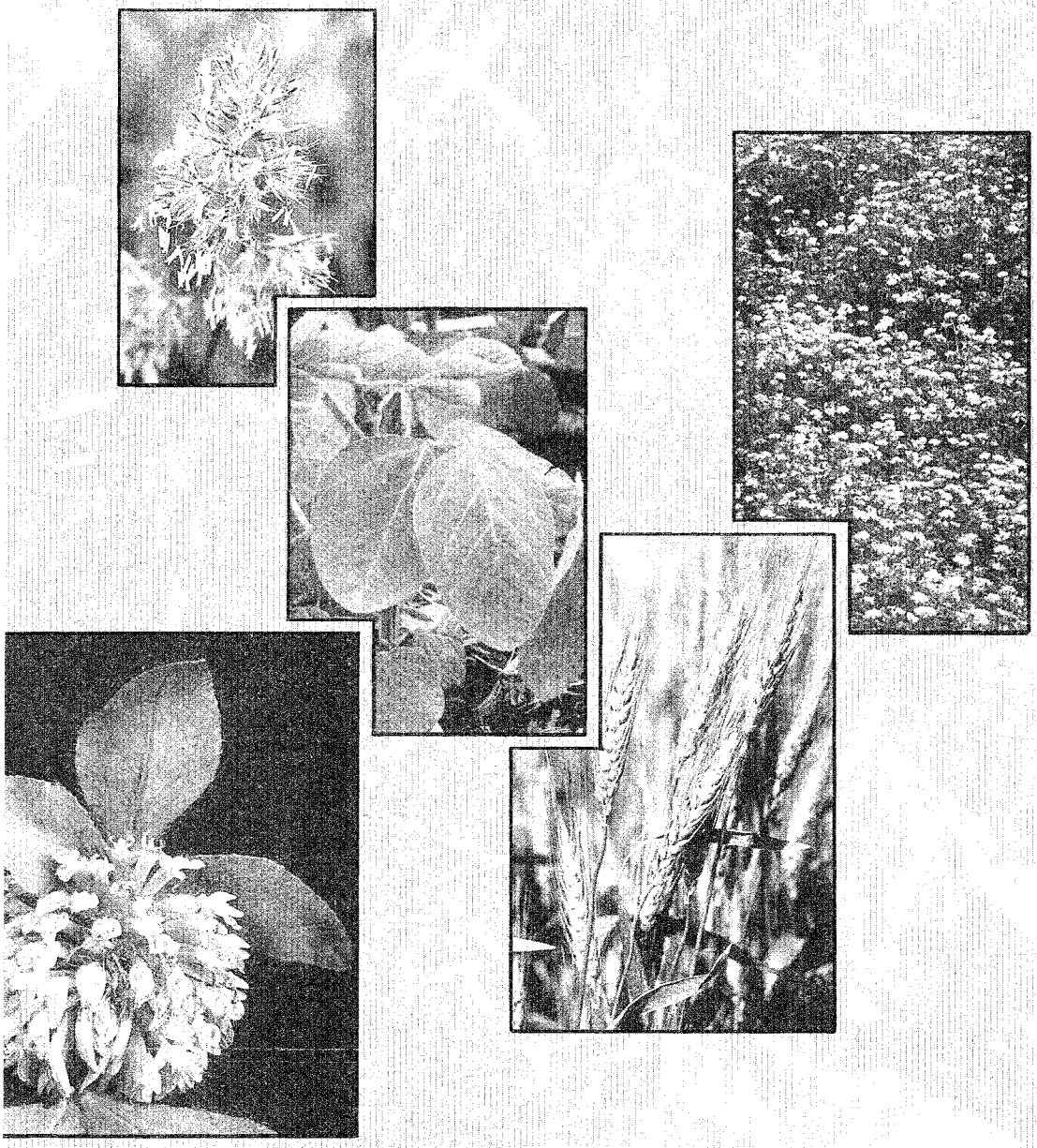
995 Edition

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 235–1995 (MR–5615–F)

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This information is presented under authority granted to the Minnesota Agricultural Experiment Station, by the Hatch Act of 1887, to conduct performance trials on farm crops and interpret data to the public.

Additional copies of this publication are available for purchase. For more information contact a county extension office in Minnesota, or the MES Distribution Center, 20 Coffey Hall, 1420 Eckles Ave., St. Paul MN 55108-6069, (612) 625-8173.

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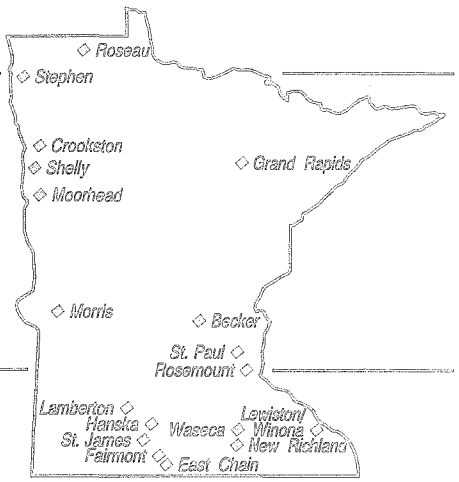

Locations of varietal trials reported in this publication.

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 scattered across Minnesota. Important old varieties and new varieties are grown in replicated plots at each location. These plots are handled so that the factors affecting yield and other characteristics are as nearly the same for all varieties at each location as is possible.

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

Variety Classifications

Varieties of many of the evaluated crops are classed, as appropriate, 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 will usually not be "recommended" 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 1995 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 many 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 each yield column, you can conclude that the higher yielding variety was indeed superior in yield. If the difference is less, the yield difference was probably due to environmental rather than varietal differences. "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: E.A. Oelke (canola); D.K. Barnes, N.P. Martin, N.J. Ehlke and C.C. Sheaffer (alfalfa, birdsfoot trefoil, orchardgrass, reed canarygrass, red clover, tall fescue 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 the following members of the Department of Plant Pathology: R. Dill-Macky (wheat, barley), R. K. Jones (wheat, barley), A.P. Roelfs (wheat); K.J. Leonard (oat); N. Young and W. Stienstra (soybean); D.V. McVey (wheat).

Field work of the varietal trials at Waseca, Lamberton, Morris, Crookston-Stephen, and Grand Rapids was supervised by T. Hoverstad, J.H. Ford, D.D. Warnes, J.V. Wiersma, and R. Mathison, respectively.

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FORAGE CROPS

ALFALFA

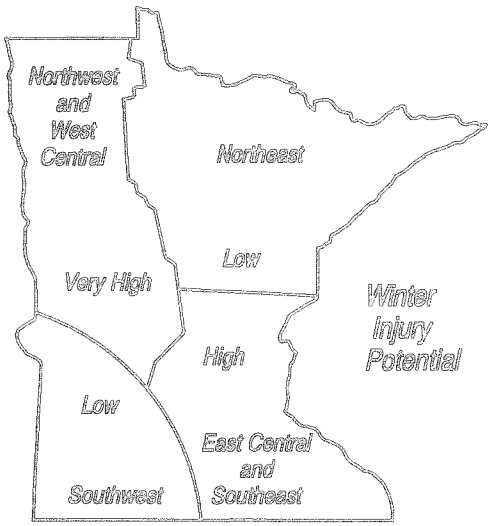
Winter hardiness and fall dormancy

Severe winters make winter hardiness a primary consideration in variety selection for most areas of Minnesota. The 1989–90 and 1991–92 winters were very damaging to alfalfa stands over wide areas of the state. These winters confirmed previous observations about areas of the state most prone to winter injury (see winter injury potential map).

The greatest winter hardiness is needed in the northwest and west central Minnesota area. Because of the high frequency of severe winters in this area only winter-hardy or very winter-hardy varieties should be selected. The east central and southeast area also experiences frequent severe winters. Winter-hardy varieties with high levels of disease resistances should be selected for this area.

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.

The varieties in tables 1 and 2 are listed alphabetically within fall dormancy, according to amount of fall growth. This is an indication of rate of growth after cutting and, to a lesser degree, winter hardiness. Very fall dormant varieties produce very little fall growth and are slow to recover after cutting. They usually are not high yielding, recover slowly for the second crop and produce only a small third crop because of early cessation of growth. Nevertheless, these 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 and 1991–92 winters 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.

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

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

Other nonwinter-hardy varieties not listed in the tables include Armona, Arroyo, Condor, CUF 101, DK 187, DK 189, Falcon, Florida 77, GT 13R Plus, Madera, Maricopa, Mecca, Moapa 69, Pierce, Sundor, SW 14, UC Cibola, WL 515, WL 516, WL 605, Yolo, 13R Supreme, 5715, 5888, and 5929.

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, Verticillium wilt, and Aphanomyces root rot. Plant resistance is available for all six diseases, and the variety resistance ratings for each disease are presented in table 1. Moderate resistance (MR) to a disease provides protection to a variety under most conditions. However, either resistance (R) or high resistance (HR) are required for protection under severe disease conditions.

Winter injury can be the result of a combination of injury from cold temperatures and from root and crown diseases. Under some conditions disease resistances can compensate for lesser levels of cold tolerance, and 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 four cuts per season management in the east central and southeast area of Minnesota.

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

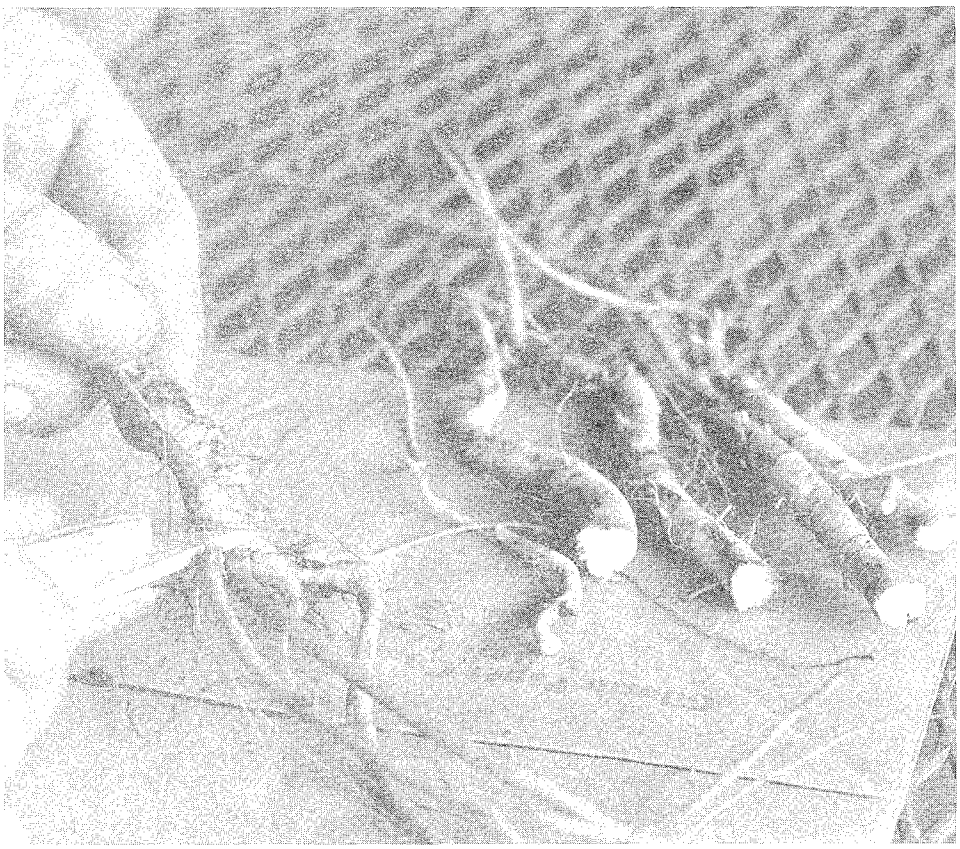
Phytophthora Root Rot—This fungal disease is a major concern on poorly drained soils, especially in the east central and southeast area of the state. It can cause stand losses of seedlings, and can contribute to lower productivity in older stands if the soil remains wet for a week or more.

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

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

Verticillium Wilt—This 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 provide insurance for long-lived stands. Varieties having at least a low level of resistance are indicated in table 2.

Aphanomyces Root Rot—This is a relatively new disease associated with very slowly drained soils. It is easily confused with Phytophthora root rot. It stunts and kills seedlings. It also causes a chronic root disease in established plants. Few cases of this disease have been identified in Minnesota, but if Phytophthora root rot resistant varieties fail to persist, you should consider planting a variety with Aphanomyces resistance.



Alfalfa roots are processed by hand for chemical analysis and evaluation of root morphology. This is done to select individual plants to use as parents for future breeding studies.

Table 1. Fall dormancy score and disease resistance of alfalfa varieties eligible for certification and marketed in the Minnesota area.

Variety	Developer or Marketer[1]	Fall dormancy rating[2]	Bacterial wilt	Phytophthora root rot	Fusarium wilt	Anthracnose	Verticillium wilt	Aphanomyces root rot
			rating[3]					
Very Fall Dormant								
Runner	Geertson Seed Farms [P]	1	R	S	R	S	S	—
Spredor 3	Northrup King Co. [f]	1	HR	MR	HR	R	MR	S
*Teton	S.Dakota Agr.Exp.Sta. [AN]	1	LR	LR	MR	S	—	—
*Travois	S.Dakota Agr.Exp.Sta. [AN]	1	R	S	MR	S	—	—
Fall Dormant								
5262	Pioneer Hi-Bred Int'l. [K]	2	HR	R	MR	—	LR	—
620	ICI Seeds [T]	2	HR	HR	HR	HR	R	R
Agate	USDA/Minnesota Agr.Exp.Sta. [ANbhmquv]	2	HR	R	HR	MR	—	—
Alfagraze	America's Alfalfa [ADUZbgs]	2	MR	LR	R	MR	—	—
Alpine	Bio-Plant Research Ltd. [E]	2	R	R	R	R	R	—
Avalanche +Z	America's Alfalfa [ADUZbgs]	2	HR	HR	HR	HR	HR	R
Clipper	Interstate/Payco Seed [U]	2	HR	R	HR	R	R	—
Defiant	AgriPro Seeds Inc. [B]	2	HR	HR	HR	R	HR	R
Dividend	Agway/Allied Seed [C]	2	HR	HR	HR	HR	R	R
DK 122	DEKALB Genetics Corp. [M]	2	HR	HR	R	HR	R	—
Evolution	Mycogen Plant Sciences [d]	2	HR	HR	HR	HR	R	R
Flagship 75	Peterson Seed Co. [m]	2	HR	HR	HR	R	R	LR
Forerunner	Research Seeds/Brown Seed [F]	2	HR	HR	HR	HR	HR	R
Garst 636	ICI Seeds [T]	2	HR	R	R	MR	R	—

Table 1 (continued). Fall dormancy score and disease resistance of alfalfa varieties eligible for certification and marketed in the Minnesota area.

Variety	Developer or Marketer[1]	Fall dormancy	Bacterial wilt	Phytophthora root rot	Fusarium wilt	Anthracnose	Verticillium wilt	Aphanomyces root rot
		rating [2]	rating [3]					
*Iroquois	Cornell University [Aqu]	2	HR	S	MR	S	S	—
LegenDairy	Cenex/Land O'Lakes [H]	2	HR	HR	HR	HR	HR	R
Milk Maker II	PGI/MBS, Inc. [Xj]	2	R	R	HR	—	—	—
Profit	Ciba Seeds/Wensman Seed [Ju]	2	HR	R	HR	MR	R	—
Quantum	Renk Seed Co. [P]	2	HR	HR	HR	HR	HR	R
Sterling	Cargill Hybrid Seeds [G]	2	HR	HR	HR	HR	R	R
VERNAL	USDA/Wisc.Agr.Exp.Sta. [AHNbcghmquv]	2	R	—	MR	—	—	—
Viking 1	Northrup King Co. [f]	2	R	R	HR	R	HR	—
WL 225	W-L Research, Inc. [w]	2	HR	HR	HR	MR	R	—
WL 252 HQ	W-L Research, Inc. [w]	2	HR	HR	HR	HR	R	LR
Wrangler	USDA/Nebraska Agr.Exp.Sta. [ANbghmquv]	2	R	HR	R	LR	LR	—
Moderately Fall Dormant								
120	DEKALB Genetics Corp. [M]	3	HR	R	LR	LR	—	—
2833	Ciba Seeds [J]	3	HR	HR	HR	HR	R	—
2841	Ciba Seeds [J]	3	HR	R	R	R	R	—
3452-ML	Olds Seed/Interstate/Payco [U]	3	HR	HR	HR	HR	R	R
5246	Pioneer Hi-Bred Int'l. [fi]	3	HR	HR	HR	HR	R	MR
5312	Pioneer Hi-Bred Int'l. [fi]	3	HR	HR	HR	HR	HR	R
Accolade	PGI/MBS, Inc. [J]	3	R	R	R	R	HR	—
Achieva	Agway/Allied Seed [C]	3	R	HR	HR	HR	R	R
Allegiance	Keltgen Seed/Lynks Seed [Y]	3	R	R	R	HR	R	—
Arrow	America's Alfalfa [ADUZbgs]	3	HR	HR	HR	MR	R	—
Blazer XL	Cenex/Land O'Lakes [H]	3	R	HR	HR	HR	R	R
Bolt ML	Research Seeds/Jung Farms [W]	3	R	HR	HR	HR	R	HR
Break-Thru	Custom Farm Seed [K]	3	HR	HR	HR	MR	R	—
Bronco	Jung Seed Farms [W]	3	HR	HR	HR	HR	R	—
Centurion	Agway/Allied Seed [C]	3	HR	R	R	R	R	—
*Crown	Cargill Hybrid Seeds [G]	3	R	R	R	HR	R	—
Crown II	Cargill Hybrid Seeds [G]	3	HR	HR	HR	HR	R	—
CUT 'N' GRAZE	AgriPro Seeds [B]	3	R	—	HR	MR	LR	LR
Den	AgriPro Seeds [B]	3	HR	HR	HR	R	R	—
*DK 125	DEKALB Genetics Corp. [M]	3	HR	R	R	HR	R	—
Elevation	Mycogen Plant Sciences [d]	3	R	MR	R	MR	MR	—
Envy	Peterson Seed Co. [QX]	3	HR	R	HR	HR	R	—
Garst 645	ICI Seeds [T]	3	HR	HR	R	HR	R	MR
*GH 715	J.C. Robinson Seed [V]	3	HR	MR	R	MR	LR	—
GH 777	Golden Harvest Seeds [R]	3	HR	HR	HR	R	R	R
GH 787	Golden Harvest Seeds [R]	3	HR	HR	R	HR	R	R
Green Field	Peterson/Premium Seed [hm]	3	HR	HR	HR	HR	R	R
Hyland	Bio-Plant Research Ltd. [E]	3	HR	HR	HR	R	R	MR
Magnum III-Wet	Dairyland Seed [L]	3	R	R	R	MR	MR	MR
Majestic	Agway/Allied Seed [C]	3	R	R	HR	HR	HR	—
*Milkmaker	Kaltenburg Seed Farms [X]	3	R	MR	HR	MR	—	—
Multi-plier	Mycogen Plant Sciences [d]	3	HR	HR	HR	HR	R	—
MultiKing 1	Northrup King Co. [f]	3	HR	R	HR	R	R	—
*Oneida	Cornell University [qu]	3	HR	HR	HR	S	—	—
Oneida VR	N.Y.S.I.P. [bqu]	3	R	MR	HR	MR	HR	—
Proof	Keltgen Seed [Y]	3	HR	HR	HR	HR	R	R
*Ranger	USDA/Nebr.Agr.Exp.Sta. [ANc]	3	MR	S	MR	S	S	—
Renegade	Geertson Seed Farms [P]	3	R	R	MR	—	LR	—
RFV-2000	Custom Farm Seed [K]	3	HR	HR	HR	HR	R	LR
Royalty	Cargill Hybrid Seeds [G]	3	HR	HR	HR	HR	R	LR
Sierra	NC+ Hybrids [e]	3	HR	HR	HR	R	R	MR
*Sure	Cenex/Land O'Lakes [H]	3	HR	R	HR	HR	R	—
Surpass	R. J. Hunt Seed [q]	3	HR	R	HR	MR	R	—
Thrive	Great Lakes Hybrids [S]	3	HR	HR	HR	HR	R	—

Table 1 (continued). Fall dormancy score and disease resistance of alfalfa varieties eligible for certification and marketed in the Minnesota area.

Variety	Developer or Marketer[1]	Fall dormancy	Bacterial wilt	Phytophthora root rot	Fusarium wilt	Anthracnose	Verticillium wilt	Aphanomyces root rot
		rating [2]	rating [3]					
Treasure	Clark Seeds [Ah]	3	HR	R	HR	HR	R	—
Trident II	Cargill Hybrid Seeds [G]	3	HR	HR	R	R	R	MR
UltraLeaf 87	La Crosse Seed Corp. [b]	3	HR	HR	HR	HR	R	R
Webfoot	Great Lakes Hybrids [S]	3	R	R	MR	—	—	—
WL 317	W-L Research, Inc. [W]	3	HR	HR	HR	R	R	—
Zenith	ICI Seeds [T]	3	HR	HR	HR	HR	R	R
5333	Pioneer Hi-Bred Int'l. [k]	4	HR	R	HR	HR	MR	—
5364	Pioneer Hi-Bred Int'l. [k]	4	R	MR	R	MR	MR	—
5454	Pioneer Hi-Bred Int'l. [k]	4	R	HR	HR	HR	MR	LR
630	ICI Seeds [T]	4	HR	R	R	MR	MR	—
631	ICI Seeds [T]	4	HR	HR	HR	R	R	MR
Aggressor	America's Alfalfa [ADUZbgs]	4	HR	HR	HR	HR	R	MR
Allegro	Keltgen Seed/Lynks Seed [Y]	4	HR	HR	HR	HR	R	R
Apollo Supreme	America's Alfalfa [ADUZbgs]	4	HR	R	HR	HR	R	—
Asset	Allied Seed [C]	4	HR	HR	R	R	R	MR
Chief	Mycogen Plant Sciences [d]	4	HR	HR	R	R	R	—
Cimarron VR	Great Plains Alfalfa Research [X]	4	HR	R	HR	HR	R	MR
Crystal	PGI/MBS, Inc. [J]	4	HR	HR	HR	R	R	LR
DK 133	DEKALB Genetics Corp. [M]	4	HR	HR	HR	HR	R	R
Dominator	AgriPro Seeds [B]	4	HR	HR	HR	HR	R	R
EMPRESS	Blaney Seeds [O]	4	HR	HR	HR	R	R	—
Fortress	Northrup King Co. [f]	4	R	HR	R	—	R	—
GH 737	Golden Harvest Seeds [V]	4	R	HR	HR	MR	R	—
*GH 747	Golden Harvest Seeds [R]	4	HR	HR	R	HR	MR	—
GH 755	Golden Harvest Seeds [V]	4	HR	HR	HR	HR	R	R
Good as Gold	Top Farm Hybrids [r]	4	HR	HR	HR	R	R	LR
Gourmet Hay	Fred Gutwein & Sons [O]	4	HR	R	HR	HR	R	—
HYGain	Hyperformer Seed [B]	4	HR	HR	HR	R	R	MR
Jade	NC÷ Hybrids [e]	4	HR	HR	R	R	R	—
Key	Great Plains Alfalfa Research [X]	4	HR	HR	HR	HR	HR	MR
Legend	Cenex/Land O'Lakes [H]	4	HR	HR	HR	HR	R	—
Magnum III	Dairyland Seed [L]	4	R	R	R	MR	MR	LR
Magnum IV	Dairyland Seed [L]	4	HR	HR	HR	R	R	—
Multi 7÷	Geerlson Seed Farms [P]	4	—	MR	MR	R	LR	—
MultiQueen	Fred Gutwein & Sons [O]	4	HR	HR	HR	HR	R	R
Persist	Kaltenberg Seed Farms [X]	4	HR	HR	HR	R	R	MR
PRO-CUT 2	L. Henried Seeds [b]	4	HR	HR	R	R	R	MR
Quest	Renk Seed Co. [P]	4	HR	HR	HR	R	R	—
Rushmore	Northrup King Co. [f]	4	HR	HR	HR	HR	R	HR
Sabre	Allied Seed [C]	4	HR	R	HR	HR	HR	—
*Saranac	Cornell University [N]	4	R	S	R	S	S	—
Target II	Bio-Plant Research Ltd. [n]	4	HR	R	R	R	R	—
Venture	Halsey Seed/Top Farm Hybrids [r]	4	HR	R	R	HR	R	R
*Voyager	Ziller Seed Company [x]	4	HR	R	R	MR	MR	—
Voyager II	Bio-Plant Research Ltd. [x]	4	HR	HR	HR	R	R	MR
Webfoot MPR	Great Lakes Hybrids Inc. [S]	4	HR	HR	HR	HR	HR	R
WL 320	W-L Research Inc. [W]	4	R	R	R	MR	MR	—
WL 322 HQ	W-L Research Inc. [W]	4	HR	R	HR	MR	R	—
WL 323	W-L Research Inc. [W]	4	HR	HR	HR	HR	R	R
Belmont	Great Plains Alfalfa Research [X]	5	HR	R	HR	HR	R	R
Nondormant								
Nitro	USDA/Minnesota Agr.Exp.Sta. [hms]	8	—	R	—	—	—	—

[1] 1995 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: 9 = tallest (tend to be least winterhardy), 1 = shortest (alphabetical order within each dormancy rating); [3] 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 dormancy and disease resistance values were published by the Certified Alfalfa Seed Council (1994/95 Edition). * Varieties no longer in CASC listing, retained here as historical reference for remaining seed supplies.

