	3/foot of row	May 5 to May 25
20-inch rows			56	6/foot of row	
30-inch rows			56	9/foot of row	
40-inch rows			56	12/foot of row	
Wheat Durum	60	12,100	90	25/square foot	Early spring
Hard red spring		15,200	80	28/square foot	Early spring
Winter		14,500	75	25/square foot	August 20 to September 20
Other Crops					
Canola B napus	50	140,000	8	25/square foot	May
Canola B campestris	50	210,000	5	25/square foot	May
Fieldpea	60	2,300	180	9/square foot	Early spring
With 1½ to 2 bushels of oat			70	4/square foot	
Lupine6- to 8-inch rows	60	1,500	170	6/square foot	Early spring
30-inch rows			70	6/foot of row	
Rape Forage	50	145,000	6	20/square foot	Early spring with oat
Rape Oilseed	50	136,000	8	25/square foot	May
Wild rice (wet)	25	7,900	33	6/square foot	Late fall

[1]US legal if established. If not established, weight given is that most widely accepted in the United States.