1994 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 232–1994 (MR–5615–F)

CONTENTS

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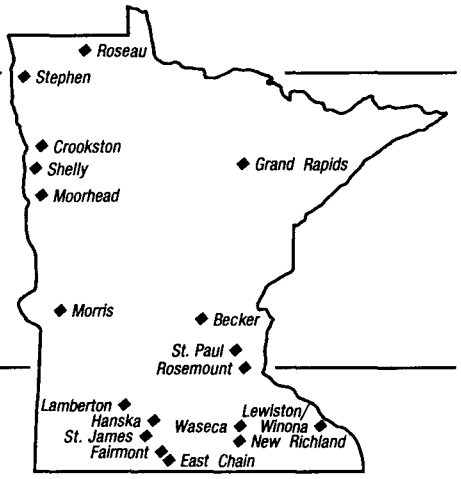
VARIETAL TRIALS

OF SELECTED FARM CROPS



Locations of varietal trials reported in this publication.

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

Minnesota Agricultural Experiment Station scientists are not currently conducting performance trials for many of the crops that were included in editions of *Varietal Trials* published prior to 1991. For those who want the most recent reports of tests or additional production information on such crops, a contact address and/or alternate publication source is indicated under each crop heading.

Variety Classifications

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

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

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

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 1994 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 yield columns in 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, then that 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); and R. Porter (wild rice).

Information on the reaction of varieties to specific pathogens was largely obtained by these members of the Department of Plant Pathology: A.P. Roelfs (wheat); K.J. Leonard (oat); N. Young and W. Stienstra (soybean); D.V. McVey (wheat).

Fieldwork for varietal trials at Waseca, Lamberton, Morris, Crookston-Stephen, and Grand Rapids was supervised by W.E. Lueschen, J.H. Ford, D.D. Warnes, J.V. Wiersma and R. Mathison, respectively.

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FORAGE CROPS

ALFALFA

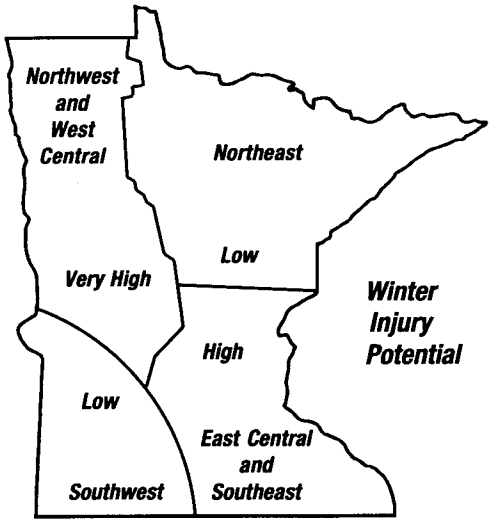
Winter hardiness and fall dormancy

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

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 for year two—similar to winter-hardy, fall dormant varieties—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 to the moderately dormant varieties during the summer, but produce more forage growth during the fall growth period. They will not survive most winters. These 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. These are the most important: 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 are presented in table 1. Moderate resistance (MR) to a disease will provide 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. 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. 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, which is why it is 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 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 then consider planting a variety with Aphanomyces resistance.

The nondormant alfalfa Nitro (right) was developed by the Minnesota Agricultural Experiment Station to provide increased root yield and increased root nitrogen, compared to dormant types (left).