Table 2. Average yields of alfalfa varieties expressed as percentage of Vernal for all tests with one or more harvest years (1967–1994) in each of four climatological areas within Minnesota. [1]

	Average yield for years 1–2 and 3–4 after seeding per test location										
	Rosemount & Waseca		Morris & Crookston		Lamberton		Grand Rapids		All locations		
Variety	1–2	3–4	1–2	3–4	1–2	3–4	1–2	3–4	1–2	3–4	Number tests [2]
	% of Vernal										
Very Fall Dormant											
Runner	—	—	98	—	—	—	—	—	98	—	1
Spredor 3	—	—	—	—	—	—	—	—	—	—	0
*Teton	—	—	102	99	—	—	—	—	102	99	1
*Travois	—	—	94	91	—	—	—	—	94	91	1
Fall Dormant											
5262	108	—	103	111	106	107	112	—	106	108	12
620	111	—	—	—	—	—	—	—	112	—	2
Agate	102	107	97	101	100	—	89	—	99	104	18
Alfagraze	104	92	97	100	101	—	103	—	100	98	7
Alpine	110	104	95	115	112	115	—	—	105	112	5
Avalanche +Z	—	—	—	—	—	—	—	—	—	—	1
Clipper	104	90	101	107	100	96	106	102	103	101	10
Defiant	—	—	—	—	—	—	—	—	—	—	2
Dividend	104	—	—	—	—	—	115	—	108	—	3
DK 122	106	71	103	113	108	—	105	—	105	105	14
Evolution	108	—	—	—	—	—	—	—	108	—	1
FLAGSHIP 75	101	—	—	—	—	—	—	—	101	—	1
Forerunner	—	—	—	—	—	—	—	—	—	—	1
Garst 636	110	107	105	113	101	106	103	102	106	107	7
*Iroquois	103	102	105	106	103	112	111	—	105	104	12
LegenDairy	103	—	—	—	—	—	104	—	104	—	3
Milkmaker II	101	—	112	—	110	—	—	—	107	—	5
Profit	107	110	101	99	108	109	105	113	105	107	12
Quantum	105	—	—	—	—	—	—	—	108	—	3
Sterling	—	—	—	—	—	—	—	—	—	—	0
VERNAL: ton/ac 15% MC	6.06	5.40	5.49	4.76	5.27	4.54	4.11	3.88	5.64	5.10	69
Viking I	110	—	—	—	—	—	112	—	111	—	6
WL 225	103	—	87	104	101	103	107	105	96	102	6
WL 252 HQ	—	—	—	—	—	—	—	—	—	—	2
Wrangler	105	107	106	101	98	102	100	95	103	102	7
Moderately Fall Dormant											
120	111	113	103	107	103	—	112	—	109	111	10
2833	110	—	89	112	104	98	—	—	100	107	5
2841	97	76	79	101	103	105	105	—	95	97	7
3452-ML	105	—	—	—	—	—	—	—	105	—	1
5246	107	—	—	—	—	—	110	—	109	—	7
5312	—	—	—	—	—	—	—	—	—	—	0
Accolade	—	—	—	—	—	—	—	—	—	—	0
Achieva	107	—	—	—	—	—	—	—	109	—	4
Allegiance	95	—	97	109	111	120	104	—	100	111	7
Arrow	108	103	105	110	108	114	110	104	107	107	11
Blazer XL	101	—	101	—	105	—	—	—	103	—	3
Bolt ML	111	—	—	—	—	—	—	—	111	—	1
Break-Thru	103	93	88	104	102	107	103	—	99	102	8
Bronco	—	—	82	101	101	93	103	—	97	98	6
Centurion	111	98	100	114	104	101	114	107	107	105	6
*Crown	109	100	92	108	123	112	113	103	107	105	6
Crown II	112	—	96	109	110	111	—	—	106	111	6
CUT 'N' GRAZE	—	—	—	—	—	—	—	—	—	—	0
Dart	108	107	104	111	106	111	109	105	107	108	13

Table 2 (continued). Average yields of alfalfa varieties expressed as percentage of Vernal for all tests with one or more harvest years (1967–1994) in each of four climatological areas within Minnesota. [1]

	Average yield for years 1–2 and 3–4 after seeding per test location										
	Rosemount & Waseca		Morris & Crookston		Lamberton		Grand Rapids		All locations		
Variety	1–2	3–4	1–2	3–4	1–2	3–4	1–2	3–4	1–2	3–4	Number tests [2]
	% of Vernal										
*DK 125	107	95	99	104	114	110	104	89	106	99	7
Elevation	112	112	103	108	111	97	106	99	108	106	10
Envy	111	90	101	111	102	111	—	—	105	107	7
Garst 645	107	—	112	—	111	—	—	—	110	—	7
*GH 715	106	102	104	113	103	113	113	112	106	109	8
GH 777	110	—	—	—	—	—	—	—	110	—	1
GH 787	101	—	—	—	—	—	109	—	104	—	3
Green Field	106	—	—	—	—	—	—	—	106	—	1
Hyland	110	—	—	—	—	—	—	—	110	—	1
Magnum III-Wet	111	—	—	—	—	—	—	—	111	—	3
Majestic	103	101	109	—	105	—	100	—	104	104	5
*Milkmaker	106	99	100	93	98	101	104	106	103	99	8
Multi-plier	109	92	99	109	104	88	100	—	103	100	14
MultiKing 1	101	—	109	—	117	—	96	—	105	—	5
*Oneida	105	106	102	107	94	—	105	—	103	106	10
Oneida VR	101	104	97	112	98	110	105	99	99	107	7
Proof	—	—	—	—	—	—	—	—	—	—	1
*Ranger	98	100	125	104	97	99	—	—	100	100	13
Renegade	111	87	103	106	101	—	96	—	104	101	5
RFV-2000	112	—	—	—	—	—	—	—	111	—	3
Royalty	105	94	90	105	101	108	102	—	100	102	7
Sierra	112	—	—	—	—	—	—	—	112	—	1
*Sure	109	97	99	110	103	99	101	105	103	103	6
Surpass	113	107	104	—	108	103	108	109	109	106	5
Thrive	101	91	103	106	—	—	106	—	103	101	8
Treasure	105	102	—	—	—	—	—	—	105	102	1
Trident II	105	91	106	115	110	—	104	—	106	106	8
UltraLeaf 87	104	—	—	—	—	—	110	—	106	—	3
Webfoot	105	105	104	110	100	—	102	105	103	106	8
WL 317	114	—	86	102	104	112	105	—	101	105	6
Zenith	107	—	110	—	111	—	—	—	109	—	8
5333	94	92	107	—	105	—	—	—	102	98	3
5364	—	—	93	112	103	112	99	—	101	113	6
5454	108	—	—	—	—	—	119	—	112	—	7
630	110	110	—	—	107	109	99	112	107	112	10
631	113	—	102	118	—	—	—	—	113	—	2
Aggressor	101	92	103	114	104	—	99	—	102	106	10
Allegro	109	—	—	—	—	—	—	—	109	—	1
Apollo Supreme	106	104	94	106	101	93	107	108	102	104	10
Asset	—	—	69	98	105	101	—	—	93	96	3
Chief	102	86	85	105	102	95	109	98	98	95	7
Cimarron VR	96	—	99	90	110	—	100	—	100	92	6
Crystal	100	99	104	112	117	—	—	—	106	110	5
DK 133	108	—	—	—	—	—	124	—	114	—	8
Dominator	108	102	—	—	—	—	—	—	108	102	4
EMPRESS	—	—	105	113	101	—	104	—	106	107	6
Fortress	102	77	80	98	106	91	103	—	97	86	8
GH 737	110	92	95	99	112	109	99	95	104	98	6
*GH 747	109	87	85	106	108	101	—	—	103	97	4
GH 755	104	—	—	—	—	—	—	—	104	—	1
Good as Gold	108	100	113	129	104	—	108	—	110	119	6
Gourmet Hay	101	—	113	—	103	—	—	—	106	—	3
HYGain	98	101	—	—	—	—	—	—	98	101	1
Jade	—	—	116	124	107	—	109	—	113	123	6
Key	—	—	—	—	—	—	—	—	—	—	0

Table 2 (continued). Average yields of alfalfa varieties expressed as percentage of Vernal for all tests with one or more harvest years (1967–1994) in each of four climatological areas within Minnesota. [1]

	Average yield for years 1–2 and 3–4 after seeding per test location										
	Rosemount & Waseca		Morris & Crookston		Lamberton		Grand Rapids		All locations		
Variety	1–2	3–4	1–2	3–4	1–2	3–4	1–2	3–4	1–2	3–4	Number tests [2]
	% of Vernal										
Legend	97	—	89	104	101	101	101	—	96	104	6
Magnum III	—	—	106	118	116	119	104	107	110	110	9
Magnum IV	110	—	—	—	—	—	—	—	111	—	4
Multi 7+	—	—	—	—	—	—	—	—	—	—	0
MultiQueen	—	—	—	—	—	—	—	—	—	—	3
Persist	113	—	—	—	—	—	—	—	113	—	4
PRO-CUT 2	—	—	83	102	110	102	100	—	98	100	6
Quest	—	—	113	—	102	—	—	—	106	—	3
Rushmore	—	—	—	—	—	—	—	—	—	—	0
Sabre	99	91	—	—	—	—	102	—	100	93	3
*Saranac	103	99	106	109	103	103	—	—	103	101	27
Target II	110	88	111	113	—	—	105	—	109	102	4
Venture	103	—	—	—	—	—	—	—	103	—	3
*Voyager	111	99	102	112	103	108	107	116	107	108	7
Voyager II	113	—	—	—	—	—	—	—	113	—	2
Webfoot MPR	102	—	—	—	—	—	—	—	103	—	5
WL 320	109	110	106	97	112	106	112	—	109	105	6
WL 322 HQ	94	101	110	—	92	—	—	—	99	105	3
WL 323	107	—	—	—	—	—	—	—	108	—	4
Belmont	94	95	105	—	94	—	—	—	97	95	3
Non-dormant											
Nitro	—	—	—	—	—	—	—	—	—	—	0

[1] Order of entries in this table parallels the fall dormancy ratings in Table 1. Reference: Certified Alfalfa Seed Council (1994/95 Edition). [2] Data for varieties having fewer than three tests is insufficient for short-term or long-term yield comparison. * Varieties no longer in CASC listing, retained here as historical reference for remaining seed supplies.

BIRDSFOOT TREFOIL

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

Eight birdsfoot trefoil varieties were established in pure stands in August 1989 on Minnesota Agricultural Experiment Station test fields at Rosemount and Grand Rapids. Severe winter injury at Grand Rapids destroyed the trial at that location. The Rosemount trial was harvested twice in 1990; three times in 1991 and 1992. The trial was discontinued in 1992.

New performance trials of birdsfoot trefoil were established at Rosemount and Grand Rapids in 1993. The trial was harvested twice at Grand Rapids and three times at Rose-

Table 3. Winter injury score (1990) and dry matter yield (1990–1992, 1994) of birdsfoot trefoil varieties seeded at Grand Rapids and Rosemount. [1]

		Forage Yields		
		Rosemount		Grand Rapids
Variety [2]	Winter Injury	1990–1992	1994	1994
	score [3]	tons DM/A		
AU-Dewey [t]	—	—	3.8	2.6
Bonnie	3.2	4.5	—	—
Carroll	1.0	5.2	4.3	2.7
Dawn	3.0	5.4	—	2.5
Empire [AHXaghmquv]	3.7	5.4	—	2.7
Fergus	1.5	5.3	3.9	2.8
Leo [qv]	2.7	4.8	—	—
Norcen [AHXaghmqsuv]	1.5	5.4	3.9	2.9
LSD (0.05)	1.0	0.5	NS	0.4

[1] Trials were established in 1989 at Rosemount and in 1993 at Rosemount and Grand Rapids; [2] 1995 seed sources are listed at the end of the forage crop section; [3] score:1 = no injury to 5 = dead on 18 May 1990.

mount during 1994. Yields were lower at Grand Rapids than Rosemount due to less favorable growing conditions.

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

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. Its 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 Rosemount, Grand Rapids and Morris. Severe winter injury at Morris destroyed the trial at that location.

Experimental plots were harvested three times per year from 1990 to 1992 at Rosemount. At Grand Rapids, plots were harvested three times per year from 1990 to 1994, except in 1992 when the stand was harvested only twice. Nitrogen was applied in the early spring and after each harvest at rate of between 40 and 50 pounds of nitrogen per acre.

Few differences were observed for the forage yield of orchardgrass at either of the experiment station locations. Varieties which showed significant winter injury in May 1990 produced adequate forage yields during the 1990 growing season. However, yields were lower in 1991 and 1992 at Grand Rapids.

Orchardgrass trials have remained productive for many year at Grand Rapids, a site which has consistent snow cover.

Differences in forage yield were found between varieties tested at both locations. Orion, a winter-hardy variety, was the highest yielding variety when averaged over both locations and all five years. The newer varieties of Ambassador, Dawn and Elsie performed well in the trials, as did the older varieties Napier and Sterling.

Table 4. Winter injury (1990), maturity (1992) and dry matter yield (1990–1994) of orchardgrass varieties seeded at Grand Rapids and Rosemount.[1]

				Forage Yield								
	Winter Injury			Grand Rapids					Rosemount			
Variety[2]	Grand Rapids	Rosemount	Maturity	1990	1991	1992	1993	1994	1990	1991	1992	Mean
	score[3]		rating[4]	tons DM/A								
Ambassador [t]	2.6	1.8	7.9	4.6	2.6	2.6	4.2	3.6	5.4	4.5	4.2	4.0
Crown [Ags]	2.4	1.5	6.8	4.6	2.7	2.6	4.3	3.4	5.1	4.5	4.1	4.0
Dawn [H]	2.3	2.0	4.5	4.7	2.9	2.6	4.0	3.7	5.5	4.4	3.8	4.0
Elsie	2.3	2.0	6.8	4.6	2.9	2.2	4.3	3.5	5.4	4.8	4.1	4.0
Justus [t]	2.8	3.8	6.0	4.5	2.4	2.3	4.2	3.4	5.2	4.6	4.2	3.9
Napier	2.4	2.0	7.0	5.0	2.9	2.5	4.1	3.4	5.0	4.5	4.3	4.0
Orbit	2.5	2.3	3.8	4.3	2.6	2.6	4.0	3.4	5.0	4.4	4.1	3.8
Orion [Xghps]	2.6	1.0	4.3	4.8	2.9	2.7	4.4	3.5	5.8	4.9	4.8	4.2
Potomac [ANXabcghmqruvx]	2.0	1.5	8.5	4.4	2.6	2.4	4.2	3.6	5.2	4.3	4.0	3.9
Shawnee	2.4	3.8	5.3	4.6	2.4	2.2	4.2	3.3	5.2	4.4	3.9	3.8
Sterling [u]	2.1	2.3	7.5	4.1	2.4	2.7	4.3	3.4	5.4	4.6	4.5	4.0
LSD 5%	0.6	0.8	1.7	NS	NS	0.3	0.3	0.4	0.5	0.5	0.5	

[1] Trials established in 1989 at both locations; [2] 1995 seed sources are listed at the end of the forage crops section; [3] Score: 1 = no injury to 5 = dead; scored on May 18, 1990; [4] Rating: 0 = no panicle emergence to 9 = complete panicle emergence; scored on June 2, 1992, at Rosemount.

RED CLOVER

Red clover can be seeded either in pure stands or with timothy for hay or silage. It is more easily established in pasture renovation than either alfalfa or trefoil.

Historically, the winter-hardy varieties of red clover have not persisted beyond two crop years in Minnesota because they are susceptible to diseases. However, most of the improved varieties currently sold for use in Minnesota can persist for three years if the weather provides good winter snow cover.

Minnesota Agricultural Experiment Station scientists established performance trials of red clover at three locations in 1991, but stands were sufficient for data collection only at Grand Rapids in 1992 and 1993, and at Rosemount from 1992 to 1994. At Grand Rapids the trial was harvested twice in 1992 and three times in 1993. At Rosemount the trial was harvested three times each in 1992 and 1993, but only once in 1994 due to stand decline.

No differences in dry matter yield were found between the varieties harvested at either trial location during either 1992 or 1993, though yields and stands were better at Rosemount than Grand Rapids in both years. Marathon produced the highest forage yield during the third production year at Rosemount.

Table 5. Percent stand and dry matter yield of red clover varieties seeded at Grand Rapids and Rosemount.[1]

		Forage Yield					
		Grand Rapids		Rosemount			
Variety [2]	Stand [3]	1992	1993	1992	1993	1994 [4]	Mean [5]
	%	tons DM/A					
Acclaim [C]	79	3.2	3.0	5.4	4.5	1.3	4.0
Arlington [ANXaghmqrsuv]	55	2.9	3.0	5.1	4.4	1.2	3.9
Marathon [HXaghmpquv]	68	2.9	3.2	5.1	4.7	1.5	4.0
Red Star [H]	68	3.1	3.4	5.3	4.8	1.0	4.2
LSD 5%	21	NS	NS	NS	NS	0.3	NS

[1] Trials established in 1991 at both locations and harvested 3 times during 1992 and 1993; [2] 1994 seed sources are listed at the end of the forage crops section; [3] Percent stand rated at Grand Rapids on June 9, 1992; [4] Residual harvest taken at Rosemount on June 3, 1994; [5] Mean for 1992–1993 only.

REED CANARYGRASS

Reed canarygrass is adapted throughout Minnesota for use as hay, pasture and silage. It is one of the best grass species for poorly drained soils and tolerates flooding better than other cool season grasses. The species utilizes nitrogen efficiently and is adapted to liquid manure application. However, 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 several varieties low in indole alkaloid concentra-

Table 6. Dry matter yields (1990–1992; 1994) of reed canarygrass varieties seeded at Morris, Grand Rapids and Rosemount. [1]

	Morris		Grand Rapids	Rosemount	
Variety [2]	1990–1992	1994	1994	1990–1992	1994
	tons DM/A				
Lara	--	--	--	--	3.0
Palaton [AHXghmqsu]	3.8	5.8	3.0	6.9	3.2
Rise	4.0	--	--	6.2	--
Vantage [L]	4.0	5.7	2.7	6.3	3.3
Venture [Ahmqs]	4.3	5.6	2.7	7.1	3.2
LSD (0.05)	NS	NS	NS	0.8	NS

[1] Trials were established in 1989 at Morris and Rosemount and in 1993 at Morris, Grand Rapids and Rosemount. Morris was harvested three times and Grand Rapids and Rosemount were harvested two times in 1994 due to slower establishment at those locations; [2] 1995 seed sources are listed at the end of the forage crops section.

tion. This dramatically improves palatability and animal performance. Alkoloids are bitter, complex, nitrogen containing compounds.

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.

Trials were established in pure stands in 1989 at Morris and Rosemount. The trial was harvested twice at Morris and three times at Rosemount in 1990, 1991 and 1992. Trials were also established in 1993 at Morris, Grand Rapids and Rosemount, and these trials were harvested twice at Grand Rapids and Rosemount in 1994, and three times at Morris. Nitrogen was applied early in the spring and after each harvest at a rates of between 40 and 50 pounds per acre.

Available varieties of reed canarygrass are winter-hardy and persistent in Minnesota. High yielding, low alkaloid varieties Palaton and Venture are currently marketed here.

Reed canarygrass trials at Morris and other experiment station sites have demonstrated that it is both palatable for livestock and productive. It is widely adapted across Minnesota.

TALL FESCUE AND WHEATGRASS

Talll fescue is a bunchgrass and can 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. Tall fescue is subject to winter injury, but may remain productive in areas with reliable snow cover.

Table 7. Dry matter yields (1993–1994) and maturity (1994) of tall fescue and wheatgrass varieties seeded at Morris, Rosemount and Grand Rapids. [1]

		Forage Yield					
		Morris		Rosemount		Grand Rapids	
Variety [2]	Maturity	1993	1994	1993	1994	1994	Mean
	rating [3]	tons DM/A					
Tall Fescue							
Barcel	1	6.6	5.6	6.1	6.1	4.4	5.8
Fawn	8	7.7	5.5	5.2	5.5	4.2	5.6
Ky 31– endophyte infected	2	7.0	5.4	6.6	6.4	5.1	6.1
Ky 31– endophyte free ANXcghmquv	4	7.2	5.4	6.6	5.8	4.6	5.9
Martin[1]	7	6.7	5.3	5.9	5.8	4.8	5.7
Mozark	7	6.8	5.8	6.2	5.7	4.8	5.9
Mustang	2	—	—	5.3	5.3	3.7	4.8
Stef	0	6.8	5.5	5.5	6.0	4.5	5.7
Wheatgrass							
Manska	0	5.6	6.0	4.2	4.0	3.4	4.7
Newhy	0	—	—	4.1	3.6	3.5	3.7
Reliant	0	5.6	6.1	4.5	4.1	3.5	4.8
LSD 5%	1	0.7	NS	0.8	0.6	0.6	

[1] Trials established in 1992 at both locations and harvested 3 times during 1993 and 1994; [2] 1995 seed sources are listed at the end of the forage crops section; [3] Rating: 0 = no panicle emergence to 9 = complete panicle emergence scored on June 3, 1994 at Rosemount.

Animal performance is better when the variety grown is endophyte-free. Endophytes are fungi that invade plant tissues, reducing forage palatability and animal performance.

The wheatgrasses are valuable native forage species. They are especially suitable for the northern Great Plains area of the United States.

Wheatgrasses can produce excellent forage yields and sustained productivity under hay and pasture management systems either in monoculture or in mixtures with alfalfa or other suitable legumes. Recent releases of improved varieties have prompted interest in these species, especially in western areas of Minnesota.

Minnesota Agricultural Experiment Station scientists initiated performance trials of tall fescue and the wheatgrasses in 1992. Data was collected from three harvests in 1993 at Morris and Rosemount and in 1994 from Morris, Grand Rapids and Rosemount. Nitrogen was applied in the early spring and after each harvest at rates of between 40 and 50 pounds per acre.

