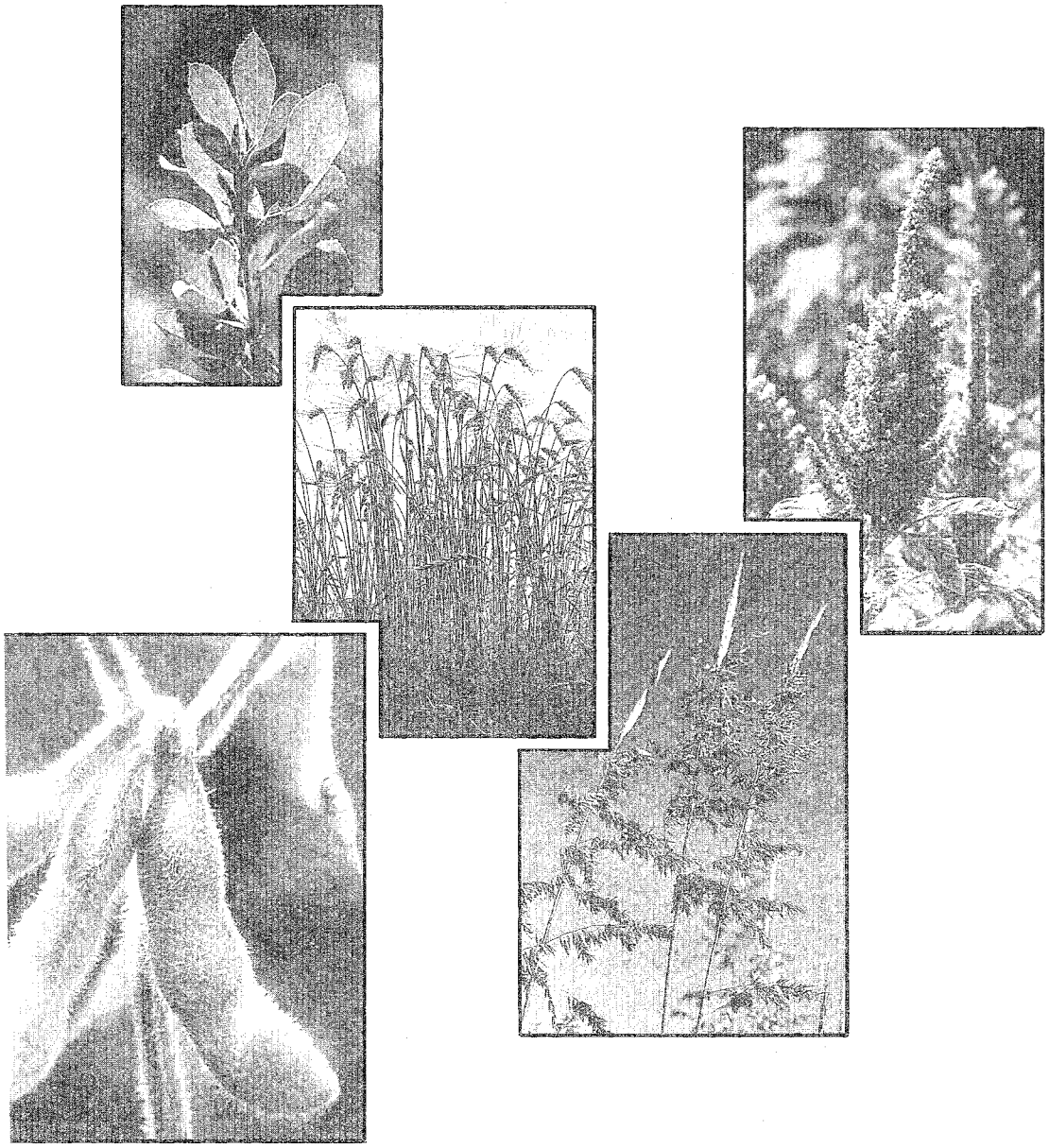
1992 Edition

VARIETAL TRIALS

OF SELECTED FARM CROPS



Forage Crops

Grain Crops

Oilseed Crops

Pulse Crops

Planting Rate & Date

Minnesota Agricultural Experiment Station — University of Minnesota

Minnesota Report 223–1992 (AD–MR–5615–E)

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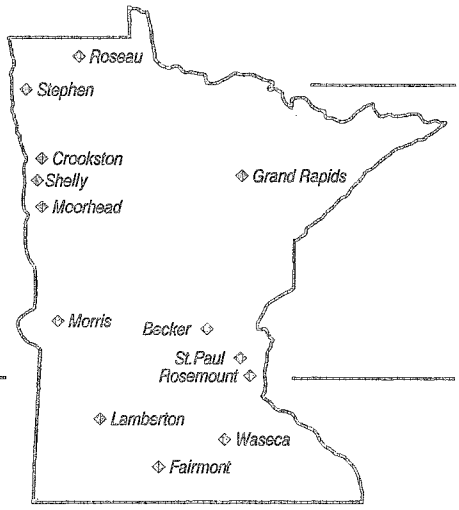
VARIETAL TRIALS

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.

Experiment Station scientists are not currently conducting trials for many crops included in previous editions of this publication. Those who want the most recent reports of tests or additional production information for such crops should contact the source noted 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 arranged in alphabetical order within groups.

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 that have not been 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.

Listings in an "other varieties" 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 MAES does not make 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 1992 Planting*. This annual 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 is used to determine whether the difference between two yields is due to 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 concluded that the higher yielding variety was superior. If the difference is less, the variation was probably due to environmental rather than varietal differences. The notation "NS" in a column indicates no significant difference exists for that characteristic.

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

The relative maturities of varieties are variously indicated in the tables as date of maturity, heading, or blooming; days to maturity, heading, or blooming; or moisture percentage at harvest.

Authors and Researchers

Authors of the crop sections are: D.H. Putnam, L.A. Field (amaranth, canola, crambe and 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 obtained by these members 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).

Field work for the 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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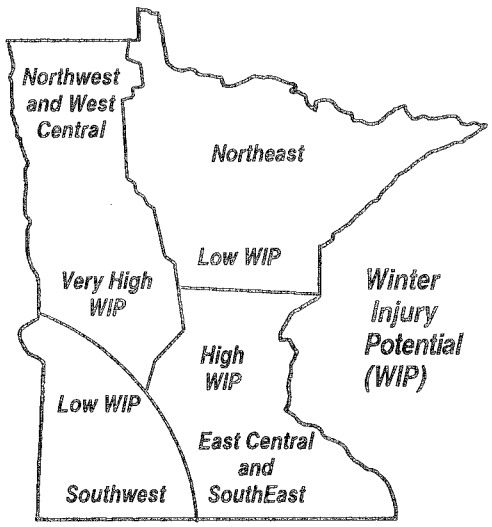
FORAGE CROPS

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. This test winter confirmed previous observations about areas of the state most prone to winter injury (Map 2), 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 regions of Minnesota (see map below). Because of frequent severe winters in these areas, only winter-hardy or very winter-hardy varieties should be selected. East central and southeast areas also experience frequent severe winters. Winter-hardy varieties with high levels of disease resistances should be selected for these areas.

Minnesota's southwest area seldom experiences severe winter injury because of dry soils, high soil potassium levels and neutral soil pH. The northeast area also 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 in Minnesota 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 recover slowly after cutting. They are not usually high yielding, recover slowly for the second crop and produce only a small third crop because of early cessation of growth. Nevertheless, these are very dependable varieties in areas where frequent winter injury is expected and where soil moisture limits third crop yields. These types of varieties survived the 1989-90 winter with little injury.

Fall dormant varieties are adaptable 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 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. The reduced yields in years three and four are usually associated with winter injury. 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 fall freeze-up. They produce yields similar to the moderately dormant varieties during the summer, but produce more forage growth during the fall growth period. They will not survive most winters. These non-dormant varieties should only be grown for plow down in the seeding year.

The Minnesota Agricultural Experiment Station and USDA released the non-dormant nonwinter-hardy variety Nitro in 1986. It 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, and Yolo.

Disease Resistance and Stand Persistence

Alfalfa root and crown diseases occur in most Minnesota soils. The most important diseases are: bacterial wilt, Phytophthora root rot, Fusarium wilt, anthracnose and Verticillium wilt. Plant resistance is available for all five diseases. Variety resistance ratings for each disease are presented in table 1. Moderate resistance (MR) to a disease will provide protection to a variety under most conditions. 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 east central and southeast Minnesota (Map 2).

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

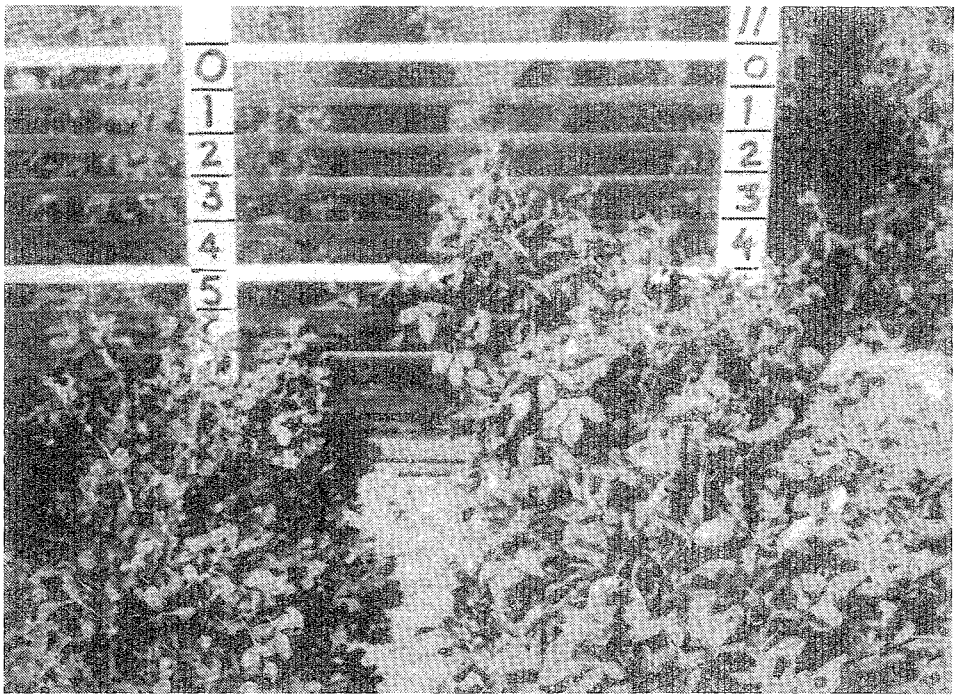
are often observed by the end of the first year after seeding. Stand reductions after winter are often due to a combination of wilt damage and winter injury.

Phytophthora Root Rot—This fungal disease is a major concern on poorly drained soils, especially in east central and southeast areas 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 areas. It infects stems and crowns and kills susceptible plants. The disease is favored by hot, moist conditions, and will be most frequently observed in southeast Minnesota.

Verticillium Wilt—This relativley new, potentially destructive fungus disease 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 will help ensure a long lived stands. Varieties having at least a low level of resistance are indicated in table 2.



Dormant (left) and non-dormant (right) alfalfa in the fall. Dormant alfalfa varieties have reduced herbage production compared to nondormant varieties, because dormant varieties store carbohydrates in their roots to promote winter survivability.

Table 1. Fall growth score, winter hardiness 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.[j]	7.5	60	HR	S	MR	S	—
Teton	S. Dakota Agr. Exp. Sta.[Pz]	7.4	—	LR	LR	MR	S	—
Travois	S. Dakota Agr. Exp. Sta.[P]	7.4	—	R	S	MR	S	—
FALL DORMANT								
Wrangler	USDA & Nebraska Agr. Exp. Sta.[Pfgkmoqz]	7.0	71	R	R	R	LR	LR
Vernal	Wisconsin Agr. Exp. Sta. & USDA[IPfgkmoqz]	6.5	67	R	S	R	S	S
Baker	USDA & Nebraska Agr. Exp. Sta.[P]	6.5	53	R	S	R	LR	—
636	ICI Seeds[W]	6.3	25	HR	HR	R	MR	R
Clipper	Interstate Seed Co.[Y]	6.3	38	HR	R	HR	R	R
Envy	Gold Country Seed[Tk]	6.3	49	HR	R	HR	HR	R
Profit	Peterson-Biddick Co.[Jm]	6.2	50	HR	R	HR	MR	R
Agate	USDA & Minnesota Agr. Exp. Sta.[Pfgkmoz]	6.0	29	HR	R	HR	MR	—
Iroquois	Cornell University[gkmoqz]	6.0	—	HR	S	MR	S	S
Blazer	Cenex/Land O'Lakes	5.9	—	HR	MR	MR	LR	LR
Nordic	ICI Seeds[W]	5.9*	45	HR	HR	R	R	R
Renegade	Gertson Seed Farms[S]	5.9	31	R	MR	R	S	LR
629	ICI Seeds[W]	5.8	20	HR	HR	R	MR	MR
Alfagraze	University of Georgia[ADey]	5.7	11	MR	LR	R	MR	—
5262	Pioneer Hi-Bred International, Inc.[n]	5.7	60	HR	R	MR	—	LR
Thunder	ABI[ADey]	5.7	57	R	R	HR	MR	—
WL 225	W-L Research, Inc.[Y]	5.7	9	HR	R	HR	MR	R
Trident II	Cargill, Inc.[H]	5.6*	37	HR	R	HR	R	R
Break-thru	Custom Farm Seed[L]	5.5	34	HR	MR	HR	MR	R

Table 1 (continued). Fall growth score, winter hardiness 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]				
DK 122	DeKalb Plant Genetics[O]	5.5	—	HR	HR	R	HR	R
120	DeKalb-Plant Genetics[O]	5.5	43	HR	R	MR	LR	—
A-54	Ramy Seed Co.[q]	5.4	—	MR	LR	MR	—	—
Alpine	Bio Plant Research[F]	5.4*	16	HR	R	R	R	R
Ranger	USDA & Nebraska Agr. Exp. Sta.[Pgm]	5.4	57	MR	S	MR	S	S
Aggressor	AgriPro[Aefy]	5.3*	—	HR	HR	HR	HR	R
Blazer XL	Cenex/Land O'Lakes[I]	5.3*	42	R	HR	HR	HR	R
Dart	AgriPro[B]	5.3	25	HR	HR	R	R	R
Milkmaker	Kaltenberg Seed Farms[c]	5.3	21	R	R	HR	MR	—
Thrive	Great Lakes Hybrids[U]	5.3*	48	HR	HR	HR	HR	R
Arrow	NAPB[ADefgy]	5.2	37	HR	HR	HR	MR	R
Majestic	Allied Seed Coop.[C]	5.2*	38	R	MR	HR	HR	HR
MultiKing 1	Northrup King Co.[J]	5.2*	62	HR	R	HR	R	R
Sparta	Cenex/Land O'Lakes[I]	5.2	31	R	MR	MR	S	R
Webfoot	Great Lakes Hybrids[U]	5.2	48	R	R	MR	S	—
Zenith	Super Crost Seeds[sv]	5.2*	48	HR	HR	R	HR	R
GH715	J.C. Robinson Seed Co.[Z]	5.1	44	HR	MR	R	MR	LR
Impact	Peterson Seed Co., Inc.[kop]	5.1	27	HR	HR	R	MR	R
Oneida	Cornell University [fmsz]	5.1	56	HR	HR	HR	S	—
Royalty	Cargill Seed Division[H]	5.1	—	HR	R	R	HR	R
MODERATELY FALL DORMANT								
AF 21	Asgrow Seed Co.[E]	5.0	24	HR	R	R	HR	R
Ultra	SeedTec Int'l[B]	5.0	16	HR	R	HR	HR	R
Cutter	Interstate Seed[Y]	4.9*	31	HR	HR	HR	R	R
Salute	Keltgen Seed Co.[d]	4.9	39	HR	R	R	MR	MR
Top Ton	ICI Seeds[W]	4.9	17	HR	R	HR	HR	R
WL322HQ	W-L Research, Inc.[Y]	4.9*	—	HR	R	HR	MR	R
Agri-MATE	Cropmate Co.[K]	4.8	20	HR	R	HR	R	R
Husky	Premium Seed[o]	4.8	35	R	MR	R	MR	S
Kingstar	Dahlgren & Co. Inc.[M]	4.8	19	R	R	HR	MR	R
Oneida VR	Cornell University [fqz]	4.8	24	R	MR	HR	MR	HR
VIP	SIGCO Research[t]	4.8	15	HR	R	HR	R	R
WL 317	W-L Research Inc.[Y]	4.8	23	HR	R	HR	R	R
Agri-Boss	CropMate Co.[K]	4.7	39	HR	HR	HR	HR	MR
Apollo Supreme	ABI[ADefgy]	4.7	39	HR	R	HR	HR	R
Elevation	Jacques Seed Co.[a]	4.7	33	HR	R	R	R	MR
G7730	CIBA-GIEGY Seed Div.[m]	4.7	—	HR	HR	HR	LR	—
Magnum	Dairyland Seed Co., Inc.[N]	4.7	36	HR	S	R	MR	—
Perry	USDA & Nebraska Agr. Exp. Sta.[gz]	4.7	—	R	LR	R	LR	—
2833	CIBA-GEIGY Seed Div.[J]	4.6	48	HR	HR	R	HR	R
5432	Pioneer Hi-Bred International Inc.[n]	4.6	29	HR	MR	HR	—	R
Commandor	Northrup King Co.[J]	4.6	52	HR	R	R	HR	MR
Edge	Interstate Seed Co.[Y]	4.6	18	HR	R	R	HR	R
Flint	Premium Seed Co., Inc.[Mo]	4.6	38	R	HR	R	HR	LR
Endure	PAG Seeds[H]	4.6	31	R	MR	R	MR	R
Fortress	Northrup King Co.[J]	4.6	13	R	R	R	R	R
Jade	NC+ Hybrids[hi]	4.6*	39	HR	HR	HR	R	R
Quest	Renk Seed[r]	4.6	13	HR	HR	HR	R	R
G2841	CIBA-GIEGY Seed Div.[J]	4.5	20	HR	R	HR	R	R
Apollo II	ABI[ADey]	4.5	23	R	HR	R	MR	MR
Chief	Jacques Seed Co.[a]	4.5	17	HR	HR	R	R	R
DK 125	DeKalb Plant Genetics[O]	4.5	13	HR	R	R	HR	R
DK 135	DeKalb Plant Genetics[O]	4.5	28	MR	MR	R	MR	MR
GH737	J.C. Robinson Seed Co.[Z]	4.5	27	HR	MR	HR	MR	R
Legend	Cenex/Land O'Lakes[I]	4.5	24	HR	R	HR	HR	R
Multi-plier	Jacques Seed Co.[a]	4.5	54	HR	R	HR	HR	R
Precedent	Wyffels Hybrids [Δ]	4.5*	11	HR	HR	R	R	R
Saranac	Cornell University [Po]	4.5	20	R	S	R	S	S
Stein 9227	Stein Seed Farm Inc.[u]	4.5*	41	HR	HR	HR	HR	R
Target II	Bio Plant Research [FΦ]	4.5	—	HR	R	R	R	R
Trident	PAG Seeds[H]	4.5	—	R	HR	HR	MR	—