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	Bacterial wilt	Phytophthora root rot	Fusarium wilt	Anthracnose	Verticillium wilt	Aphanomyces root rot
		rating[2]	rating[3]					
Very Fall Dormant								
Teton	S. Dakota Agr. Exp. Sta.[ANr]	1	LR	LR	MR	S	–	–
Travois	S. Dakota Agr. Exp. Sta.[Ner]	1	R	S	MR	S	–	–
Fall Dormant								
5262	Pioneer Hi-Bred International[k]	2	HR	R	MR	–	LR	–
Agate	USDA & Minnesota Agr. Exp. Sta.[ANjmqrvw]	2	HR	R	HR	MR	–	–
Alfagraze	University of Georgia[ADcdtx]	2	MR	LR	R	MR	–	–
Alpine	Bio Plant Research[E]	2	R	R	R	R	R	–
Baker	USDA & Nebraska Agr. Exp. Sta.[N]	2	HR	–	R	LR	–	–
Clipper	Interstate/Payco Seed Company[W]	2	HR	R	HR	R	R	–
DK 122	DeKalb Plant Genetics[M]	2	HR	HR	R	HR	R	–
Evolution	Mycogen Plant Sciences/Jacques[g]	2	HR	HR	HR	HR	R	R
Flagship 75	Peterson Seed[j]	2	HR	HR	HR	R	R	–
Garst 636	ICI Seeds[U]	2	HR	R	R	MR	R	–
Iroquois	Cornell University[Aqv]	2	HR	S	MR	S	S	–
Milk Maker II	MBS Inc.(PGI)[Zf]	2	R	R	MR	–	–	–
Nordic	ICI Seeds[U]	2	HR	HR	R	R	R	MR
Profit	Ciba Seed/Wensman Seed[lv]	2	HR	R	HR	MR	R	–
Quantum	Renk Seed[p]	2	HR	HR	HR	HR	HR	R
VERNAL	Wisconsin Agr. Exp. Sta. & USDA[AHNdejmqrvw]	2	R	–	MR	–	–	–
Viking I	Northrup King[i]	2	R	R	HR	R	HR	–
WL 225	W-L Research, Inc.[Q]	2	HR	HR	HR	MR	R	–
Wrangler	USDA & Nebraska Agr. Exp. Sta.[ANdjmqrvw]	2	R	HR	R	LR	LR	–