Yields of tall fescue and of wheatgrasses were high in 1993 and 1994, probably due to mild winters, abundant rainfall and cool growing season temperatures. Wheatgrasses did yield less forage than tall fescue varieties; however, the wheatgrasses are better adapted to environments drier than experienced during the previous two growing seasons.

TIMOTHY

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

Varieties of timothy differ in maturity so care should be taken in choosing ones that fit the management requirements of your crop and mixture. Early varieties are best adapted to a three-cut system with alfalfa.

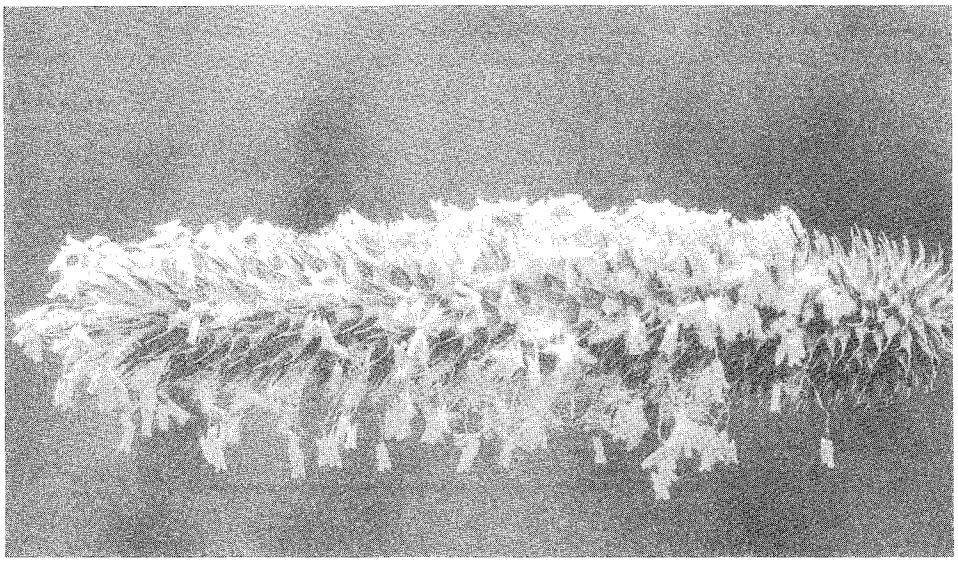
Varieties that are intermediate to late maturing should not be harvested more than twice during the growing season. Therefore, appropriately selected timothy varieties are compatible with red clover and birdsfoot trefoil in mixtures for hay production.

The varieties in the Minnesota Agricultural Experiment Station's timothy trials were established in pure stands in August 1989 at Grand Rapids and Rosemount, in 1992 at Rosemount and Morris, and then again in 1993 at Grand Rapids. Nitrogen was applied in the early spring and after each harvest at rates of between 40 and 50 pounds per acre.

Table 8. Dry matter yields of timothy varieties seeded at Grand Rapids, Rosemount and Morris. [1]

	Grand Rapids		Rosemount			Morris		
Variety [2]	1990–1991	1994	1990–1992	1993	1994	1993	1994	Mean
	tons DM/A							
Early - Intermediate Maturity								
Chazy	3.3	—	4.3	—	—	—	—	3.8
Climax ANXabcghmpqrsuvx	3.0	3.8	3.9	4.8	4.7	5.5	4.0	4.2
Comtal g	3.0	3.9	4.0	4.6	5.1	—	—	4.1
Goliath	2.9	3.8	4.1	4.3	4.5	—	—	3.9
Timfor f	—	4.0	—	4.5	4.8	—	—	4.4
Toro	—	4.2	—	4.8	5.0	—	—	4.6
Tupper	3.2	—	4.4	—	—	—	—	3.8
Late Maturity								
Champlain	2.8	—	3.8	—	—	—	—	3.3
Heidemij	2.5	3.7	3.4	4.1	3.6	4.1	3.9	3.6
Hokusen	—	3.6	—	4.0	4.4	4.7	3.7	4.1
LSD 5%	0.3	0.6	0.6	0.6	0.4	0.5	0.5	

[1] Trials established in 1989 at Grand Rapids and Rosemount, in 1992 at Morris and Rosemount, and in 1993 at Grand Rapids; [2] 1995 Seed sources are listed at the end of the forage crops section.



Timothy head with fully developed anthers emerged.

Early maturing timothy varieties had greater forage production than late maturing varieties at all locations over all harvest years.

Exceptionally high yields of timothy in 1993 and 1994 at Morris and Rosemount may be partly attributed to mild winters, and to abundant rainfall and cool temperatures during the growing seasons. Timothy is normally less persistent than other cool season grasses such as reed canarygrass.

CROP NOT IN CURRENT TRIALS

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 bromegrass varieties may not be higher yielding, but are generally less susceptible to leaf diseases. They are also earlier in maturity than northern types.

Varieties presently being sold in Minnesota are all 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 conducting performance trials of bromegrass. If you want information from a recent report of tests of this crop, contact Extension Agronomy, 411 Borlaug Hall, 1991 Buford Circle, University of Minnesota, St. Paul, MN 55108.

1995 FORAGE SEED SOURCES

A. Agassiz Seed & Supply, 4121-1/2 South University Drive, Fargo, ND 58104

B. AgriPro Seeds, Inc., 824 2nd St. South, P.O. Box 250, Brookings, SD 57006

C. Allied Seed Cooperative, 1917 East Fargo Ave., Nampa, ID 83687

D. America's Alfalfa, 6700 Antioch, P.O. Box 2955, Shawnee Mission, KS 66201

E. Bio-Plant Research, Ltd., P.O. Box 320, Camp Point, IL 62320

F. Brown Seed Farms, P.O. Box 7, Bay City, WI 54723

G. Cargill Hybrid Seeds, Rte 1, Box 56, Plainview, MN 55964

H. Cenex/Land O'Lakes, Station 680, P.O. Box 64089, St. Paul, MN 55164-0089

J. Ciba Seeds, P.O. Box 6346, Rochester, MN 55903,

K. Custom Farm Seed, Box 160, Momence, IL 60954

L. Dairyland Seed Co., P.O. Box 958, West Bend, WI 53095

M. DEKALB Genetics Corp., 7665 Commerce Way, Suite 101, Eden Prairie, MN 55344

N. Discount Farm Center, P.O. Box 84, West Hwy 212, Watertown, SD 57201

O. Gutwein/Blaney Seeds, RR1, Box 175, Sleepy Eye, MN 56085

P. Geertson Seed Farms, 1665 Burroughs Rd. Adrain, OR 97901

Q. Gold Country Seed, 3374 80th St.,Plato, MN 55370

R. Golden Seed, 27420 137th Ave. North, Cordova, IL 61242

S. Great Lakes Hybrids, P.O. Box 637, 9915 West M-21, Ovid, MI 48866

T. ICI Seeds, 6945 Vista Drive, West Des Moines, IA 50266

U. Interstate Payco Seed, P.O. Box 338, West Fargo, ND 58078

V. Golden Harvest, Box 37, Westbrook, MN 56183

W. Jung Farms Inc., 1229 NW 41st St, Rochester, MN 55901

X. Kaltenberg Seed Farms, 20155 Biscayne Ave. West, Farmington, MN 55024

Y. Keltgen Seed Co., Box 209, Olivia, MN 56277

Z. Kruger Seed, Box A, Hwy 20 East, Dike, IA 50624

a. La Crosse Seed Corp., 2615 Commerce St., LaCrosse, WI 54601

b. L. Herried Seeds, Inc., P.O. Box 216, 925 Dexter, Prescott, WI 54021

c. Lincoln Seed, Inc., P.O. Box 2803, Sioux City, IA 51106

d. Mycogen Plant Sciences, 720 St. Croix, Prescott, WI 54021

e. NC+ Hybrids, P.O. Box 4408, Lincoln, NE 68504

f. Northrup King Co., P.O. Box 959, 7500 Olson Memorial Hwy., Golden Valley, MN 55427

g. Olds Seed Co., Box 7790, Madison, WI 53707-7790

h. Peterson Seed Co., Inc., P.O. Box 346, Savage, MN 55378

j. PGI/MBS Inc., P.O. Box 308, Ames, IA 50010-0308

k. Pioneer Hi-Bred Int'l, Inc., 130 Willmar Ave. SE, Willmar, MN 56201-4582

m. Premium Seed Co., Inc., 7800 East State Hwy 101, Shakopee, MN 55379

n. Producers Hybrids, Inc., RR1, Box C, Battle Creek, NE 68715

p. Renk Seed Company, 6800 Wilburn Rd., Sun Prairie, WI 53590

q. R.J. Hunt Seed Co., RR1, Box 112, Wadena, MN 56482

r. Top Farm Hybrids, Box 850, 17177 60th St SW, Cokato, MN 55321

s. Trelay Inc., 11623 Hwy 80 North, Livingston, WI 53554

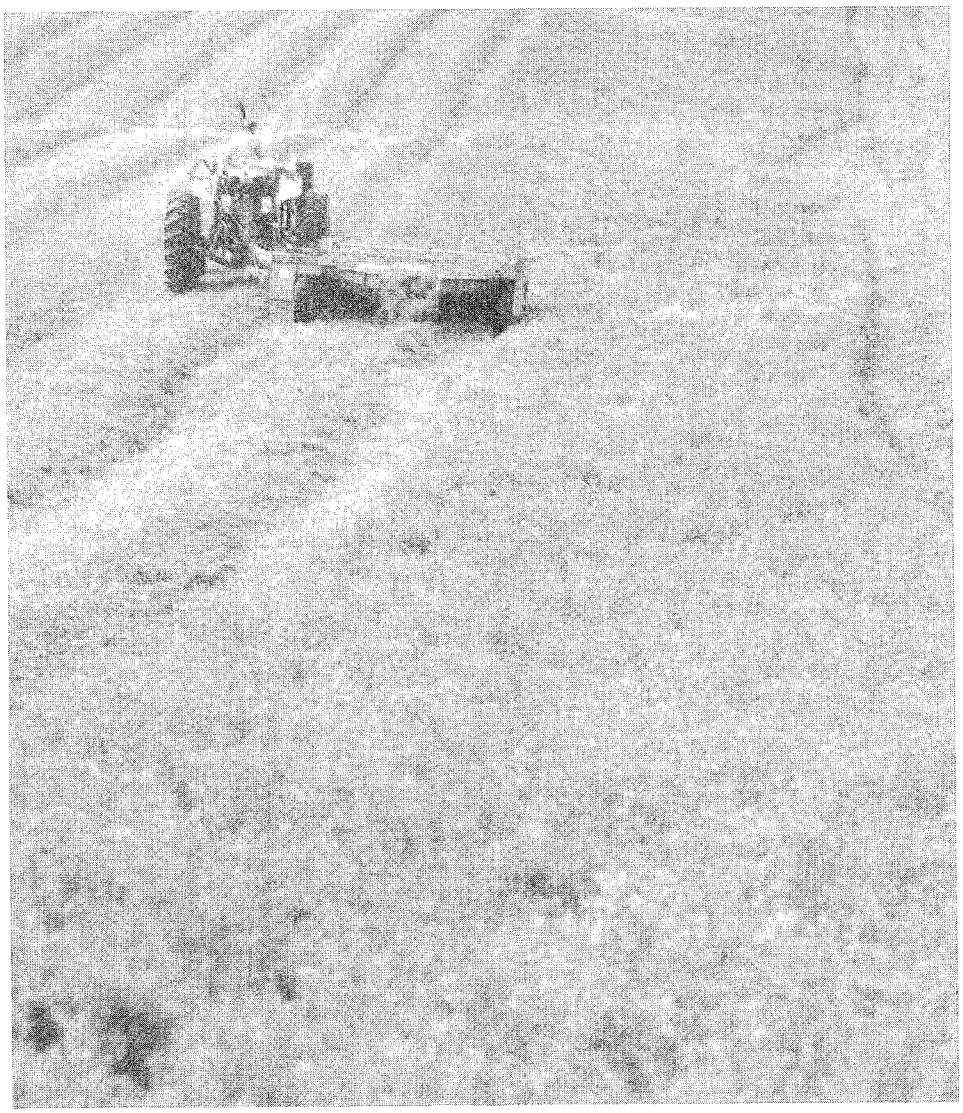
t. Twin City Seeds, 7263 Washington Ave. South, Edina, MN 55439

u. Wensman Seed Co., 102 Aldrich Ave. SE, Wadena, MN 56482

v. Werner Farm Seeds, 3104 Millersburg Blvd., Dundas, MN 55019

w. W-L Research, Inc., 8701 West U.S. Hwy 14, Evansville, WI 53536-8752

x. Ziller Seed Co., RR1, Box 122, Bird Island, MN 55310-9730



GRAIN CROPS

BARLEY

A new development in barley this year is the release of a variety, Royal, specifically developed for use as a forage companion crop. The primary advantage of this variety is its significantly shorter height compared to barleys that have been commonly used for this purpose in the past. This means that it does not compete unfavorably with the forage crops with which it would be typically interplanted. It also has good grain yield and good forage quality. Two new tables in this section, and the variety description in the text, provide specific forage related information on Royal.

Recommended public varieties

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 allowing grain to be distinguished from that of Robust and Stander. Classified as a malting variety by AMBA. Resistant to spot blotch. Developed by Minnesota Agricultural Experiment Station from cross involving Robust, Manker, and a sister-line of Morex. Released 1990. Seed sale regulated by U.S. Variety Protection Act.

Robust—Medium yield. Medium maturity. Good lodging resistance and kernel

The experiment station barley breeding program continues to develop and test new varieties malting characteristics and overall productivity for Minnesota growers.

Table 9. Yields of barley varieties (bushels per arce).

Variety	Crookston 1988–1994	Crookston 1994	Morris 1988–1994	Morris 1994	Stephen 1988–1994	Stephen 1994	St. Paul 1988–1994	St. Paul 1994	Roseau 1988–1994	Roseau 1994	Mean 1988–1994	Mean 1994
Number of trials:	*15*	*3*	*12*	*1*	*2*	—	*10*	*1*	*5*	*1*	*44*	*6*
Morex	89	86	69	88	56	—	85	91	76	77	80	86
Robust	97	87	76	97	67	—	89	93	89	82	87	89
Excel	108	98	82	94	76	—	94	100	95	91	94	97
Stander	107	95	79	112	75	—	96	106	100	97	95	100
Royal	—	87	—	84	—	—	—	108	—	75	—	88
LSD 5%	7	5	7	17	13	—	7	10	8	10	3	4

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.

Stander—High yield. Superior in lodging resistance to Robust and Excel. Good kernel plumpness, similar to Robust. Six-rowed, semi-smooth awn, short rachilla hairs, colorless aleurone. Malting quality status undetermined. Resistant to spot blotch. Developed by Minnesota Agricultural Experiment Station from crosses involving Excel, Robust and Bumper. Released 1993. Seed sale regulated by U.S. Variety Protection Act.

Royal—Intended for use as a forage-companion crop and feed-grain variety. Not a malting type. Six-rowed, semi-smooth awn, blue aleurone, semidwarf stature. Forage quality superior to taller varieties based on digestibility and intake potential; low in fiber and lignin. Similar to Robust in forage protein and forage yield at the soft dough stage. Compared to taller barley and oat varieties, it competes less with underseeded forage legumes because of its short stature and superior lodging resistance. Resistant to spot blotch. Developed by the Minnesota Agricultural Experiment Station from cross involving Robust, Azure and semidwarf Minn. M32. Released 1994. Seed sale regulated by U.S. Variety Protection Act.

Other public varieties

Azure—Medium yield. Medium maturity. Six-rowed, semi-smooth awn, long rachilla hairs, blue aleurone. Classified as a malting variety by AMBA. Resistant to spot blotch. Yield was similar to Robust in Minnesota trials, but is not recommended because of limited Minnesota demand for a blue aleurone malting variety. 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, 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.

Morex—Low yield. 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. Moderate resistance to spot blotch. Developed by Minnesota Agricultural Experiment Station from cross of Cree and Bonanza. Released 1978.

Table 10. Characteristics of barley varieties, 1989–1994.

Variety	Heading	Height	Lodging	Plump Kernels	Net Blotch
	date	inches	%	%	score [1]
Number of trials:	*24*	*22*	*10*	*30*	*8*
Morex	6-19	34	57	66	4.7
Robust	6-20	34	39	74	3.7
Excel	6-20	32	39	63	3.7
Stander	6-21	31	28	74	3.7

[1] Score of 1 is best.

Table 11. Characteristics of Royal barley compared to two standard varieties, 1992–1994.

Variety	Heading	Height	Lodging	Plump Kernels	Net Blotch
	date	inches	%	%	score [1]
Number of trials:	*24*	*22*	*10*	*30*	*8*
Robust	6-23	35	37	81	6.4
Excel	6-22	32	36	77	6.5
Royal	6-23	28	24	80	5.5

[1] Score of 1 is best.

Table 12. Forage composition and forage yield of Robust and Royal at the soft dough stage of growth, grown at St. Paul, Crookston, and Stephen.

	Composition[1] (%)				Yield [2]
Variety	CP	NDF	ADF	ADL	tons/acre
Robust	8.8	51.4	31.7	4.0	5.0
Royal	9.2	47.0	28.0	3.2	4.9
LSD 5%	NS	1.8	1.3	0.3	NS

[1] Crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF) and acid detergent lignin (ADL) concentration were measured on whole plants; [2] Measured only at St. Paul and Crookston.

OAT

Crown rust infection has dramatically increased in Minnesota oat fields since 1990, and at least five new races have been identified. As a result, varieties previously reported to have good crown rust resistance are now known to be vulnerable. *Varieties with limited or no rust resistance should be grown with caution.*

Minnesota Agricultural Experiment Station's interest in developing crop varieties for specialized uses has resulted in a new dwarf variety of oat. This special purpose forage oat

variety, Pal, was released in 1994 by the experiment station. It is a yellow mid-season dwarf designed to function as a superior forage or companion crop. It has good yield, high levels of crude protein and good relative feed value. However, no forage data for Pal is provided in this publication.

Recommended varieties

Dane—Early maturity, high yield, short, good lodging resistance, high test weight, very high groat percentage, yellow seed. Moderately susceptible to crown rust and 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. Seed sale regulated by U.S. Variety Protection Act.

Milton—Medium-late maturity, very high yield, medium height, good lodging resistance, high test weight and groat percentage, yellow seed. Small resistance to crown rust, resistant to smut, susceptible to red leaf. Selected at the Minnesota Agricultural Experiment Station. Released 1994. Application for Plant Variety Protection Certificate has been submitted.

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

Oat breeder Deon Stuthman (left), USDA geneticist Howard Rines (right) and students evaluate oat varieties being tested at the West Central Experiment Station, Morris.

Special purpose — forage establishment only

Pal—Medium maturity, medium yield, very short, good lodging resistance, low test weight, medium groat percentage, yellow seed. Susceptible to crown rust and red leaf, resistant to smut. Selected at the Minnesota Agricultural Experiment Station. Released 1994. Application for Plant Variety Protection Certificate has been submitted.

Varieties not adequately tested

INO 9201—Early maturity, very high yield, short, very good lodging resistance, high test weight, very high groat percentage,

Table 13. Oat yield by location, 1992–1994.

Variety	Rosemount	Waseca	Lamberton	Morris	Crookston	Grand Rapids	Six location ave.	Roseau	Winona
	bu/A								
Dane	69	76	76	81	120	102	87	95	55
INO 9201 [1]	79	95	71	85	119	96	91	89	62
INO 9212 [2]	66	72	80	65	116	86	81	85	62
Armor [2]	56	43	32	37	121	84	62	114	37
Pal	60	70	64	50	110	73	71	103	79
Jerry [1]	108	100	84	66	117	99	96	94	62
Milton	87	82	75	104	139	92	97	107	63
Brawn [2]	69	63	54	71	139	82	80	115	59
Troy	91	107	77	96	133	73	96	107	66
Ensiler [2]	54	58	49	28	105	77	62	105	52
Paul (hulless) [1]	81	71	72	69	108	69	78	117	70
Bay [2]	67	64	59	73	139	95	83	116	54
LSD 5%	10	7	9	9	10	11	4	10	7

[1] 1994 only; [2] 1993–1994.

Table 14. Characteristics of oat varieties, 1992–1994.

Variety	Heading	Height	Lodging	Test Weight	Groat	Reaction to Disease [2]		
						crown rust	smut	BYDV [3]
	date	inches	score [1]	lbs/bu	%	rating [2]	%	rating [3]
Dane	6-21	34	2.2	38	72	MS	0	7.5
INO 9201 [4]	6-22	34	1.9	37	70	S	50	5.5
INO 9212 [5]	6-23	34	2.0	34	70	S	10	6.5
Armor [5]	6-25	36	2.9	31	68	S	1	4.0
Pal	6-25	30	2.3	32	68	S	1	6.0
Jerry [4]	6-26	40	2.7	41	74	S	50	4.4
Milton	6-27	37	2.0	38	72	S-MS	10	7.5
Brawn [5]	6-28	34	2.1	33	69	S	20	6.0
Troy	6-28	42	3.0	39	71	MR	2	5.5
Ensiler [5]	6-30	43	2.9	34	67	S	0	3.5
Paul (hulless) [4]	6-30	40	2.4	51	—	MS	20	6.5
Bay [5]	6-30	36	1.8	33	69	MS	20	4.5

[1] 1 = erect, 5 = flat; [2] MS = moderately susceptible, S = susceptible; [3] 1 = no symptoms, 9 = dead; [4] 1994 only; [5] 1993-1994.

yellow seed. Susceptible to crown rust, resistant to smut and some tolerance to red leaf. Selected at the Purdue Agricultural Experiment Station. Released 1994. Foundation Seed available to Certified Seed producers only under a license/fee collection agreement. Application for Plant Variety Protection Certificate has been submitted.

Jerry—Medium maturity, very high yield, tall, fair lodging resistance, very high test weight and groat percentage, ivory seed. Susceptible to crown rust and smut, tolerant to red leaf. Selected at North Dakota Agricultural Experiment Station. Released 1994. Application for Plant Variety Protection Certificate has been submitted. Because of smut susceptibility, planting only treated seed is recommended.

Paul—Late maturity, high yield for hulless cultivar, tall, good lodging resistance, hulless so very high test weight. Moderately susceptible to crown rust and smut, susceptible to red leaf. Selected at North Dakota Agricultural Experiment Station. Released 1994. Application for Plant Variety Protection Certificate has been submitted.

Other varieties

Armor—Medium maturity, poor yield, medium height, fair lodging resistance, poor test weight and groat percentage, yellow seed. Susceptible to crown rust, resistant to smut, tolerant to red leaf. Selected at the Ohio Agricultural Experiment Station. Released 1992.

Bay—Late maturity, medium yield and height, very good lodging resistance, poor test weight, fair groat percentage, ivory seed. Moderately susceptible to crown rust and smut, tolerant to red leaf. Selected at the Wisconsin Agricultural Experiment Station. Released in 1993. Foundation Seed available to Certified Seed producers only under a license/fee collection agreement. Application for Plant Variety Protection Certificate has been submitted.

Brawn—Medium-late maturity, medium yield and height, good lodging resistance, poor test weight, fair groat percentage, dark ivory seed. Susceptible to crown rust, some resistance to smut and little tolerance to red leaf. Selected at the Illinois Agricultural Experiment Station. Released 1993.

Don—Early maturity, medium yield, short, fair lodging resistance, high test weight and groat percentage, low protein percentage, white seed. Susceptible to crown rust and red leaf, some resistance to smut. Selected at the Illinois Agricultural Experiment Station. Released 1985.

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

INO 9212—Medium maturity and yield, short, good lodging resistance, medium test weight, fair groat percentage, yellow seed. Susceptible to crown rust, smut and red leaf. Foundation Seed available to Certified Seed producers only under a license/fee collection agreement. Application for Plant Variety Protection Certificate has been submitted. Because of smut susceptibility, planting only treated seed is recommended.