Table 1 (continued). Fall growth score, winter hardiness 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]				
RamRod	Bio Plant Research[F]	4.5*	55	HR	R	R	MR	R
Voyager	Bio Plant Research[Φ]	4.5	31	HR	R	R	MR	MR
630	ICI Seeds[W]	4.5	28	HR	R	R	MR	MR
5333	Pioneer Hi-Bred International Inc.[n]	4.5	—	HR	R	HR	HR	MR
Bronco	Jung Farms' Inc.[b]	4.4	14	HR	HR	HR	HR	R
Allegiance	Keltgen Seed Co.[d]	4.4	34	HR	R	R	HR	R
Drummor	Northrup King Co.[J]	4.4	25	R	R	MR	MR	—
Dynasty	Dairyland Seed Co. Inc.[N]	4.4	19	HR	R	R	MR	R
Gourmet Hay	Fred Gutewein & Sons[R]	4.4	51	HR	R	HR	HR	R
Target	Ziller Seed Farm, Inc.[FΦ]	4.4	24	HR	R	R	MR	MR
Vector	ProfiSeed, Inc.[kpΦ]	4.4	15	HR	MR	HR	R	MR
Verta+	NC+ Hybrids[j]	4.4	29	HR	R	R	HR	R
Aquarius	Lincoln Seed & Feed Co.[g]	4.3	—	HR	S	R	HR	—
Asset	Allied Seed Coop[C]	4.3	5	HR	HR	R	R	R
Premier	Dahlgren & Co., Inc.[M]	4.3	18	HR	R	HR	HR	R
Sure	Cenex/Land O'Lakes[I]	4.3	22	HR	R	HR	HR	R
Armor	ABI[ADey]	4.2	46	R	R	R	MR	—
Crown	Paymaster Seeds[H]	4.2	15	R	R	R	HR	R
Crystal	Mike Brayton Seeds[h]	4.2*	—	HR	HR	HR	R	R
Echo	ProfiSeed, Inc.[p]	4.2	17	R	R	R	MR	R
Good as Gold	Mike Brayton Seeds[h]	4.2*	—	HR	HR	HR	R	R
Promise	ICI Seeds[W]	4.2	3	HR	HR	HR	HR	R
WL 320	W-L Research Inc.[Y]	4.2	31	HR	R	HR	MR	MR
Crown II	Cargill Seed Div.[H]	4.1	48	HR	R	R	HR	R
Hi-Phy	Premium Seed Co., Inc.[o]	4.1	—	HR	HR	MR	—	—
New Era 90	Stine Seed Farm[u]	4.1	17	HR	HR	HR	HR	R
Pro-Cut 2	L. Herried Seed, Inc.[e]	4.1	9	HR	HR	HR	R	R
Terminator	Ramy Seed Co.[q]	4.1	24	HR	MR	HR	R	R
Eagle	Asgrow Seed Co.[E]	4.0	26	HR	R	R	R	MR
Magnum +	Dairyland Seed Co., Inc.[N]	4.0	13	R	R	R	MR	LR
Magnum III	Dairyland Seed Co., Inc.[N]	4.0	17	HR	MR	R	MR	MR
Pro-Cut	L. Herried Seed, Inc.[e]	4.0	15	HR	R	HR	R	R
Empress	Blaney Seeds, Inc.[G]	3.9*	9	HR	HR	HR	R	R
Epic	Profiseed, Inc.[p]	3.9	31	HR	R	R	S	—
G 2852	CIBA-GEIEGY Seed Div.[J]	3.8	19	HR	R	R	HR	R
AF 31	Asgrow Seed Co.[E]	3.7*	41	HR	HR	HR	HR	R
Cimarron	Great Plains Research[Vc]	3.6	19	R	MR	HR	R	LR
Shenandoah	Great Plains Research[Vc]	3.6	23	HR	LR	R	HR	—
Belmont	Great Plains Research[V]	3.2*	—	HR	R	R	HR	R
Cimarron VR	Great Plains Research[Vc]	3.2*	26	HR	R	R	HR	R
NON-DORMANT								
Nitro	USDA & Minnesota Agr. Exp. Sta.[ko]	2.4	—	S	R	HR	S	S

Alfalfa trials at the Minnesota Agricultural Experiment Station fields in Rosemount.

[1] 1992 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, 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 (1967-1991) 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										
VERY FALL DORMANT											
Spredor 2	93	85	96	108	—	—	94	94	95	94	5
Teton	—	—	102	99	—	—	—	—	102	99	1
Travois	—	—	94	91	—	—	—	—	94	91	1
FALL DORMANT											
Wrangler	105	107	106	101	98	102	100	95	103	102	7
Vernal, tons/acre 15% M	6.03	5.38	5.26	4.54	5.08	4.20	4.10	3.79	5.29	4.64	59
Baker	99	105	99	102	107	103	89	82	98	100	17
636	110	107	99	104	101	106	103	102	105	106	6
Clipper	102	90	92	—	100	—	106	102	99	96	6
Envy	111	90	95	—	102	—	—	—	104	90	6
Profit	110	110	101	95	107	109	105	113	106	109	6
Agate	100	107	97	101	100	100	89	96	99	104	20
Iroquois	103	102	105	107	103	112	111	96	105	104	12
Blazer	108	114	95	104	102	—	100	104	104	111	10
Nordic	99	—	—	—	—	—	—	—	99	—	1
Renegade	111	87	107	—	—	—	94	—	106	87	4
629	108	105	99	97	96	103	96	106	101	103	7
Affagraze	103	74	93	—	—	—	106	—	102	74	5
5262	108	105	96	—	103	—	117	—	105	105	7
Thunder	105	104	96	101	100	101	103	85	101	101	7
WL 225	103	90	89	—	101	—	107	105	99	99	6
Trident II	105	—	106	—	—	—	105	—	105	—	5
break-thru	103	93	91	—	102	—	100	—	101	93	8
DK 122	114	71	95	—	—	—	104	—	103	71	5
120	111	113	103	107	103	—	112	107	109	111	10
A-54	105	107	109	102	101	105	104	102	105	105	7
Alpine	110	104	81	—	111	—	—	—	100	104	3
Ranger	96	100	125	104	97	99	—	—	100	100	13
Aggressor	100	—	102	—	—	—	106	—	100	—	5
Blazer XL	101	—	—	—	—	—	—	—	101	—	1
Dart	111	107	107	109	109	110	109	105	109	107	7
Milkmaker	106	99	100	93	98	101	104	106	103	99	8
Thrive	106	—	105	—	—	—	108	—	106	—	5
Arrow	108	103	100	95	110	113	110	104	107	104	7
Majestic	100	—	—	—	—	—	105	—	100	—	3
MultiKing 1	103	—	—	—	—	—	—	—	103	—	1
Sparta	110	108	105	95	110	98	104	107	107	103	7
Webfoot	105	105	109	—	—	—	101	107	105	105	6
Zenith	105	—	—	—	—	—	—	—	105	—	1
GH715	106	102	98	—	103	—	113	112	104	105	7
Impact	110	94	102	114	112	104	112	104	109	101	6
Oneida	105	106	102	107	94	97	105	107	100	106	10
Royalty	111	—	90	—	101	—	111	—	103	—	7
MODERATELY FALL DORMANT											
AF 21	99	92	83	—	102	—	—	—	94	92	5
Ultra	102	82	85	—	106	—	114	106	100	91	6
Cutter	103	—	100	—	—	—	105	—	103	—	4
Saluie	109	110	106	100	95	95	111	101	106	104	7
Top Ton	92	92	76	—	109	—	—	—	94	92	4
WL 322 HQ	101	—	—	—	—	—	—	—	101	—	1
Agri-MATE	111	82	98	—	—	—	105	—	107	82	4
Husky	110	98	98	95	111	105	103	105	106	100	12
Kingstar	102	86	85	—	103	—	101	102	97	91	7
Oneida VR	101	104	85	—	105	—	105	99	100	102	5
VIP	111	87	83	—	108	—	110	—	103	87	7
WL 317	114	93	89	—	104	—	104	—	103	93	6
Agri-Boss	107	96	94	—	96	—	—	—	100	96	5
Apollo Supreme	110	104	91	—	100	—	107	108	102	105	6

Table 2 (continued). Average yields of alfalfa varieties expressed as percentage of Vernal for all tests with one or more harvest years (1967-1991) 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										
Elevation	112	112	104	107	111	97	106	98	109	106	10
G7730	103	108	105	105	98	101	98	103	103	106	8
Magnum	106	109	100	105	102	101	95	99	103	107	8
Perry	108	111	98	108	100	102	102	—	103	108	6
2833	110	—	90	—	104	—	—	—	101	—	5
5432	109	105	100	108	101	100	104	114	104	106	6
Commander	109	105	88	94	103	101	103	101	103	102	7
Edge	108	94	95	102	105	104	112	97	105	98	6
Flint	100	104	80	—	105	—	—	—	97	104	5
Endure	107	100	104	103	103	113	110	94	106	103	7
Fortress	102	77	79	—	106	—	108	—	97	77	8
Jade	118	109	116	—	—	—	109	—	115	109	4
Quest	104	96	—	—	—	—	—	—	104	96	1
G2841	97	76	83	—	107	—	110	—	96	76	6
Apollo II	103	93	103	95	103	95	103	84	103	93	8
Chief	102	86	89	—	102	—	109	93	99	90	7
DK 125	107	95	100	93	125	106	104	89	108	96	6
DK 135	105	94	96	107	102	100	102	85	102	97	7
GH 737	110	92	93	82	112	109	99	95	104	97	6
Legend	97	102	90	—	101	—	110	—	97	102	6
Multi-plier	108	—	93	—	103	—	105	—	102	—	7
Precedent	106	95	—	—	—	—	—	—	106	95	1
Saranac	103	99	—	—	103	103	96	109	103	101	27
Stein 9227	102	—	—	—	—	—	—	—	102	—	1
Target II	110	88	108	—	—	—	105	—	108	88	4
Trident	106	112	97	98	103	—	97	96	102	106	8
RamRod	110	106	96	—	113	—	—	—	106	106	3
Voyager	112	99	102	118	103	108	107	116	107	108	6
630	111	110	101	98	107	109	99	112	107	109	7
5333	101	—	—	—	—	—	—	—	101	—	1
Bronco	116	94	79	—	101	—	104	—	97	94	6
Allegiance	95	101	94	—	111	—	101	—	100	101	6
Drummor	101	90	100	85	110	107	98	87	102	91	8
Dynasty	110	98	98	84	99	94	105	112	104	98	6
Gourmet Hay	101	—	—	—	—	—	—	—	101	—	1
Target	107	107	108	100	108	110	100	100	108	105	7
Vector	105	107	93	—	105	—	102	—	100	107	6
Verta +	106	96	95	93	96	95	105	96	101	95	6
Aquarius	99	90	99	89	—	—	—	—	99	89	5
Asset	107	85	69	—	105	—	—	—	93	85	3
Premier	100	84	85	—	98	—	—	—	95	84	6
Sure	109	97	99	106	103	99	101	105	104	101	6
Armor	106	102	101	109	100	102	113	108	105	104	8
Crown	109	100	91	101	123	112	113	103	108	104	6
Crystal	102	97	93	—	—	—	—	—	99	97	3
Echo	99	—	70	—	99	—	—	—	93	—	4
Good as Gold	118	—	107	—	—	—	108	—	113	—	4
Promise	113	99	78	—	108	—	103	—	100	99	6
WL 320	109	110	106	97	112	106	112	102	109	105	6
Crown II	112	—	96	—	105	—	—	—	105	—	5
Hi-Phy	111	127	100	100	103	—	99	102	105	114	7
New Era 90	105	69	80	—	99	—	—	—	95	69	3
Pro-Cut 2	111	88	81	—	110	—	108	—	99	88	6
Terminator	105	100	87	—	106	—	104	—	99	100	6
Eagle	102	79	105	91	114	103	109	82	106	87	7
Magnum +	106	107	89	100	107	—	104	107	100	107	8
Magnum III	110	101	105	106	114	115	104	107	108	105	6
Pro-Cut	96	82	83	—	98	—	102	—	93	82	6
Empress	117	73	103	—	—	—	103	—	110	73	4
Epic	104	109	105	101	99	105	108	90	104	107	10
G 2852	100	87	102	92	105	101	109	102	105	93	7

Table 2 (continued). Average yields of alfalfa varieties expressed as percentage of Vernal for all tests with one or more harvest years (1967-1991) 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		Number
Variety	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	Tests
	% of Vernal										
AF 31	109	—	100	—	—	—	104	—	100	—	4
Cimarron	104	87	94	92	119	111	108	80	104	93	6
Shenandoah	103	86	103	91	92	97	115	93	103	90	6
Belmont	97	—	—	—	—	—	—	—	97	—	1
Cimarron VR	96	—	99	—	—	—	103	—	97	—	4
NON-DORMANT											
Nitro	—	—	—	—	—	—	—	—	—	—	—

BIRDSFOOT TREFOIL

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

Eight birdsfoot trefoil varieties were established in pure stands in August 1989 on Minnesota Agricultural Experiment Station fields at Rosemount and Grand Rapids. However, severe winter injury at Grand Rapids destroyed the trial at that location. The Rosemount trial was harvested twice in 1990 and three times in 1991. Yields in 1991 were generally better than in 1990. There was no observable winter injury in 1991.

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

Table 3. Winter injury score (1990) and dry matter yield of birdsfoot trefoil varieties seeded in 1989 at Rosemount.

		Forage Yields		
Variety	Winter Injury	1990	1991	Mean
	score[1]	tons DM/A		
Bonnie	3.2	3.9	5.0	4.4
Carroll[o]	1.0	5.6	4.8	5.2
Dawn	3.0	5.0	5.8	5.4
Empire[IPcfgmoqwz]	3.7	4.6	5.0	4.8
Fergus	1.5	4.9	5.3	5.1
GA-1	5.0	NH[2]	NH	NH
Leo[foz]	2.7	4.4	5.0	4.7
Norcen[ICfgkmoqwz]	1.5	5.2	5.3	5.2
LSD 5%	1.0	0.8	0.6	0.4

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

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 stands in August, 1989 at Morris, Grand Rapids and Rosemount. Severe winter injury at Morris destroyed the trial at that location. Experimental plots were harvested three times in 1990 and 1991 at the other locations. Nitrogen was applied in the early spring and after each harvest at a rate of 40 to 50 lbs N/acre. Few differences were observed for yield at either harvested location. Varieties which showed significant winter injury in May, 1990 produced adequate forage yields during the 1990 growing season. Yields were lower in 1991 than 1990, especially at Grand Rapids.

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.

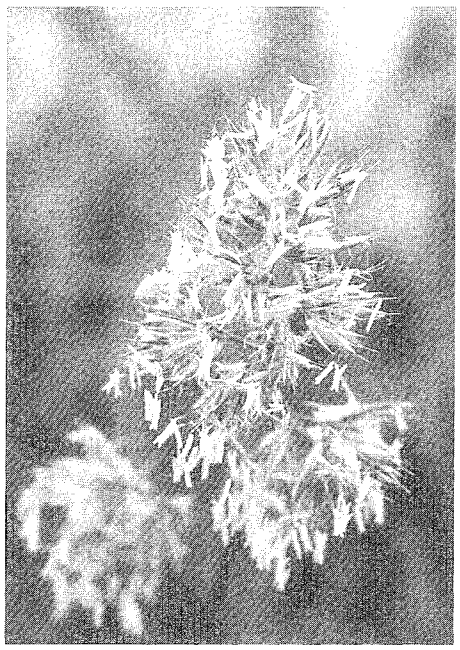


Table 4. Winter injury score (1990), maturity and dry matter yield of orchardgrass varieties seeded in 1989 at two locations

Variety	Winter Injury		Forage Yield				
			Grand Rapids		Rosemont		
	Grand Rapids	Rosemount	1990	1991	1990	1991	Average
	score[1]		Tons DM/A				
Ambassador[X]	2.6	1.8	4.6	2.6	5.4	4.5	4.3
Crown[cfz]	2.4	1.5	4.6	2.7	5.1	4.5	4.2
Dawn[l]	2.3	2.0	4.7	2.9	5.5	4.4	4.4
Elsie	2.3	3.8	4.6	2.9	5.4	4.8	4.4
Justus[S]	2.8	2.8	4.5	2.4	5.2	4.6	4.2
Napier	2.4	2.0	5.0	2.9	5.0	4.5	4.3
Orbit	2.5	2.3	4.3	2.6	5.0	4.4	4.1
Orion	2.6	1.0	4.8	2.9	5.8	4.9	4.6
Potomic[Pcefgkmoqwx]	2.0	1.5	4.4	2.6	5.2	4.3	4.1
Shawnee	2.4	3.8	4.6	2.4	5.2	4.4	4.1
Sterling	2.1	2.3	4.1	2.4	5.4	4.6	4.1
LSD 5%	0.6	0.8	NS	NS	0.5	0.5	0.2

[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 hay or silage. It is more easily established in pasture renovation than either alfalfa or birdsfoot trefoil. Historically, winter-hardy varieties have not persisted beyond two crop years because they are susceptible to diseases. Most improved varieties currently sold in Minnesota can persist for three years with good winter snow cover.

Minnesota Agricultural Experiment Station scientists established performance trials of red clover in 1991 at three locations and data collection will start in 1992. 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.

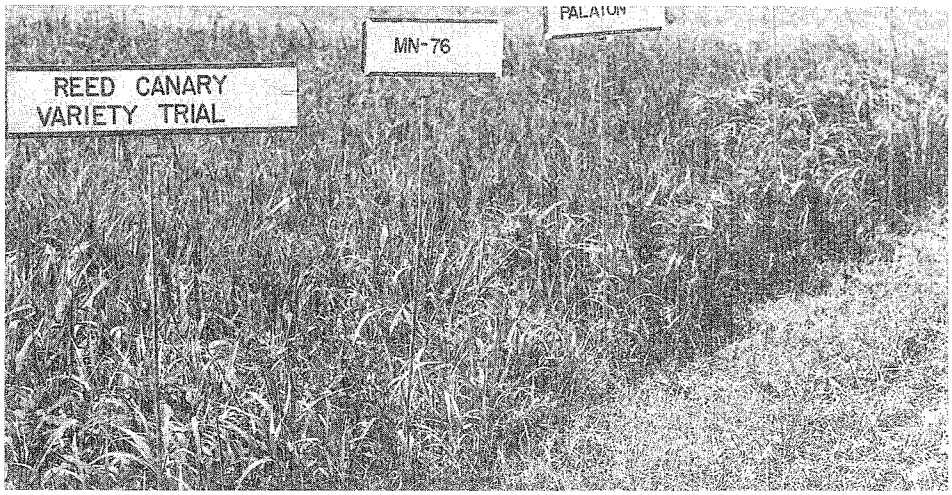
Seed sources for the varieties sold in Minnesota are listed in Crop News No. 42 (revised), January 1991, prepared by Neal P. Martin, Extension Agronomist-forages.