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 rating[2]	Bacterial wilt	Phytophthora root rot	Fusarium wilt	Anthracnose	Verticillium wilt	Aphanomyces root rot
			rating[3]					
Moderately Fall Dormant								
120	DeKalb Plant Genetics [M]	3	HR	R	R	LR	–	–
2833	Ciba Seeds [I]	3	HR	HR	HR	HR	R	–
2841	Ciba Seeds [I]	3	HR	R	R	R	R	–
5246	Pioneer Hi-Bred International [K]	3	HR	HR	HR	HR	R	MR
Achieva	Agassiz Seed/Allied Seed Cooperative [AC]	3	R	HR	HR	HR	R	–
AgriBoss	Cropmate Company [J]	3	HR	HR	HR	HR	MR	–
Allegiance	Keltgen Seed Company [a]	3	R	R	R	HR	R	–
Arrow	America's Alfalfa [ADcdtx]	3	HR	HR	HR	MR	R	–
Blazer	Cenex/Land O'Lakes [H]	3	HR	MR	R	LR	LR	–
Blazer XL	Cenex/Land O'Lakes [H]	3	R	HR	HR	HR	R	R
Bolt ML	Jung Farms [Y]	3	R	HR	HR	HR	R	R
break-thru	Custom Farm Seed [K]	3	HR	HR	HR	MR	R	–
Bronco	Jung Farms [Y]	3	HR	HR	HR	HR	R	–
Centurion	Allied Seed Cooperative [C]	3	HR	R	R	R	R	–
Class	Cropmate [J]	3	HR	HR	R	HR	R	R
Columbo	MBS Inc.(PGI) [f]	3	R	R	HR	R	HR	–
Crown	Cargill Seed Division [G]	3	R	R	R	HR	R	–
Crown II	Cargill Seed Division [G]	3	HR	HR	HR	HR	R	–
Dart	AgriPro [B]	3	HR	HR	HR	R	R	–
DK 125	DeKalb Plant Genetics [M]	3	HR	R	R	HR	R	–
Elevation	Mycogen Plant Sciences/Jacques [g]	3	R	MR	R	–	MR	–
Envy	Gold Country Seed [QZj]	3	HR	R	HR	HR	R	MR
Garst 645	ICI Seeds [U]	3	HR	HR	R	HR	R	MR
GH 715	J.C. Robinson Seed [X]	3	HR	MR	R	MR	LR	–
GH 777	Golden Seed [R]	3	HR	HR	HR	R	R	R
GH 787	Golden Seed [R]	3	HR	HR	R	HR	R	R
Green Field	Peterson Seed [j]	3	HR	HR	HR	HR	R	R
Husky	Premium Seed [fm]	3	R	MR	R	MR	–	–
Impact	Peterson Seed [jm]	3	HR	R	HR	MR	R	–
Magnum III-WET	Dairyland Seed Company [L]	3	–	R	R	MR	MR	MR
Majestic	Allied Seed Cooperative [C]	3	R	R	HR	HR	HR	–
Milkmaker	Kaltenberg Seed Farms [Z]	3	R	MR	HR	MR	–	–
Multi-plier	Mycogen Plant Sciences/Jacques [g]	3	HR	HR	HR	HR	R	–
MultiKing 1	Northrup King [I]	3	HR	R	HR	R	R	–
Oneida	Cornell University [iqv]	3	HR	HR	HR	S	–	–
Oneida VR	Cornell University [Adv]	3	R	MR	HR	MR	HR	–
Ranger	USDA & Nebraska Agr. Exp. Sta. [ANev]	3	MR	S	MR	S	S	–
Renegade	Geertson Seed Farms [P]	3	R	R	MR	–	LR	–
Royalty	Cargill Seed Division [G]	3	HR	HR	HR	HR	R	LR
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	–
Trident II	Cargill Seed Division [G]	3	HR	HR	R	R	R	MR
Ultraleaf 87	LaCrosse Seed [bo]	3	R	HR	HR	HR	R	R
Webfoot	Great Lakes Hybrids [S]	3	R	R	MR	–	–	–
WL 317	W-L Research Inc. [QW]	3	HR	HR	HR	R	R	–
Zenith	ICI Seeds [U]	3	HR	HR	R	HR	R	–
630	ICI Seeds [U]	4	HR	MR	R	MR	MR	–
631	ICI Seeds [U]	4	HR	HR	HR	R	R	MR
5333	Pioneer Hi-Bred International [K]	4	HR	R	HR	HR	MR	–
5364	Pioneer Hi-Bred International [K]	4	R	MR	R	MR	MR	–
5432	Pioneer Hi-Bred International [K]	4	HR	MR	HR	–	R	–
Aggressor	America's Alfalfa [ADcdtx]	4	HR	HR	HR	HR	R	MR
Agri-MATE	Cropmate Company [J]	4	R	R	HR	R	R	–
Allegro	Keltgen Seed [a]	4	HR	HR	R	HR	R	R
Apollo	America's Alflafa [ADcdtx]	4	R	R	R	LR	–	–
Apollo II	America's Alflafa [ADcdtx]	4	R	HR	R	MR	MR	–
Apollo Supreme	America's Alflafa [ADcdtx]	4	HR	R	HR	HR	R	–
Aquarius	Lincoln Seed [e]	4	HR	S	R	HR	–	–
Asset	Allied Seed Cooperative [C]	4	HR	HR	R	R	R	MR
Chief	Mycogen Plant Sciences/Jacques [g]	4	HR	HR	R	R	R	–
Cimarron VR	Great Plains Research [TZ]	4	HR	R	HR	HR	R	MR