Premier—Medium maturity, yield and height, good lodging resistance, medium test weight, groat percentage and protein percentage, 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. Seed sale regulated by U.S. Variety Protection Act.

Prairie—Medium-late maturity, medium yield, fair lodging resistance, medium test weight and groat percentage, white seed. Susceptible to crown rust and smut, very tolerant to red leaf. Selected at the Wisconsin Agricultural Experiment Station. Released 1992. Foundation Seed available to Certified Seed producers only under a license/fee collection agreement. Seed sale regulated by U.S. Variety Protection Act. Because of smut susceptibility, planting only treated seed is recommended.

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

Valley—Late maturity, medium yield, short, fair lodging resistance, medium test weight and groat percentage, medium protein percentage, ivory seed. Susceptible to crown rust and smut, some tolerance to red leaf. Selected at the North Dakota Agricultural Experiment Station. Released 1988. Because of smut susceptibility, planting only treated seed is recommended.

WHEAT (DURUM)

With one exception, performance tests for durum wheats have been of publicly developed varieties. These varieties, classed as either "recommended" or "other," are listed in maturity order within their classes. *All durum wheat varieties are very susceptible to scab.*

Recommended publicly developed varieties

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

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

Other public varieties

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

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

Privately developed variety

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

Table 15. Characteristics of durum wheat varieties, 1992–1993. [1]

Variety	Heading	Height	Lodging [2]	Rust Reaction [4] leaf	Rust Reaction [4] stem	Seeds [3]	Test Weight	Yield Morris	Yield Crookston	Yield Stephen	Yield State Mean
	date	inches	score [3]	rating [5]		no/lb	lbs/bu [2]	bu/A			
PUBLICLY DEVELOPED VARIETIES											
Renville	6-28	40	0.7	MR	R	10,500	60.7	74	46	85	63
Cando	6-29	32	0.3	S	R	10,800	59.8	58	39	95	58
Monroe	6-21	37	1.0	MR	R	10,700	61.2	60	36	79	53
Vic	6-25	40	1.0	MS	R	10,700	61.6	63	40	77	55
Mindum (check)	6-28	48	3.7	MS	S	10,700	60.8	52	41	48	45
PRIVATELY DEVELOPED VARIETIES											
Fjord	6-24	39	0.7	MR	R	10,200	61.6	57	39	81	54
LSD 5%								7	—	21	13

[1] 1992 and 1993 data, 1994 data not usable due to scab; [2] 1993 Crookston data; [3] 1 = erect, 9 = flat; [4] 1992 data; [5] Reaction to prevalent races: R = resistant, MR = moderately resistant, MS = moderately susceptible, S = susceptible.

WHEAT (HARD RED SPRING)

Recommendations for hard red spring wheat varieties are no longer being made by Minnesota Agricultural Experiment Station evaluators. The basis on which recommendations were made in the past are no longer considered appropriate because of the severity of the scab epidemic.

The scab epidemic in hard red spring wheat growing areas has demonstrated the clear need to give much greater weight in selecting varieties to their tolerance to this devastating disease. To assist growers in selecting such varieties, a new table 18 presents performance data under both diseased and low disease conditions.

Table 16 presents long term grain yield for varieties grown at various locations in Minnesota. Other important agronomic, disease and bread-making quality characteristics are in table 17. However, these two tables should no longer be the only, or even primary basis for selecting varieties to plant. They should be used in conjunction with table 18 to reduce risk of loss. Use of more than one variety is also highly recommended to reduce risk.

Variety description do not provide information on scab resistance. Table data should be used. Varieties are listed in maturity order.

Publicly developed varieties

Butte 86—Awned, early, medium height. Resistant to stem and moderately resistant

Table 16. Yields of hard red spring wheat varieties, 1992–1994.

Variety	Crookston	Stephen	Roseau [1]	Northern average	St. Paul	Morris	Waseca	Southern average	State average
					bu/A				
PUBLICLY DEVELOPED VARIETIES									
Butte 86	47	45	44	44	60	53	40	49	47
Sharp	53	50	44	48	62	50	45	51	50
Grandin	47	46	38	43	63	46	37	47	45
Norm	49	52	48	49	64	48	41	49	49
Prospect	54	54	39	50	59	42	37	44	46
Vance	47	46	37	44	52	51	34	44	44
Marshall	45	49	37	44	56	45	32	44	44
Stoa	48	52	47	50	57	49	38	47	48
Minnpro	48	51	42	46	50	41	33	41	43
Wheaton	48	55	35	46	62	48	39	48	47
Gus	50	50	47	49	51	45	32	42	45
Kulm[1]	50	50	34	44	60	54	45	53	48
PRIVATELY DEVELOPED VARIETIES									
2375	55	55	46	52	59	54	44	52	52
2370	53	55	45	51	65	53	41	51	51
Dalen	48	56	35	47	65	45	37	48	47
Bergen	52	57	43	50	66	50	37	50	50
2371	49	47	34	43	57	46	35	44	44
Sonja	54	52	36	47	66	51	43	52	50
Krona	58	54	37	49	62	49	36	48	49
Nordic	52	54	40	50	60	45	36	46	48
LSD 5%	10	12	10	6	9	8	6	5	4

[1] 1993 and 1994 data.

to leaf rust. High yield and test weight. Medium protein percent. Moderately susceptible to tan spot, black chaff, and lodging. Best adapted south of I-94. Released by North Dakota Agricultural Experiment Station 1986.

Sharp—Awned, early, medium height. Resistant to stem rust and moderately resistant to leaf rust. High yield and test weight. Medium protein percent. Moderately susceptible to lodging and black chaff. Best adapted south of I-94. Released by South Dakota Agricultural Experiment Station 1990.

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

Norm—Awned, midseason, semidwarf. Resistant to stem rust and leaf rust. Very high yield and test weight. Good lodging resistance. Tolerant to leaf spots. Moderately susceptible to loose smut. Medium protein

Staff at the Northwest Experiment Station, Crookston, ready a small plot combine to harvest these mature hard red spring wheat test plots.

Table 17. Characteristics of hard red spring wheat varieties, 1992–1994.

Variety	Heading	Height	Lodging	Rust reaction leaf	Rust reaction stem	Seeds	Test weight	Wheat protein	Milling baking
	date	inches	score[1]	rating[2]		no/lb	lbs/bu	%[3]	quality
PUBLICLY DEVELOPED VARIETIES									
Butte 86	6-23	32	2.7	MR	R	12,900	57.9	15.0	Med-High
Sharp	6-23	33	3.1	MR	R	13,100	59.7	14.8	Med-High
Grandin	6-24	32	2.5	R	R	13,400	58.0	15.4	High
Norm	6-25	32	2.3	R	R	12,600	56.1	14.1	High-Med
Prospect	6-26	31	2.1	MR	MS	13,900	56.7	14.4	Med-Low
Stoa	6-26	36	3.1	R	R	14,300	56.8	14.9	Med-High
Minnpro	6-26	32	2.9	R	R	12,600	54.6	15.9	High-Med
Gus	6-26	33	2.9	MS	R	15,200	56.5	16.0	High
Vance	6-27	31	2.9	R	R	13,300	55.5	15.0	Med-Low
Marshall	6-27	31	2.3	MR	R	15,800	56.6	14.0	Med-High
Wheaton	6-27	30	2.8	R	R	14,000	53.6	13.8	Low-Med
Kulm	6-22	35	2.4	MR	R	14,600	57.9	15.2	High-Med
PRIVATELY DEVELOPED VARIETIES									
2375	6-24	31	3.3	MR	MR	12,700	58.7	14.7	Med
2370	6-24	32	2.4	MS	MS	15,300	57.1	14.4	Med
Dalen	6-24	29	2.4	R	R	14,000	57.1	14.7	Low-Med
Bergen	6-25	29	1.9	R	R	13,100	56.4	14.5	Med
2371	6-25	31	1.9	MS	MR	13,100	55.9	14.9	High
Sonja	6-25	29	2.7	R	R	13,800	56.2	14.3	Med-Low
Krona	6-27	30	2.3	R	R	14,200	53.3	13.9	Low
Nordic	6-27	32	2.7	MR	R	12,400	56.4	13.3	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.

percent. Satisfactory milling and baking characteristics. Released by Minnesota Agricultural Experiment Station and USDA-ARS 1992. Seed sales regulated by U.S. Variety Protection Act.

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

Stoa—Awned, midseason, medium height. Resistant to stem rust and leaf rust. Moderately tolerant of loose smut and ergot. Very high yield and medium test weight. Medium protein percent. Higher potential for lodging. Released by North Dakota Agricultural Experiment Station 1984.

Minnpro—Awned, midseason, semidwarf. Resistant to stem rust and leaf rust. High yield and very high protein percent. Low test weight. Moderately susceptible to loose smut and lodging. Best adapted to northern Minnesota. Released by Minnesota

Agricultural Experiment Station and USDA-ARS 1989. Seed sale regulated by the U.S. Variety Protection Act.

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

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

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

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

Public variety not adequately tested

Kulm—Awned, early, medium height. Moderately resistant to leaf rust and resistant to stem rust. High yield and test weight. High protein percentage. Moderately susceptible to lodging. Satisfactory milling and baking, Released by North Dakota Agricultural Experiment Station 1994.

Table 18. Yield, test weight, and scab evaluation of hard red spring wheat varieties, 1992–1994.

	Yield		Test Weight		
Variety	Low Scab [1]	Scab [2]	Low Scab [1]	Scab [3]	Rating [4]
	bu/A		lb/bu		
PUBLICLY DEVELOPED VARIETIES					
Butte 86	52	35	59.3	51.6	1.4
Sharp	56	41	60.6	54.1	0.5
Grandin	49	35	58.8	53.9	2.3
Norm	55	30	57.0	46.8	4.9
Prospect	55	33	57.9	51.0	2.9
Stoa	55	42	57.5	52.5	1.7
Minnpro	48	26	56.1	47.7	6.6
Gus	50	33	57.1	51.6	4.3
Vance	49	28	56.7	47.9	6.3
Marshall	50	35	57.4	53.3	2.5
Wheaton	54	29	55.3	46.0	8.9
Kulm	—	44	—	53.3	2.2
PRIVATELY DEVELOPED VARIETIES					
2375	55	44	59.0	55.6	0.6
2370	56	43	58.1	49.6	1.6
Dalen	55	34	58.5	49.9	2.9
Bergen	55	37	57.3	47.1	2.8
2371	49	33	57.3	47.7	3.2
Sonja	56	33	57.9	47.7	4.6
Krona	56	34	54.8	49.6	7.8
Nordic	56	34	57.5	53.0	2.8
LSD 5%	5	6	1.1	2.0	

[1] Low scab = All locations in 1992 and three locations in 1994; [2] Scab = all locations in 1993 and two locations in 1994; [3] Stephen not included in 1992; [4] Disease (visual) x % light kernels; 1 = best, 10 = worst.

Privately developed varieties

2375—Awned, early, medium height. Resistant to stem rust and moderately resistant to leaf rust. Tolerant to loose smut. Very high yield and test weight. Medium to high protein percent. Moderately susceptible to lodging and to shattering. Best adapted to areas south of I-94. Released by Pioneer Hi-Bred 1988. Sold by North Dakota State University Research Foundation 1990. Seed sale regulated by U.S. Variety Protection Act.

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

Dalen—Awned, midseason, semidwarf. Resistant to stem rust and leaf rust. High yield and medium test weight. Good lodging resistance. Medium protein percent. Released by AgriPro 1991. Seed sale regulated by U.S. Variety Protection Act.

Bergen—Awned, midseason, semidwarf. Resistant to stem rust and leaf rust. Very high yield and medium test weight. Low to medium protein percent. Susceptible to ergot. Released by AgriPro 1990. Seed sale regulated by U.S. Variety Protection Act.

2371—Awned, midseason, semidwarf. Resistant to stem rust and leaf rust. Medium yield and low test weight. Good lodging resistance. Medium protein percent. Satisfactory milling and baking quality. Released by North Dakota State University Research Foundation 1991. Seed sales regulated by U.S. Variety Protection Act.

Sonja—Awned, midseason, semidwarf. Resistant to stem rust and leaf rust. High yield and medium test weight. Good lodging resistance. Low to medium protein percent. Released by AgriPro 1993. Seed sale regulated by U.S. Variety Protection Act.

Krona—Awned, midseason, semidwarf. Resistant to stem rust and leaf rust. Good lodging resistance. High yield. Low protein percent. Low test weight. Released by AgriPro 1992. Seed sale regulated by U.S. Variety Protection Act.

Nordic—Awned, midseason, semidwarf. Resistant to stem rust and moderately susceptible to leaf rust. Moderately tolerant of loose smut. High yield and medium test weight. Low protein percent. Medium lodging resistance. Released by AgriPro 1986. Seed sale regulated by the U.S. Variety Protection Act.

WHEAT (WINTER)

Publicly developed varieties are listed within classes in maturity order. Privately developed varieties are listed and described separately. A minimum of two years testing is required before any data is presented from these trials.

Hard red winter wheat is grown on fewer than 5 percent of the total acreage planted to wheat in Minnesota. However, there are several reasons for choosing to grow this crop. Winter wheat matures earlier than spring wheat varieties, and it will often produce a crop on soils that are subject to drought during the latter part of July, when temperatures are usually high and rainfall more limited.

With its fall planting and early harvest, winter wheat distributes work load and land utilization, which can be appropriate for some cropping programs. Winter wheat can also provide soil conservation benefits when planted on potentially erodible soils. And, if the wheat doesn't survive the winter, another crop can be planted in the spring with minimal cost.

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.

Publicly developed varieties

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

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

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 by the North Dakota Agricultural Experiment Station 1987.

Other public varieties

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

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

Table 19. Yield and characteristics of publicly developed winter wheat varieties, 1992–1994.

Variety	Heading	Height	Winter Survival	Lodging	Rust Reaction		Test Weight	Protein	Yield			
					leaf	stem			Rosemount	Morris	Roseau	Mean
	date [1]	inches	rating [2]	score [3]	rating [4]		lbs/bu [5]	% [6]	bu/A			
Arapahoe	7	43	H	2.6	R	R	57.4	12.2	69	57	51	60
Roughrider	10	46	VH	3.9	S	R	57.8	12.7	52	45	45	48
Seward	12	45	VH	3.6	MR	R	57.5	11.0	64	51	54	57
Brule	8	43	MH	2.9	MS	R	57.8	11.5	59	51	49	54
Rose	9	42	H	3.8	MS	MR	59.1	12.0	56	50	43	50
LSD 5%									7	8	4	4

[1] Heading date data does not include Roseau; [2] VH = very hardy, H = hardy, MH = moderately hardy, NH = not hardy; [3] 1 = erect, 9 = flat; [4] R = resistant, MR = moderately resistant, MS = moderately susceptible, S = susceptible; [5] Test weight, 1992 and 1994; [6] 12 percent moisture.

WILD RICE

Wild rice is a relatively recently developed cultivated crop. Seed shattering, an important characteristic of the plant's wild dispersal and survival, remains a problem for commercial growers. The main focus of wild rice breeeding efforts and research is the improvement of seed retention.

Cultivated wild rice is grown on 20,000 acres in Minnesota. Most cultivated wild rice is produced from varieties with at least some non-shattering 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 both lodging and disease susceptible.

Varieties

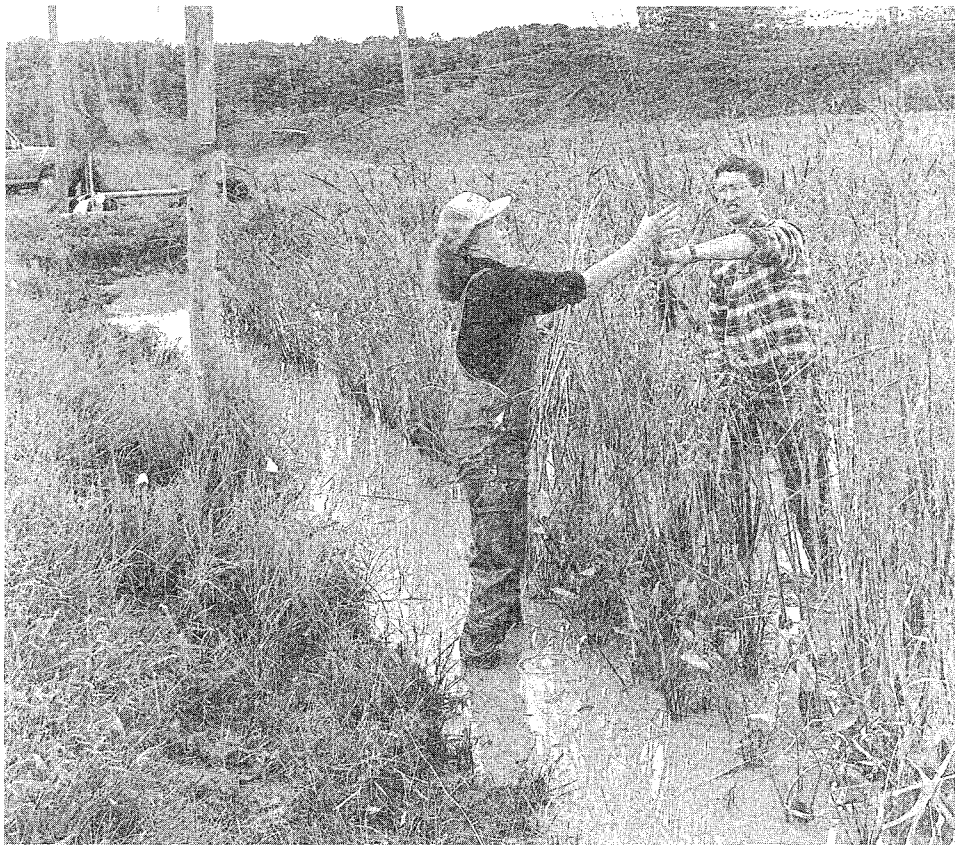
Franklin—Medium height, medium to early maturity. More shattering resistant than

K2 or other currently grown varieties, especially retaining more seed when harvest is delayed. Released by the Minnesota Agricultural Experiment Station 1992.

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

Petrowske bottlebrush—Medium height, medium to late maturity, and high yield. Up to 50 percent of plants can have bottlebrush panicle type, depending on continued selection for the trait. Developed by K & D Wild Rice.

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



Wild rice test test plots at Grand Rapids and other sites require extensive hands-on management to minimize losses of the products of seeding trials. The plant's natural tendency to drop its seeds is a substantial obstacle to both research and commercial production.

Table 20. Yield and seed shattering losses of wild rice varieties, 1991–1994.[1]

	Grand Rapids[2]		Waskish[3]		Clearbrook[4]		Aitkin[5]		Average[6]	
Variety	Yield	Shattering	Yield	Shattering	Yield	Shattering	Yield	Shattering	Yield	Shattering
	lb/A	%	lb/A	%	lb/A	%	lb/A	%	lb/A	%
Franklin	1450	12	1284	14	1319	16	1819	13	1417	13
K2	1449	21	1143	23	1391	21	1488	22	1350	19
Petrowske bottlebrush	1571	25	1254	31	1249	27	1862	14	1430	24
Voyager	1210	18	865	29	1110	32	1854	11	1175	23
LSD 5%	139	3	118	3	116	3	363	6	128	3

[1] Yield adjusted to 40 percent moisture; shattering expressed as a percentage of harvested plus shattered grain; [2] Means of trials at Grand Rapids in 1991 and 1992; [3] Means of trials at Clearbrook, 1992 and 1993; [4] Means of trials at Waskish, 1992 and 1994; [5] Means of trials at Aitkin, 1993; [6] Means of all trials at all five locations.

CROPS NOT IN CURRENT TRIALS

Amaranth

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

Amaranth has large seed heads that 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 that grows best in warm, dry weather. It is widely adapted to many locations in the Midwest including Minnesota.

An amaranth crop is planted in late May or early June. Cultivation of wide rows is required in the absence of approved herbicides. Seed yields of 300 to 3,800 pounds per acre (hand harvested) have been reported in Minnesota, and it is reasonable to expect a yield of 1,200 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 con-

tract 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.

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

Production information is provided in the amaranth 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. Additional information is provided in the "Amaranth Grain Production Guide" available from The Amaranth Institute, Box 216, Bricelyn, MN 56097.

Annual Canarygrass

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

Production in the U.S. developed after World War II in the states of Minnesota and North Dakota, and later shifted to Manitoba and then Saskatchewan. In 1987, over 180,000 acres of canarygrass were produced in Canada.

Fewer than 3,000 acres of canarygrass have been planted annually in Minnesota and North Dakota in recent years. It is grown under contract as a specialty crop, used primarily as bird feed. The largest users are Japan and other countries of East Asia and Europe.

Minnesota Agricultural 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 nutritionally superior to all cereals, including oats.

However, Minnesota Agricultural 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 is again evaluating corn hybrid performance in order to provide unbiased information for growers who need to choose a hy-brid for their farm production. This program is partly funded by fees paid by the seed companies who enter hybrids in these trials.

Results of the 1992–1994 tests were published in an early December issue of *Agri-News*. You can also obtain copies of those results at your country extension office or by contacting extension agronomist Dale Hicks, University of Minnesota, 411 Borlaug Hall, 1991 Buford Circle, St. Paul MN 55108.

Buckwheat in full bloom.

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 acreages 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 often occurs with every hotter and drier than normal growing season.

Sorghum is a food grain for humans but in the U.S. is primarily used as feed for livestock. Feed value is similar to corn. Grain sorghum may also be used as whole-plant silage; however, sweet sorghum was specifically developed as a silage crop for that purpose. And while sweet sorghum produces much higher forage yields than grain sorghum, 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 Agricultural 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.

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 the world's cultivated crops, but it is not a single crop. The name is applied to several grass crops whose seeds are harvested for food or feed, with five species having 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.

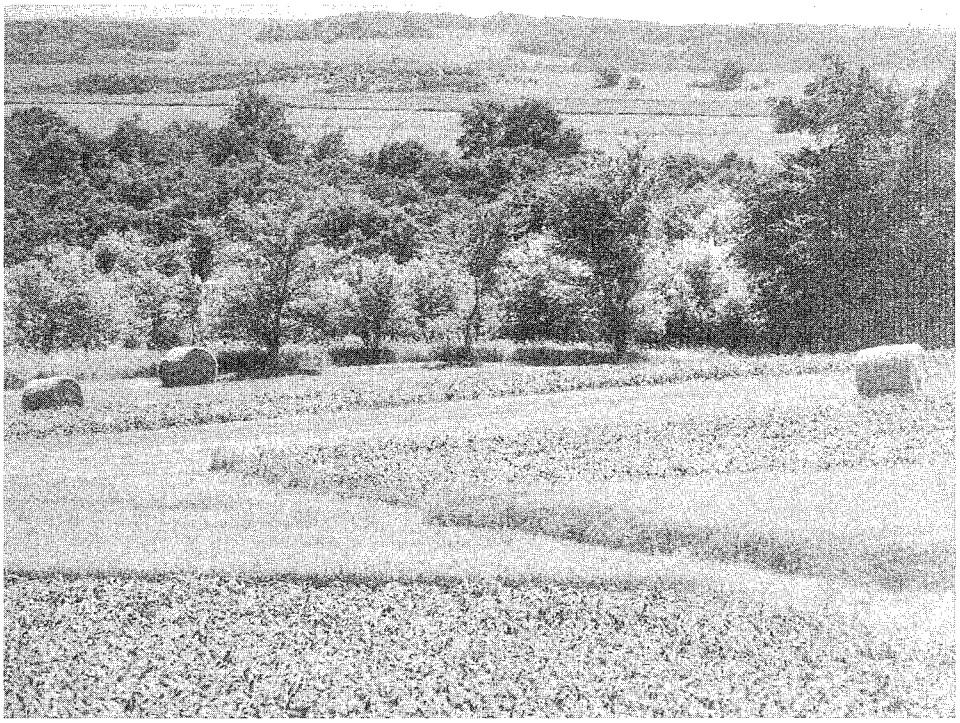
Barnyard or Japanese millet *(Echinochloa frumentaceae* L.*)*, is a domesticated relative of the barnyard grass weed. In the U.S. it is grown primarily as a forage.