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 uses nitrogen efficiently and is adapted to liquid manure application. Seedling vigor of reed canarygrass 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 only 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 which dramatically improves animal perfor-



Established reed canarygrass has good stand density.

mance and palatability. In grazing trials, lambs and steers gained more weight and sheep had less diarrhea on low alkaloid varieties than on common reed canarygrass. Hay should be harvested between heading and early bloom because quality declines with maturity.

Reed canarygrass trials were established in pure stands in 1989 at Morris and at Rosemount. The trial was harvested twice at Morris and three times at Rosemount in 1990 and 1991. Nitrogen was applied early in the spring and after each harvest at a rate of 40 to 50 lbs N/acre. Available varieties are winter-hardy and persistent in Minnesota. Palaton and Venture are two high yielding, low alkaloid varieties which are currently marketed in Minnesota.

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

Variety	Morris 1990	Morris 1991	Rosemount 1990	Rosemount 1991	Average
	tons DM/A				
Palaton[lfgkmo]	5.1	2.7	8.8	6.8	5.8
Rise	5.4	2.9	7.5	6.3	5.5
Vantage	5.7	2.7	8.3	5.9	5.6
Venture[gko]	6.0	2.9	9.2	6.6	6.2
LSD 5%	0.9	NS	1.2	0.8	0.4

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.

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 its yield and quality. Harvesting timothy at early heading is the preferred time. Timothy produces the majority of its forage at the first harvest.

Timothy varieties differ in maturity so care needs to be exercised in choosing varieties that fit the management requirements of a crop and mixture. The 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, appropriately selected timothy varieties are compatible with red clover and birdsfoot trefoil in mixtures for hay production.

Varieties in these timothy trials were established in pure stands in August 1989 at Grand Rapids and Rosemount. Two harvests were taken at each location during 1990 and 1991. Nitrogen was applied in the early spring and after each harvest at a rate of 40 to 50 lbs per acre. Early maturing varieties had greater forage production than late maturing varieties at both locations.

Seed sources for the timothy 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 1990	Grand Rapids 1991	Rosemount 1990	Rosemount 1991	Average
	tons DM/A				
MURITY					
Chazy	4.0	2.6	3.8	4.8	3.8
Tupper	4.0	2.4	3.6	4.7	3.7
INTERMEDIATE MATURITY					
Comtal	3.6	2.4	3.5	4.3	3.5
Climax[Pcefgkmoqwxz]	3.6	2.4	2.9	4.4	3.3
Goliath	3.3	2.4	3.7	4.3	3.4
LATE MATURITY					
Champlain	3.2	2.4	3.1	4.4	3.3
Heidemij	2.7	2.2	2.6	3.5	2.8
LSD 5%	0.4	0.2	0.8	0.4	0.3

CROPS NOT IN CURRENT TRIALS

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 classified as southern, intermediate, and 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 Agricultural Experiment Station scientists are not currently conduct-

ing performance trials of bromegrass. For 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.

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 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 Agricultural Experiment Station scientists are not currently conducting performance trials of tall fescue. For 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.

1992 FORAGE SEED SOURCES

A. Agassiz Seeds, 4121-1/2 S. University Drive, Fargo, ND 58104;
B. AgriPro, 824 2nd St. South, P.O. Box 250, Brookings, SD 57006;
C. Allied Seed Cooperative, 1917 E. Fargo, Nampa, ID 83687;
D. Americas Alfalfa Distributors, 6700 Antioch, Shawnee Mission, KS 66201;
E. Asgrow Seed Co., 7000 Portage Rd., Kalamazoo, MI 49001;
F. Bio Plant Research, P.O. Box 300, Camp Point, IL 62320;
G. Blaney Seeds, Inc., 5292 East Lacy Drive, Madison, WI 53711;
H. Cargill Seed Div., P.O. Box 5645, Mpls., MN 55440;
I. Cenex/Land O'Lakes, Station 680, P.O. Box 64089, St. Paul, MN 55164-0089;
J. CIBA-GIEGY Seed Div., P.O. Box 18300, Greensboro, NC 27419-2900;
K. CropMate Co., P.O. Box 978, Pekin, IL 61555;
L. Custom Farm Seed, Box 160, Momence, IL 60954
M. Dahlgren & Co., Inc., 1220 Sunflower Street, Crookston, MN 56716-0609;
N. Dairyland Seed Co., Inc., R.R. #1, P.O. Box 129, Clinton, WI 53525;
O. DeKalb Plant Genetics, 3100 Sycamore Rd., DeKalb, IL 60115;
P. Discount Farm Center, Inc., P.O. Box 84, Watertown, SD 57201;
Q. FFR Cooperative, 4112 East St. Rd. 225, West Lafayette, IN 47905;
R. Fred Gutwein & Sons, Inc., R.R. 1, Box 40, Francesville, IN 47946;
S. Geertson Seed Farms, 1665 Burroughs Rd. Adrain, OR 97901;
T. Gold Country Seed, 3374 80th Street, Plato, MN 55370;
U. Great Lakes Hybrids, P.O. Box 637, 9915 West M-21, Ovid, MI 48866;
V. Great Plains Research Co, Inc., 3624 Kildaire Farm Rd., Apex, NC 29502;
W. ICI Seeds, P.O. Box 300, 615 Main St., Coon Rapids, IA 50058;
X. International Seeds Inc., P.O. Box 168, Halsy, OR 97348;
Y. Interstate Seed Co., P.O. Box 338, West Fargo, ND 58078;
Z. J.C. Robinson Seed Co./Golden Harvest, 100 J.C. Robinson Blvd., Waterloo, NE 68069;
a. Jacques Seed Co., 720 St. Croix, Prescott, WI 54021;
b. Jung Farms Inc., 335 South High Street, Randolph, WI 53957;
c. Kaltenberg Seed Farms, Inc., P.O. Box 278, Waunakee, WI 53597;
d. Keltgen Seed Co., Box A, Olivia, MN 56277;
e. L. Herried Seeds, Inc., P.O. Box 216, Prescott, WI 54021;
f. L.L. Olds Seed Co., Box 7790, Madison, WI 53707-7790;
g. Lincoln Seed, Inc., 5600 Harbor Drive, P.O. Box 2803, Sioux City, IA 51106;
h. Mike Brayton Seeds, 2055 Ironwood Ct., Suite 100, Ames, IA 50010;
i. NC+ Hybrids, P.O. Box 4408, Lincoln, NE 68504;
j. Northrup King Co., P.O. Box 959, 7500 Olson Memorial Hwy., Golden Valley, MN 55427;
k. Peterson Seed Co., Inc., P.O. Box 346, Savage, MN 55378;
m. Peterson-Biddick Co., Box 190, 102 Aldrich S.E., Wadena, MN 56482;
n. Pioneer Hi-Bred Int'l, Inc., P.O. Box 287, 7305 NW 62nd Ave., Johnston, IA 50131;
o. Premium Seed Co., Inc., 7800 E. State Hwy 101, Shakopee, MN 55379;
p. ProfiSeed, Inc., Rt. 2, Hampton, IA 50441;
q. Ramy Seed Company, 1329 N. Riverfront Drive, Mankato, MN 56001;
r. Renk Seed, 6800 Wilburn Rd., Sun Prairie, WI 53590;
s. Seedsman, P.O. Box 542, St. Peter, MN 56082;
t. SIGCO Research, P.O. Box 289, Breckenridge, MN 56520;
u. Stine Seed Farm, Inc., 2225 Laredo Trail, Adel, IA 50003;
v. Super Crost Seeds, P.O. Box 118, St. Peter, MN 56082;
w. The Sexauer Co., P.O. Box 58, Brookings, SD 57006;
x. Top Farm Hybrids, Inc., Box 850, Cokato, MN 55321;
y. Trelay, Inc., Route 1, Livingston, WI 53554;
z. Werner Farm Seeds, 3104 Millersburg Blvd., Dundas, MN 55019;
Δ. Wyffels Hybrids, Inc., P.O. Box 246, Atkinson, IL 61235;
Φ. Ziller Seed Farms, Inc., R.R.1, Box 122, Bird Island, MN 55310-9730.

GRAIN CROPS

AMARANTH

Amaranth is a high-protein grain crop for human food. First used by the Aztec civilization, amaranth is currently grown in China, India, and both American continents. Interest in this crop in Minnesota has been increasing 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, including Minnesota.

The crop is planted in late May or early June. Cultivation of wide rows is required in the absence of approved herbicides. Seed yields ranging from 300 to 3,800 pounds per acre (hand harvested) have been reported in Minnesota. It is reasonable to expect a yield of between 900 and 1,500 pounds per acre combine harvested. 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 preferably 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 *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: $7.00).

A stand of amaranth. Not yet a frequent sight in Minnesota, but interest in the crop is growing.

Table 7. Seed yield and characteristics of amaranth, 1990 and 1991.

	Seed Yield							
	Rosemount 1991	3-locations[1] 1990	Crude Protein[2]	Planting to 90% Bloom[3]	Plant Height[4]	Lodging[4]	Seed Weight[2]	Test Weight[2]
	lbs/a		%	days	inches	score[5]	1,000 s/lb	lb/bu
Amont	1,650	1,351	14.1	72	77	9	673	58
D136	685	1,116	—	78	65	1	797	60
K266	1,338	1,475	15.4	74	74	8	966	58
K432	—	1,134	17.2	66	49	3	849	58
Plainsman	1,254	1,058	15.8	69	68	5	713	60
LSD 5%	221	287	—	—	—	—	—	—

[1]Rosemount, Lamberton, and St. Paul; [2]Rosemount, 1990; [3]three location/years; [4]four location/years; [5]1 = no lodging, 10 = severe lodging.

BARLEY

Recommended Public Varieties

Morex—Low yield. Early. Susceptible to lodging. 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. Developed by Minnesota Agricultural Experiment Station from cross of Cree and Bonanza. Released 1978.

Robust—High yield. Medium maturity. Good 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. 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. Developed by Minnesota Agricultural Experiment Station from cross involving Robust, Manker, and a sisterline of Morex. Released 1990. Seed sale regulated by U.S. Variety Protection Act.

Table 8. Yields of barley varieties 1986-1991.

	Location					
Variety	Crookston 5[1]	Morris 6	Stephen 3	St. Paul 3	Roseau 1	20 Trial Average
	bu/A					
Morex	81	66	66	77	52	72
Robust	87	71	62	82	61	76
Excel	90	69	75	84	56	78
B1602	84	67	66	81	62	74
B1603	85	66	60	79	57	73
LSD 5%	6	5	10	4	9	2

[1]Number of trials

Table 9. Characteristics of barley varieties, 1986-91.

Variety	Heading 15[1]	Height 14	Lodging 5	Plump kernels 17	Net blotch 6
	date	inches	%	%	score[2]
Morex	6-20	32	43	62	3.5
Robust	6-22	32	33	70	2.4
Excel	6-22	30	33	53	2.1

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

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 a blue aleurone malting variety in Minnesota. Developed by North Dakota Agricultural Experiment Station from a cross involving Bonanza, Nordic, and ND B130. Released 1982.

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 non-malting type in Minnesota. Similar to Robust in resistance to leaf diseases. Developed by North Dakota Agricultural Experiment Station from cross involving several parents. Released 1984.

Privately Developed Varieties

B1602—Medium yield. Similar to Robust in maturity and lodging resistance. Kernel plumpness lower than Robust. 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. Developed and marketed by Busch Agricultural Resources Inc. Parents include Bumper and Morex. Released 1989.

B1603—Medium yield and lodging resistance. Kernel plumpness lower than Robust. Six-rowed, rough awn, long rachilla hairs, colorless aleurone. Resistant to spot blotch. Classified as a malting variety by Anheuser Busch Inc., and by AMBA. Developed and marketed by Busch Agricultural Resources Inc. Parents include Morex and Glenn. Released 1990.

OAT

During 1990 and 1991, crown rust infection dramatically increased in many or most Minnesota oat fields. At least three new races have been identified, in the last three years. As a result, varieties previously considered to have good crown rust resistance are now quite vulnerable. Varieties with limited or no rust resistance (MS or S in Table 11) should be grown with caution.

Recommended Varieties

Don—Early maturity, high yield, short, fair lodging resistance, high test weight, high groat percent, low protein percent, white seed. *Some resistance to crown rust* and resistant to 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. *Moderately 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 suseptibility, planting only treated seed is recommended.

Premier—Medium maturity and yield, short, good lodging resistance, high test weight and groat percentage, 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 between Noble and an unreleased Wisconsin line. Released 1990. Plant Variety Protection applied for.

Valley—Late maturity, 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. Selected at the North Dakota Agricultural Experiment Station. Released 1988. Because of smut suseptibility, planting only treated seed is recommended.

Varieties Not Adequately Tested

Dane—Early maturity, very high yield, short, good lodging resistance, high test weight, very high groat percentage, yellow seed. *Moderately resistant to crown rust,* moderately susceptible to smut and susceptible to red leaf. Selected at the Wisconsin Agricultural Experiment Station. Released 1990. Foundation Seed available to Certified Seed producers only under a license/fee collection agreement. Plant Variety Protection Certificate applied for.

Ensiler—Late maturity, poor grain yield but excellent forage yield, tall, 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. Foundation Seed available to Certified Seed producers only under a license/fee collection agreement. Plant Variety Protection Certificate has been applied for. *For forage only.*

Troy—Late maturity, very high yield, tall, very high test weight and high groat percent, white seed. *Very good crown rust resistance,* resistant to smut and good tolerance to red leaf. Selected at the South Dakota Agricultural Experiment Station. Released 1991.

Other Varieties

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. Foundation Seed available to Certified Seed producers only under a license/fee collection agreement. Plant Variety Protection Certificate applied for. Because of smut suseptibility, planting only treated seed is recommended.

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

Newdak—Medium maturity, high yield, short, fair lodging resistance, medium-poor

Table 10. Oat yield, 1989-91.

Variety	Rosemount	Waseca	Lamberton	Morris	Crookston	Grand Rapids	All Loc. Ave.
	bu/A						
Dane[1]	109	111	67	87	86	69	88
Starter	60	56	44	75	83	68	64
Don	94	72	58	90	89	75	80
Hazel	91	85	62	89	91	76	82
Premier	73	69	52	88	89	71	74
Newdak	78	73	55	89	101	81	80
Settler[1]	70	74	56	93	93	75	77
Steele	67	59	41	72	85	72	66
Troy[1]	101	112	60	113	99	103	98
Valley	86	76	47	108	110	87	86
LSD 5%	8	8	7	7	9	9	3

[1]1990-91 data.

Table 11. Characteristics of oat varieties, 1989-91.

Variety	Heading	Height	Lodging Score	Test Weight	Groat	Reaction to Disease		
						Crown Rust[1]	Smut[1]	BYDV[2]
	date	inches	(1-5)	lbs/bu	percent	rating		
Dane[3]	6/21	31	1.1	36.0	73.9	MR	MR	7.0
Starter	6/22	32	1.6	36.1	71.7	S	HR	6.0
Don	6/23	31	1.3	36.6	71.7	MS	HR	8.0
Hazel	6/24	32	1.1	36.0	74.2	MR	S	4.0
Premier	6/25	33	1.3	36.6	71.5	MS	HR	5.0
Newdak	6/26	34	1.6	35.4	71.3	MS	S	3.0
Settler[3]	6/27	36	1.9	35.8	71.2	MS	MR	5.0
Steele	6/27	37	1.6	36.7	71.1	MS	MS	4.5
Troy[3]	6/28	37	1.5	39.5	72.6	HR	HR	4.0
Valley	6/28	33	1.5	36.3	71.4	MS	S	4.5

[1]1991 only. HR = highly resistant; MR = moderately resistant; MS = moderately susceptible; S = susceptible; [2]1990 data only. 1 = resistant, 9 = dead; data supplied by F. Kolb and A. Hewings, Univ. of Illinois and USDA-ARS; [3]1990-1991.

test weight and groat percentage, white seed. *Some resistance to rust,* susceptible to smut, good tolerance to red leaf. Selected at North Dakota Agricultural Experiment Station. Released 1990. Because of smut susceptibility, planting only treated seed is recommended.

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, planting only treated seed is recommended.

Preston—Early maturity, 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 maturity, medium yield, tall, poor lodging resistance, medium test weight, white seed. *Some resistance to crown rust,* susceptible to smut. Selected by Agriculture Canada, Winnipeg, from a cross involving several lines. Licensed 1952. Because of smut susceptibility, planting only treated seed is recommended.

Settler—Medium-late maturity, medium yield and height, poor lodging resistance, medium test weight and groat percent, medium protein percent, 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.

Starter—Early maturity, medium yield, short, fair 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. *Well suited for companion cropping.*

Steele—Late, low yield, tall, fair lodging resistance, medium test weight, groat percent, and protein percent, 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.

WHEAT (DURUM)

Publicly developed varieties are classed into "Recommended" and "Other" categories and listed within classes in maturity order. Privately developed varieties are also listed and described in maturity order.

Recommended Publicly Developed Varieties

Monroe—Awned, early, medium height and 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 1985 by North Dakota Agricultural Experiment Station.

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

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

Other Public Varieties

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

Vic—Awned, midseason, medium height and fair lodging resistance. Resistant to stem

rust and moderately susceptible to leaf rust. High yield, high test weight, high seed weight. Superior quality for export market. Released 1979 by North Dakota Agricultural Experiment Station.

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

Privately Developed Varieties

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

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

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

Table 12. Characteristics of durum wheat varieties, 1989-91.

Variety	Heading	Height	Lodging	Rust Reaction Stem	Rust Reaction Leaf	Seeds	Test Weight	Yield Morris[3]	Yield Crookston[4]	Yield Stephen	Yield State Average
	date	inches	score[1]	rating	rating	no/lb	lbs/bu	bu/A	bu/A	bu/A	bu/A
PUBLICLY DEVELOPED VARIETIES											
Monroe	6-23	35	3.7	R	MR	10,200	58.4	35	41	51	43
Renville	6-26	36	3.6	R	MR	11,200	58.6	34	48	49	44
Cando	6-27	30	1.4	R	S	13,300	56.7	26	44	54	41
Medora	6-25	38	4.0	R	MR	11,500	58.4	36	40	50	42
Vic	6-26	36	3.6	R	MS	10,700	59.4	36	42	51	43
Lloyd	6-27	30	1.9	R	MS	11,200	54.3	21	39	53	38
PRIVATELY DEVELOPED VARIETIES											
Fjord	6-25	36	3.9	R	MR	11,100	59.4	32	38	48	39
Stockholm	6-26	30	2.3	R	MS	11,600	56.8	21	43	51	38
Laker	6-26	33	2.2	R	MR	11,100	56.7	27	42	54	41
LSD 5%								8	—	—	—

[1] 1 = erect, 9 = flat; [2] Reaction to prevalent races: R = resistant, MR = moderately resistant, MS = moderately susceptible, S = susceptible; [3] 1991, severe scab; [4] 1991, hail damage.

WHEAT (HARD RED SPRING)

Publicly developed varieties are classed into "Recommended," "Not Adequately Tested," and "Other" categories and listed within classes in maturity order. Privately developed varieties are also listed and described in maturity order. All varieties are susceptible to *Fusarium* head blight (scab) unless indicated in their description.