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]					
Crystal	MBS Inc.(PGI) [f]	4	HR	HR	HR	R	R	LR
Cutter	Interstate/Payco Seed [W]	4	R	HR	HR	R	R	MR
DK 133	DeKalb Plant Genetics [M]	4	HR	HR	HR	HR	R	R
EMPRESS	Fred Gutwein & Sons/Blaney [FO]	4	HR	HR	HR	R	R	–
Flint	Premium Seed Company [m]	4	R	HR	R	HR	LR	–
GH 737	J.C. Robinson Seed [X]	4	R	HR	R	MR	R	–
GH 747	Golden Seed [R]	4	HR	HR	R	HR	MR	–
GH 755	J.C. Robinson Seed [X]	4	HR	HR	HR	HR	R	–
Good as Gold	Top Farm Hybrids [s]	4	HR	HR	HR	R	R	LR
Gourmet Hay	Fred Gutwein & Sons/Blaney [FO]	4	HR	R	HR	HR	R	–
Hi-phy	Premium Seed Company [m]	4	HR	HR	MR	–	–	–
Jade	NC+ Hybrids [h]	4	HR	HR	R	R	R	–
Legend	Cenex/Land O'Lakes [H]	4	HR	HR	HR	HR	R	–
Magnum III	Dairyland Seed Company [L]	4	R	R	R	MR	MR	LR
Persist	Kaltenberg Seed Farms [Z]	4	HR	HR	HR	R	R	MR
Pro-Cut	L. Herried Seeds [c]	4	HR	HR	HR	R	R	–
Pro-Cut 2	L. Herried Seeds [c]	4	HR	HR	R	R	R	MR
Quest	Renk Seed [p]	4	HR	HR	HR	R	R	–
RamRod	Bio Plant Research [E]	4	R	R	R	MR	R	–
Sabre	Allied Seed Cooperative [C]	4	HR	R	HR	HR	HR	–
Saranac	Cornell University [N]	4	R	S	R	S	S	–
Target II	Producers Hybrids [n]	4	HR	R	R	R	R	–
Terminator	Ramy International [o]	4	HR	R	HR	R	R	–
Vector	Peterson Seed [j]	4	HR	MR	HR	R	MR	–
Verta+	NC+ Hybrids [h]	4	HR	R	R	HR	R	–
Voyager	Ziller Seed Company [y]	4	HR	R	R	MR	MR	–
WL 320	W-L Research Inc. [Q]	4	R	R	HR	MR	MR	–
WL 322 HQ	W-L Research, Inc. [QW]	4	HR	R	HR	MR	R	–
WL 323	W-L Research, Inc. [Q]	4	HR	HR	HR	HR	R	R
Belmont	Great Plains Research [TZ]	5	HR	R	HR	HR	R	–
Nondormant								
Nitro	USDA & Minnesota Agr. Exp. Sta. [im]	8	–	R	HR	–	–	–

[1] 1994 seed sources are listed at the end of the forage crops section; [2] Based on mid-October fall growth after cutting 1st week of September: 9 = tallest (tend to be least winter-hardy), 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 (1993/94 Edition).

Table 2. Average yields of alfalfa varieties expressed as percentage of Vernal for all tests with one or more harvest years (1967-1993) 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
	% of Vernal										
Very Fall Dormant											
Teton	–	–	102	9	–	–	–	–	102	99	1
Travois	–	–	94	91	–	–	–	–	94	91	1
Fall Dormant											
5262	108	105	100	106	103	107	112	107	104	106	8
Agate	102	107	97	101	100	100	89	96	99	104	18
Alfagraze	104	85	97	83	101	–	103	94	100	87	7
Alpine	110	104	95	108	112	110	–	–	105	107	5
Baker	99	105	97	101	107	103	89	82	97	100	17
Clipper	103	90	97	101	100	96	106	102	101	97	9
DK 122	107	71	98	105	110	–	105	102	105	93	10
Evolution	108	–	–	–	–	–	–	–	108	–	1

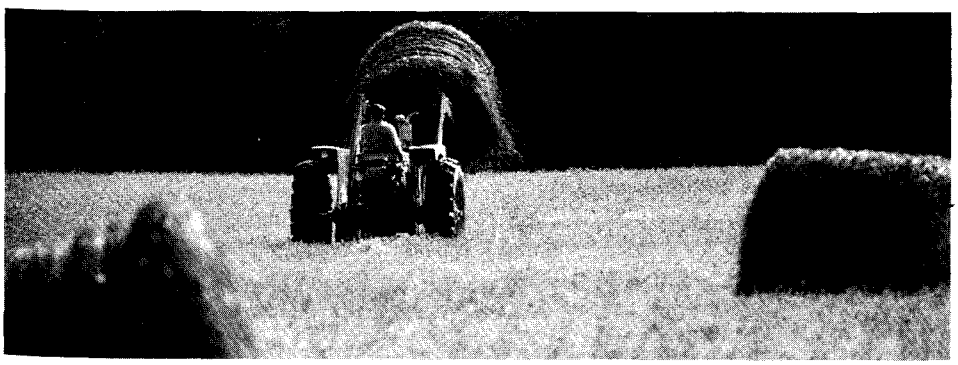
Table 2 (continued). Average yields of alfalfa varieties expressed as percentage of Vernal for all tests with one or more harvest years (1967–1993) in each of four climatological areas within Minnesota.