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

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

Minnesota Agricultural Experiment Station scientists are not currently conducting performance trials for any of the species 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.

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.



Corn, oats and forage planted in contour strips.

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

Minnesota Agriculture Experiment Station scientists are not currently conducting trials of rye. 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.

Production information is provided in the rye 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.

Manual. Contact your county extension agent or The Center for Alternative Plant & Animal Products, 340 Alderman Hall, University of Minnesota, St. Paul, MN 55108, for details about this publication.

OILSEED CROPS

CANOLA

Canola (*Brassica napus* or *B. campestris*) is used for edible oil extraction and as protein feed meal. Canola oil is considered one of the highest quality edible oils available and is being used in an increasing number of products for human consumption. Considerable acreage of spring canola is grown in Canada.

Interest in spring canola has increased recently in Minnesota, especially in Roseau County, which currently plants about 85 percent of Minnesota's canola acreage. Roseau producers grew canola on 5,146 acres in 1992, 9,300 acres in 1993, and 21,265 acres in 1994. About 25,000 acres in total were grown in Minnesota in 1994.

Canola is a crop developed from oilseed rape by Canadian plant breeders. The first canola variety was licensed in 1974.

The oil in canola seed contains less than 2 percent erucic acid. This compares with the 20 to 40 percent found in oilseed rape. The meal remaining after oil extraction contains less than 0.1 percent of glucosinolate (sulfur containing compounds) compared with about 1 percent in rapeseed meal. High levels of erucic acid in food oils are hazardous to health, and high levels of glucosinolates are detrimental in livestock feeds. Therefore, canola is also referred to as "double low" or "00" rapeseed.

All of the canola varieties described here are spring-sown types. Winter canola has also been evaluated by University of Minnesota researchers at locations throughout the state, but in trials conducted over 15 year/locations, less than 30 percent of the trials successfully overwintered, making current winter varieties too risky for Minnesota's growing conditions.

Production information is provided in the canola chapter of the *Alternative Field Crops Manual*. The cost of the manual is $45. Contact your county extension educator or the Center for Alternative Plant & Animal Products, 340 Alderman Hall, University of Minnesota, St. Paul, MN 55108 for more information about purchasing this publication. A more complete *Canola Growers Manual* is also available from the Canola Council of Canada, 400-167 Lombard Ave., Winnipeg, Manitoba, R3B 0T6. It contains detailed information on canola production practices and costs $68 (U.S. currency). The Canola Council also provides free updates to keep the information in the manual current.

Harvested canola plants are allowed to dry on the stubble after being pressed down with a roller to keep them from being blown away.

Spring Canola Varieties

B2416—(SV02416)—Developed and marketed by Svalof Weibull Seed Ltd., P.O. Box 217, Lindsay, Ontario, Canada K9V 5Z4.

Celebra—Developed by Svalof Weibull Seed Ltd. Marketed by Agri-Tel Grain Ltd., Box 808, Beausejour, Manitoba R0E 0C0.

Crusher—Developed by Svalof Weibull Seed Ltd. Marketed by Interstate Payco Seed Co., Box 338, West Fargo, ND 58078.

Cyclone—Developed by Danish Plant Breeders and King Agro. Marketed by Limagrain Canada Seeds, P.O. Box 9077, Saskatoon, Saskatchewan, Canada S7K 7E7.

Defender—(SW02506)—Developed by Svalof Weibull Seed Ltd. Marketed by Interstate Payco Seed Co., Box 338, West Fargo, ND 58078.

Excel—Developed by Cargill-France. Marketed by Cargill Hybrid Seeds, P.O. Box 5645, Minneapolis, MN 55440.

Garrison—Developed and marketed by Svalof Weibull Seed Ltd., PO Box 217, Lindsay, Ontario, Canada K9V 5Z4.

Global—Developed by Svalof AB, Sweden. Distributed by Can Am Seed Co., Box 5236, Grand Forks, ND 58206 and Peterson Seeds, Box 346, Savage, MN 55378.

Helios—Developed by Danish Plant Breeders. Marketed by SeedTec International, 12005 N. Burgard Rd, Portland, OR 97283.

Hyola 308—(GSN038, Hyola X038)—Available in 1995. Hybrid developed by Zeneca Seeds, Winnipeg. Marketed by Kaystar Seed, 702 3rd St. SW., PO Box 947, Huron, SD 57350.

Hyola 329—(GSN029, Hyola X029)—Available in 1995. Hybrid developed by Zeneca Seeds, Winnipeg. Marketed by Kaystar Seed, 702 3rd St. SW., PO Box 947, Huron, SD 57350.

Hyola 401—Hybrid developed by Zeneca Seeds, Winnipeg. Marketed by Kaystar Seed, 702 3rd St. SW., PO Box 947, Huron, SD 57350.

IMC02—Specialty oil canola developed by Inter-Mountain Canola, 2300 North, Yellowstone Ave., Idaho Falls, ID 83401. Grown on contract basis.

Impact—Developed by Svalof Weibull Seed Ltd. Marketed by Cenex/Land O' Lakes Seed Plant, P.O. Box 489, Mentor, MN 56736.

IP 35-89—Marketed by Interstate Payco Seed, Box 338, West Fargo, ND 58078.

IP 93108—Developed by Ag. Canada. Marketed by Interstate Payco Seed, Box 338, West Fargo, ND 58078. May not be available in 1995.

Table 21. Seed yield of spring canola (*Brassica napus* and *B. campestris*) varieties.

	1992			1993	1994			1992–94
Variety	Morris	Roseau	Average[1]	Morris	Morris	Roseau	Average	Average
	lb/A[2]							
B2416	—	—	—	1,348	—	—	—	—
Celebra	2,625	1,548	1,958	—	1,023	2,341	1,682	1,848
Crusher	2,889	1,582	1,972	—	1,157	2,682	1,919	1,951
Cyclone	2,886	2,406	2,493	1,334	1,313	2,364	1,838	2,082
Defender	—	—	—	—	1,047	2,634	1,840	—
Excel	—	—	—	—	—	2,075	—	—
Garrison	—	—	—	—	1,334	2,680	2,060	—
Global	3,198	2,106	2,335	1,226	—	—	—	1,790[4]
Helios	2,994	2,156	2,258	770	1,478	2,457	1,967	1,913
Hyola 308	—	—	—	1,460	—	3,014	—	2,237
Hyola 329	—	—	—	1,619	—	2,553	—	2,086
Hyola 401	2,809	2,895	2,719	2,070	1,334	3,186	2,260	2,458
IMC02	—	—	—	—	1,351	2,345	1,848	—
Impact	—	—	—	—	991	2,292	1,642	—
IP 35-89	—	—	—	—	1,242	2,573	1,907	—
IP 93108	—	—	—	—	1,331	2,458	1,895	—
IP Desiree	—	—	—	—	1,056	2,394	1,725	—
Iris	3,122	2,438	2,321	950	—	—	—	1,978
Klondike[3]	—	—	—	—	—	2,104	—	—
Legacy	—	—	—	1,259	—	—	—	—
Legend	2,355	2,123	2,087	1,247	1,131	2,136	1,634	1,796
LG 94-04	—	—	—	—	943	2,705	1,824	—
LG 94-05	—	—	—	—	1,064	2,814	1,939	—
LG 94-06	—	—	—	—	767	2,153	1,460	—
LG 94-07	—	—	—	—	947	2,816	1,881	—
Maverick[3]	—	—	—	—	—	2,034	—	—
Norseman	—	—	—	—	1,120	2,361	1,741	—
OAC Springfield	—	—	—	1,262	1,210	2,546	1,878	1,673
OAC Summit	—	—	—	—	1,785	2,568	2,199	—
Polo	2,746	1,790	2,075	1,148	—	2,416	—	1,958
Princeton	—	—	—	1,795	—	—	—	—
Reward[3]	—	—	—	—	—	1,848	—	—
S-9410	—	—	—	—	1,008	2,289	1,648	—
S-9420	—	—	—	—	1,089	2,445	1,767	—
SCHP 004	—	—	—	—	—	3,161	—	—
Seville	—	—	—	—	1,164	2,230	1,697	—
Sponsor	—	—	—	—	1,376	2,803	2,090	—
Tobin[3]	1,797	2,293	1,945	1,087	—	1,801	—	1,745
Trojan	2,733	2,034	2,204	1,589	1,032	2,650	1,841	—
Westar	2,323	1,809	1,904	1,073	—	—	—	1,513[4]
LSD 0.05	441	396	252	502	405	392	266	—

[1] Average yield of Crookston, Morris and Roseau; [2] 10 percent moisture basis; [3] Klondike, Maverick, Reward, and Tobin are *Brassica campestris* varieties; [4] Long-term average (16 location/years) for Global and Westar are, 1,703 and 1,618, respectively.

Table 22. Agronomic characteristics of spring canola (*Brassica napus* and *B. campestris*) grown in 1994.

Variety	Planting to 90% bloom		Planting to maturity		Height		Lodging	Test Weight		Oil	
	Morris	Roseau	Morris	Roseau	Morris	Roseau	Roseau	Morris	Roseau	Morris	Roseau
	days		days		inches		score [1]	lbs/bu		% [2]	
Celebra	75	74	96	99	45	45	1.3	49.0	49.5	36.8	37.2
Crusher	79	77	98	99	44	43	1.0	51.0	51.5	36.8	37.5
Cyclone	73	75	95	101	39	44	2.3	48.5	50.0	35.6	36.3
Defender	71	71	95	99	42	46	2.8	51.0	51.0	35.4	35.9
Excel	—	71	—	99	—	43	3.3	—	49.5	—	37.2
Garrison	78	75	98	98	46	47	1.3	51.0	51.0	35.4	36.6
Helios	76	76	98	98	42	47	1.5	50.5	50.0	35.9	37.2
Hyola 308	61	63	86	93	30	43	4.8	—	48.0	—	36.0
Hyola 329	63	62	88	95	31	44	4.8	—	44.5	—	36.1
Hyola 401	62	67	93	99	30	41	2.8	48.5	50.5	35.6	37.3
IMC02	71	71	96	101	34	45	2.5	49.5	51.0	36.9	38.2
Impact	78	74	97	102	41	45	2.5	50.5	50.5	35.6	36.4
IP 35-89	79	78	99	98	54	46	1.3	50.0	50.5	36.7	36.6
IP 93108	69	68	95	98	38	44	2.3	49.5	50.0	36.8	38.8
IP Desiree	78	75	99	100	41	46	1.3	48.5	48.5	35.9	36.7
Klondike [3]	65	62	85	90	38	45	2.3	—	50.5	—	35.8
Legend	70	70	96	97	36	44	2.8	48.5	49.5	35.5	36.6
LG 94-04	81	74	99	102	38	46	1.0	50.0	49.0	34.9	35.8
LG 94-05	81	74	99	98	42	45	2.5	51.5	51.0	34.6	36.0
LG 94-06	81	74	98	98	44	41	3.3	52.0	52.0	33.5	35.1
LG 94-07	70	70	94	98	37	43	2.8	50.5	51.5	35.3	37.4
Maverick [3]	—	59	—	89	—	44	4.0	—	51.0	—	37.3
Norseman	75	74	96	99	45	46	1.8	50.5	51.5	36.3	36.5
OAC Springfield	67	66	96	100	35	44	3.8	48.0	49.5	35.7	37.8
OAC Summit	67	72	96	98	44	46	2.8	48.0	51.0	36.5	37.1
Polo	—	69	—	96	—	43	3.0	—	50.0	—	39.8
Reward [3]	62	59	84	69	37	43	4.5	—	50.0	—	36.3
S-9410	73	71	96	100	39	44	1.8	50.5	50.5	36.9	37.8
S-9420	69	68	95	99	44	44	2.3	51.0	51.0	35.4	37.7
SCHP 004	—	73	—	100	—	46	2.0	—	50.5	—	36.0
Seville	78	76	97	100	43	46	1.8	51.0	51.5	35.5	36.3
Sponsor	76	74	100	98	40	46	1.0	50.5	51.0	34.5	36.4
Tobin [3]	63	60	85	95	34	43	3.8	—	51.0	—	34.7
Trojan	80	75	97	101	46	45	1.8	50.5	51.0	36.2	36.0
LSD (0.05)	5	2	2	4	11	2	0.9	1.0	1.0	—	—

[1] 1 = no lodging, 5 = severe lodging; [2] 10 percent moisture basis; [3] Klondike, Maverick, Reward, and Tobin are *Brassica campestris* varieties.

IP Desiree—Developed by VanderHave. Marketed by Interstate Payco Seed, Box 338, West Fargo, ND 58078. May not be available in 1995.

Iris—Developed by NPZ, Germany. Licensed to Ameri-Can Pedigreed Seed Co., Raymond, OH 43067.

Klondike—Developed by Svalof Weibull Seed Ltd., PO Box 217, Lindsay, Ontario, Canada K9V 5Z4.

Legacy—Developed by Svalof-Weibull Seed Ltd. Distributed by Bonis and Co. Ltd., Lindsay, Ontario, Canada K9V 5Z4.

Legend—Developed by Svalof Weibull Seed Ltd. Marketed by Interstate Payco Seed, Box 338, West Fargo, ND 58078.

LG 94-04—Developed by Limagrain Canada Seeds, P.O. Box 9077, Saskatoon, Saskatchewan, Canada S7K 7E7. Marketed by Interstate Payco Seed, Box 338, West Fargo, ND 58078.

LG 94-05—Developed by Limagrain Canada Seeds. Marketed by Interstate Payco Seed, Box 338, West Fargo, ND 58078.

LG 94-06—Developed by Limagrain Canada Seeds. Marketed by Interstate Payco Seed, Box 338, West Fargo, ND 58078.

LG 94-07—Developed by Limagrain Canada Seeds. Marketed by Interstate Payco Seed, Box 338, West Fargo, ND 58078.

Maverick—(SV03902)—Developed and marketed by Svalof Weibull Seed Ltd., P.O. Box 217, Lindsay, Ontario, Canada K9V 5Z4.

Norseman—(SV02414)—Developed by Svalof Weibull Seed Ltd. Marketed by Interstate Payco Seed, Box 338, West Fargo, ND 58078.

OAC Springfield—Developed by Ontario Agriculture College, Guelph, Ontario. Market-

ed by Agri-Tel Grain Ltd., Box 808, Beausejour, Manitoba R0E 0C0.

OAC Summit—Originated by Ontario Agriculture College, Guelph, Ontario.

Polo—High oil canola developed by Mycogen Plant Sciences/Maribo Seeds. Marketed by Mycogen Plant Sciences/Performance Seeds, 5649 E. Buckeye Rd, Madison, WI 53716.

Princeton—(SV02418)—Developed and marketed by Svalof Weibull Seed Ltd., P.O. Box 217, Lindsay, Ontario, Canada K9V 5Z4.

Reward—Developed by University of Manitoba, and is a public variety.

S-9410—Marketed by Calgene, 519 St. Catherine Court, Newburgh, IN 47630.

S-9420—Marketed by Calgene, 519 St. Catherine Court, Newburgh, IN 47630.

SCHP 004—Developed by Svalof Weibull Seed Ltd. Marketed by Cargill Hybrid Seeds, P.O. Box 5645, Minneapolis, MN 55440.

Seville—Developed by Svalof Weibull Seed Ltd. Marketed by Northstar Seed Ltd., Box 714, Neepawa, Manitoba R0J 1H0.

Sponsor—(SV02051)—Developed by Svalof Weibull Seed Ltd. Marketed by Agri-Tel Grain Ltd., Box 808, Beausejour, Manitoba R0E 0C0.

Tobin—Developed by Agriculture Canada, Saskatoon. Marketed by Northern Sales, 135 Lombard Ave., Winnipeg, Manitoba R3B 0T4.

Trojan—(SV02413)—Developed by Svalof Weibull Seed Ltd. Marketed by Interstate Payco Seed, Box 338, West Fargo, ND 58078.

Westar—Originated by Agriculture Canada, Saskatoon. Licensed in 1982. Marketed by Northern Sales, 135 Lombard Ave., Winnipeg, Canada R3B OT4.

SOYBEAN

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

Tables 24 through 27 deal with varieties which have been developed by publicly supported institutions and are being considered for recommendation by the Minnesota Agricultural Experiment Station. Tables 28 through 31 show performance characteristics of privately developed varieties as well as several public varieties.

Performance trials were conducted at various locations in the northern, central and southern zones of Minnesota (see map of soybean maturity zones). Specific test locations for each zone are indicated in each table. Trials were planted between May 5 and May 25 unless otherwise indicated. Becker was the only irrigated test site. Row spacings are varied in some tables.

There are several major factors to be considered in selecting soybean varieties. These include maturity, yield, row spacing, plant height and lodging, chlorosis response, protein and oil values, phytophthora gene, soybean cyst nematode and brown stem rot resistance.

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.

To obtain high yield and quality, varieties should be selected that mature before the fall killing frost. 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.

Descriptions of public varieties include relative maturity ratings. These consist of a maturity group designation followed by a number (varying from 0 to 9) which indicates the ranking within each maturity group. For example, Agassiz with a relative maturity rating of 0.0, is the earliest group 0 maturity variety while Dassel, with a rating of 0.9, is the latest. These rating designations are the result of our experience with the variety over years and test locations.

The relative maturity ratings in the tables for private varieties were provided by the companies which market them.

Soybean Maturity Zones

Performance data for soybean is collected at the sites noted in each of the maturity zones.

Yield—Varieties are arranged in the tables in order of increasing maturity as determined in the 1994 season. Later maturing varieties are normally expected to have higher yield potential than earlier maturing varieties. Yields should be compared by looking at varieties with a similar maturity rating. 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 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 this LSD value, you 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. Differences occuring the remaining 20 percent of the time are considered to be 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). 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 relate to the stem strength and standability of varieties. They also 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—Ratings for chlorosis are an indication of how much leaf yellowing occurs in tests conducted on a high lime (high pH) soil near Lamberton. They indicate how well varieties perform relative to each other on such soils.

The rating designations for chlorosis used in this year's publication are new. They relate directly to the numerical values used in previous years' editions according to the following scale:

Previous Numerical Score	New Rating Designation
1-2	Resistant (R)
2.1-3	Moderately Resistant (MR)
3.1-4	Moderately Susceptible (MS)
4.1-5	Susceptible (S)

Phytophthora—Phytophthora root rot can cause significant yield losses when susceptible varieties are planted in poorly drained fields. Because there are numerous races of this fungus, it is important to know which are present in your field. Any of several genes that have been incorporated into many soybean varieties provide those varieties with complete resistance to specific races (table 23).

Some information is also provided that refers to "tolerance" or "field resistance" which is not race-specific. This information should not be confused with race specific resistance. Reliable tests for tolerance have not yet been developed.

Table 23. Genes for resistance to races of Phytophthora root rot (shaded box indicates resistance is present).

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	■	■								■	■		■	■	■	■	■	■						■	
Rps1b	■		■	■	■	■	■	■	■				■	■	■		■	■			■	■			
Rps1c	■	■	■			■	■	■	■	■	■		■		■		■					■	■	■	
Rps1k	■	■	■	■	■	■	■	■	■	■	■		■	■	■		■	■				■		■	
Rps3	■	■	■	■	■			■	■		■		■	■	■	■		■				■	■		■
Rps4	■	■	■	■						■	■	■		■		■		■	■	■	■	■	■		
Rps6	■	■	■	■						■		■		■	■	■		■	■	■	■				■

Determinations of which resistance genes are present were based on data from greenhouse plants grown by scientists in the University of Minnesota Department of Plant Pathology, and on information supplied by the companies.

Soybean Cyst Nematode—This nematode pest was first identified in Minnesota in 1978 and is now known to occur in 32 Minnesota counties, according to Cooperative Pest Survey Program data. Areas infested and numbers of nematodes both appear to be increasing. Several races of the nematode are known to occur in the state.

When soybean cyst nematode numbers are high, significant yield losses can occur. Rotations to non-host crops and planting resistant varieties assist in managing nematode populations.

Results of a special performance test of public and private varieties resistant to soybean cyst nematode are provided in Table 30. These trials were conducted on "infested" sites near East Chain, New Richland and St. James and on "non-infested" sites at Fairmont, Lamberton and Waseca. Egg counts at the end of the 1994 growing season on susceptible variety plots at St. James, East Chain, and New Richland were 31,650, 3,950 and 5,350 eggs/100cc of soil respectively. Low levels of the nematode were also found on a portion of the test plot site at Fairmont in 1994.

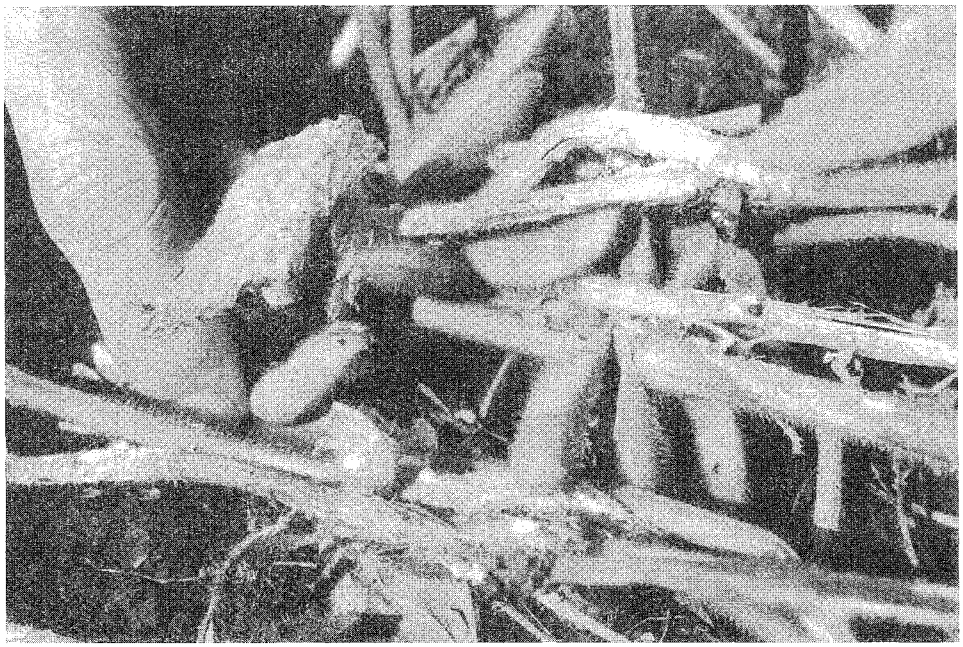
Additional details on soybean cyst nematode and on the management of infested fields can be found in the publication *The Soybean Cyst Nematode* (AG-FO-3935), prepared by the Minnesota Extension Service, University of Minnesota. It is available from County Extension offices or from the MES Distribution Center, 20 Coffey Hall, 1420 Eckles Ave., University of Minnesota, St. Paul, MN 55108-6069.

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. See text descriptions of public varieties for information about their resistance to this fungus.

Some information provided on brown stem rot refers to "tolerance" or "field resistance" which is not race-specific. This should not be confused with race specific resistance. Reliable tests for tolerance have not yet been developed.

White Mold—White mold (Sclerotinia) was reported in many fields during the 1994 growing season. Minnesota Agricultural Experiment Station scientists have not yet rated varieties for white mold resistance, and reliable ratings of varieties are difficult to obtain because variety reaction to white mold infection is highly dependent on environmental conditions at flowering time.