Recommended Publicly Developed Varieties

Butte 86—Awned, early, medium height. Resistant to stem and moderately resistant to leaf rust. Moderately susceptible to scab, tan spot, black chaff, and lodging. High yield and test weight. Medium protein percent. Released 1986 by North Dakota Agricultural Experiment Station.

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

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

Minnpro—Awned, midseason, semidwarf. Resistant to stem and leaf rust. Moderately susceptible to loose smut and lodging. High yield and very high protein percent. Low test weight. Best adapted to northern Minnesota. Released 1989 by Minnesota Agricultural Experiment Station and USDA-ARS. Seed sale regulated by the U.S. Variety Protection Act.

Stoa—Awned, midseason, medium height. Resistant to stem and to leaf rust. Moderately tolerant of loose smut and ergot.

Moderately susceptible to scab. Higher potential for lodging. Very high yield and medium test weight. Medium protein percent. Released 1984 by North Dakota Agricultural Experiment Station.

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

Vance—Awned, midseason, semidwarf. Resistant to stem and leaf rust. Tolerant to loose smut. High yield and medium test weight. Medium protein percent. Best adapted to northern Minnesota. Released 1989 by Minnesota Agricultural Experiment Station and USDA-ARS. Seed sale regulated by the U.S. Variety Protection Act.

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

Public Variety Not Adequately Tested

Roblin—Awnless, very early, medium height. Resistant to stem rust and moderately susceptible to leaf rust. Susceptible to lodging. Medium yield and test weight. High protein percent. Released 1986 by Agriculture Canada.

Other Public Varieties

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

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

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

Gus—Awned, midseason, semidwarf. Resistant to stem rust and leaf rust. Higher potential for lodging. High yield and test weight. High protein percent. Satisfactory milling and baking. Released 1989 by North Dakota Agricultural Experiment Station.

Privately Developed Varities

2370—Awned, early, semidwarf. Moderately resistant to stem and leaf rust. High yield and medium test weight. Good lodging resistance. Medium protein percent. Released 1989 by Pioneer Hi-Bred. Sold by North Dakota State Development Foundation in 1990. Seed sale regulated by U.S. Variety Protection Act.

Table 13. Yields of hard red spring wheat varieties, 1989-91.

Variety	Crookston	Stephen	Roseau[1]	Northern Average	St. Paul	Morris[2]	Lamberton[1]	Waseca[2]	Southern Average	State Average
	bu/A									
PUBLICLY DEVELOPED VARIETIES										
Butte 86	54	62	59	59	51	36	49	45	45	52
Prospect	51	65	53	58	54	29	47	47	47	51
Grandin	48	66	51	57	55	32	46	38	45	50
Minnpro	56	63	61	61	49	25	40	38	40	49
Stoa	53	61	60	58	49	34	51	44	44	51
Wheaton	53	64	53	58	54	31	50	41	45	51
Vance	56	66	53	59	51	32	42	40	42	50
Marshall	52	64	49	56	48	28	44	35	39	47
Roblin[3]	46	43	46	45	46	32	38	35	40	43
Shield	53	51	57	53	56	35	54	45	48	50
Sharp	53	61	56	57	52	34	51	49	47	52
Len	53	57	53	55	50	24	39	37	40	46
Gus	58	62	63	61	51	29	45	45	44	53
PRIVATELY DEVELOPED VARIETIES										
2370[3]	58	61	49	57	48	29	40	39	44	50
2375	56	62	63	61	53	38	52	46	48	54
Fjeld	55	67	52	59	54	30	49	45	45	52
Bergen[1]	58	70	56	63	58	34	47	37	45	53
W2501	55	64	55	59	54	32	49	40	46	51
Telemark	53	64	42	55	—	26	43	39	40	46
2369	57	64	53	59	50	28	40	38	41	48
Nordic	58	67	52	60	46	30	37	44	41	49
Norseman	55	63	57	59	54	26	40	39	42	49
LSD 5%	9	11	11	6	9	--	--	--	5	4

[1] Two year data, 1989 and 1990; [2] two year data, 1989 & 1991; [3] two year data.

Table 14. Characteristics of hard red spring wheat varieties, 1989-91.

Variety	Heading	Height	Lodging	Rust Reaction Stem	Rust Reaction Leaf	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	6-20	31	3.2	R	MR	13,800	59.3	15.2	Medium-High
Prospect	6-22	30	2.0	MS	MR	14,100	58.7	14.7	Medium-Low
Grandin	6-22	31	2.0	R	R	14,200	59.2	15.5	High
Minnpro	6-23	30	3.0	R	R	13,400	56.6	16.2	High-Medium
Stoa	6-24	34	3.6	R	R	14,700	58.3	14.9	Medium-High
Wheaton	6-24	28	2.2	R	R	14,000	56.7	14.4	Low-Medium
Vance	6-25	29	2.4	R	R	14,200	57.1	15.1	Medium-High
Marshall	6-26	29	1.7	R	MS	16,000	57.5	14.4	Medium-Low
Roblin[4]	6-19	33	4.1	R	MS	15,100	57.5	15.8	Medium-High
Shield	6-20	33	3.6	MS	MR	13,600	58.6	14.7	Medium
Sharp	6-20	32	3.7	R	MR	13,500	60.1	15.0	Medium
Len	6-23	30	1.9	R	MR	14,600	58.0	15.5	High-Medium
Gus	6-24	31	3.2	R	R	15,800	58.4	15.7	High
PRIVATELY DEVELOPED VARIETIES									
2370[4]	6-21	30	1.8	MR	MR	16,000	58.2	14.7	Medium
2375	6-22	30	3.7	R	MR	13,800	60.1	15.1	Medium
Fjeld	6-22	29	2.2	R	MR	14,000	57.3	13.8	Low-Medium
Bergen	6-23	28	1.7	R	R	14,200	57.7	14.5	Medium
W2501	6-23	28	1.7	R	R	15,200	55.8	14.3	Low-Medium
Telemark	6-24	27	1.3	R	MR	14,400	56.7	15.2	Medium-High
2369	6-24	29	3.0	MR	MS	13,600	58.7	14.9	Low-Medium
Nordic	6-25	31	3.4	R	MS	12,900	58.2	13.6	Low
Norseman	6-25	28	1.5	R, S	R	13,800	55.9	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.

2375—Awned, midseason to early, medium height. Resistant to stem rust and moderately resistant to leaf rust. Tolerant to loose smut. Moderately susceptible to scab and lodging. Very high yield and test weight. Medium to high protein percent. Released 1988 by Pioneer Hi-Bred. Sold by North Dakota Development Foundation in 1990. 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. Lower flour water absorption. Released 1989 by AgriPro. Seed sale regulated by U.S. Variety Protection Act.

Bergen—Awned, midseason, semidwarf. Resistant to stem and leaf rust. Very high yield and medium test weight. Low to medium protein percent. Released 1990 by Agripro. 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 protein percent. Low test weight. Sold by Busch Agricultural Research. Seed sale regulated by U.S. Variety Protection Act. Released 1989.

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

Nordic—Awned, midseason, semidwarf. Resistant to stem rust and moderately susceptible to leaf rust. Medium lodging resistance. Moderately tolerant of loose smut. High yield and medium 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. Low to medium protein percent. Low bake absorption and low test weight. First marketed by Agripro in 1984. Seed sale regulated by U.S. Variety Protection Act.

WHEAT (WINTER)

Publicly developed varieties are classed as "Recommended," or "Other" and listed within classes in winter hardiness order. Privately developed varieties are listed and described separately. A minimum of two years testing is required before data is presented. 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 and fair lodging resistance. Very winter-hardy. Susceptible to leaf rust but resistant to stem rust. High yield and test weight. Satisfactory quality. Released 1975 by the North Dakota Agricultural Experiment Station.

Seward—Awned, tall, late, and fair lodging resistance. Very 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 1987 by the North Dakota Agricultural Experiment Station.

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

Other Public Varieties

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

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

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

Siouxland—Awned, very early, medium height with medium lodging resistance. Moderately winter-hardy. Moderately susceptible to leaf rust and resistant to stem rust. High yield and medium test weight. Released 1984 by Nebraska Agricultural Experiment Station and USDA-ARS. Seed sale regulated by U.S. Variety Protection Act.

Privately Developed Varieties

Bighorn—Awned, early, semidwarf with good lodging resistance. Winter-hardy. Susceptible to leaf and stem rust. Medium 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 and good lodging resistance. Moderately winter-hardy. Moderately susceptible to leaf rust and moderately resistant to stem rust. Medium yield and test weight. Satisfactory quality. Released 1987 by Agripro. Seed sale regulated by U.S. Variety Protection Act.

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

Table 15. Yield and characteristics of winter wheat varieties, 1989-91

Variety	Heading	Height	Winter Survival	Lodging	Rust reaction Stem	Rust reaction Leaf	Test Weight	Protein	Yield Rosemount	Yield Morris	Yield Crookston[5]	Yield Roseau[6]	Yield Avg.
	date	inches	rating[1]	score[2]	rating[3]		lbs/bu	%[4]	bu/A				
PUBLICLY DEVELOPED VARIETIES													
Roughrider	6-11	41	VH	3.6	R	S	59.8	13.4	37	52	60	35	44
Seward	6-11	41	VH	2.4	R	MS	58.1	12.0	43	57	62	45	50
Arapahoe	6-9	36	H	3.0	R	MR	58.2	12.9	42	59	59	25	46
Agassiz	6-13	42	VH	3.6	R	S	58.9	13.2	29	44	51	41	39
Rose	6-10	38	H	1.9	MR	S-MS	59.4	13.0	38	51	50	22	40
Brule	6-9	39	MH	2.9	R	MS	57.9	12.5	39	55	41	20	37
Siouxland	6-7	37	MH	3.0	R	S	58.5	12.4	46	58	49	16	43
PRIVATELY DEVELOPED VARIETIES													
Bighorn	6-10	38	H	2.8	S	S	56.6	12.9	38	48	25	24	37
Abilene	6-8	37	MH	4.4	MR	MS	57.7	13.7	29	53	57	17	37
Thunderbird	6-6	36	NH	2.3	MS	MR	58.7	13.0	37	48	14	6	31
LSD 5%									10	—	21	11	6

[1] VH=very hardy, H=hardy, MH=moderately hardy, NH=not hardy; [2] 1=erect, 9=flat; [3] R=resistant, MR=moderately resistant, MS=moderately susceptible, =susceptible; [4] 12% moisture; [5] 1989, winter kill in 1990, 1991; [6] no 1990 data due to winter kill.

WILD RICE

Cultivated wild rice is grown on 20,000 acres in Minnesota. Most wild rice 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, and medium to high yield. Developed 1972 by Kosbau Brothers.

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

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

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

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

Table 16. Yield and characteristics of wild rice varieties.

	Yield[1]		Shattering[1]		Harvest	Height		Seed Head Length[1]		
Variety	1989	1991	1989	1991	1981–1986	1989	1991	1989	1991	Seeds
	lbs/A[2]		%[3]		date	inches		inches[4]		no/lb[5]
K2	1,083	640	37	35	8-23	64	73	7.8	8.6	7,300
M3	649	805	55	39	8-27	62	72	7.7	8.7	9,460
Meter	1,070	156	21	42	8-2	63	63	7.2	9.1	6,880
Netum	728	453	27	24	8-17	56	75	7.0	9.0	8,300
Voyager	1,082	395	31	32	8-18	61	68	8.0	9.0	8,600
LSD 5%	292	213	9	9	—	6	11	0.8	1.8	—

[1]1991 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]Percent of total yield lost at optimum harvest date for variety; [4]Average length of seed bearing part of panicle; [5]Seeds per pound based on wet, stored seed. Seed size varies from year to year and seed-lot to seed-lot.

CROPS NOT IN CURRENT TRIALS

Annual Canarygrass

Annual Canarygrass or canaryseed is a grain crop with production practices and a life cycle similar to spring wheat or oat. The plant is grown on large acreage in the Middle East, Europe and Argentina. There is also 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 the states of Minnesota and North Dakota. Production shifted out of the U.S. into the Canadian province of 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.

Buckwheat

Buckwheat is a nutritionally excellent grain. USDA-ARS analyses indicate that the grain has an amino acid composition nutri-

tionally superior to all 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 in 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 are 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 hotter and drier than normal growing seasons.

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 the 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 several 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 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*) It is primarily grown in southern U.S. as a temporary pasture.

Minnesota Agriculture Experiment Station scientists are not currently conducting performance trials of millet. For information from the most 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.

Winter Rye

Cultivated rye (*Secale cereale*) is believed to have originated in southern Europe and nearby parts of Asia. Rye was found as a weed widely distributed in wheat and barley fields in southern Asia. It apparently co-evolved with wheat and barley until its value as a seperate crop was recognized. Rye was brought to the western hemisphere by the English and Dutch who settled in the northeastern areas of the United States.

Average production of rye in the United States in 1987-89 was about 15.9 million bushels on some 2.3 million acres. The leading states in rye production are South Dakota, Georgia, Nebraska, North Dakota, and Minnesota. In 1930 Minnesota grew 7.2 million acres of rye for grain, while by 1989 only 32,000 acres were harvested. Average yield in 1920 was 17 bushels per acre, while in 1989 it was 34 bushels in the Upper Midwest.

Less than half of U.S. grown rye is harvested for grain. The rest is used as pasture, hay, or a cover crop. About half of the amount 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 did not conduct performance trials of rye in 1990-91, but performance data for 1991-92 is being developed. If you want information from the most 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 and Animal Products, 340 Alderman Hall, University of Minnesota, St. Paul, MN 55108, for details about this publication.

OILSEED CROPS

CANOLA

Canola (*Brassica napus* or *B. campestris*) is used for edible oil extraction and protein feed mel. A considerable acreage of spring canola is currently grown in Canada, and canola is occasionally produced in Minnesota when market prices are high. Interest in canola and other minor oilseeds has increased in recent years with the flexible crop opportunities for minor oilseeds in the 1990 Farm Bill.

Canola is a crop developed from oilseed rape by Canadian plant breeders. The first canola variety was licensed in 1974. Oil in canola seed contains less than 2 percent erucic acid compared with 20 to 40 percent in oilseed rape. Furthermore, the meal remaining after oil extraction from canola contains less than 0.1 percent of glucosinolate (sulfur-containing compounds) compared with about 1 percent in rapeseed meal. Therefore, 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. By contrast, Canola oil is considered to be one of the highest quality edible oils available. Consequently, canola is rapidly replacing oilseed rape for both food oil and livestock feed.

These canola variety descriptions are for spring sown types. Winter canola has also been evaluated by University of Minnesota researchers at locations throughout the state. In trials over 15 year/locations, fewer than 30 percent of the trials successfully overwintered, making current varieties of the winter canola crop too risky for Minnesota's growing conditions.

Production information is provided in the Canola chapter of 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. Another publication *Prospects for Canola in Minnesota* contains detailed information about spring canola production and processing and is also available from the Center (address above) for $5.00.

Spring Canola Varieties

A114—Developed by Ameri-Can Pedigreed Seed Co., Raymond, Ohio. Seed availability is limited.

Bingo—Developed in Denmark. Distributed by Ameri-Can Pedigreed Seed Co., Raymond, Ohio.

C86-800—Distributed by Terramax Seed Tec., Saskatchewan, Canada.

Celebra—Developed by Svalof AB, Sweden. Distributed by Cenex/Land O'Lakes, Minot, North Dakota and Agri-Tel Grain Ltd., Beausejour, Manitoba, Canada.

Global—Developed by Svalof AB, Sweden. Distributed by Can Am Seed Co., Grand Forks, North Dakota.

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

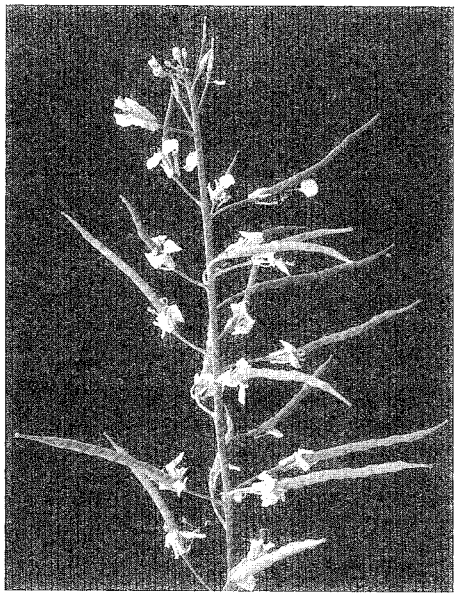


Table 17. Seed yield of spring canola *(Brassica napus)* varieties.

Variety	Crookston 1991	Morris 1991	Roseau 1991	Average 1991	Average 1990-91[1]	Average 1989-91[1]
	lbs/A					
A114	826	1,389	2,516	1,577	1,870	—
Bingo	1,122	1,579	2,152	1,618	—	—
C86800	1,066	1,348	2,481	1,632	—	—
Celebra	1,166	1,202	2,392	1,587	1,876	1,724
Global	784	1,385	2,132	1,433	1,969	1,662
Hyola 40	1,233	1,224	2,111	1,523	1,822	1,736
Hyola 41	1,448	1,335	2,205	1,663	1,777	—
Hyola 401	1,213	1,382	2,330	1,642	—	—
IMC129	980	1,153	1,783	1,305	—	—
IMC144	1,026	1,118	2,062	1,402	—	—
Iris	849	1,472	2,244	1,522	—	—
Legend	1,025	979	1,586	1,196	1,603	1,624
OAC Triumph	778	705	1,496	993	1,372	1,208
SV02406	1,383	1,705	2,890	1,992	—	—
Tobin[2]	631	883	1,205	906	—	—
Vanguard	913	955	1,803	1,223	1,663	—
Westar	1,127	1,141	1,539	1,269	1,670	1,571
LSD 5%	293	638	667	559	535	502

[1]1990-91 and 1989-91 are three-location averages. Long-term averages (13 location/year) for Global and Westar are 1557 and 1552 lbs/a, respectively; [2] Tobin is a *Brassica campestris* variety.

ICI Seeds Inc., Coon Rapids, Iowa. Seed availability is limited.

Hyola 41—Hybrid developed by Garst Seed Co., Winnipeg, and marketed in U.S. by ICI Seeds Inc., Coon Rapids, Iowa. Seed availability is limited.

Hyola 401—Hybrid developed by Garst Seed Co., Winnipeg, and marketed in U.S. by ICI Seeds, Inc., Coon Rapids, Iowa.

IMC 129—Special fatty acid profile. Developed by Intermountain Canola Co., Idaho Falls, Idaho. Contract only.

IMC 144—Special fatty acid profile. Developed by Intermountain Canola Co., Idaho Falls, Idaho. Contract only.

Iris—Distributed by Ameri-Can Pedigreed Seed Co., Raymond, Ohio.

Legend—Developed by Svalof AB, Sweden. Distributed by Interstate Seed Co., West Fargo, North Dakota.