	Average yield for years 1–2 and 3–4 after seeding per test location										
	Rosemount & Waseca		Morris & Crookston		Lamberton		Grand Rapids		All locations		
Variety	1–2	3–4	1–2	3–4	1–2	3–4	1–2	3–4	1–2	3–4	Number tests
	% of Vernal										
Flagship 75	101	–	–	–	–	–	–	–	101	–	1
Garst 636	109	107	105	108	101	106	103	102	106	106	8
Iroquois	103	102	105	106	103	112	111	96	105	104	12
Milk Maker II	102	–	108	–	110	–	–	–	107	–	4
Nordic	103	–	112	–	111	–	–	–	108	–	5
Profit	110	110	97	93	107	109	105	113	104	106	8
Quantum	103	–	–	–	–	–	–	–	107	–	2
VERNAL: tons/ac 15% M	5.94	5.29	5.41	4.69	5.09	4.53	3.94	3.79	5.10	4.58	65
Viking 1	109	–	–	–	–	–	112	–	110	–	3
WL 225	103	90	87	101	101	103	107	105	98	101	6
Wrangler	105	107	106	101	98	102	100	95	103	102	7
Moderately Fall Dormant											
120	111	113	103	107	103	–	112	107	109	111	10
2833	110	–	89	107	104	98	–	–	100	103	5
2841	97	76	79	94	103	104	105	105	95	92	7
5246	107	–	–	–	–	–	112	–	107	–	4
Acheiva	107	–	–	–	–	–	–	–	107	–	3
AgriBoss	107	96	84	107	96	108	–	–	100	103	5
Allegiance	95	101	97	106	111	120	104	109	100	111	7
Arrow	107	103	104	100	108	113	110	104	107	104	10
Blazer	108	114	95	104	102	–	100	104	104	111	10
Blazer XL	101	–	101	–	105	–	–	–	103	–	3
Bolt ML	111	–	–	–	–	–	–	–	111	–	1
break-thru	103	93	88	103	102	107	103	93	99	101	8
Bronco	116	94	82	96	101	93	103	89	97	94	6
Centurion	111	98	100	97	104	101	114	107	107	101	6
Class	110	–	–	–	–	–	–	–	110	–	1
Columbo	109	–	110	–	96	–	–	–	103	–	3
Crown	109	100	92	98	123	112	113	103	107	103	6
Crown II	112	–	96	108	110	103	–	–	106	106	6
Dart	111	107	104	106	105	110	109	105	107	107	11
DK 125	107	95	99	96	114	106	104	89	106	96	7
Elevation	112	112	103	104	111	97	106	99	108	104	10
Envy	111	90	101	109	102	111	–	–	105	104	7
Garst 645	103	102	111	–	112	–	–	–	108	102	5
GH 715	106	102	104	107	103	113	113	112	106	107	8
GH 777	110	–	–	–	–	–	–	–	110	–	1
GH 787	105	–	–	–	–	–	104	–	104	–	3
Green Field	106	–	–	–	–	–	–	–	106	–	1
Husky	110	98	99	96	111	105	103	103	106	99	12
Impact	110	94	104	109	112	103	112	104	109	101	6
Magnum III-WET	112	–	–	–	–	–	–	–	112	–	2
Majestic	103	105	109	–	105	–	100	104	104	105	5
Milkmaker	106	99	100	93	98	101	104	106	103	99	8
Multi-plier	108	99	96	107	103	88	98	100	102	100	10
MultiKing 1	102	–	109	–	117	–	104	–	108	–	5
Oneida	105	106	102	107	94	97	105	107	103	106	10
Oneida VR	101	104	97	108	98	109	105	99	99	105	7
Ranger	98	100	125	104	97	99	–	–	100	100	13
Renegade	111	87	103	98	101	–	96	102	104	94	5
Royalty	105	97	90	106	101	108	102	95	100	105	7
Sure	109	97	99	104	103	99	101	105	103	101	6
Surpass	113	107	104	105	108	103	108	109	109	106	5
Thrive	103	89	101	103	–	–	106	110	103	101	5
Trident II	105	94	106	102	111	–	104	106	106	100	7
UltraLeaf 87	105	–	–	–	–	–	122	–	110	–	3
Webfoot	105	105	104	107	100	–	102	105	103	105	8
WL 317	114	93	86	100	104	112	105	105	102	103	6
Zenith	109	–	111	–	112	–	–	–	111	–	5
630	110	110	102	100	107	109	99	112	107	109	10