Protein and Oil—Protein and oil values have been determined using near infrared reflectance analysis. Protein and oil values



Sclerotinia (white mold) is a disease of soybean, caused by a fungus that thrives when weather conditions are warm and moist during the flowering period. In several areas of Minnesota, 1994 was a bad year for some soybean growers because it was a good year for the mold's growth.

are expressed on a 13 percent moisture basis. You can use the following formula to convert the protein and oil value to another moisture basis:

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

Value of a bushel of soybeans, based on oil and protein content, can be calculated by:

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

Where:

- *APV* = approximate value of soybeans (per bushel)
- *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:

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

phytophthora. Released 1989 by Iowa Agricultural Experiment Station. Seed Sale regulated by U.S. Variety Protection Act.

BSR 101—Southern zone. Relative maturity 1.9. 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. Relative maturity 2.2. Resistant to race 3 and race 14 of the Soybean Cyst Nematode. Recommended as part of a management package for producers with a soybean cyst nematode problem. Fair yield potential. *Susceptible to phytophthora.* Released by Illinois Agricultural Experiment Station 1989. Seed sale regulated by U.S. Variety Protection Act.

Bert—Southern zone. Relative maturity 1.8. 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.

Dawson—Central zone. Relative maturity 0.7. 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. Relative maturity 0.6. *Rps1 gene for resistance to phytophthora.*

Table 24. Yields of publicly developed soybean varieties in northern zone, 1990–1994.

Variety	Crookston	Grand Rapids	Moorhead	Roseau	Shelly
	bu/A				
McCall	33	18	28	32	—
Agassiz [1]	38	24	28	32	—
Ozzie	35	—	33	—	34
Glenwood	36	—	36	—	35
Evans	35	—	34	—	31
Dawson	37	—	36	—	36
Lambert	—	—	33	—	36
Proto	—	—	30	—	28
LSD 20%	2	1	2	2	1

[1] 1991-1994 data adjusted to 5 year average.

Recommended public varieties

Agassiz—Northern zone. Relative maturity 0.0. Very good yield potential. Good lodging resistance. *Rps1 gene for resistance to phytophthora.* Developed by Minnesota Agricultural Experiment Station. Released 1992. Seed sale regulated by U.S. Variety Protection Act.

Alpha—Central and southern zones. Relative maturity 1.4. Resistant to race 3 and race 14 of soybean cyst nematode. Resistant to brown stem rot. Recommended as part of a management package for producers with a soybean cyst nematode problem. Moderate yield potential. *Susceptible to phytophthora root rot.* Developed by Minnesota Agricultural Experiment Station. Released 1992. Seed sale regulated by U.S. Variety Protection Act.

Archer—Southern zone. Relative maturity 1.9. Yield, brown stem rot resistance and iron chlorosis resistance similar to BSR 101. *Rsp1k and Rps6 genes for resistance to*

Table 25. Yields of publicly developed soybean varieties in central zone, 1990–1994.

Variety	Rosemount (10-inch)	Morris (10-inch)	Becker (30-inch)	Average
	bu/A			
Ozzie	41	37	44	41
Evans	43	42	44	43
Dawson	44	40	43	42
Glenwood	43	40	41	41
Lambert	47	44	55	49
Hendricks [2]	47	43	52	48
Kato	45	44	49	46
Hodgson 78	45	43	49	46
Kasota	44	49	46	46
Parker [2]	48	47	51	49
Hardin [2]	52	45	47	48
Alpha [2]	41	43	44	43
Bert [1]	45	49	50	48
Leslie [1]	47	48	50	48
LSD 20%	2	2	2	2

[1] 1991-1994 data adjusted to 5 year average; [2] 1992-1994 data adjusted to 5 year average.

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.

Faribault—Central and southern zones. Relative maturity 1.6. Resistant to race 3 and moderately resistant to race 1 of soybean cyst nematode. Different source of soybean cyst nematode resistance than Alpha and Bell. Recommended as part of a management package for producers with a soybean cyst nematode problem. Good yield potential. Resistant to brown stem rot. *Rps1 gene for resistance to phytophthora.* Developed by Minnesota Agricultural Experiment Station. Released 1994. Seed sales regulated by U.S. Plant Variety Protection Act.

Glenwood—Central zone. Relative maturity 0.4. 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. Relative maturity 1.8. 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.

Hardin 91—Southern zone. Relative maturity 2.0. *Rps1K gene for resistance to phytophthora.* Developed by Iowa Agricultural Experiment Station. Released 1991. Seed sale regulated by U.S. Variety Protection Act.

Hendricks—Central zone. Relative maturity 0.9. High yield. Good lodging resistance. *Rps1 gene for resistance to phytophthora.* Developed by Minnesota Agricultural Experiment Station. Released 1994. Seed sales regulated by U.S. Plant Variety Protection Act.

Hodgson 78—Central and southern zones. Relative maturity 1.4. 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.

IA2008—Southern zone. Relative maturity 2.1. High yield potential. Resistant to brown stem rot. *Rps1 gene for resistance to phytophthora.* Released 1991. Developed by Iowa Agricultural Experiment Station. Seed sale regulated by U.S. Variety Protection Act.

Kasota—Central and Southern zones. Relative maturity 1.3. 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. Relative maturity 1.4. 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.

Table 26. Yields of publicly developed soybean varieties in southern zone, 1990–1994.

	Waseca and Lamberton		Fairmont	Waseca	Lamberton	Altura [3]	Average
	mid-May	mid-June	mid-May planting				
Variety	planting	planting	30-inch	10-inch	10-inch	10-inch	
	bu/A						
McCall	—	26	—	—	—	—	—
Agassiz	—	32 [2]	—	—	—	—	—
Ozzie	45	32	29	41	49	46	40
Dawson	50	33	32	45	54	46	44
Evans	49	36	32	45	53	48	43
Glenwood	47	36	32	44	51	49	42
Lambert	54	40 [1]	38	48	60	54	49
Hendricks	56	—	41 [3]	52	61	—	51 [3]
Kato	55	39	42	54	55	56	50
Hodgson 78	53	38	39	51	55	52	48
Bert	57	40	43	53	61	64	52
Bell	49 [2]	—	44	39 [2]	59 [2]	51	47 [2]
Hardin	58	39	39	57	58	58	51
Alpha	52	32 [2]	39	50	53	50	47
Parker	64	42	45	60	67	55	57
Hardin 91	60 [2]	37 [2]	44 [1]	58 [2]	62 [2]	62	55 [2]
Leslie	59	35	42	57	60	52	53
Faribault	56	—	44	51	60	58	52
Kasota	54	35	42	52	54	52	49
Archer	56	34 [1]	40	54	58	51	51
BSR 101	57	39	42	56	59	58	52
Sturdy	60	34	44	59	62	66	55
IA 2008	65 [2]	36 [2]	45 [1]	62 [2]	68 [2]	64	58 [2]
LSD 20%	1	1	1	2	2	3	1

[1] 1991-1994 data; adjusted to 5 year average; [2] 1992-1994 data; adjusted to 5 year average; [3] 1993-1994 data, adjusted to 5 year average.

Lambert—Central zone. Relative maturity 0.8. Excellent yield potential. Good lodging resistance. *Rps1 gene for resistance to phytophthora.* Developed by Minnesota Agricultural Experiment Station. Released 1992. Seed sale regulated by U.S. Variety Protection Act.

Leslie—Southern zone. Relative maturity 1.8. 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.

McCall—Northern zone. Relative maturity 00.7. 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. Relative maturity 0.3. 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.

Parker—Southern zone. Relative maturity 1.5. Excellent yield potential. Lodging resistance similar to Corsoy 79. *Rps1 gene for phytophthora resistance.* Developed by Minnesota Agricultural Experiment Station. Released 1992. Seed sale regulated by U.S. Variety Proection Act.

Sturdy—Southern zone. Relative maturity 2.1. 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.

Other public varieties

Corsoy 79—Southern zone. Relative maturity 2.2. Very good yield performance. *Rps1c gene for phytophthora resistance.* Poor

Table 27. Characteristics of publicly developed soybean varieties, 1994.

Variety	Mature: mid-May planting	Mature: mid-June planting	Lodging	Height	Phyto-phthora	Protein	Oil	Chlorosis [3]
	------- date -------		score [1]	inches	gene	% [2]	% [2]	rating [1]
Northern Zone (Crookston and Moorhead)								
McCall	9-6	—	1.0	23	S	30.2	20.8	MS
Harmony	9-8	—	1.0	25	S	30.9	20.5	MR
Chico	9-13	—	1.0	26	Rps1	32.8	19.0	MS
Agassiz	9-13	—	1.0	22	Rps1	34.2	18.3	MS
Ozzie	9-18	—	1.0	22	Rps1	34.7	17.9	MR
Dawson	9-19	—	1.0	28	Rps1	32.3	19.4	MR
Glenwood	9-20	—	1.0	27	Rps1	34.5	17.9	MS
Lambert	9-20	—	1.0	28	Rps1	34.9	17.8	MR
Evans	9-20	—	1.0	31	Rps1	32.9	19.0	MR
Hendricks	9-22	—	1.0	31	Rps1	33.4	18.7	MR
Central Zone (Morris and Rosemount)								
McCall	8-30	—	2.0	31	S	32.9	18.8	MS
Chico	9-2	—	2.0	34	Rps1	33.2	18.5	MS
Agassiz	9-6	—	1.3	33	Rps1	34.2	18.0	MS
Ozzie	9-10	—	1.3	34	Rps1	36.0	16.8	MR
Glenwood	9-12	—	1.3	35	Rps1	35.2	17.3	MS
Proto	9-13	—	2.0	29	S	39.3	14.5	MS
Evans	9-13	—	1.8	37	Rps1	33.2	18.7	MR
Lambert	9-13	—	1.8	35	Rps1	35.3	17.4	MR
Dawson	9-14	—	2.5	38	Rps1	32.7	19.0	MR
Minnatto	9-14	—	1.5	34	Rps1	36.3	16.3	MR
Hendricks	9-16	—	2.0	35	Rps1	34.0	18.2	MR
Kato	9-21	—	1.8	41	Rps1	37.1	16.1	MR
Hodgson 78	9-24	—	1.5	42	Rps1	33.3	18.5	MS
Parker	9-24	—	3.0	43	Rps1	33.0	18.8	MS
Kasota	9-26	—	1.8	38	Rps1c	36.8	16.3	MS
Bert	9-27	—	2.5	45	Rps1	32.6	19.0	MS
Leslie	9-27	—	1.5	42	Rps1	33.3	18.5	MS
Hardin	9-27	—	2.3	44	Rps1	33.5	18.4	S
Sturdy	9-31	—	2.5	43	Rps1	34.8	17.8	MR
Southern Zone (Lamberton and Waseca)								
McCall	9-1	9-21	1.8	23	S	31.2	20.1	MS
Proto	9-6	—	2.3	28	S	36.6	16.5	MS
Glenwood	9-8	9-28	1.5	27	Rps1	32.6	19.3	MS
Dawson	9-10	9-29	2.3	30	Rps1	30.7	20.5	MR
Minnatto	9-10	—	1.5	27	Rps1	33.8	18.3	MR
Ozzie	9-10	9-27	1.5	29	Rps1	33.0	19.0	MR
Agassiz	9-11	9-23	1.5	28	Rps1	31.4	20.0	MS
Evans	9-11	9-29	1.8	31	Rps1	31.6	19.9	MR
Lambert	9-11	9-30	1.8	31	Rps1	33.3	18.8	MR
Hendricks	9-13	10-2	1.8	32	Rps1	33.2	19.0	MR
Hodgson 78	9-17	10-5	2.0	37	Rps1	32.2	19.5	MS
Kato	9-18	10-4	2.0	39	Rps1	35.7	17.3	MR
Alpha	9-18	10-6	3.0	37	S	34.6	17.9	MS
Hardin	9-20	10-7	2.0	36	Rps1	32.3	19.4	S
Kasota	9-20	10-6	2.0	33	Rps1c	34.3	18.2	MS
Parker	9-21	10-5	2.8	34	Rps1	32.4	19.5	MS
Bert	9-23	10-5	2.0	41	Rps1	30.8	20.4	MS
BSR101	9-24	10-11	1.8	36	Rps1	30.5	20.5	MR
Hardin91	9-25	10-9	2.0	37	Rps1k	32.6	19.2	S
Archer	9-25	10-10	2.0	37	Rps1k+Rps6	31.7	19.8	MR
Leslie	9-25	10-9	1.8	37	Rps1	32.2	19.5	MS
Faribault	9-26	10-7	2.3	34	Rps1	33.3	18.8	MR
Bell	9-27	—	2.0	35	S	34.9	17.7	MS
Sturdy	9-28	10-11	2.0	39	Rps1	33.1	18.9	MR
IA2008	9-29	10-14	2.3	39	Rps1	31.5	19.9	MR

[1] 1 = excellent, 5 = very poor; [2] 13 percent moisture; [3] R = resistant, MR = moderately resistant, MS = moderately susceptible, S = susceptible.

chlorosis ratings, somewhat lodging susceptible. Developed by Illinois Agricultural Experiment Station. Released 1979.

Dassel—Central zone. Relative maturity 0.9. 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.

Hodgson—Central and southern zones. Relative maturity 1.4. Largely superseded by phytophthora-resistant Hodgson 78. Developed by Minnesota Agricultural Experiment Station. Released 1974. Seed sale regulated by U.S. Variety Protection Act.

Weber 84—Southern zone. Relative maturity 1.8. 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.

Special purpose public varieties

Chico—Small-seeded variety for specialty markets. Relative maturity 0.2. 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. Relative maturity 0.6. 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. Relative maturity 0.7. 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. Relative maturity 0.6. Protein content 3 percent 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. Relative maturity 1.8. 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 28. Yields and characteristics of public and private soybean varieties, northern zone, 1994 (Crookston, Moorhead, Shelly).

Brand or Originator	Variety	Relative Maturity	Yield			Phyto-phthora	Chlorosis	Protein			Oil		
			1994	1992–1994	1993–1994		1992-1994	1992–1994	1993–1994	1994	1992–1994	1992–1993	1994
		rating [1]	bu/A			gene [2]	rating [4]	% [7]			% [7]		
Agric. Canada	Maple Ridge	00.1	28	30	33	S	MS	32.6	31.5	29.1	19.4	19.9	21.4
Minn. A.E.S.	McCall	00.7	31	31	34	S	MS	32.1	31.6	30.1	19.6	19.7	20.7
Agric. Canada	Harmony	00.8	—	—	37	S	MR [6]	—	—	30.6	—	—	20.5
Pioneer	9007	00.7	—	—	35	Rps1	MS [6]	—	—	30.2	—	—	20.7
Pioneer	9008	00.8	—	—	33	S	MS [6]	—	—	29.7	—	—	21.2
Payco	EX9404	0.3	—	—	34	S	MS [6]	—	—	29.5	—	—	21.1
NK	Solana	00.9	—	—	44	S	S [6]	—	—	29.0	—	—	21.5
Mycogen	S34	00.9	34	36	41	S	MS	31.4	30.6	28.8	20.2	20.4	21.6
Dyna-Gro	3001	00.9	—	—	42	S	MR [6]	—	—	31.9	—	—	19.5
GCS	Hunter	0.4	36	38	40	S	MS	31.9	31.2	29.0	20.0	20.1	21.4
Dairyland	DSR-045	0.2	35	36	39	S	MS	32.4	32.0	30.5	19.5	19.6	20.5
Agric. Canada	Maple Glen	0.3	35	39	45	S	S	33.4	33.6	31.8	18.8	18.5	19.7
Minn A.E.S.	Agassiz	0.0	33	34	40	Rps1	MS	34.0	33.7	32.2	18.4	18.2	19.3
Pioneer	9042	0.4	—	—	46	Rps1	MS [6]	—	—	33.2	—	—	18.7
GCS	Tracker	0.5	36	37	42	S	MS	32.8	33.1	33.2	19.3	18.8	18.6
Ciba	3033	0.3	—	40	46	Rps1	S [5]	—	32.9	32.5	—	19.0	19.2
Mycogen	040	0.3	—	—	45	Rps1-c	MS [6]	—	—	29.9	—	—	20.8
Prairie Brand	PB-060	0.3	—	—	44	Rps1-c	MS [6]	—	—	31.3	—	—	19.9
Dyna-Gro	3030	0.3	—	37	43	S	MS [5]	—	32.4	31.4	—	19.3	19.9
Dairyland	DST0704	0.3	—	—	43	S	MS [6]	—	—	31.5	—	—	19.9
Payco	EX9402	0.3	—	—	42	S	MS [6]	—	—	33.3	—	—	18.6
Mycogen	J-033	0.3	36	37	41	S	MS	33.4	33.1	32.9	18.9	18.9	18.9
Minn A.E.S.	Ozzie	0.3	34	37	40	Rps1	MR	34.0	33.5	32.6	18.4	18.5	19.1
DeKalb	CX076	0.7	36	39	47	S	MS	33.3	32.8	33.0	18.9	19.0	18.9
Kaltenberg	KB053	0.3	—	41	47	S	S [5]	—	34.0	33.6	—	18.2	18.4
C/LOL	LO511	0.5	—	—	45	Rps6	S [6]	—	—	33.9	—	—	18.3
Dairyland	DSR-068 [8]	0.3	—	38	43	S	S [5]	—	33.1	32.3	—	18.9	19.4
Pioneer	9071	0.7	—	40	44	Rps1-c	MS [5]	—	30.2	28.8	—	20.6	21.2
DeKalb	EX405	0.4	—	—	44	S	MR [6]	—	—	30.9	—	—	20.1
Payco	EX9403	0.3	—	—	42	S	MR [6]	—	—	32.9	—	—	18.9
Minn. A.E.S.	Glenwood	0.4	34	35	39	Rps1	MS	33.1	32.6	31.8	19.1	19.1	19.6
GL	GL0735	0.7	—	—	53	Rps1-c	S [6]	—	—	32.3	—	—	19.4
Sexauer	SX0451	0.3	—	—	43	S	S [6]	—	—	31.8	—	—	19.6
Thompson	X1589	0.2	—	—	42	M [3]	MR [6]	—	—	32.8	—	—	19.0
M.O.	0653	0.3	—	—	52	S	MS [6]	—	—	33.9	—	—	18.2
Star	EXP9408	0.3	—	—	51	Rps1-c	MS [6]	—	—	33.3	—	—	18.7
Minn. A.E.S.	Evans	0.6	34	38	46	Rps1	MR	31.7	31.8	30.8	20.0	19.7	20.2
Sexauer	SX0332 [8]	0.3	—	35	39	S	MS [5]	—	33.4	33.2	—	18.6	18.7
Minn. A.E.S.	Lambert	0.8	38	40	45	Rps1	MR	33.0	33.7	33.3	19.2	18.4	18.7
Minn A.E.S	Dawson	0.7	35	36	42	Rps1	MR	31.2	31.0	29.5	20.4	20.2	21.1
Stine	0560	0.3	—	—	52	S	S [6]	—	—	31.0	—	—	20.1
GL	GL0945	0.9	—	—	42	S	MR [6]	—	—	30.9	—	—	20.2
DeKalb	CX096	0.9	31	34	41	Rps1	MR	32.2	32.9	32.2	19.7	18.9	19.4
ICI	EX4071	0.7	—	—	48	Rps1-c	S [6]	—	—	29.9	—	—	20.9
LSD 20%			1	1	2								

[1] Provided by originator; [2] Specific genes noted, or S = susceptible; [3] Mixture Resistant and Susceptible; [4] R = Resistant, MR = Moderately Resistant, MS = Moderately Susceptible, S = Susceptible; [5] 2 year average; [6] 1 year data, [7] 13 percent moisture; [8] Blend (information furnished by originator).

Privately developed varieties

The private companies entering varieties in the 1994 Minnesota tests and the brand names were:

AgriPro Seeds, R.R. 2, Hwy 30 East, Ames, IA 50010 (AgriPro)

Asgrow Seed Co., 9635-190-31, 7000 Portage Rd., Kalamazoo, MI 49001 (Asgrow)

Cenex/Land O'Lakes, 2728 8th Ave. South, Fort Dodge, IA 50501 (Cenex/LOL)

Ciba Seeds, 202 North Prospect Road, Suite 201, Bloomington, IL 61704 (Ciba)

Dairyland Seed Company, Inc., P.O. Box 958, 3570 Hwy H., West Bend, WI 53095 (DSR)

Table 29. Yields and characteristics of public and private soybean varieties, central zone, 1994 (Becker, Morris, Rosemount).