Crambe is an erect an

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

Stallion—Tolerant of triazine herbicides (Sencor, Lexone, Atrazine, etc.). Product of Svalof AB, Sweden. Distributed by Agri-Tel Grain Ltd., Beausejour, Manitoba, Canada.

SVO2406—Developed by Svalof AB, Sweden. Distributed by Bonis and Co. Ltd., Lindsay, Ontario, Canada. Seed availability is limited.

Table 18. Characteristics of spring canola *(Brassica napus)* varieties, Crookston, Morris, and Roseau, 1991[1]

Variety	Oil 1991	Oil 1990[1]	Weight	Weight	Planting to 50% Bloom	Planting to Maturity	Lodging 1991	Lodging 1990[1]	Plant Height
	------ %[2] -----		lbs/bu	1,000s/lb	------ days ------		-- score[3] ---		inches
A114	34	36	53	144	58	101	2	2	40
Bingo	35	—	52	126	55	102	4	—	48
C86800	35	—	51	134	54	102	4	—	49
Celebra	37	37	52	132	50	100	3	4	43
Global	35	37	52	125	57	101	4	7	48
Hyola 40	36	37	52	125	43	92	3	4	34
Hyola 41	36	37	51	152	42	89	4	6	36
Hyola 401	36	—	53	118	47	96	2	—	38
IMC 129	37	—	53	1,21	48	95	3	—	36
IMC 144	35	—	53	126	49	96	5	—	38
Iris	36	—	51	121	56	103	2	—	49
Legend	35	37	52	129	46	93	4	6	37
OAC Triumph	34	35	52	145	53	103	4	6	41
SV02406	38	—	53	124	54	103	1	—	46
Tobin[4]	33	—	53	211	39	87	5	—	36
Vanguard	36	37	52	132	49	98	3	6	42
Westar	37	38	52	117	49	94	4	7	39
LSD 5%	1	—	1	19	3	4	2	—	5

[1]Average of Crookston, Morris and Roseau; [2]10% moisture basis; [3]1 = no lodging, 10 = severe lodging; [4]Tobin is avariety.

Tobin—*(Brassica campestris)* Originated by Agriculture Canada, Saskatoon. Licensed 1981. Production of certified seed is limited to Canada.

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

Westar—Originated by Agriculture Canada, Saskatoon. Licensed 1982. Production of certified seed is limited to Canada.

CRAMBE AND OILSEED RAPE

Crambe (*Crambe abyssinica*) and oilseed rape (*Brassica napus* or *B. campestris*) are crops grown for the production of high erucic acid industrial oil. This oil is used in the production of plastic films, waxes, lubricants, nylons, and in the steel industry. Both crambe and oilseed rape are members of the cruciferae (mustard) family, and are crops best grown under contract.

An erect annual, Crambe grows to about 35 inches (see photo on page 37). Most common varieties mature in about 90 days. Its numerous seeds have a low test weight because a large percentage of the seed is hull. Flowering is indeterminate, but early seeds stay on the plant until later seeds mature. Crambe is cold and drought tolerant.

Canadian plant breeders have developed oilseed rape varieties with oil containing over 40 percent erucic acid. These varieties are grown under a specific contract. Oilseed rape is occasionally grown under contract in Minnesota.

Crambe varieties were tested at Rosemount in 1991. Yields of cruciferae crops are generally lower at Rosemount than at more northerly locations. For further information about crambe and oilseed rape, contact Extension Agronomy, 411 Borlaug Hall, 1991 Buford Circle, University of Minnesota, St. Paul, MN 55108, or the Center for Alternative Plant and Animal Products, 340 Alderman Hall, Univ. of Minnesota, St. Paul, MN 55108.

Table 19. Performance of crambe varieties at Rosemount, MN 1991.

Variety	Vigor	Planting to 50% Bloom	Planting to Maturity	Test Weight	Seed Weight	Lodging	Plant Height	Oil	Seed Yield
	score[1]	------ days ----		lbs/bu	no/lb	score[2]	inches	%[3]	lbs/acre
Belenzian	8.9	47	85	25.4	0.60	2.8	37	31.5	875
Bel Ann	8.9	48	86	25.8	0.64	2.1	39	31.2	649
Meyer	8.5	47	85	24.7	0.56	2.4	35	30.9	785
Indy	9.1	47	86	26.0	0.60	1.6	36	32.6	1,067
Prophet	9.1	49	86	25.8	0.54	2.1	43	30.7	791
Canola check[4]	9.8	48	97	43.4	0.30	6.2	46	35.6	756
LSD 5%	NS	NS	1	3.1	0.06	2.1	3	1.4	223

[1]Score = 1 = least vigorous, 10 = most vigorous; [2]Score = 1=no lodging, 10=severe lodging; [3]10% moisture basis; [4]'Global' canola;

SOYBEAN

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

Tables 21 to 26 deal with varieties which have been developed by publicly supported institutions and are being considered for recommendation by the Minnesota Agricultural Experiment Station.

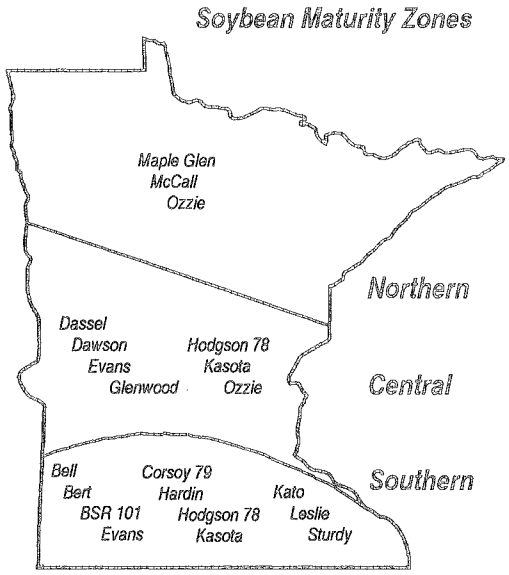
Tables 27 to 30 show performance characteristics of privately developed varieties along with several public varieties. Performance trials were conducted at various locations in the northern, central and southern zones (see map). Specific test locations for each zone are indicated in each table. Becker was the only irrigated location. Trials were planted between May 5 and May 25 unless otherwise indicated. Row spacings vary in some tables. The 1991 planting date at the Fairmont location was delayed to June 12 because of excessively wet field conditions.

There are several major factors to be considered in selecting varieties, including maturity, yield, row spacing, plant height and lodging, chlorsis response, protein and oil values, and phytophthora race, soybean cyst nemotode and brown stem rot resistances.

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. *Maturity had not been achieved at the Fairmont location in 1991 when the growing season was terminated by the killing frost on September 18. Full-season varieties tested at this location showed yield reductions due to this premature end of the growing season.* The accompanying map relates production zones to the recommended varieties evaluated in the 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 are 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 (least significant difference) figures listed 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 the table's 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). No variety response to row spacing tests were conducted in 1991 because of the need to use test plot space at the various stations for other priority studies. Tables 22 and 24 present data from previous tests. 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. They relate somewhat to ease of combining. Actual height and lodging scores are influenced by environmental 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—This score is a measure of how much leaf yellowing occurred in variety tests conducted each year on a high lime (high pH) soil near Lamberton. It indicates how well varieties perform relative to each other on such soils. These scores are annual ratings and can change from year to year due to environmental conditions.

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.(Table 20)

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 from greenhouse data on plants grown by scientists in the University of Minnesota Department of Plant Pathology, and from information supplied by the companies.

Soybean Cyst Nematode—SCN was first identified in Minnesota in 1978, and Cooperative Pest Survey Program data now shows it present in 26 counties. Areas infested and numbers of nematodes both appear to be increasing. When SCN numbers are high, significant yield losses can occur. Several SCN races are known to occur in Minnesota. Rotations to non-host crops and

Table 20. 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-b	■		■	■	■	■	■	■	■				■	■	■	■	■	■			■	■			
Rps1-c	■	■	■			■	■	■	■	■	■		■	■	■	■	■	■			■		■	■	
Rps1-k	■	■	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■			■		■	■	
Rps3	■	■	■	■	■			■	■		■		■	■	■	■	■	■			■	■	■		■
Rps4	■	■	■	■				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Rps6	■	■	■	■				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

planting resistant varieties assist in managing nematode populations.

First year results of a special performance test of public and private varieties resistant to SCN are provided in Table 29. These trials were conducted on infested sites near Hanska and New Richland, and on non-infested sites at Fairmont, Lamberton and Waseca. Soybean cyst nematode was present at moderate levels at the infested sites.

Additional detail on SCN and management of infested fields can be found in the Minnesota Extension Service publication, *The Soybean Cyst Nematode* (AG-FO-3935). 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 it can occur where soybeans are planted every other year. Resistant varieties, or longer rotations out of soybeans, assist in the management of this disease. Text descriptions of the public varieties provide information about their resistance to this fungus.

Protein and Oil—Protein and oil values were 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:

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

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

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

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:

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

Recommended Public Varieties

BSR 101—Southern zone. Similar in maturity to Corsoy 79. High yield potential, resistant 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 1989 by Illinois Agricultural Experiment Station. Seed sale regulated by U.S. Variety Protection Act.

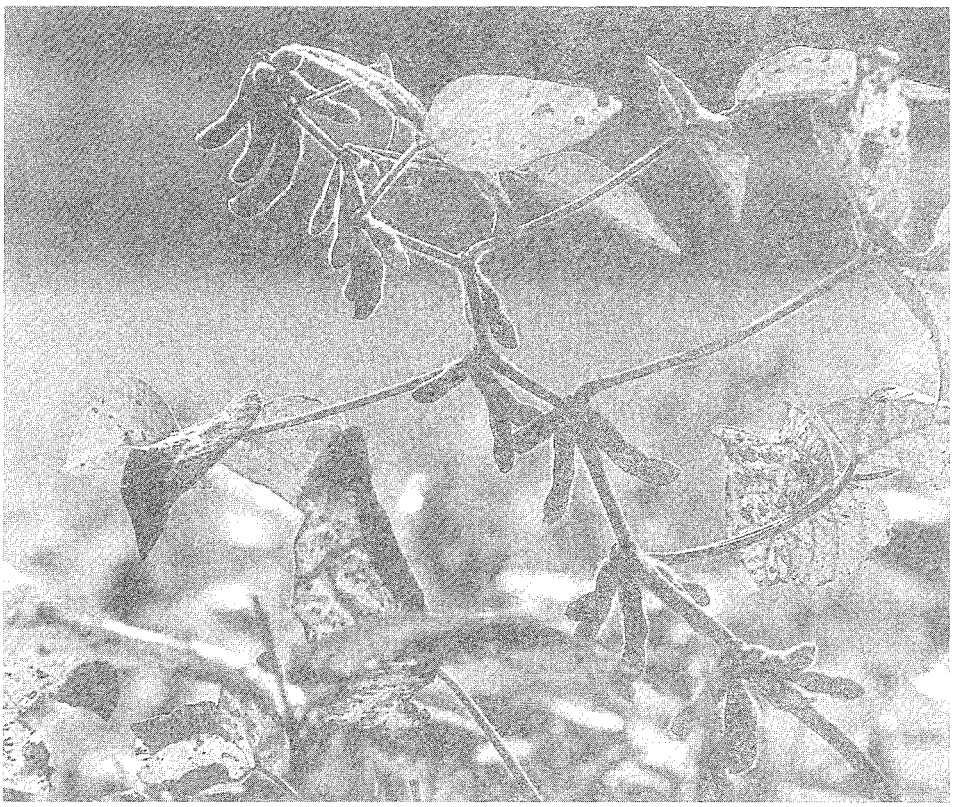
Bert—Southern zone. Maturity similar to Hardin. High yielding with taller than average plant height. *Rps1 gene for resistance to phytophthora*. Developed by Minnesota Agricultural Experiment Station. Released 1991. Seed sale regulated by U.S. Variety Protection Act.

Corsoy 79—Southern zone. Very good yield performance. *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 susceptible to the 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*. A good variety for late season plantings in the southern zone. Developed by Minnesota Agricultural Experiment Station. Released 1974. Seed sale regulated by U.S. Variety Protection Act.



Glenwood—Central zone. One to two days later than Evans. Good 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 79. 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.

Leslie—Southern zone. Matures about the same as Hardin. High yield potential. Good lodging resistance. *Rps1 gene for resistance to phytophthora*. Developed by Minnesota Agricultural Experiment Station. Released 1991. Seed sales 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.

Sturdy—Southern zone. Matures later than Hardin but earlier than Corsoy 79. High yield potential. Good lodging resistance and iron chlorosis resistance. *Rsp1 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 Hardin in maturity. Good tolerance to high lime soils. *Rps1 gene for resistance to phytophthora*. Lodging similar to Corsoy 79. Developed by Iowa Agricultural Experiment Station. Released 1984.

Table 21. Yields of publicly developed soybean varieties in northern zone, 1987-91.

Variety	Crookston	Grand Rapids	Moorhead[1]	Roseau
	bu/A			
McCall	25	30	31	38
Maple Arrow	22	—	24	—
Ozzie	28	—	33	—
Evans	28	—	34	—
Proto	—	—	31	—
Dawson	28	—	38	—
Dassel	—	—	32	—
Glenwood	—	—	35	—
Maple Donovan	29	—	33	—
Simpson	—	—	33	—
LSD 20%	2		2	

[1]1987, 89-91.

Table 22. Yields of publicly developed soybean varieties in 10 inch and 30 inch spacings, and three planting dates at Morris, 1986-87, 89-90.

Variety	Mid-May Planting		Late May Planting		Mid-June Planting	
	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 23. Yields of publicly developed soybean varieties in central zone, 1987-91.

Variety	Rosemount (10-inch)	Morris (10-inch)	Becker (30-inch)	Average
	bu/A			
McCall	37	29	—	33
Ozzie	40	33	48	40
Evans	39	38	48	42
Dawson	42	40	48	43
Dassel	42	37	49	43
Glenwood	39	40	49	43
Simpson	41	39	49	43
Hodgson 78	47	43	53	48
LSD 20%	2	2	2	1

Public Varieties Not Adequately Tested

Archer—Similar 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 1989 by Iowa Agricultural Experiment Station. Seed Sale regulated by U.S. Variety Protection Act.

Hardin 91—Slightly later in maturity than Hardin. Similar in other respects to Hardin except it has the *Rps1k gene for resistance to phytophthora*. Developed by Iowa Agricultural Experiment Station. Released 1991. Seed sale regulated by U.S. Variety Protection Act.

IA2008—Similar in maturity to Corsoy 79.

Table 24. 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	

High yield potential. *Rps1 gene for resistance to phytophthora*. Developed by Iowa Agricultural Experiment Station. Released 1991. 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. Matures slightly later than Evans. *Rps1 and Rps4 genes for resistance to phytophthora*. Developed by Agriculture Canada, Ottawa. Licensed 1986.

Sibley—Central and southern zones. Matures one day later than Hodgson 78. Higher yielding, 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.

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.

Special Purpose Public Varieties

Chico—Small-seeded variety for specialty markets. Matures slightly earlier than Clay. Seed weight is 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 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 25. Yields of publicly developed soybean varieties in southern zone, 1987-91.

Variety	Waseca and Lamberton		Fairmont	Waseca	Lamberton	Average
	Mid-May Planting	Mid-June Planting	Mid-May Planting 30-inch	Mid-May Planting 10-inch	Mid-May Planting 10-inch	Mid-May Planting
	bu/A					
McCall	—	32	—	—	—	—
Ozzie	38	41	39	37	40	39
Evans	41	41	40	40	43	41
Dawson	45	42	41	45	44	43
Glenwood	43	41	45	43	44	44
Dassel	46	42	42	48	45	45
Simpson	46	—	43	48	45	45
Kato	47	44[2]	45[1]	50	45	47
Hodgson 78	47	43	43	50	45	46
Sibley	48	44	43	48	49	47
Kasota	48	44[2]	46[1]	52	45	48
Hardin	52	46	44	52	51	49
Bert[1]	52	—	46	54	49	50
Leslie[1]	51	—	45	54	48	49
Weber 84	52	46	44	53	50	49
Sturdy	54	44[1]	48	56	52	52
BSR 101	49	42	44	53	45	47
Corsoy 79	52	42	44	54	51	50
LSD 20%	2	2	2	2	2	1

[1]1988-91 data; adjusted to 5 year average; [2]1989-91 data; adjusted to 5 year average.

Privately Developed Varieties

The private companies entering varieties in the 1991 Minnesota tests and the brand names were:

AgriPro, Route 2, Hwy 30 East, Ames, IA 50010 (AgriPro);
Asgrow Seed Company, P.O. Box 7570, Des Moines, IA 50322 (Asgrow);
Cargill Incorporated, P.O. Box 5602, Minneapolis, MN 55440 (Cargill);
Cenex/Land O'Lakes Seed, 2827 8th Avenue South, Fort Dodge, IA 50501 (C/LOL);
CIBA GEIGY Seed Division, P.O. Box 18300, Greensboro, NC 27419 (Funk's G Brand);
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);
Ehrich Seed Farms, RR 1, Elmore, MN 56027 (Ehrich);
Garst Seed Company, 615 Main St., Box 300, Coon Rapids, IA 50058 (Diamond);
Gold Country Seed, 3374 80th St., Plato, MN 55370 (GCS);
Great Lakes Hybrids, 9915 W.M.-21, Ovid, MI 48866 (GL);
Hy-Vigor Seeds, Inc., R.R. 1, Paullina, IA 51046 (Hy-Vigor);
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 (Golden Harvest);
Kaltenberg Seed Farms, Inc., 5506 Hwy. 19, P.O. Box 278, Waunakee, WI 53597 (Kaltenberg);
Kruger Seed Company, Box A, Hwy 20 East, Dike, IA 50624 (Kruger);
Latham Brothers Farm, Rt. 1, Box 12, Alexander, IA 50420 (Latham);
Latham Seed Company, Rt. 1, Box 12, Alexander, IA 50420 (Latham);
Midwest Oilseeds, Inc., 2225 Laredo Trail, Adel, IA 50003 (Midwest Oilseeds);
Mustang Brand Seed, Domestic Seed & Supply, Inc., Box 466, Madison, SD 57042 (Mustang);
Northrup King, 7500 Olson Memorial Highway, Golden Valley, MN 55427 (NK);
Pioneer Hi-Bred Int'l, Inc., 130 SE Willmar Ave., Willmar, MN 56201, (Pioneer);
Prairie Brand Seed, Inc., Rt. 1, Box 76, Story City, IA 50248 (Prairie Brand);
ProfiSeed, Inc., Route 2, Hampton, IA 50441 (Profiseed);
Ramy International, Ltd., 1329 North Riverfront, Mankato, MN 56001 (Ramy);
Renk Seed Company, 6800 Wilburn Rd., Sun Prairie, WI 53590 (Renk);
Rossbach Seed, Route 1, Box 70, Hanska, MN 56041 (Lakeside);
Sand Seed Service, Inc., P.O. Box 648, Marcus, IA 51035 (Sands);

Table 26. Characteristics of publicly developed soybean varieties, 1991.