Table 2 (continued). Average yields of alfalfa varieties expressed as percentage of Vernal for all tests with one or more harvest years (1967–1993) in each of four climatological areas within Minnesota.

	Average yield for years 1-2 and 3-4 after seeding per test location										
	Rosemount & Waseca		Morris & Crookston		Lamberton		Grand Rapids		All locations		
Variety	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	Number tests
	% of Vernal										
631	108	–	–	–	–	–	–	–	108	–	2
5333	94	96	107	–	105	–	–	–	102	96	3
5364	116	113	93	107	103	112	98	109	101	110	6
5432	109	105	99	101	101	100	104	114	104	105	6
Aggressor	100	95	103	99	107	–	99	107	102	100	8
Agri-MATE	111	82	102	92	100	–	103	96	105	89	6
Allegro	109	–	–	–	–	–	–	–	109	–	1
Apollo	104	106	96	103	103	102	94	91	100	104	11
Apollo II	103	93	103	95	103	95	103	84	103	93	8
Apollo Supreme	108	104	90	104	100	93	107	108	101	102	7
Aquarius	99	90	99	89	–	–	–	–	99	89	5
Asset	107	85	69	98	105	101	–	–	93	96	3
Chief	102	86	85	103	102	95	109	98	98	94	7
Cimarron VR	96	–	99	83	110	–	100	101	100	92	6
Crystal	100	95	104	93	117	–	–	–	106	95	5
Cutter	103	–	102	100	110	–	106	95	105	98	6
DK 133	108	–	–	–	–	–	113	–	109	–	4
EMPRESS	117	73	105	104	101	–	104	101	106	92	6
Flint	100	104	96	101	105	102	–	–	99	102	6
GH 737	110	92	95	87	107	109	99	95	103	97	7
GH 747	109	87	85	106	108	101	–	–	103	97	4
GH 755	105	–	–	–	–	–	–	–	105	–	2
Good as Gold	108	99	113	100	104	–	108	115	110	105	6
Gourmet Hay	101	–	113	–	103	–	–	–	106	–	3
Hi-phy	111	127	100	100	103	–	99	102	105	114	7
Jade	118	109	116	110	107	–	109	108	113	109	6
Legend	97	102	89	103	101	101	101	103	96	104	6
Magnum III	109	101	106	103	116	115	104	107	110	104	9
Persist	115	–	–	–	–	–	–	–	115	–	1
Pro-Cut	96	82	84	100	98	99	93	97	92	94	6
Pro-Cut 2	111	88	83	97	110	102	100	91	98	97	6
Quest	104	96	113	–	102	–	–	–	106	96	3
RamRod	110	106	105	113	113	109	–	–	108	109	4
Sabre	99	91	–	–	–	–	102	98	100	94	3
Saranac	103	99	106	109	103	103	96	109	103	101	27
Target II	110	88	111	106	–	–	105	97	109	94	4
Terminator	105	100	87	102	106	108	102	99	99	104	6
Vector	105	107	89	101	105	107	103	95	99	104	6
Verta +	106	96	98	95	96	95	105	96	101	95	6
Voyager	111	99	102	110	103	108	107	116	106	107	7
WL 320	109	110	106	97	112	106	112	102	109	105	6
WL 322 HQ	94	104	110	–	92	–	–	–	99	104	3
WL 323	107	–	–	–	–	–	–	–	107	–	1
Belmont	94	97	105	–	94	–	–	–	97	97	3

[1]Order of entries in this table parallels the fall dormancy ratings in table 1.