Brand or Originator	Variety	Relative Maturity	Yield 1992–1994	Yield 1993–1994	Yield 1994	Phytophthora gene [2]	Chlorosis 1992-1994 rating [4]	Protein 1992–1994	Protein 1993–1994	Protein 1994	Oil 1992–1994	Oil 1993–1994	Oil 1994
		rating [1]	bu/A					% [7]			% [7]		
Mycogen	J-033	0.3	—	—	44	S	MR [6]	—	—	36.1	—	—	17.2
Minn. A.E.S.	Ozzie	0.3	40	39	45	Rps1	MR	36.0	35.9	36.0	17.5	17.4	17.3
Payco	EX9409	0.9	—	—	52	Rps1-c	S [6]	—	—	35.5	—	—	17.7
Mycogen	J-083	0.8	44	42	46	Rps1	MS	34.8	34.5	34.5	18.3	18.5	18.4
Dyna-Gro	3033	0.8	—	—	44	Rps1	MS [6]	—	—	33.8	—	—	18.8
Minn. A.E.S.	Lambert	0.8	47	46	53	Rps1	MR	36.3	35.7	35.3	17.5	17.6	17.7
KSC/Challenger	K-0909	0.8	—	—	50	S	MS [6]	—	—	35.1	—	—	17.9
Dyna-Gro	3055	0.6	—	—	46	Rps1	MR [6]	—	—	35.9	—	—	17.3
Golden Harvest	X078	0.8	—	—	53	Rps1	MR [6]	—	—	33.9	—	—	18.7
PBR	094	0.9	—	—	50	Rps1-c	MS [6]	—	—	35.0	—	—	18.0
Ciba	3072	0.7	44	43	49	Rps1	S	35.4	35.6	35.0	17.9	17.6	18.0
Minn. A.E.S.	Evans	0.6	42	42	47	Rps1	MR	35.1	35.0	35.0	18.1	18.1	17.9
Golden Harvest	H-1075	0.7	—	—	47	S	MS [6]	—	—	35.1	—	—	17.9
Minn. A.E.S.	Dawson	0.7	42	41	45	Rps1	MR	34.7	34.3	34.3	18.4	18.6	18.4
Dyna-Gro	3050	0.5	—	—	45	S	MS [6]	—	—	34.9	—	—	18.0
NK	S07-80	0.7	44	41	44	S	MS	34.1	33.8	33.8	18.9	19.0	18.8
DeKalb	CX076	0.7	—	—	43	S	MS [6]	—	—	34.5	—	—	18.3
Pioneer	9092	0.9	—	—	54	Rps1-c	S [6]	—	—	33.8	—	—	18.8
Mustang	M-0770	0.5	—	44	51	Rps1	MS [5]	—	33.9	33.4	—	18.7	19.1
NK	S09-95	0.9	—	—	51	S	MR [6]	—	—	34.5	—	—	18.3
Pioneer	9091	0.9	46	44	50	S	MS	35.1	34.9	35.0	18.1	18.2	17.9
Minn. A.E.S.	Hendricks	0.9	46	44	49	Rps1	MR	35.1	34.8	34.8	18.1	18.2	18.2
Kruger	K-0999	0.8	—	—	59	S	MS [6]	—	—	33.4	—	—	19.0
Ciba	3103	1.0	—	50	56	S	S [5]	—	36.0	35.9	—	17.4	17.3
Mycogen	S74	0.9	47	47	54	S	MS	35.4	35.5	35.1	17.9	17.8	17.9
Mustang	M-1000	0.8	45	46	50	Rps1	MS	36.5	35.9	35.5	17.2	17.5	17.6
Thompson	T-3120	1.0	—	—	50	M [3]	MS [6]	—	—	34.7	—	—	18.2
Payco	EX9410	1.0	—	—	49	S	MS [6]	—	—	34.7	—	—	18.2
Golden Harvest	H-1112	1.1	45	44	48	S	MR	35.3	34.8	34.7	17.9	18.2	18.1
Payco	0010	1.0	—	—	46	Rps1	MR [6]	—	—	35.6	—	—	17.5
Sexauer	SX0832 [8]	0.8	—	40	46	Rps1	MS [5]	—	35.4	35.5	—	17.9	17.7
ICI	D138	1.3	51	51	58	S	S	36.6	36.0	36.1	17.0	17.4	17.3
Ziller	BT1510	1.1	—	—	55	S	S [6]	—	—	36.9	—	—	16.7
Sansgaard	S-103EXP	1.0	—	—	52	S	MS [6]	—	—	33.5	—	—	19.0
Mycogen	AG112	1.2	—	—	51	S	MS [6]	—	—	35.6	—	—	17.6
GCS	Goodwin	1.3	—	—	51	Rps1-k	S [6]	—	—	33.7	—	—	18.9
Pioneer	9141	1.4	—	44	50	Rps1-c	MS [5]	—	34.8	34.9	—	18.2	18.1
DeKalb	CX096	0.9	44	44	50	Rps1	MR	35.9	35.4	35.6	17.6	17.7	17.5
Thompson	T-3140	1.3	46	45	50	Rps1	S	35.5	35.0	34.5	17.8	18.0	18.2
HyPerformer	HSC098	0.9	—	45	50	Rps1	MS [5]	—	36.1	36.3	—	17.2	17.0
Sexauer	SX1432 [8]	1.4	—	44	49	S	S [5]	—	34.9	34.8	—	18.1	18.1
Prairie Brand	PB-117	1.1	—	—	45	S	S [6]	—	—	34.1	—	—	18.5
DeKalb	CX121	1.2	47	49	56	Rps1	MS	34.6	34.1	33.6	18.6	18.8	18.9
Prairie Brand	PB-104	1.0	—	—	56	S	MS [6]	—	—	33.2	—	—	19.1
Dyna-Gro	3038	1.0	—	—	54	S	MR [6]	—	—	35.1	—	—	17.9
ICI	EX4092	1.9	—	—	52	Rps1	MS [6]	—	—	33.6	—	—	19.0
HyPerformer	HY105	1.0	—	—	51	S	MS [6]	—	—	36.2	—	—	17.2
Dyna-Gro	X104	1.0	—	—	50	M [3]	MS [5]	—	—	34.1	—	—	18.6
Mustang	M-1040	1.2	46	44	49	Rps1	S	35.6	35.4	35.6	17.8	17.8	17.6
NK	S12-22	1.2	45	44	48	S	MS	34.2	34.0	33.8	18.8	19.0	18.9
Golden Harvest	H-1140	1.4	—	—	60	Rps1-k	MS [6]	—	—	37.6	—	—	16.4
Asgrow	A1395	1.3	—	50	58	Rps1-k	S [5]	—	34.9	34.9	—	18.2	18.1
ICI	EX4133	1.3	—	—	54	Rps1-k	MS [6]	—	—	33.0	—	—	19.3
Ramy	1320	1.3	—	—	52	Rps1-k	MS [6]	—	—	35.2	—	—	17.7
Dairyland	DSR-133	1.3	—	47	52	Rps1	MS [5]	—	34.5	34.5	—	18.5	18.5
HyPerformer	HSC140	1.4	—	44	48	Rps1-c	MS [5]	—	34.9	34.4	—	18.0	18.4
Stine	1610	1.1	—	—	59	S	MS [6]	—	—	36.2	—	—	17.1
L. Herried	3143	1.2	—	46	51	S	MS [5]	—	34.0	33.9	—	19.0	18.8

Table 29 (continued). Yields and characteristics of public and private soybean varieties, central zone, 1994 (Becker, Morris, Rosemount).

Brand or Originator	Variety	Relative Maturity	Yield 1992–1994	Yield 1993–1994	Yield 1994	Phytophthora gene [2]	Chlorosis 1992-1994	Protein 1992–1994	Protein 1993–1994	Protein 1994	Oil 1992–1994	Oil 1993–1994	Oil 1994
		rating [1]	bu/A				rating [4]	% [7]			% [7]		
Dairyland	DSR-173	1.5	46	46	51	Rps1	S	36.6	36.2	35.9	17.1	17.2	17.4
C/LOL	L1301	1.3	—	—	48	Rps1-k	MS [6]	—	—	35.2	—	—	17.7
Mustang	M-1050	1.3	45	42	46	Rps1	S	35.3	35.2	35.0	17.9	17.9	18.0
Pioneer	9171	1.7	—	—	57	S	MS [6]	—	—	33.9	—	—	18.6
Kruger	K1313+	1.1	—	—	55	S	MR [6]	—	—	34.8	—	—	18.2
GCS	Kandi	1.4	49	48	54	Rps1-k	S	37.5	37.3	36.6	16.3	16.3	16.9
Latham	170 Brand	1.3	—	47	54	S	MS [5]	—	34.9	34.8	—	18.2	18.2
Prairie Brand	PB-137	1.3	51	51	53	S	MS [5]	35.1	34.8	34.9	18.0	18.3	18.1
Ciba	3144	1.4	—	—	53	S	MR [6]	—	—	35.4	—	—	17.7
M/W Genetics	G1380	1.4	—	—	52	S	MR [6]	—	—	34.1	—	—	18.6
Thompson	T-3163	1.5	—	—	49	Rps1-k	S [6]	—	—	33.6	—	—	19.0
Thompson	T-1339	1.2	—	—	47	Rps1	MR [6]	—	—	34.0	—	—	18.6
GL	GS1315	1.3	52	50	58	S	MS	34.9	34.8	34.8	18.3	18.2	18.3
Kaltenberg	KB154	1.5	—	50	57	S	MS [5]	—	35.0	35.3	—	17.9	17.7
Iowa A.E.S.	Hardin	1.8	46	47	54	Rps1	S	35.4	34.9	34.1	17.7	18.1	18.5
Sand	SOI113	1.1	49	48	54	S	MS	34.6	34.5	34.0	18.3	18.4	18.6
Payco	9314	1.4	—	49	53	S	MR [5]	—	34.3	34.3	—	18.5	18.5
Sand	SOI135	1.2	—	—	52	Rps1-k	MR [6]	—	—	37.8	—	—	16.1
Minn. A.E.S.	Kato	1.4	43	45	49	Rps1	MR	38.1	37.9	38.6	15.9	15.8	15.5
Minn. A.E.S.	Parker	1.5	47	45	49	Rps1	MS	35.0	34.7	34.3	18.2	18.3	18.4
Minn. A.E.S.	Hodgson 78	1.4	44	43	48	Rps1	MS	34.5	34.2	34.3	18.5	18.6	18.4
Dyna-Gro	3150	1.5	—	—	52	S	MR [6]	—	—	34.4	—	—	18.4
Minn. A.E.S.	Alpha	1.4	41	41	47	S	MS	37.0	36.6	37.2	16.7	16.8	16.1
M.O.	EX1740	1.4	—	—	58	S	MR [6]	—	—	35.7	—	—	17.5
M/W Genetics	G1795	1.5	—	—	57	S	S [6]	—	—	34.9	—	—	17.9
Profiseed	1504	1.5	—	—	56	S	S [6]	—	—	34.6	—	—	18.3
Yield King	K-1414+	1.3	—	—	56	S	S [6]	—	—	34.1	—	—	18.5
Thompson	T-1166	1.3	—	—	56	S	MS [6]	—	—	34.9	—	—	18.1
Minn. A.E.S.	Kasota	1.3	45	47	51	Rps1-c	MS	37.3	36.8	36.8	16.6	16.7	16.7
ICI	EX4164	1.6	—	—	60	S	MS [6]	—	—	35.0	—	—	18.0
AgriPro	AP1440	1.4	49	50	58	S	MS	35.4	34.8	34.8	17.9	18.1	18.0
Kruger	K-1717+	1.4	—	—	58	S	MS [6]	—	—	35.8	—	—	17.5
Star	EXP9418	1.5	—	—	57	S	MS [6]	—	—	36.3	—	—	17.1
Yield King	K-2020	1.7	—	52	57	S	S [5]	—	35.5	35.7	—	17.7	17.5
AgriPro	AP1876	1.8	—	—	55	Rps1-k	S [6]	—	—	34.9	—	—	18.0
Dairyland	DSR-189	1.5	47	47	54	Rps1-c	MS	34.3	34.1	34.6	18.6	18.6	18.2
Minn. A.E.S.	Bert	1.8	46	46	50	Rps1	MS	33.5	33.1	32.6	19.2	19.4	19.5
Yield King	D-1716	1.5	—	—	50	S	S [6]	—	—	35.6	—	—	17.5
Yield King	K-1819	1.5	—	54	62	S	S [5]	—	36.6	36.4	—	17.0	17.1
AgriPro	AP1880	1.8	51	53	59	S	MS	34.9	34.6	34.4	18.1	18.2	18.3
AgriPro	EX1995	1.9	—	—	58	Rps1-c	MS [6]	—	—	32.3	—	—	19.8
KSC/Challenger	K-1777	1.6	—	—	57	S	S [6]	—	—	36.9	—	—	16.6
GL	GL1593	1.5	—	50	56	S	MS [5]	—	33.9	33.6	—	18.8	18.8
KSC/Challenger	K-1707	1.6	—	—	55	S	MS [6]	—	—	35.2	—	—	17.8
DeKalb	CX187	1.8	47	46	52	S	MS	34.1	33.6	33.9	18.9	19.1	18.7
HyPerformer	HY191	1.9	—	46	51	Rps1-c	S [5]	—	35.0	34.9	—	17.9	18.0
Premier	P-1700	1.7	—	—	50	S	S [6]	—	—	34.3	—	—	18.5
Kruger	K-1909	1.6	—	—	59	Rps1-k	MS [6]	—	—	35.7	—	—	17.5
Stine	1570	1.5	—	52	58	S	S [5]	—	36.0	36.1	—	17.4	17.3
Ciba	3172	1.7	47	49	55	S	S	35.0	34.6	34.7	18.1	18.3	18.1
KSC/Challenger	K-1444	1.3	—	—	55	S	S [6]	—	—	34.7	—	—	18.2
Star	EXP9418A	1.5	—	—	62	S	S [6]	—	—	35.1	—	—	17.9
Minn. A.E.S.	Leslie	1.8	46	47	53	Rps1	MS	34.8	34.2	34.2	18.3	18.6	18.5
Dairyland	DST 1309	1.5	—	—	52	S	MR [6]	—	—	35.1	—	—	17.8
LSD 20%			1	1	2								

[1] Provided by originator; [2] Specific genes noted, or S = Susceptible; [3] Mixture Resistant and Susceptible; [4] R = Resistant, MR = Moderately Resistant, MS = Moderately Susceptible, S = Susceptible; [5] 2 year average; [6] 1 year data; [7] 13 percent moisture; [8] Blend (information furnished by originator).

Table 30. Yields and characteristics of public and private soybean varieties from tests on soybean cyst nematode infested (East Chain, New Richland, St. James, and Hanska) and non-infested (Fairmont, Lamberton, and Waseca) sites.

Brand or Originator	Variety	Relative Maturity	Infested Yield 1992–1994	Infested Yield 1993-1994	Infested Yield 1994	Matures	Noninfested Yield 1992–1994	Noninfested Yield 1993-1994	Noninfested Yield 1994	Phyto-phthora	Chlorosis	SCN
		rating [1]	bu/A			date	bu/A			gene [2]	rating [3]	rating [6]
Iowa A.E.S.	Hardin	1.8	—	—	31	9-18	—	—	53	Rps1	S	S
Minn. A.E.S.	Parker	1.5	33	28	37	9-19	52	51	56	Rps1	MS	S
Dairyland	DSR-143N	1.5	—	28	35	9-17	—	48	52	S	MS [4]	MR
Latham	360 CN Brand	1.9	—	26	32	9-19	—	43	49	S	MS [4]	MR
Minn. A.E.S.	Alpha	1.4	30	27	34	9-18	42	43	48	S	MS	R
Star	Exp 418N	1.8	—	—	30	9-21	—	—	51	S	MS [5]	MR
Ciba	1812Y	1.8	—	28	34	9-21	—	46	55	S	MS [4]	MR
Kruger	K-1919SCN	1.7	—	—	30	9-26	—	—	51	S	MS [5]	MS
Stine	1662CN	1.7	—	—	42	9-21	—	—	57	S	MS [5]	S
Thompson	T-3198CN [7]	1.9	36	31	41	9-24	52	52	59	S	S	MS
Thompson	T-3192CN	1.9	—	30	38	9-27	—	44	47	S	S [4]	R
Pioneer	9221	2.2	31	28	37	9-23	43	44	49	Rps1	MS	R
Latham	550CN Brand	2.2	—	32	42	9-24	—	48	54	S	S [4]	MR
Minn. A.E.S.	Faribault	1.6	31	26	37	9-23	—	45	53	Rps1	MR	R
Sexauer	SX1951N	1.9	—	—	36	9-23	—	—	47	S	S [5]	MS
Minn. A.E.S.	Sturdy	2.1	33	29	39	9-25	50	49	55	Rps1	MR	S
Kruger	K-1919 + SCN	1.9	—	—	44	9-27	—	—	57	S	MS [5]	R
Illinois A.E.S.	Bell	2.2	32	27	39	9-28	44	44	58	S	MS	R
DeKalb	CX260C	2.6	—	—	44	10-4	—	—	57	S	S [5]	MR
Iowa A.E.S.	Newton	2.6	31	29	42	10-2	—	44	51	Rps1	MS	R
LSD 20%			1	1	2		1	1	2			

[1] Provided by originator; [2] Specific gene noted, or S = susceptible; [3] R = resistant, MR = moderately resistant, MS = moderately susceptible, S = susceptible; [4] 2 year average; [5] 1 year data; [6] Reaction to Minnesota isolate of Race 3, R = resistant, MR = moderately resistant, MS = moderately susceptible, S = susceptible; [7] Blend (information supplied by originator).

DeKalb Genetics Corporation, 3100 Sycamore Rd., DeKalb, IL 60115 (DeKalb)

Dennis Ewing Farm Seed, 3903 Squaw Road, Ames, IA 50014 (Yield King)

Domestic Seed (Mustang Seeds), 306 S. Washington, Box 466, Madison, SD 57042 (Mustang)

Ehrich Seed Farms, Inc., R.R. 1, Box 47, Elmore, MN 56027 (Ehrich)

Gold Country Seed, 3374 80th St., Plato, MN 55370 (GCS)

Golden Harvest Seeds, J.C. Robinson Seed Company, 100 J.C. Robinson Blvd., Waterloo, NE 68069-0301 (Golden Harvest)

Great Lakes Hybrids, Inc., 9915 W. M-21, Ovid, MI 48866 (GL)

HyPerformer Seed Company, One Hy Crop Row (Corporate Office), Memphis, TN 38120 (HyPerformer)

Hy-Vigor Seeds, Inc., 4970 Redwood Ave., Paullina, IA 51046 (Hy-Vigor)

ICI Seeds, 6945 Vista Drive, West Des Moines, IA 50266 (ICI)

Interstate Payco Seed Co., P.O. Box 338, West Fargo, ND 58078 (Payco)

Kaltenberg Seed Farms, P.O. Box 278, 506

Soybean is grown in tests under irrigation only at Becker, Minn. This research provides performance data for varieties that could be used on the sandy soils common to central Minnesota.

Table 31. Yields and characteristics of public and private soybean varieties, southern zone, 1994 (Fairmont, Lamberton, Waseca)

Brand or Originator	Variety	Relative Maturity	Yield 1992–1994	Yield 1993–1994	Yield 1994	Phytophthora gene [2]	Chlorosis rating [4]	Protein 1992–1994	Protein 1993–1994	Protein 1994	Oil 1992–1994	Oil 1993–1994	Oil 1994
		rating [1]	bu/A			gene [2]	rating [4]	% [7]			% [7]		
Premier	P-2012	2.0	—	—	58	S	MS[6]	—	—	31.4	—	—	20.1
Pioneer	9171	1.7	48	49	57	S	S	33.6	32.9	31.8	19.2	19.6	19.7
Golden Harvest	H-1140	1.4	—	—	56	Rps1k	S[6]	—	—	36.5	—	—	16.8
Minn. A.E.S.	Kato	1.4	44	44	49	Rps1	MR	37.6	36.8	35.7	16.6	16.8	17.2
Dairyland	DSR-173	1.5	47	47	52	Rps1	S	35.9	35.7	35.1	17.5	17.4	17.6
Ziller	Exp12822	1.2	—	—	52	S	S[6]	—	—	33.1	—	—	19.0
Minn. A.E.S.	Hodgson 78	1.4	44	45	50	Rps1	MS	34.5	33.9	32.9	18.5	18.8	19.1
Ciba	3144	1.4	—	—	54	S	MR[6]	—	—	32.9	—	—	19.1
M/W Genetics	G1795	1.5	—	—	60	S	S[6]	—	—	32.1	—	—	19.5
Thompson	T-3172	1.7	—	—	60	S	MS[6]	—	—	31.4	—	—	19.9
Minn. A.E.S.	Parker	1.5	51	50	58	Rps1	MS	34.4	34.2	33.1	18.6	18.7	18.9
Ehrich	E-1933	1.7	—	—	57	S	MS[6]	—	—	32.4	—	—	19.2
Dyna-Gro	3150	1.5	—	—	53	S	MR[6]	—	—	32.7	—	—	19.2
Asgrow	A1900	1.9	—	53	60	Rps1k	MS[5]	—	32.8	31.7	—	19.6	19.9
Kruger	K-2222	2.0	—	—	59	S	S[6]	—	—	32.9	—	—	19.1
Latham	240 Brand	1.9	48	50	58	S	MS	32.4	31.8	31.0	20.0	20.3	20.2
ICI	D162	1.6	48	48	58	S	MS	36.4	36.0	35.6	17.2	17.2	17.3
Sansgaard	S-212E	2.1	—	—	64	S	S[6]	—	—	33.0	—	—	19.0
NK	S16-60	1.6	—	—	63	S	MS[6]	—	—	34.5	—	—	18.0
KSC/Challenger	K-2020	1.9	—	—	60	S	S[6]	—	—	33.4	—	—	18.7
Premier	P-1999	1.9	—	—	58	S	MS[6]	—	—	33.5	—	—	18.9
Mycogen	J-204	2.0	48	48	56	S	MS	34.0	33.4	32.7	18.9	19.2	19.1
Asgrow	A2012	2.0	—	51	55	Rps1k	MS[5]	—	33.3	32.5	—	19.2	19.3
Minn. A.E.S.	Leslie	1.8	46	46	55	Rps1	MS	33.8	33.3	32.5	19.0	19.4	19.3
Mustang	M-1170	1.9	—	46	54	S	MS[5]	—	34.0	33.5	—	18.8	18.6
Iowa A.E.S.	Hardin 91	2.0	—	—	52	Rps1k	S[6]	—	—	33.8	—	—	18.4
Stine	1590	1.9	56	57	64	S	MS	34.9	34.6	34.1	18.4	18.5	18.3
DeKalb	CX232	2.3	—	55	64	S	S[5]	—	34.6	33.7	—	18.4	18.6
Ziller	BT2494	1.7	—	52	62	S	S[5]	—	33.9	33.6	—	18.8	18.6
Terra	TS194E	1.9	—	—	62	S	S[6]	—	—	33.4	—	—	18.7
Thompson	T-1183	1.5	—	54	61	Rps1	MS[5]	—	33.3	32.3	—	19.2	19.3
Thompson	T3188[1]	1.8	—	54	61	S	S[5]	—	32.7	31.7	—	19.6	19.8
Yield King	K-1818+	1.7	—	—	58	S	S[6]	—	—	34.0	—	—	18.3
Kruger	K-1909	1.6	—	—	58	Rps1k	MS[6]	—	—	33.5	—	—	18.6
NK	S19-90	1.9	49	48	58	Rps1c	S	33.2	32.6	33.0	19.3	19.7	19.0
GCS	Springfield	2.0	—	—	58	Rps1k	MS[6]	—	—	32.7	—	—	19.1
Thompson	T-1131	1.9	—	—	58	S	MS[6]	—	—	34.0	—	—	18.3
Latham	2005 Brand [8]	1.9	49	48	56	S	MS	34.1	33.8	33.2	18.8	18.9	18.8
Minn. A.E.S.	Bert	1.8	47	47	55	Rps1	S	33.2	32.9	32.0	19.3	19.4	19.6
ICI	D190	1.9	—	—	55	S	S[6]	—	—	33.1	—	—	18.8
Sands	SOI149	2.0	—	—	54	Rps1k	MR[6]	—	—	35.5	—	—	17.4
Minn. A.E.S.	Kasota	1.3	43	43	48	Rps1c	MS	36.2	35.9	35.7	17.4	17.5	17.3
GCS	Hadley	2.2	54	56	67	S	S	34.7	34.1	33.5	18.4	18.7	18.7
Sands	SOI214	2.2	56	57	66	S	S	34.7	34.4	34.6	18.4	18.6	17.9
Stine	2500	2.0	—	—	65	S	MS[6]	—	—	33.3	—	—	18.8
Pioneer	9204	2.0	—	—	65	Rps1	S[6]	—	—	33.1	—	—	18.9
Latham	EX460	2.1	—	—	65	S	MS[6]	—	—	33.8	—	—	18.5
Ehrich	E-298	2.2	54	54	64	S	S	34.7	34.4	33.5	18.4	18.5	18.6
KSC/Challenger	K-2021	1.9	—	58	64	S	S[5]	—	34.3	33.8	—	18.6	18.4
Prairie Brand	PB-197	1.9	—	52	64	S	S[5]	—	34.4	33.8	—	18.5	18.5
Hy-Vigor	2050	2.3	—	—	63	S	MS[6]	—	—	34.0	—	—	18.3
Payco	9419	1.9	—	—	63	S	S[6]	—	—	33.5	—	—	18.5
Latham	280 Brand	1.9	—	—	62	S	S[6]	—	—	34.0	—	—	18.3
Pioneer	9203	2.0	—	—	62	Rps1	MS[6]	—	—	32.4	—	—	19.4
Mustang	M-1200	2.2	54	55	62	S	S	34.9	34.3	34.0	18.3	18.5	18.3

Table 31 (continued). Yields and characteristics of public and private soybean varieties, southern zone, 1994 (Fairmont, Lamberton, Waseca)