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	8-24	—	1.5	30	S	33.1	19.3	2.5
Chico	8-28	—	2.0	34	Rps1	34.8	18.1	2.5
Maple Arrow	9-4	—	1.5	33	Rps6	35.0	18.4	3.5
Maple Donovan	9-5	—	1.5	31	Rps1+4	34.1	19.0	3.0
Ozzie	9-6	—	1.0	36	Rps1	35.3	18.2	2.5
Proto	9-6	—	2.0	30	S	38.6	16.2	2.5
Glenwood	9-6	—	1.8	35	Rps1	36.2	17.7	2.8
Dawson	9-7	—	2.3	36	Rps1	34.2	18.8	2.0
Evans	9-8	—	2.0	36	Rps1	34.7	18.7	2.5
Simpson	9-10	—	2.3	35	Rps1	35.3	18.3	3.2
Dassel	9-10	—	2.0	34	Rps6	35.0	18.4	2.5
Minnatto	9-18	—	3.0	37	Rps1	35.8	17.7	2.8
CENTRAL ZONE (MORRIS AND ROSEMOUNT)								
McCall	8-24	—	2.8	26	S	33.9	19.0	2.5
Chico	8-25	—	3.3	30	Rps1	35.1	18.3	2.5
Ozzie	8-29	—	1.5	35	Rps1	36.1	17.7	2.5
Maple Donovan	8-31	—	1.8	32	Rps1+4	35.2	18.2	3.0
Evans	9-1	—	3.0	40	Rps1	35.3	18.2	2.5
Glenwood	9-1	—	1.5	34	Rps1	36.1	17.7	2.8
Proto	9-1	—	2.5	29	S	39.6	15.3	2.5
Dawson	9-1	—	2.8	36	Rps1	35.1	18.1	2.0
Simpson	9-2	—	1.8	34	Rps1	35.0	18.3	3.2
Swift	9-2	—	3.3	44	S	34.6	18.5	1.8
Dassel	9-2	—	1.5	32	Rps6	36.3	17.6	2.5
Kato	9-8	—	1.8	42	Rps1	38.2	16.4	2.0
Hodgson 78	9-8	—	3.0	40	Rps1	35.7	18.1	2.5
Sibley	9-11	—	4.3	40	Rps1	36.8	17.3	3.3
Kasota	9-11	—	3.0	34	Rps1-c	37.3	16.4	2.8
Weber 84	9-11	—	4.0	46	Rps1	35.8	17.8	1.8
Hardin	9-12	—	3.8	46	Rps1	35.3	18.2	3.5
Sturdy	9-13	—	2.3	41	Rps1	35.6	18.0	2.5
Corsoy 79	9-14	—	3.8	48	Rps1-c	36.8	17.3	4.0
SOUTHERN ZONE (LAMBERTON AND WASECA)								
McCall	8-31	9-19	1.5	23	S	33.3	19.3	2.5
Ozzie	9-4	9-28	1.0	28	Rps1	35.9	17.8	2.5
Proto	9-4	—	1.8	26	S	39.6	15.3	2.5
Glenwood	9-6	10-1	1.5	29	Rps1	35.7	17.9	2.8
Evans	9-7	9-28	1.5	33	Rps1	34.1	19.0	2.5
Dawson	9-7	9-29	1.8	31	Rps1	33.9	19.0	2.0
Dassel	9-7	10-1	1.5	29	Rps6	35.0	18.4	2.5
Simpson	9-8	—	2.3	32	Rps1	35.3	18.1	3.3
Swift	9-10	—	2.5	41	S	33.6	19.2	1.8
Kato	9-13	10-4	1.5	40	Rps1	37.4	16.8	2.0
Hodgson 78	9-13	10-3	2.3	39	Rps1	34.7	18.5	2.5
Sibley	9-16	10-4	3.0	40	Rps1	36.6	17.5	3.3
BSR 101	9-16	10-7	2.0	42	Rps1	35.3	18.0	2.5
Archer	9-16	10-7	2.3	41	Rps1k+6	35.3	17.9	2.5
Kasota	9-17	10-3	2.3	39	Rps1-c	37.6	16.9	2.8
Bert	9-17	10-5	2.5	42	Rps1	34.8	17.7	3.2
Hardin	9-17	10-5	2.8	41	Rps1	35.8	17.8	3.5
Leslie	9-18	10-5	1.8	38	Rps1	34.8	17.6	3.5
Hardin 91	9-19	—	2.7	40	Rps1k	35.0	17.4	3.8
Weber 84	9-19	10-4	2.8	44	Rps1	34.8	18.4	1.8
Sturdy	9-20	10-6	2.0	39	Rps1	35.8	17.7	2.5
IA2008	9-21	—	2.8	41	Rps1	34.2	18.1	3.3
Corsoy 79	9-21	10-6	2.8	46	Rps1-c	36.0	17.7	4.0
Bell	9-21	—	2.8	38	S	37.7	16.7	2.8

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

Sansgaard Seed Farms, Inc., RR 1, Box 76, Story City, IA 50248 (Sansgaard);
Sigco Research, Box 289, Breckenridge, MN 56520 (Sigco);
Star Brand Seed, P.O. Box 648, Marcus, IA 51035 (Star);
Stine Seed Company, 2225 Laredo Trail, Adel, IA 50003 (Stine);
Terra International, Inc., Terra Centre, 600 Fourth St., Sioux City, IA 51101 (Terra);
Thompson Agronomics, Inc., Route 1, Box 34, Leland, IA 50453 (Thompson);
Thompson Seeds, Inc., Route 1, Box 34, Leland, IA 50453 (Thompson);
VDH-Interstate dba Payco Seeds, P.O. Box 70, Dassel, MN 55325 (Payco);
Willette Seed Farm, Inc., R.R. 1, Delavan, MN 56023 (Willette Seed Farm);
Wilson Hybrids, Inc., P.O. Box 391, Harlan, IA 51537 (Wilson);
Ziller Seed Company, Route 1, Box 122, Bird Island, MN 55310 (Ziller).

Table 27. Yields and characteristics of public and private soybean varieties, northern zone, 1991 (Crookston, Moorhead, Shelly).

Brand or Originator	Variety	Matures	Yield 1989-1991	Yield 1990-1991	Yield 1991	Phytophthora gene[3]	Chlorosis score[2]	Protein 1989-1991	Protein 1990-1991	Protein 1991	Oil 1989-1991	Oil 1990-1991	Oil 1991
		date	bu/A					%[4]			%[4]		
Agric. Canada	Maple Ridge	8-22	21	24	26	S	2.3	34.8	34.4	33.3	18.3	18.2	19.3
Agric. Canada	Maple Belle	8-24	22	26	30	Rps1	2.3	35.2	34.6	33.0	17.9	18.1	19.4
Minn. A.E.S.	McCall	8-25	25	30	37	S	2.3	34.2	33.6	32.2	18.6	18.5	19.8
GCS	Hunter	8-29	—	—	39	S	2.3	—	—	34.0	—	—	18.5
Sigco	44	8-30	—	—	42	S	2.8	—	—	34.0	—	—	18.6
Jacques	J-033	9-2	—	34	44	S	2.3	—	34.8	34.5	—	17.8	18.2
Sigco	34	9-2	—	—	38	S	2.5	—	—	33.5	—	—	18.8
Dairyland	DSR-045	9-3	—	33	40	S	2.5	—	34.4	33.5	—	18.0	19.0
Minn. A.E.S.	Ozzie	9-4	27	33	42	Rps1	2.0	36.1	35.7	35.4	17.1	17.2	17.6
Stine	EXO300	9-4	—	—	39	S	2.5	—	—	33.5	—	—	18.9
Minn. A.E.S.	Glenwood	9-5	—	32	41	Rps1	2.3	—	35.4	35.2	—	17.3	17.8
Dahlgren	KG41	9-5	24	29	35	S	3.3	35.6	34.8	33.9	17.5	18.0	18.8
Dahlgren	KG60	9-6	—	—	42	Rps1-c	3.5	—	—	33.8	—	—	18.8
Agric. Canada	Maple Glen	9-6	25	29	35	S	4.0	35.4	35.3	35.7	17.7	17.5	17.4
Agric. Canada	Maple Arrow	9-6	19	23	30	Rps1	2.3	35.7	34.6	33.8	17.3	17.8	18.5
Dahlgren	KG40	9-7	23	26	32	S	3.3	35.3	34.8	34.1	17.7	17.8	18.6
Univ. of Guelph	OAC Libra	9-8	26	30	38	S	2.5	34.0	33.8	33.2	18.8	18.5	19.2
NK	S00-88	9-8	23	28	35	Rps1-c	2.0	35.0	33.8	32.9	17.7	18.4	19.2
Pioneer	9061	9-9	28	34	41	Rps1	3.0	34.2	33.9	33.0	18.6	18.4	19.4
Agric. Canada	Maple Donovan	9-9	28	34	40	Rps1+4	3.0	35.1	34.7	34.0	17.8	17.8	18.5
Minn. A.E.S.	Dawson	9-9	28	33	39	Rps1	2.5	34.7	34.6	33.8	18.1	17.9	18.6
Minn. A.E.S.	Evans	9-9	25	32	36	Rps1	2.0	35.0	34.7	33.7	18.0	18.0	18.9
Univ. of Guelph	Bicentennial	9-9	21	25	31	Rps6	3.8	36.4	35.6	34.6	16.9	17.4	18.2
Univ. of Guelph	OAC Scorpio	9-9	24	30	31	S	2.5	34.5	34.4	34.2	18.3	18.0	18.5
Golden Harvest	H-1075	9-11	—	33	40	S	3.5	—	35.3	34.9	—	17.4	17.9
Dairyland	DSR-070	9-11	27	32	39	S	2.8	35.7	35.2	34.2	17.4	17.6	18.6
AgriPro	AP 0919	9-14	—	34	42	S	2.5	—	35.3	34.7	—	17.5	18.2
Cargill	097	9-14	—	—	40	Rps1	2.0	—	—	35.4	—	—	17.7
GCS	Roscoe	9-14	—	—	37	Rps1	3.0	—	—	36.3	—	—	17.1
Univ. of Guelph	OAC Pisces	9-15	26	30	36	S	3.0	35.3	35.3	34.9	17.9	17.6	18.2
Stine	EX 0380	9-17	—	—	43	S	3.0	—	—	35.2	—	—	17.8
Hy-Vigor	EX HV18	9-18	—	—	30	S	3.5	—	—	36.5	—	—	17.1
LSD 20%			2	2	2								

[1]Blend (information furnished by originator); [2]1=excellent, 5=very poor; [3]Specific genes noted; S=susceptible; [4]13% moisture.

Table 28. Yields and characteristics of public and private soybean varieties, central zone, 1991 (Becker, Morris, Rosemount).

Brand or Originator	Variety	Matures	Yield 1989-1991	Yield 1990-1991	Yield 1991	Phytophthora gene[3]	Chlorosis score[2]	Protein 1989-1991	Protein 1990-1991	Protein 1991	Oil 1989-1991	Oil 1990-1991	Oil 1991
		date	bu/A					%[4]			%[4]		
Minn. A.E.S.	Ozzie	9-3	40	40	42	Rps1	2.0	36.4	36.4	35.8	17.1	16.8	17.2
Jacques	J-083	9-4	—	—	53	Rps1	2.3	—	—	34.3	—	—	18.2
Minn. A.E.S.	Glenwood	9-4	43	44	52	Rps1	2.5	36.0	35.8	35.0	17.3	17.0	17.6
Minn. A.E.S.	Evans	9-4	42	43	50	Rps1	2.0	35.5	35.3	34.3	17.8	17.5	18.2

Table 28 continued. Yields and characteristics of public and private soybean varieties, central zone, 1991 (Becker, Morris, Rosemount).

Brand or Originator	Variety	Matures	Yield			Phyto-phthora	Chlorosis	Protein			Oil		
			1989-1991	1990-1991	1991			1989-1991	1990-1991	1991	1989-1991	1990-1991	1991
		date	bu/A			gene[3]	score[2]	%[4]			%[4]		
GCS	Baker	9-4	—	43	49	S	3.0	—	36.5	35.5	—	16.7	17.5
Minn. A.E.S.	Dawson	9-4	42	41	48	Rps1	2.5	34.8	34.6	34.3	18.1	17.8	18.0
Renk	RSO792	9-5	—	—	54	Rps1	3.5	—	—	36.9	—	—	16.4
Great Lakes Hybrid	GLO814	9-5	—	—	53	Rps1	2.5	—	—	34.7	—	—	17.9
Asgrow	A0949	9-5	46	46	51	Rps1-c	2.3	35.9	35.8	34.7	17.4	17.2	18.1
Golden Harvest	H-1075	9-5	—	—	47	S	3.5	—	—	35.0	—	—	17.9
Univ. of Guelph	OAC Musca	9-5	—	—	43	S	2.8	—	—	33.1	—	—	18.8
DeKalb	CX076	9-5	—	—	43	S	4.0	—	—	35.0	—	—	17.9
DeKalb	CX096	9-6	45	47	54	Rps1	2.5	36.5	36.6	35.5	17.1	16.7	17.5
Payco	PS0010	9-6	—	—	54	Rps1	2.3	—	—	36.1	—	—	17.0
Sigco	80	9-6	46	47	53	Rps1	2.3	36.6	36.7	35.9	17.0	16.6	17.1
Mustang	M-1000	9-6	—	—	51	Rps1	2.5	—	—	36.0	—	—	17.2
Pioneer	9091	9-6	46	47	51	S	2.0	35.9	35.9	35.4	17.4	17.0	17.3
Minn. A.E.S.	Simpson	9-6	42	43	49	Rps1	2.3	35.4	35.4	34.8	17.8	17.4	17.9
Minn. A.E.S.	Dassel	9-6	44	44	49	Rps6	2.5	36.3	36.1	35.2	17.0	16.9	17.5
Univ. of Guelph	OAC Eclipse	9-6	—	—	47	S	3.3	—	—	34.8	—	—	17.9
NKB	117	9-7	47	47	55	S	3.0	35.6	35.6	34.7	17.7	17.4	18.1
NK	S07-80	9-7	47	47	56	S	3.0	34.9	34.9	34.2	18.3	17.8	18.4
Dahlgren	KG62	9-7	—	48	53	S	3.5	—	35.3	34.8	—	17.4	17.8
Sigco	HP71	9-7	—	45	51	Rps1	3.3	—	37.5	36.4	—	16.1	16.8
Payco	PS9109	9-7	—	—	50	Rsp1	2.5	—	—	34.1	—	—	18.3
Ziller	BT 1790	9-7	48	45	49	Rps1-c	3.3	35.2	35.3	34.7	18.0	17.4	17.8
Ziller	EXP 962	9-8	—	—	61	S	3.3	—	—	35.5	—	—	17.4
Dairyland	DSR-088[1]	9-8	—	—	55	S	2.5	—	—	35.5	—	—	17.5
Diamond	SC 134	9-8	—	48	54	S	2.8	—	35.5	34.5	—	17.4	18.2
Thompson	T-3100	9-8	47	47	54	S	4.3	36.0	36.2	35.5	17.5	16.9	17.2
Ramy	Roysoy 900	9-9	—	—	57	S	3.3	—	—	35.2	—	—	17.6
Pioneer	9111	9-9	49	48	55	S	2.5	36.3	36.4	35.4	17.1	16.7	17.4
Ziller	BT 1422	9-9	47	48	55	S	2.0	35.6	35.9	35.0	17.8	17.1	17.8
Univ. of Guelph	OAC Aires	9-9	—	—	49	S	2.5	—	—	33.6	—	—	18.5
DeKalb	CX 117	9-10	50	50	57	S	3.8	35.2	35.2	34.8	17.9	17.5	17.8
Mustang	M-1050	9-10	—	—	57	Rps1	4.0	—	—	36.3	—	—	17.0
NK	X90-12	9-10	—	50	57	S	2.5	—	35.1	34.4	—	17.6	18.0
GCS	Courtland	9-10	49	49	56	S	2.8	36.6	36.8	35.9	17.1	16.6	17.2
Star	EXP 911	9-10	—	—	56	Rps1	4.3	—	—	35.5	—	—	17.3
Stine	1220	9-10	—	—	56	S	2.3	—	—	34.9	—	—	17.6
Thompson	EX 807	9-10	—	—	55	Rps1	3.5	—	—	37.2	—	—	16.1
Univ. of Guelph	OAC Dorado	9-10	—	—	53	S	2.3	—	—	34.4	—	—	18.2
Dairyland	DSR-135	9-10	46	46	52	M[3]	3.5	36.0	36.0	35.5	17.5	17.1	17.4
Jacques	J-145	9-11	—	—	59	Rps1	3.3	—	—	36.6	—	—	16.7
Great Lakes Hybrid	GL1315	9-11	—	—	58	S	2.3	—	—	35.0	—	—	17.7
Thompson	EX 746	9-11	—	—	58	Rps1	3.0	—	—	35.7	—	—	17.5
Dairyland	DSR-130B[1]	9-11	—	—	57	M[3]	3.0	—	—	34.9	—	—	17.9
Pioneer	9131	9-11	—	—	57	S	2.3	—	—	34.7	—	—	18.1
Kaltenberg	KB151	9-11	—	—	56	S	2.3	—	—	34.8	—	—	17.8
Agripro	AP1776	9-11	52	52	56	Rps1	2.5	33.8	33.8	33.0	19.0	18.5	19.0
Asgrow	A1662	9-11	—	—	55	Rps1-k	2.5	—	—	37.2	—	—	16.3
Minn. A.E.S.	Kato	9-11	50	49	55	Rps1	2.0	38.6	38.7	38.2	15.5	15.3	15.8
GCS	Crete	9-11	—	—	53	Rps1-c	3.8	—	—	36.0	—	—	17.1
Minn. A.E.S.	Hodgson 78	9-11	47	47	52	Rps1	2.3	35.1	35.1	34.3	18.1	17.6	18.2
Star	EXP 9013	9-12	—	—	59	S	2.8	—	—	35.0	—	—	17.8
AgriPro	AP1347	9-12	—	—	59	S	3.0	—	—	34.1	—	—	18.3
DeKalb	CX187	9-12	49	50	58	S	3.0	35.2	35.2	34.8	17.9	17.5	17.8
Cargill	155	9-12	—	50	57	Rps1-c	2.3	—	35.5	35.5	—	17.4	17.4
Minn. A.E.S.	Kasota	9-12	—	47	54	Rps1-c	2.8	—	37.8	37.8	—	15.9	15.9
AgriPro	AP1890	9-13	—	—	64	Rps1	3.3	—	—	33.9	—	—	18.4
Thompson	EX905	9-13	—	—	61	S	2.5	—	—	35.4	—	—	17.4
Dairyland	DSR-170	9-13	—	—	59	S	3.5	—	—	34.5	—	—	18.2
Hy-Vigor	EX-HV-R09	9-13	—	—	58	S	2.3	—	—	34.3	—	—	18.0
Payco	PS9115	9-13	—	—	57	Rps1-c	2.8	—	—	34.3	—	—	18.2
Minn. A.E.S.	Sibley	9-13	46	44	51	Rps1	3.3	36.2	36.4	35.7	17.3	16.7	17.2
Funks G-Brand	G-3197	9-14	52	52	62	S	2.8	35.2	35.3	34.9	17.9	17.4	17.7

Table 28 continued. Yields and characteristics of public and private soybean varieties, central zone, 1991 (Becker, Morris, Rosemount).