A well established alfalfa stand will produce a profitable, quality forage crop.

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.

Birdsfoot trefoil derived its name from the arrangement of its flowers and seed pods, which reminded people of bird's foot.

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

Variety [2]	Winter Injury	Forage Yields			
		1990	1991	1992	Mean
	score [3]	tons DM/A			
Bonnie	3.2	3.9	5.0	4.6	4.5
Carroll	1.0	5.6	5.8	5.6	5.2
Dawn	3.0	5.0	5.8	5.4	5.4
Empire AHNZdejmoqrvw	3.7	4.6	5.0	5.3	5.0
Fergus	1.5	4.9	5.3	5.8	5.3
GA-1	5.0	NH [3]	NH	NH	NH
Leo ow	2.7	4.4	5.0	5.1	4.8
Norcen AHZdjmoqvw	1.5	5.2	5.3	5.7	5.4
LSD 5%	1.0	0.8	0.6	0.8	0.5

[1] Trial established in 1989 at Rosemount, MN; [2] 1994 seed sources are listed at the end of the forage crops section; [3] Score: 1 = no injury to 5 = dead on May 18, 1990; [4] NH: not harvested.

The Rosemount trials were harvested twice in 1990; three times in 1991 and 1992. Dry matter yields in 1992 were excellent and similar to the yields obtained in 1991. These yields were higher than anticipated for birdsfoot trefoil and may be partially attributed to a lack of winter injury and a cool, moist growing season in 1992. This trial was discontinued in 1992, but new performance trials of birdsfoot trefoil were established at Rosemount and Grand Rapids in 1993.

Winter-hardy varieties such as Carroll, Norcen and Dawn 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.

Eight birdsfoot trefoil varieties were established in pure stands in August 1989 on Minnesota Agricultural Experiment Station fields at Rosemount and Grand Rapids. Severe winter injury at Grand Rapids destroyed the trial at that location.

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, 1991 and 1993. The stands were harvested twice in 1992. Nitrogen was applied in the early spring and after each harvest at rates of between 40 and 50 pounds of nitrogen per acre.

Orchardgrass trials are well established at Grand Rapids in 1993. They were planted in 1989.

Table 4. Winter injury (1990), maturity (1992) and dry matter yield (1990-1993) of orchardgrass varieties seeded at two locations.[1]

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

[1] Trials established in 1989 at both locations; [2] 1994 seed sources are listed at the end of the forage crops section; [3] Score: 1 = no injury to 5 = dead; scored May 1990; [4] Rating: 0 = no panicle emergence to 9 = complete panicle emergence; scored June 2, 1992, at Rosemount.

Few differences were observed for orchardgrass forage yield at either location. Varieties which showed significant winter injury in May, 1990, produced adequate forage yields during the 1990 growing season. Yields at Grand Rapids were lower in 1991 and 1992 than in 1990 and 1993.

In 1992, differences in forage yield were found between varieties tested at both locations. Orion, a winter hardy variety, was the highest yielding variety averaged over all locations and years. The newer varieties of Ambassador, Dawn and Elsie also performed well in the trial, as did the older varieties Napier and Sterling.

RED CLOVER

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

Minnesota Agricultural Experiment Station scientists established performance trials of red clover at three locations in 1991, but stands were sufficient for data collection only at Grand Rapids and Rosemount in 1992 and 1993. The trials were harvested three times at both locations during the past two years, except for Grand Rapids in 1992 when the trial was only harvested twice. No differences in dry matter were found between the varieties at either location during either year. Yields and stands were better at Rosemount than Grand Rapids in both years.

Red clover is a legume that is best adapted to northeastern Minnesota.

Table 5. Percent stand and dry matter yield of red clover varieties seeded at two locations.[1]

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

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 also 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 varieties low in indole alkaloid concentration. 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.

Reed canarygrass can also be used as hay or for silage, whether grown in pure stands or in mixture with legumes. If grown for hay, it should be harvested between heading and early bloom because reed canarygrass quality declines with maturity.