Brand or Originator	Variety	Relative Maturity	Yield			Phyto-phthora	Chlorosis	Protein			Oil		
			1992–1994	1993–1994	1994			1992–1994	1993–1994	1994	1992–1994	1993–1994	1994
		rating [1]	bu/A			gene [2]	rating [4]	% [7]			% [7]		
PBR	221	2.1	—	55	61	S	S[5]	—	33.2	32.7	—	19.3	19.1
Thompson	T-3190	2.0	53	54	61	S	MS	34.9	34.6	34.4	18.2	18.3	18.1
L. Herried	3203	2.1	—	—	60	S	MS[6]	—	—	32.4	—	—	19.4
Premier	P-2100	2.1	—	—	59	S	S[6]	—	—	35.0	—	—	17.7
Dairyland	DSR-217	2.1	49	51	58	S	MS	33.9	33.3	32.7	18.9	19.2	19.1
KSC/Challenger	K-1919	1.8	—	—	58	S	MS[6]	—	—	33.3	—	—	18.8
KSC/Challenger	K-2020+	1.9	—	—	58	S	MS[6]	—	—	35.0	—	—	17.6
ICI	D213	2.1	—	50	57	Rps1	MS[5]	—	33.5	33.2	—	19.2	18.8
Dairyland	DSR-222	2.3	—	52	57	S	MS[5]	—	32.4	31.8	—	19.9	19.8
HyPerformer	HY191	1.9	—	50	57	Rps1c	MS[5]	—	33.9	33.8	—	18.9	18.4
AgriPro	AP2122	2.1	—	51	56	Rps1b+3	S[5]	—	34.9	34.8	—	18.2	17.8
DeKalb	CX210	2.1	48	49	56	S	S	33.6	33.3	32.8	19.1	19.2	19.0
GCS	Dundee	2.1	50	51	56	Rps1k	MS	35.5	35.3	34.7	18.0	17.9	17.9
NK	S20-20	2.0	48	50	56	Rps1c	MS	34.0	33.1	33.6	19.0	19.5	18.6
Prairie Gold	1993	1.9	—	—	55	Rps1k	MS[6]	—	—	35.5	—	—	17.4
GL	GL1927	1.9	—	—	55	Rps1k	MS[6]	—	—	35.5	—	—	17.4
Terra	TS195E	1.9	—	—	55	S	MS[6]	—	—	34.6	—	—	17.9
Latham	580 Brand	2.2	—	48	54	S	MS[5]	—	31.8	31.7	—	20.4	19.8
Latham	660 Brand	2.4	55	55	66	S	MS	34.3	33.8	33.2	18.6	18.8	18.8
Mycogen	J-251	2.4	54	56	66	S	S	34.6	33.9	33.6	18.5	18.8	18.6
Star	EXP9320	2.0	—	—	65	S	MS[6]	—	—	34.1	—	—	18.2
Payco	9225	2.4	—	55	64	S	MS[5]	—	33.9	33.5	—	18.9	18.7
M/W Genetics	G2440	2.4	—	56	64	S	S[5]	—	34.3	33.6	—	18.6	18.6
Sansgaard	S-214	2.1	—	—	64	S	MS[6]	—	—	32.6	—	—	19.2
Sexauer	SX2390	2.3	55	56	64	S	MS	34.3	33.7	33.6	18.7	19.0	18.6
Profiseed	2035	1.9	—	—	63	S	S[6]	—	—	33.3	—	—	18.8
GL	GL2415	2.4	—	55	63	S	S[5]	—	33.9	33.5	—	18.9	18.6
HyPerformer	HSC223	2.2	—	55	63	S	S[5]	—	34.2	33.9	—	18.6	18.4
Kruger	K-2121	1.9	54	53	63	S	S	34.7	34.4	34.6	18.4	18.4	17.9
Payco	9023	2.2	54	54	62	S	S	34.7	34.1	33.0	18.4	18.7	19.0
ICI	D260	2.6	—	53	62	S	S[5]	—	34.0	33.2	—	18.8	18.6
Kaltenberg	KBX225	2.2	—	—	62	S	S[6]	—	—	32.5	—	—	19.4
Kruger	K-2525	2.3	56	55	62	S	S	34.6	33.8	33.6	18.6	18.9	18.6
Asgrow	A2396	2.3	52	52	61	Rps1	S	33.0	32.4	32.2	19.6	19.9	19.5
Mustang	M-1188	2.1	—	53	61	S	S[5]	—	34.3	33.8	—	18.6	18.5
Terra	TS205	2.0	53	53	61	S	MS	35.1	34.8	34.3	18.3	18.3	18.2
Ciba	3253	2.5	—	—	60	S	MS[6]	—	—	33.8	—	—	18.5
Latham	440 Brand	2.1	51	53	60	S	S	33.7	33.1	32.6	19.0	19.3	19.0
Sansgaard	S-227EXP	2.2	—	—	60	S	S[6]	—	—	31.9	—	—	19.6
Wilson	1993 [8]	1.9	52	53	59	S	MS	34.3	34.2	32.9	18.6	18.6	19.1
Thompson	T-3210	2.2	—	—	59	S	MS[6]	—	—	32.2	—	—	19.5
Profiseed	1904B	2.0	—	—	58	S	MS[6]	—	—	34.3	—	—	18.2
Golden Harvest	H-1196	1.9	50	52	58	S	S	34.4	33.8	33.6	18.6	18.8	18.5
Iowa A.E.S.	Archer	1.9	47	49	56	Rps1k+6	MR	34.2	33.8	33.2	18.8	19.0	18.9
Sexauer	SX1941	1.9	—	51	55	Rps1k	MS[5]	—	35.7	35.2	—	17.6	17.5
Ramy	Prefered II Plus	1.9	48	48	54	S	S	36.4	36.1	35.8	17.2	17.3	17.2
Illinois A.E.S.	Corsoy 79	2.2	46	47	53	Rps1c	S	35.0	34.3	34.4	18.3	18.6	18.0
Profiseed	2555	2.4	—	59	65	S	S[5]	—	33.9	33.5	—	18.7	18.6
Stine	2555 [8]	2.4	—	—	65	S	S[6]	—	—	33.4	—	—	18.7
Kaltenberg	KB184	1.9	—	—	64	S	MS[6]	—	—	33.5	—	—	18.6
Prairie Brand	PB-2120	2.4	54	54	64	S	S	34.4	33.7	33.2	18.6	19.0	18.8
Ziller	BT2919	2.0	52	53	63	S	MS	34.6	34.0	33.3	18.4	18.7	18.7
Asgrow	A2242	2.2	54	56	62	Rps1k	MS	33.6	33.0	32.5	19.1	19.4	19.2
Golden Harvest	H-1263	2.4	53	54	62	S	S	34.4	34.2	34.0	18.7	18.7	18.4
Prairie Brand	PB-237	2.3	—	56	62	S	S[5]	—	33.4	32.9	—	19.2	19.0

Table 31 (continued). Yields and characteristics of public and private soybean varieties, southern zone, 1994 (Fairmont, Lamberton, Waseca)

Brand or Originator	Variety	Relative Maturity	Yield 1992–1994	Yield 1993–1994	Yield 1994	Phytophthora gene [2]	Chlorosis rating [4]	Protein 1992–1994	Protein 1993–1994	Protein 1994	Oil 1992–1994	Oil 1993–1994	Oil 1994
		rating [1]	bu/A					% [7]			% [7]		
NK	S24-92	2.4	53	54	62	S	S	34.6	33.8	33.6	18.6	19.0	18.7
Sexauer	SX2351	2.3	—	—	62	Rps1	MS [6]	—	—	32.5	—	—	19.3
Pioneer	9231	2.3	49	50	59	Rps1k	MS	35.0	34.7	34.7	18.1	18.2	17.8
Golden Harvest	H-1228	2.2	—	51	59	Rps1	S [5]	—	32.9	32.5	—	19.6	19.3
PBR	194	1.9	—	—	58	S	S [6]	—	—	32.4	—	—	19.3
Minn. A.E.S.	Sturdy	2.1	52	52	58	Rps1	MR	34.2	33.6	33.6	18.8	19.1	18.5
Prairie Gold	2250	2.2	—	—	56	S	MS [6]	—	—	35.7	—	—	17.3
Dairyland	DSR-189	1.5	48	49	56	Rps1c	MS	33.6	32.9	32.8	19.0	19.5	19.0
Minn. A.E.S.	Faribault	1.6	—	—	56	Rps1	MR	—	—	33.7	—	—	18.6
Thompson	T-3193 [8]	2.0	—	—	56	S	S [6]	—	—	35.2	—	—	17.6
Yield King	K2323+	2.2	—	—	67	S	MS [6]	—	—	35.3	—	—	17.4
Payco	9421	2.1	—	—	64	S	MR [6]	—	—	33.8	—	—	18.4
HyPerformer	HY244	2.4	—	—	63	S	S [6]	—	—	33.1	—	—	18.9
Kaltenberg	KB204	2.1	—	—	63	S	MS [6]	—	—	34.3	—	—	18.1
Profiseed	2134	2.1	—	—	62	S	MS [6]	—	—	34.4	—	—	18.3
Prairie Brand	PB-201	2.0	—	55	62	S	MS [5]	—	34.9	35.0	—	18.1	17.7
DeKalb	CX228	2.2	—	—	61	Rps1c	S [6]	—	—	32.2	—	—	19.5
Latham	590 Brand	2.2	—	—	61	S	MR [6]	—	—	34.8	—	—	17.8
Ehrich	E-1398	1.9	—	—	61	S	S [6]	—	—	34.3	—	—	18.1
Iowa A.E.S.	IA2008	2.1	52	52	61	Rps1	MR	32.8	32.1	32.2	19.6	19.7	19.4
Yield King	K-2162	1.9	—	—	61	S	MS [6]	—	—	34.0	—	—	18.3
HyPerformer	HY202	2.0	—	—	60	S	S [6]	—	—	35.6	—	—	17.2
Prairie Gold	2194	2.1	—	—	59	Rps1	MS [6]	—	—	32.0	—	—	19.6
Ramy	2250	2.2	—	—	58	S	MR [6]	—	—	35.3	—	—	17.5
Ciba	3202	2.0	47	48	56	S	MS	34.9	34.6	34.0	18.4	18.4	18.4
Dyna-Gro	X90	2.0	—	—	56	S	MS [6]	—	—	33.6	—	—	18.5
AgriPro	AP2344	2.3	—	—	55	S	MS [6]	—	—	33.4	—	—	18.7
GL	GL2237	2.2	—	49	54	Rps1k	MS [5]	—	35.3	34.8	—	17.8	17.8
PBR	232	2.3	—	51	62	Rps1	S [5]	—	33.0	32.7	—	19.4	19.1
Star	EXP9321	2.1	—	55	61	S	MS [5]	—	34.7	34.4	—	18.3	18.1
Sansgaard	S-213-27	2.0	—	—	61	S	MS [6]	—	—	34.7	—	—	17.8
Thompson	T-1195	2.1	—	—	60	S	S [6]	—	—	34.9	—	—	17.8
C/LOL	L2233	2.2	—	52	58	M [3]	MS [5]	—	35.5	34.9	—	17.7	17.7
Hy-Vigor	2187	2.6	—	—	51	S	MS [6]	—	—	34.3	—	—	18.1
Yield King	K-2555	2.3	—	57	67	S	S [5]	—	33.4	32.8	—	19.2	19.1
PBR	247	2.4	—	55	65	S	MS [5]	—	33.6	32.8	—	19.0	19.0
Mustang	M-1222	2.4	—	52	59	S	S [5]	—	32.6	32.4	—	19.8	19.4
Premier	P-2442	2.4	—	—	62	S	MS [6]	—	—	34.1	—	—	18.3
Stine	2621	2.1	—	—	59	S	MR [6]	—	—	35.1	—	—	17.5
Dyna-Gro	3233	2.3	—	—	56	S	S [6]	—	—	32.9	—	—	18.9
DeKalb	CX250b	2.5	—	—	62	Rps1	S [6]	—	—	34.4	—	—	18.1
M.O.	2660	2.2	—	—	64	S	S [6]	—	—	32.9	—	—	19.0
Sexauer	SX2251	2.2	—	—	56	S	S [6]	—	—	33.1	—	—	18.8
LSD 20%			1	2	2								

[1] Provided by originator; [2] Specific genes noted, S = Susceptible; [3] Mixture Resistant and Susceptible [4] R = Resistant, MR = Moderately Resistant, MS = Moderately Susceptible, S = Susceptible; [5] 2 year average; [6] 1 year data; [7] 13% moisture; [8] Blend (Information furnished by originator).

State Rd 19, Waunakee, WI 53597-0278 (Kaltenberg)

KSC/Challenger, Box 747, Cedar Falls, IA 50613 (KSC/Challenger)

Kruger Seed Company, Hwy 20 East, Box A, Dike, IA 50624 (Kruger)

L. Herried Seeds, 925 Dexter St., P.O. Box 216, Prescott, WI 54021 (L. Herried)

Latham Brothers Farm, 131 180th St., Alexander, IA 50420 (Latham)

Latham Seed Company, 131 180th St., Alexander, IA 50420 (Latham)

Midwest Oilseeds, Inc., 2225 Laredo Trail, Adel, IA 50003 (M.O.)

Midwest Seed Genetics, Box 518, Carroll, IA 51401 (M/W Genetics)

Mycogen Plant Sciences, 720 St. Croix St., Prescott, WI 54021 (Mycogen)

Northrup King, 7500 Olson Mem. Hy., Golden Valley, MN 55427 (NK)

Pioneer Hi-Bred International, Inc., 130 SE Willmar Ave., Willmar, MN 56201 (Pioneer)

Prairie Brand Research, 15 X Avenue, Story City, IA 50248 (PBR)

Prairie Brand Seed Company, 15 X Avenue, Story City, IA 50248 (Prairie Brand)

ProfiSeed, Inc., 1691 Highway 65, Hampton, IA 50441 (Profiseed)

Prairie Gold Seeds, LLC, P.O. Box 3041, 1329 N. Riverfront Drive, Mankato, MN 56002 (Prairie Gold)

Ramy International Ltd., 1329 N. Riverfront Drive, P.O. Box 3722, Mankato, MN 56001 (Ramy)

Sand Seed Service, Inc., P.O. Box 648, Marcus, IA 51035 (Sands)

Premier Brand Seed Company, 15 X Avenue, Story City, IA 50248 (Premier)

Sansgaard Seed Farms, Inc., 15 X Avenue, Story City, IA 50248 (Sansgaard)

The Sexauer Company, P.O. Box 58, Brookings, SD 57006 (Sexauer)

Star Brand Seed, Box 648, Marcus, IA 51035 (Star)

Stine Seed Company, 2225 Laredo Trail, Adel, IA 50003 (Stine)

Terra International, Inc., 600 4th St., P.O. Box 6000, Sioux City, IA 51102-6000 (Terra)

Thompson Agronomics, Inc., R.R. #1, Box 34, Leland, IA 50453 (Thompson)

Thompson Seeds, Inc., R.R. 1, Box 34, Leland, IA 50453 (Thompson)

UAP Seed Company/Dyna-Gro, P.O. Box 5015, Fargo, ND 58105-5015 (Dyna-Gro)

UAP Seed Company, P.O. Box 55, Kasota, MN 56050 (Dyna Gro)

Wilson Seeds, Inc., P.O. Box 391, Harlan, IA 51537 (Wilson)

Ziller Seed Co., Inc., R.R. 1, Box 122, Bird Island, MN 55310 (Ziller)

CROPS NOT IN CURRENT TRIALS

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. Substantial acreage of crambe has been contracted in North Dakota in recent years. 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. Both are crops best grown under contract so that they are not marketed as canola.

An erect annual, crambe grows to a height of about 35 inches. 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. Some of these varieties are occasionally grown under contract in Minnesota.

A fertile field of flax in full flower.

Crambe varieties were last tested in Rosemount in 1991, but are not currently undergoing performance trials. Production information is provided in the crambe chapter in *Alternative Field Crops Manual.* Contact your county extension agent or the Center for Alternative Plant & Animal Products, 340 Alderman Hall, Univ. of Minnesota, St. Paul, MN 55108.

Flax

Common flax was one of the first crops domesticated. It is thought to have originated in the Mediterranean region of Europe. In the United States, early colonists grew small fields of flax for home use.

Commercial production of fiber flax began in 1753. During the 1940s fiber flax production in the U.S. dropped to nearly zero. Today only a few individuals still grow fiber flax for their own use to make linen. Interest in the production of oilseed flax has shifted from traditional uses in paints and oils to use in human foods. Presently 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 was 9.5 bushels per acre in 1920, increasing to 16 bushels in 1987. In Minnesota, flax acreage is concentrated in the northwest, but flax has been grown successfully in nearly all counties.

Minnesota Agricultural 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.

Production information is provided in the flax 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.

Mustard

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

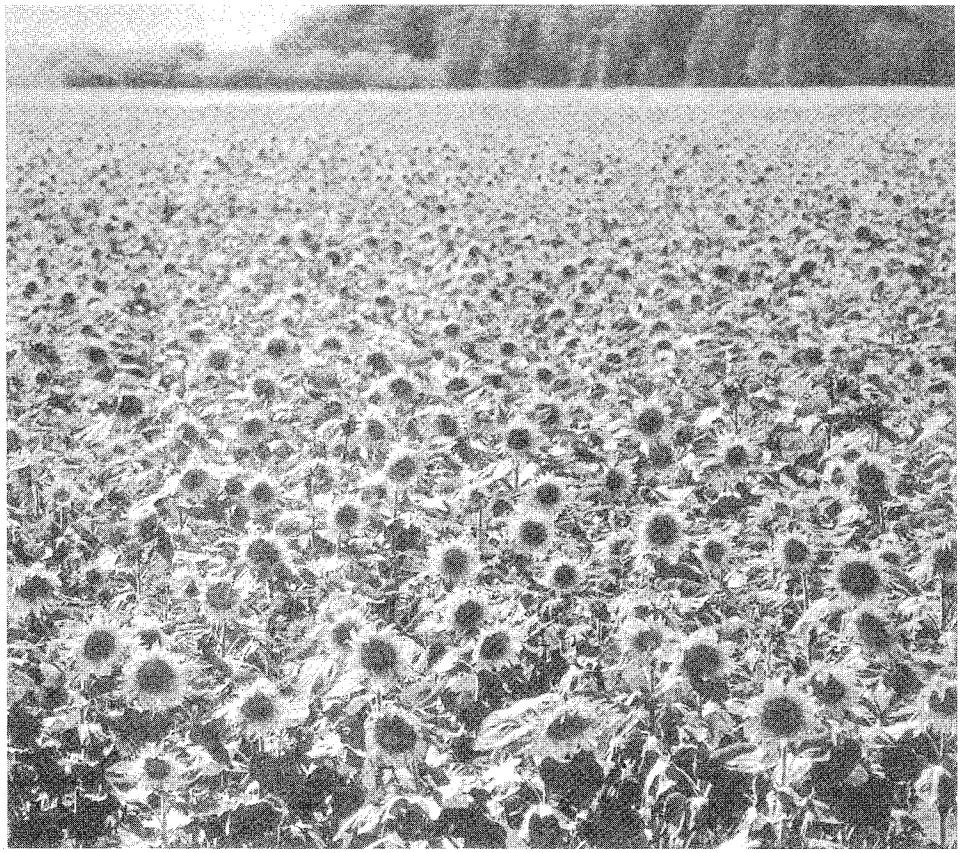
About 25,000 Minnesota acres were planted to mustard in 1963. Most was grown under contract in the northwest part of the state. Present Minnesota mustard acreage is unknown, but Canada, Denmark and the United Kingdom are now large producers.

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 Agricultural 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 reaching Russia where it was readily adapted. Selection for high oil began in Russia in 1860.



In the aftermath of World War II, high oil lines 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, plant disease, insect and bird problems. Sunflower acreage is moving west into drier regions, but about 85 percent of North American sunflower seed is still produced in North and South Dakota and Minnesota.

Minnesota Agricultural 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.

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

CROPS NOT IN CURRENT TRIALS

No pulse crops are currently involved in performance trials at any of the branch stations or farm field locations of the Minnesota Agricultural Experiment Station. The following crops have, however, been involved in such inquiries in the past.

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 Agricultural 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.

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 annually, the fieldbean is the world's third most important legume. Acreage in the U.S. is concentrated in Michigan, North Dakota, Minnesota, Idaho, Colorado, and Nebraska. Grower interest is largely determined by the factors of price and proximity of buying stations or processors.

Minnesota Agricultural Experiment Station scientists are not currently conducting performance trials of fieldbeans. 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.

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

Fieldpea

Fieldpea (*Pisum sativum*) is usually combine-harvested as mature, dry seed. The seed is sold for use in soup 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 to variability in seed quality. Seed quality may also be responsible for differences in stand which may have an effect on seed yield.

Varieties of fieldpea have not been tested recently. For the most recent data on fieldpea

varieties, write to Extension Agronomy, 411 Borlaug Hall, 1991 Buford Circle, University of Minnesota, St. Paul MN 55108. Information on fieldpea production 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.

Lentil

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

Minnesota Agricultural 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.

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.

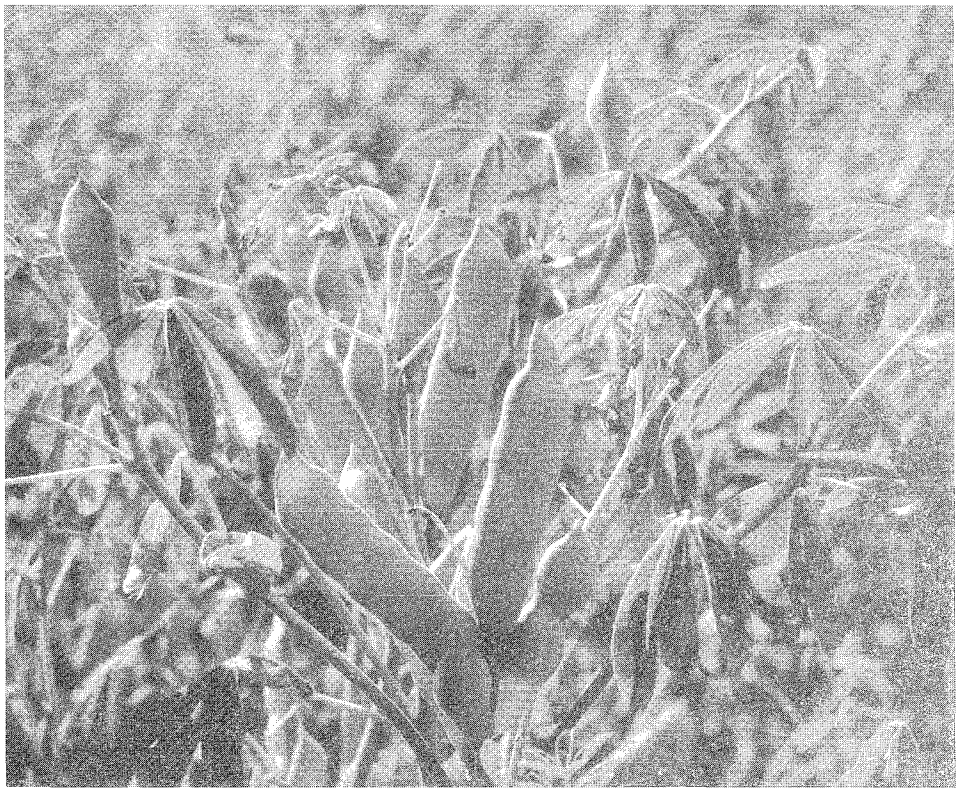
A lupin crop should be planted from early to mid-April and should be ready to harvest in August or September. Lupins are easily direct-combined because of their upright habit. Yields up to 4,400 pounds per acre have been produced in Minnesota, but have averaged about 1,900 pounds per acre (32 bushels) over 14 year/locations. Crude protein ranges from 28 to 40 percent in the seed, and averages about 34 percent.

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

Minnesota Agricultural Experiment Station scientists are not currently conducting performance trials on lupin. Detailed research data from 1988-1990 is available by writing Extension Agronomy, 411 Borlaug Hall, 1991 Buford Circle, University of Minnesota, St. Paul MN 55108.

Production information is provided in the lupin 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. A more detailed *Lupin Production and Utilization Guide* is available from the Center for $10. This guide contains production, disease, insect, feeding and economic data.

Potential seed sources include Wolf River Valley Seeds, N2976 County M, White Lake WI 54491; and Lupin-Triticale Enterprises, P.O. Box 187, Perham MN 56573.



PLANTING RATE AND DATE

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/square 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	90,000/acre	
	Kidney		900	90–115	90,000/acre	
	Navy		2,500	42	105,000/acre	
	Navy 6– to 14–inch rows			60	150,000/acre	
	Pink		1,700	60	105,000/acre	
	Pinto		1,300	80	90,000/acre	
	Small Red		1,400	75	100,000/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	1,234,000	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/acre	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	65,000	15	23/square foot	Late April to early May
	Fieldpea	60	2,300	180	9/square foot	Early spring
	With 1½ 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.*