Brand or Originator	Variety	Matures	Yield 1989-1991	Yield 1990-1991	Yield 1991	Phytophthora gene[3]	Chlorosis score[2]	Protein 1989-1991	Protein 1990-1991	Protein 1991	Oil 1989-1991	Oil 1990-1991	Oil 1991
		date	bu/A					%[4]			%[4]		
Thompson	Ex3177[1]	9-14	—	—	61	S	2.8	—	—	34.9	—	—	17.7
Thompson	T-3187[1]	9-14	—	—	61	S	3.5	—	—	35.7	—	—	17.3
Kaltenberg	KB171	9-14	—	—	59	S	3.8	—	—	34.7	—	—	17.9
Minn. A.E.S.	Leslie	9-14	—	—	59	Rps1	3.8	—	—	35.5	—	—	17.5
Golden Harvest	H-1150	9-14	—	49	57	S	3.0	—	36.0	35.2	—	17.0	17.6
Diamond	Ex11601	9-14	—	—	56	S	3.0	—	—	37.4	—	—	16.2
Minn. A.E.S.	Bert	9-14	—	—	60	Rps1	3.0	—	—	33.7	—	—	18.6
Funks G-Brand	G-3185	9-14	48	48	53	S	2.0	35.6	35.5	35.5	17.6	17.4	17.3
Sansgaard	S1924	9-15	—	—	57	S	2.5	—	—	35.4	—	—	17.5
Stine	1070	9-15	50	50	57	S	3.8	36.3	36.3	35.8	17.1	16.9	17.3
Thompson	Ex933	9-15	—	—	57	S	2.8	—	—	33.8	—	—	18.3
G.C.S.	Russell	9-15	—	—	55	S	2.3	—	—	35.4	—	—	17.5
Kaltenberg	KB180	9-15	—	—	60	S	2.8	—	—	36.7	—	—	16.7
Stine	1255[1]	9-16	—	—	57	S	3.0	—	—	35.7	—	—	17.5
Dahlgren	D3151	9-16	—	—	56	S	2.8	—	—	36.4	—	—	16.8
Sand	SOI 116	9-17	48	47	51	S	2.8	36.8	36.9	36.7	16.7	16.3	16.5
LSD 20%			2	2	3								

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

Table 29. 1991 yields and characteristics of public and private soybean varieties from tests on soybean cyst nematode infested (New Richland and Hanska) and non-infested (Fairmont, Lamberton and Waseca) sites.

Brand / Originator	Variety	Infested Maturity	Infested Yield	Non-Infested Maturity	Non-Infested Yield	Phytophthora gene[2]	Chlorosis score[3]	SCN race(s)[4]
Illinois A.E.S.	Bell	9-21	37	9-23	49	S	2.8	R3, 14
Minn. A.E.S.	Sturdy	9-23	32	9-21	56	Rps1	2.8	S
Thompson	Ex 1171	9-24	29	9-22	50	S	2.8	R3
Latham	550 CN	9-24	28	9-25	47	S	3.3	R
Thompson	T-3198[1]	9-25	32	9-22	56	S	3.3	M3, 14
Stine	2830	9-25	32	9-26	46	S	3.3	R3, 14
Stine	1292[1]	9-25	30	9-21	54	S	3.8	M3, 14
Stine	2222	9-26	30	9-24	51	S	3.3	R3, 14
Thompson	T-30CN[1]	9-26	30	9-26	53	S	2.5	M3, 14
Thompson	Ex 1236	9-27	31	9-29	38	S	3.0	R3
LSD 20%			4		3			

[1]Blend (information supplied by originator); [2]Specific genes noted, S = susceptible; [3]1 = excellent, 5 = poor, see text for additional explanation; [4]R = resistant, S = susceptible, M = mixture of resistance and susceptible specific races noted.Information in column supplied by originator of variety.

Table 30. Yields and characteristics of public and private soybean varieties, southern zone, 1991 (Fairmont, Lamberton, Waseca).

Brand or Originator	Variety	Matures	Yield 1989-1991	Yield 1990-1991	Yield 1991	Phytophthora gene[3]	Chlorosis score[2]	Protein 1989-1991	Protein 1990-1991	Protein 1991	Oil 1989-1991	Oil 1990-1991	Oil 1991
		date	bu/A					%[4]			%[4]		
Dairyland	DSR-173	9-13	--	--	56	S	3.3	--	--	36.6	--	--	16.3
Minn. A.E.S.	Kato	9-14	49	52	50	Rps1	2.0	37.8	38.2	38.8	16.0	15.5	15.1
Terra	Flag	9-15	53	55	55	S	3.0	35.8	36.2	36.5	17.5	16.9	16.6
Pioneer	9171	9-15	--	56	52	S	3.3	--	34.1	34.3	--	18.0	18.0

Table 30 (continued). Yields and characteristics of public and private soybean varieties, southern zone, 1991 (Fairmont, Lamberton, Waseca).

Brand or Originator	Variety	Matures	Yield			Phyto-	Chlorosis	Protein			Oil		
			1989-1991	1990-1991	1991	phthora gene[3]	score[2]	1989-1991	1990-1991	1991	1989-1991	1990-1991	1991
		date	bu/A					%[4]			%[4]		
Minn. A.E.S.	Hodgson 78	9-15	50	52	51	Rps1	2.3	34.9	35.2	35.9	18.0	17.5	17.0
Minn. A.E.S.	Kasota	9-15	--	52	49	Rps1-c	2.8	--	37.7	37.5	--	16.1	16.3
Latham	EX 170	9-16	--	--	55	S	2.5	--	--	36.5	--	--	16.8
Funks G-Brand	G-3185	9-16	--	55	52	S	2.0	--	35.6	35.8	--	17.1	17.0
Golden Harvest	H-1150	9-16	--	55	51	S	3.0	--	36.0	36.4	--	17.1	16.8
NK	S17-18	9-16	50	52	49	Rps1	3.0	35.1	35.8	35.5	18.0	17.1	17.3
Jacques	J-181[1]	9-17	58	60	56	S	2.8	34.4	34.9	34.9	18.4	17.6	17.6
Sands	SOI 117	9-17	57	61	56	S	3.5	34.1	34.5	34.5	18.6	17.8	17.8
DeKalb	CX 187	9-17	--	--	55	S	3.3	--	--	35.4	--	--	17.2
NK	S20-20	9-17	--	58	54	Rps1-c	2.5	--	35.8	35.8	--	17.0	17.0
Terra	Runner III	9-17	54	58	54	S	2.5	35.3	36.0	36.2	17.9	17.0	16.8
Mustang	M-1150	9-17	55	57	53	S	2.8	35.0	35.5	34.9	18.0	17.2	17.6
Pioneer	9162	9-17	--	58	53	S	2.5	--	35.0	35.2	--	17.7	17.6
Profiseed	2198	9-17	53	57	53	S	2.8	34.9	35.3	35.2	18.1	17.3	17.3
Star	Exp 8412	9-18	--	--	60	Rps1	3.0	--	--	36.4	--	--	16.7
Prairie Brand	Exp 176	9-18	--	--	56	S	3.3	--	--	34.5	--	--	18.0
Latham	200B[1]	9-18	56	59	55	S	2.5	35.1	35.4	35.3	17.8	17.3	17.3
Payco	PS 8818	9-18	--	--	55	S	2.8	--	--	35.6	--	--	17.4
Golden Harvest	X196	9-18	--	--	53	S	3.5	--	--	36.2	--	--	16.6
Ramy	Roysoy 1500	9-18	--	--	53	S	3.0	--	--	35.3	--	--	17.4
Yield King	K-2030	9-18	--	59	52	Rps1	3.5	--	35.9	36.5	--	17.0	16.7
Funks G-Brand	G-3197	9-18	54	58	52	S	2.8	35.2	35.8	35.8	17.9	17.1	17.1
GCS	Wilmont	9-18	--	59	52	Rps1	2.8	--	35.3	35.0	--	17.5	17.6
Sigco	94	9-18	54	57	52	S	2.8	36.5	36.9	37.3	16.9	16.4	16.1
Mustang	M-1140	9-18	--	56	51	S	4.3	--	36.8	36.6	--	16.6	16.7
Pioneer	9161	9-18	53	56	49	S	3.0	35.2	35.6	35.8	17.8	17.2	17.0
Asgrow	A1929	9-19	58	61	58	Rps1-k	2.5	34.9	35.4	35.9	18.0	17.3	16.9
C/LOL	Exp 2184	9-19	--	--	56	S	3.3	--	--	36.1	--	--	16.9
Iowa A.E.S.	Hardin	9-19	55	58	55	Rps1	3.0	35.6	36.1	36.1	17.6	16.9	16.9
LathamEx	240	9-19	--	--	55	S	3.5	--	--	35.7	--	--	17.1
Profiseed	1850	9-19	--	58	55	S	2.8	--	36.4	36.7	--	16.7	16.4
Hy-Vigor	EX 2029	9-19	--	59	54	Rps1	2.5	--	35.7	36.2	--	17.1	16.8
AgriPro	AP 2040	9-19	--	56	52	S	2.5	--	36.1	36.6	--	16.9	16.6
Dairyland	DSR-206	9-19	55	57	51	S	2.8	35.7	36.0	36.2	17.6	17.1	17.0
GCS	Prosper	9-19	53	55	51	Rps1	3.3	36.5	36.8	36.5	17.1	16.6	16.9
Minn. A.E.S.	Sibley	9-19	53	56	51	Rps1	3.3	35.5	35.8	36.7	17.7	17.1	16.6
Payco	PS 8919	9-19	--	--	51	S	3.5	--	--	36.7	--	--	16.7
Renk	RS 1592	9-19	--	--	47	Rps1	2.8	--	--	36.1	--	--	17.1
Kruger	K1818	9-20	--	63	61	S	3.0	--	35.0	35.3	--	17.6	17.4
Latham	Ex 410	9-20	--	--	57	S	3.5	--	--	35.8	--	--	17.0
Asgrow	A2234	9-20	55	57	56	Rps1-k	2.3	35.8	35.9	36.6	17.5	17.1	16.6
GCS	Dundee	9-20	--	--	56	Rps1-k	3.3	--	--	36.8	--	--	16.5
Latham	250	9-20	--	58	56	S	3.3	--	36.5	36.8	--	16.6	16.3
Prairie Brand	PB 182	9-20	--	--	56	S	3.0	--	--	36.3	--	--	16.8
Ziller	Exp 952	9-20	--	--	56	S	3.8	--	--	36.4	--	--	16.7
GCS	Russell	9-20	--	58	55	S	2.3	--	36.5	36.5	--	16.8	16.9
Ramy	Preferred II	9-20	--	--	55	Rps1-c	3.5	--	--	37.5	--	--	16.0
Stine	1255[1]	9-20	--	--	54	S	3.0	--	--	37.2	--	--	16.2
Iowa A.E.S.	Weber 84	9-20	52	55	53	Rps1	2.3	35.2	35.6	36.0	17.9	17.3	17.1
NK	S19-90	9-20	54	57	53	Rps1-c	2.3	35.4	35.9	36.1	17.7	16.9	16.8
Thompson	Ex 3178[1]	9-20	--	--	53	S	2.8	--	--	35.9	--	--	16.9
Ziller	Exp 803	9-20	--	--	53	S	3.0	--	--	35.3	--	--	17.4
Iowa A.E.S.	BSR 101	9-20	56	57	52	Rps1	2.3	34.6	34.9	35.3	18.2	17.6	17.3
Minn. A.E.S.	Leslie	9-20	--	--	52	Rps1	4.0	--	--	36.4	--	--	16.8
Thompson	EX 757	9-20	--	59	52	S	2.5	--	36.6	36.9	--	16.6	16.4
Minn. A.E.S.	Bert	9-20	--	--	51	Rps1	3.5	--	--	35.0	--	--	17.5
Iowa A.E.S.	Archer	9-20	--	--	50	Rps1-k + 6	2.0	--	--	35.6	--	--	17.2
Thompson	Ex 901	9-20	--	--	50	S	3.8	--	--	36.7	--	--	16.4
Ramy	Roysoy 2025	9-20	--	--	49	S	3.5	--	--	35.5	--	--	17.3
Profiseed	2350	9-21	--	--	61	S	2.5	--	--	37.2	--	--	16.1
Stine	1090	9-21	--	--	60	S	3.8	--	--	35.4	--	--	17.3
Minn. A.E.S.	Sturdy	9-21	55	58	56	Rps1	2.8	35.8	36.3	37.2	17.4	16.8	16.2

Table 30 (continued). Yields and characteristics of public and private soybean varieties, southern zone, 1991 (Fairmont, Lamberton, Waseca).

Brand or Originator	Variety	Matures	Yield			Phyto-	Chlorosis	Protein			Oil		
			1989-1991	1990-1991	1991	phthora		1989-1991	1990-1991	1991	1989-1991	1990-1991	1991
		date	bu/A			gene[3]	score[2]	%[4]			%[4]		
AgriPro	AP 1989	9-21	57	58	54	Rps1-c	3.5	33.3	33.5	34.0	19.2	18.6	18.5
Yield King	D-233	9-21	--	--	54	S	3.0	--	--	36.6	--	--	16.6
Ehrich	E-213[1]	9-21	--	--	54	S	3.3	--	--	35.5	--	--	17.3
Sigco	96	9-21	--	--	54	S	2.8	--	--	35.5	--	--	17.2
Stine	1292	9-21	--	--	54	S	3.8	--	--	36.7	--	--	16.5
Ziller	BT 2585	9-21	55	58	54	S	2.8	36.0	36.5	36.8	17.3	16.6	16.4
Lakeside	Lakeside 109[1]	9-21	--	58	53	Rps1	2.8	--	36.5	36.7	--	16.7	16.5
Willette Seed	Prescott 110[1]	9-21	--	58	52	Rps1	2.0	--	35.8	36.3	--	17.1	16.7
Cargill	207	9-21	--	57	51	Rps1-c	3.8	--	35.8	36.0	--	17.2	17.1
Pioneer	9231	9-21	--	--	51	Rps1-k	2.3	--	--	37.4	--	--	16.1
Illinois A.E.S.	Bell	9-21	--	52	49	S	2.8	--	37.8	38.3	--	15.8	15.5
Midwest Oilseeds	2220	9-22	--	62	57	Rps1	3.5	--	35.6	35.9	--	17.2	17.0
Thompson	T-3198[1]	9-22	--	--	56	S	3.3	--	--	36.3	--	--	16.8
Diamond	D200	9-22	55	59	54	S	3.3	35.7	36.0	36.0	17.6	17.1	17.3
Renk	RS 1992	9-22	--	--	54	Rps1-c	2.8	--	--	36.3	--	--	16.8
Ramy	Roysoy 2100	9-22	--	--	53	Rps1-c	3.3	--	--	37.6	--	--	15.9
Sansgaard	Exp 206	9-22	--	--	52	Rps1	3.3	--	--	36.3	--	--	16.9
Star	Exp 9019	9-22	--	--	52	Rps1-c	3.3	--	--	36.5	--	--	16.6
Jacques	J-245	9-22	54	55	51	S	3.0	35.8	36.2	35.8	17.5	16.8	17.1
Wilson	1990[1]	9-22	--	--	51	S	2.3	--	--	36.8	--	--	16.6
Thompson	Ex 1171	9-22	--	--	50	S	2.8	--	--	34.9	--	--	17.5
Prairie Brand	PB 225	9-23	--	66	62	S	3.0	--	36.4	36.5	--	16.8	16.8
Terra	Exp 205	9-23	--	--	58	S	2.5	--	--	36.5	--	--	16.6
Cargill	237	9-23	--	--	57	Rps1	2.5	--	--	37.4	--	--	16.0
Illinois A.E.S.	Corsoy 79	9-23	55	59	57	Rps1-c	3.5	35.6	36.1	35.9	17.6	16.9	17.0
Great Lakes	GL 1803	9-23	--	--	54	S	2.5	--	--	36.7	--	--	16.4
Thompson	T-3197[1]	9-23	--	--	54	S	3.8	--	--	37.5	--	--	16.3
Thompson	T-3190	9-23	60	61	52	S	3.0	36.0	36.2	36.2	17.4	16.9	16.9
Payco	PS 9023	9-24	--	--	62	S	3.5	--	--	36.3	--	--	16.7
Sands	SOI 214	9-24	--	65	60	S	4.3	--	36.1	36.1	--	16.9	16.9
Ehrich	E-298	9-24	--	63	59	S	3.0	--	36.4	36.4	--	16.8	16.7
Sansgaard	S 2062	9-24	59	62	58	S	3.3	36.2	36.5	36.9	17.2	16.7	16.4
Thompson	T-30P[1]	9-24	--	--	58	S	2.5	--	--	36.1	--	--	16.9
Dahlgren	D3223	9-24	--	62	56	S	3.5	--	36.2	36.3	--	16.8	16.7
Kaltenberg	KB 220	9-24	--	63	56	S	3.5	--	36.3	36.6	--	16.7	16.5
Sands	SOI 296	9-24	59	61	55	S	3.3	35.7	36.0	36.4	17.5	17.0	16.7
Asgrow	A2543	9-24	54	57	52	Rps1-k	2.8	37.2	37.0	36.7	16.0	15.9	15.6
Stine	2222	9-24	--	--	51	S	3.3	--	--	37.9	--	--	15.9
Mustang	M-1200	9-25	--	65	62	S	3.5	--	35.9	35.8	--	17.2	17.2
Yield King	D-212[1]	9-25	--	--	61	S	2.5	--	--	35.9	--	--	16.8
Kruger	K2121	9-25	--	64	60	S	3.0	--	36.0	35.8	--	16.8	17.0
Sansgaard	S2120	9-25	--	--	58	S	3.3	--	--	36.8	--	--	16.4
Kruger	K2525	9-25	--	63	57	S	3.5	--	35.8	35.9	--	17.2	17.1
Kaltenberg	KB211	9-25	--	--	56	S	3.3	--	--	36.8	--	--	16.7
Latham	440	9-25	--	59	56	S	3.3	--	34.8	35.1	--	17.7	17.4
AgriPro	AP 2535	9-25	--	--	55	S	3.0	--	--	37.0	--	--	16.4
Dairyland	DSR-217	9-25	--	--	55	S	3.5	--	--	34.8	--	--	17.7
DeKalb	CX210	9-25	--	58	54	S	3.0	--	34.7	34.8	--	17.8	17.7
Iowa A.E.S.	Hardin 91	9-25	--	--	54	Rps1-k	2.3	--	--	36.3	--	--	16.7
Sansgaard	S 2030	9-25	--	--	54	S	3.0	--	--	37.1	--	--	16.4
Wilson	Exp 9101[1]	9-25	--	--	54	S	2.5	--	--	36.4	--	--	17.0
Sands	SOI 216	9-25	--	--	51	Rps1-c	4.5	--	--	37.3	--	--	16.1
Star	Exp 9124	9-25	--	--	51	S	4.0	--	--	35.9	--	--	17.2
Latham	550CN	9-25	--	--	47	S	3.3	--	--	36.0	--	--	17.0
Kruger	Desoy 222+[1]	9-26	--	62	57	S	4.0	--	35.7	36.0	--	17.2	17.0
Diamond	SC 232	9-26	--	--	56	S	3.3	--	--	35.6	--	--	17.4
Prairie Brand	Exp 224	9-26	--	--	55	S	2.8	--	--	35.4	--	--	17.3
Wilson	2060[1]	9-26	--	--	55	S	2.8	--	--	36.7	--	--	16.4
Golden Harvest	H-1229	9-26	--	57	54	S	2.8	--	36.8	37.5	--	16.4	16.0
Asgrow	A2396	9-26	--	59	53	Rps1	2.8	--	35.0	35.1	--	17.6	17.5
Dairyland	DSR-252	9-26	--	--	53	S	3.5	--	--	36.9	--	--	16.6
Latham	401[1]	9-26	55	57	51	S	2.3	35.6	35.9	36.3	17.5	16.9	16.7

Table 30 (continued). Yields and characteristics of public and private soybean varieties, southern zone, 1991 (Fairmont, Lamberton, Waseca).

Brand or Originator	Variety	Matures	Yield 1989-1991	Yield 1990-1991	Yield 1991	Phytophthora gene[3]	Chlorosis score[2]	Protein 1989-1991	Protein 1990-1991	Protein 1991	Oil 1989-1991	Oil 1990-1991	Oil 1991
		date	bu/A					%[4]			%[4]		
Kaltenberg	KB230	9-26	--	--	49	M[3]	3.3	--	--	36.8	--	--	16.5
Hy-Vigor	Ex 602	9-26	--	--	47	Rps1	2.5	--	--	36.3	--	--	16.7
DeKalb	CX 259	9-26	53	53	46	S	3.8	35.0	35.4	35.1	18.2	17.5	17.8
Stine	2830	9-26	--	--	46	S	3.3	--	--	36.7	--	--	16.7
Thompson	Ex 520	9-27	--	--	55	S	3.0	--	--	35.6	--	--	17.1
AgriPro	AP 2324	9-27	--	58	53	S	3.0	--	35.6	35.8	--	17.2	17.0
DeKalb	CX 264	9-27	56	58	53	S	3.0	35.4	35.5	35.3	17.7	17.3	17.3
Thompson	T-30N	9-27	--	--	53	S	2.5	--	--	36.4	--	--	16.7
Yield King	K-2101	9-27	--	--	50	S	3.3	--	--	36.6	--	--	16.6
Great Lakes	GL 2291	9-27	--	--	50	S	2.5	--	--	36.0	--	--	17.0
Latham	650	9-28	54	55	50	S	2.8	35.9	36.2	36.6	17.3	16.8	16.5
Profiseed	1152	9-28	55	55	48	S	2.5	35.8	36.0	35.7	17.5	17.1	17.3
Thompson	Ex 1236	9-29	--	--	38	S	3.0	--	--	34.2	--	--	16.0
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.

CROPS NOT IN CURRENT TRIALS

Flax

Common flax was one of the crop first crops domesticated, 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 1940's fiber flax production in the U.S. dropped to nearly zero. Today only a few individuals in North America grow fiber flax for their own use to make linen. The major fiber flax producing countries are the Soviet Union, Poland, and France.

Minnesota had 378,000 acres planted to flax in 1920 and over 16,000,000 acres in 1943. Since 1943, acreage has steadily declined to only 15,000 in 1988. State average yield of 9.5 bushels per acre in 1920, increased to 16 bushels in 1987. Minnesota, flax acreage is concentrated in the northwest, 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 the most 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.

Mustard

During the Middle Ages seeds from cultivated mustard (*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 such as wheat, oats and barley.

About 25,000 Minnesota acres were planted to mustard in 1963. Most was 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 mustards 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.

Sunflower

Sunflower originated in North America. Introduced to Europe, it spread as a curiosity until it reached Russia where it was readily adapted. Selection for high oil in Russia began in 1860.

High oil lines 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, disease, insect and bird problems. Sunflower acreage is moving west 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

LUPIN

Lupin (*Lupinus albus* L.) is a cool-season grain legume suited to well-drained, coarsely textured, neutral to acidic soils. It is 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 or September. Lupins are easily direct combined because of their upright habit. Yields up to 4,400 pounds per acre have been produced in Minnesota, but have averaged about 1,900 pounds per acre (32 bushels) over 14 year/locations. Crude protein ranges from 28 to 40 percent of the seed, and averages about 34 percent.

Lupin utilization includes direct feeding to poultry and livestock, as well as markets for human consumption products. Lupin has been successfully direct-fed in dairy rations. In Minnesota lupins are processed into flour, pasta and hulls for dietary fiber. Lupin should not be produced until potential markets or uses are first identified.

In 1991, varieties of lupin were planted at Staples, MN. Shortly after flowering, disease incidence (primarily Anthracnose or

Table 31. Characteristics of lupin varieties.

Variety	Planting to 90% Bloom[1]	Planting to Maturity[1]	Lodging[2]	Plant Height[1]	Plant Weight[1]	Seed Protein[4]
	days		score[3]	inches	no/lb	%[5]
Blanca 101	58	119	2.1	33	1,553	33
Gela x 243	59	119	2.2	32	1,495	32
Horizont	58	120	2.0	33	1,457	34
Kiev	59	113	3.2	28	1,768	33
L 2019 N[7]	64	122	2.5	31	1,501	32
L 2085 N	59	117	2.1	30	1,864	33
Primorski	58	116	2.9	29	1,731	34
Strain 21	60	120	2.1	31	1,477	34
Ultra	60	117	2.1	30	1,564	32
46-10	59	119	2.1	33	1,452	34
47-5	58	123	1.5	34	1,415	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] 10% moisture basis; [5] Becker, Grand Rapids, Rosemount and Staples 1989-1990; [6] Becker and Staples 1989-1990, Grand Rapids and Rosemount 1990; [7] Staples 1989-1990, Becker, Grand Rapids and Rosemount 1989.

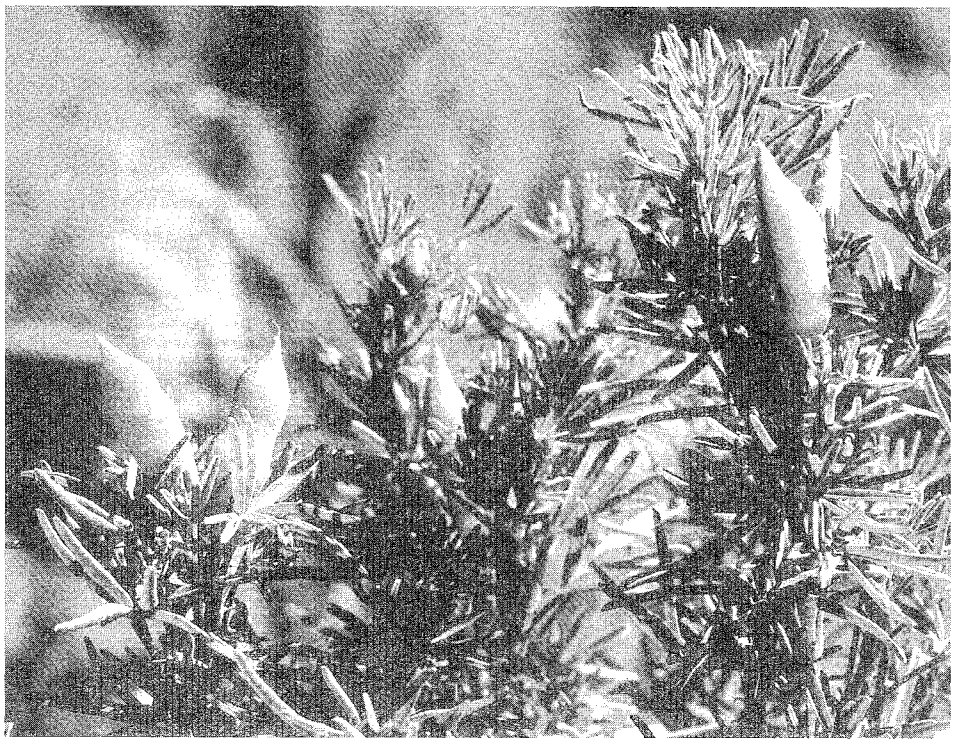
Table 32. Seed yield of lupin varieties.

Variety	Becker 1990	Becker 1987-1990	Grand Rapids 1990	Grand Rapids 1988-1990	Rosemount 1990	Rosemount 1987-1990	Staples 1990	Staples 1988-1990	Overall Average[1]
	lbs/A								
Blanca 101	2,708	1,737	3,739	2,274	3,807	1,855	2,400	2,300	1,984
Gela x 243	2,240	1,692	3,667	2,148	3,536	1,889	2,371	2,064	1,926
Horizont	2,878	1,837	3,580	1,982	3,786	1,861	2,860	2,154	1,943
Kiev	—	1,127	—	822	—	1,123	2,492	2,141	1,347[2]
L 2019 N	2,470	2,025	3,725	2,244	3,334	—	2,357	2,489	3,407[3]
L 2085 N	2,555	2,283	3,840	2,557	3,504	2,875	2,553	2,572	2,572[4]
Primorski	2,669	1,632	3,768	2,062	3,488	1,861	2,348	1,929	1,853
Strain 21	2,492	1,676	3,566	2,115	3,497	1,797	2,694	2,258	1,929
Ultra	2,543	1,644	3,725	2,015	3,854	1,669	3,178	2,238	1,858
46-10	2,671	1,666	3,629	2,063	3,875	1,809	2,753	2,162	1,898
47-5	2,519	1,796	3,269	1,794	3,478	1,762	2,964	2,199	1,872
LSD 5%	401		512		605		520		

[1] Becker and Rosemount 1987-1990, Grand Rapids and Staples 1989-1990; [2] Becker and Rosemount 1987-1989, Grand Rapids 1988-1989, Staples 1988-1990; [3] Becker and Grand Rapids 1989-1990, Rosemount 1990, Staples 1987, 1989-1990; [4] Becker, Grand Rapids, Rosemount and Staples 1989-1990.

Colletotrichum) became particularly severe, greatly reducing seed set and causing death of plants in many cases. The plots were destroyed to prevent spread of the disease, therefore no yield data is presented from 1991.

Additional production information is provided in the Lupin chapter of 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. A more detailed *Lupin Production and Utilization Guide* is also available from the Center for $5.00. This guide contains production, disease, insect, feeding, and economic data.



Potential Seed Sources

Wolf River Valley Seeds, N2976 County M, White Lake, WI 54491 (47-5, 46-10, Primorski, Ultra L2085N);
Lupin-Triticale Enterprises, P.O. Box 187, Perham, MN 56573 (Ultra, Primorski, Strain 21)

CROPS NOT IN CURRENT TRIALS

Adzuki

Adzuki, the sixth largest crop in Japan, is prized for its red color, delicate flavor and the characteristic grainy texture of the 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 United States.

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. Fieldbean acreage in the U.S. is concentrated in Michigan, North Dakota, Minnesota, Idaho, Colorado, Nebraska. Grower interest is largely determined by two factors: prices and proximity of buying stations or processors.

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 *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 (*Pisum sativum*) is usually combine harvested as mature, dry seed. The seed is sold for use in soups and as pigeon feed or is fed on the farm to sheep, hogs, or cattle. When it is used for a forage or feed grain crop, fieldpea is often sown in a 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 they 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 variability in seed quality. Seed quality may be responsible for differences in stand which may have an effect on seed yield.

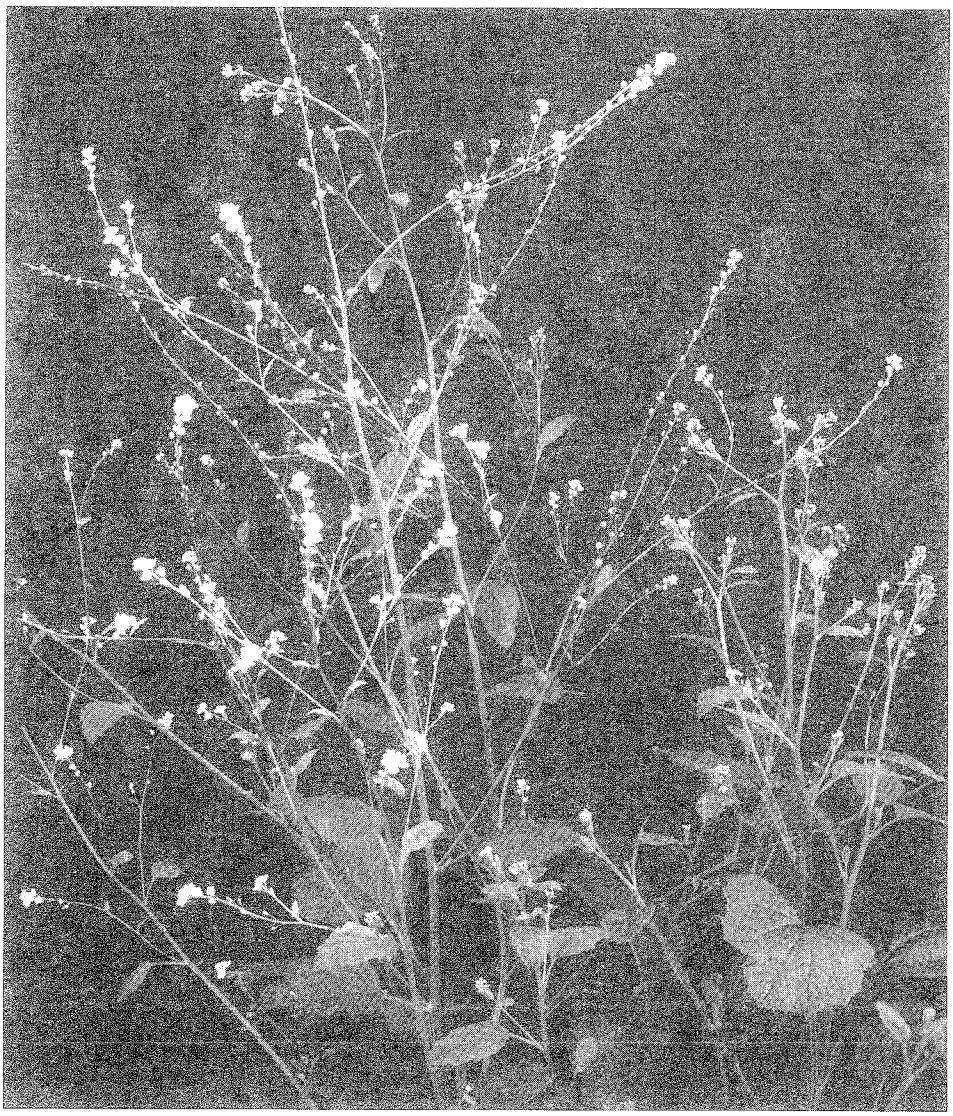
Varieties of fieldpea were not tested in 1991. For recent data on fieldpea varieties, write to Extension Agronomy, 411 Borlaug Hall, 1991 Buford Circle, Univ. of Minnesota, St. Paul, MN 55108. Further information on fieldpea production is also provided in the *Alternative Field Crops Manual*. Contact your county extension agent or the Center for Alternative Plant and Animal Products, 340 Alderman Hall, University of Minnesota, St. Paul, MN 55108.

Lentil

Lentil, 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 of the *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.



Crambe is the newest addition to crops being evaluated by researchers of the Minnesota Agricultural Experiment Station. Variety performance information is on page 23.

PLANTING RATES AND DATES

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)	Planting Date
Barley		48	14,300	85	28/sqare foot	Early spring
Corn		56	1,400	17	24,000/acre	Late April or early May
Fieldbean	Black turtle soup	60	2,300	45	105,000/acre	May 20 to June 15
	Great northern		1,000	100	105,000/acre	
	Kidney		900	115	105,000/acre	
	Navy		2,500	42	105,000/acre	
	Navy 6- to 14-inch rows			60	155,000/acre	
	Pink		1,700	60	105,000/acre	
	Pinto		1,300	80	105,000/acre	
	Small Red		1,400	75	105,000/acre	
	Small White		3,000	35	105,000/acre	
Flax		56	88,000	42	85/square foot	April 15 to May 15
Forage Grasses (perennial — If mixed with legume, sow at time indicated for the legume)						
	Bromegrass alone	14	136,000	16	50/square foot	Early spring or summer
	in mixtures			10	31/square foot	
	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	
	Tall fescue in mixtures	25	229,000	4	21/square foot	Early spring or summer
	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	
	Alsike clover in mixtures	60	653,000	2	30/square foot	Early spring to August 10
	Birdsfoot trefoil alone	60	372,000	7	60/square foot	Early spring or summer
	with grass			4	34/square foot	
	Ladino clover in mixtures	60	784,000	1	18/square foot	Early spring to August 10
	Red clover alone	60	252,000	9	50/square foot	Early spring to August 10
	with grass			5	30/square foot	
Oat		32	16,200	80	28/square foot	Early spring
Rye		56	18,200	60	25/square foot	September
Sorghum	18- to 40-inch rows	56	15,000	10	150,000/acre	May 20 to June 5 for grain
	6- to 14-inch rows			15	5/square foot	
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	
Sunflower	Nonoilseed	24	4,300	4	17,000/acre	May 1 to June 15
	Oilseed	27	7,700	3	23,000/acre	
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						
	Adzuki	60	3,500	40-60	150,00-200,000	May 20 to June 10
	Annual canarygrass	50	58,000	30	40/square foot	Early spring
	Buckwheat	48	14,900	50	17/square foot	June 15 to July 20
	Canola B napus	50	140,000	8	25/square foot	May
	Canola B campestris	50	210,000	5	25/square foot	May
	Crambe	22	64,800	15		Late April to early May
	Fieldpea	60	2,300	180	9/square foot	Early spring
	with 1 1/2 to 2 bushels of oat			70	4/square foot	
	Fababean-medium size	60	1,300	180	5/square foot	Early spring
	with 2 bushels of oat			60	2/square foot	
	Lentil-small	60	15,600	55	20/square foot	Early spring
	Lupine 6- to 8-inch rows	60	1,500	170	6/square foot	Early spring
	30-inch rows			70	6/foot of row	
	Millet Foxtail	48	218,000	15	75/square foot	June 15 to July 15
	Proso	56	65,000	20	30/square foot	June 15 to July 15
	Mustard Yellow	56	90,000	12	25/square foot	May
	Oriental, Brown	50	180,000	6	25/square foot	May
	Rape Forage	50	145,000	6	20/square foot	Early spring with oat
	Oilseed	50	136,000	8	25/square foot	May
	Sudangrass 18- to 40-inch rows	40	44,000	10	25/foot of row	May 20 to June 10
	6- to 14-inch rows			20	20/square foot	
	Sweetclover	60	240,000	10	55/square foot	Early spring
	Tangierpea	60	4,500	85	9/square foot	Early spring
	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.