Reed canarygrass 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 each of the years 1990, 1991 and 1992. Nitrogen was applied early in the spring and after each harvest, at rates of between 40 and 50 pounds of nitrogen per acre.

Available varieties of reed canarygrass are winter-hardy and persistent in Minnesota. Palaton and Venture are two high yielding, low alkaloid varieties currently being marketed in the state.

Reed canarygrass is widely adapted across Minnesota, and has potential for better performance than most other perennial grasses.

Table 6. Dry matter yields (1990–1992) of reed canarygrass varieties seeded at two locations.[1]

	Morris			Rosemount			
Variety [2]	1990	1991	1992	1990	1991	1992	Mean
	tons DM/A						
Palaton AHZdjmqv	5.1	2.7	3.6	8.8	6.8	5.1	5.4
Rise	5.4	2.9	3.8	7.5	6.3	4.8	5.1
Vantage	5.7	2.7	3.7	8.3	5.9	4.6	5.2
Venture Ajm	6.0	2.9	3.9	9.2	6.6	5.6	5.7
LSD 5%	0.9	NS	NS	1.2	0.8	0.7	0.3

[1] Trials established in 1989 at both locations; [2] 1994 seed sources are listed at the end of the forage crops section.

TALL FESCUE AND WHEATGRASS

Tall fescue is a bunchgrass that may be planted in mixtures with other grasses and legumes. It establishes rapidly, withstands trampling, tolerates summer drought and produces fall season pasture when other grasses become dormant. Tall fescue is subject to winter injury, but may remain productive in areas with reliable snow cover.

Animal performance on tall fescue is better when the variety grown is endophyte-free. Endophytes are fungi that invade plant tissues and reduce forage palatibility and animal performance.

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

Wheatgrasses can produce excellent forage yields and show sustained productivity under hay and pasture management systems either in monoculture or in mixtures with alfalfa or other suitable legumes. Recent

Table 7. Dry matter yields (1993) and maturity of tall fescue and wheatgrass varieties seeded at two locations.[1]

Variety[2]	Maturity	Forage Yield		
		Morris	Rosemount	Mean
	rating[3]	tons DM/A		
Fescue				
Barcel	1	6.6	6.1	6.4
Fawn [djmrv]	8	7.7	5.2	6.5
Ky 31 – endophyte infected	2	7.0	6.6	6.8
Ky 31 – endophyte free [ANZdejmoqrv]	4	7.2	6.6	6.9
Martin [u]	7	6.7	5.9	6.3
Mozark	7	6.8	6.2	6.5
Mustang	2	–	5.3	5.3
Stef	0	6.8	5.5	6.2
Wheatgrass				
Manska	0	5.6	4.2	4.9
Newhy	0	–	4.1	4.1
Reliant	0	5.6	4.5	5.1
LSD 5%	1	0.7	0.8	

[1] Trials established in 1992 at both locations and harvested three times during 1993. [2] 1994 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 2, 1993, at Rosemount.

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. Nitrogen was applied in the early spring and after each harvest at rates of between 40 and 50 pounds of nitrogen per acre.

Yields of tall fescue and of wheatgrasses were exceptionally high in 1993, probably due to a mild winter, abundant rainfall and cool growing season temperatures. The wheatgrasses did yield less forage than the tall fescue varieties; however, the wheatgrasses are better adapted to environments drier than the 1993 growing season.

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.

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

Timothy plants in full bloom.

Table 8. Dry matter yields of timothy varieties seeded at three locations.

Variety[1]	Forage Yield			
	Grand Rapids	Rosemount		Morris
	1990-1991	1990-1992	1993	1993
	DM/A			
Early - Intermediate Maturity				
Chazy [c]	3.3	4.3	–	–
Climax [ANZcdejmopqrsvwy]	3.0	3.9	4.8	5.5
Comtal [d]	3.0	4.0	4.6	–
Goliath	2.9	4.1	4.3	–
Timfor [i]	–	–	4.5	–
Toro	–	–	4.8	–
Tupper	3.2	4.4	–	–
Late Maturity				
Champlain	2.8	3.8	–	–
Heidemij	2.5	3.4	4.1	4.1
Hokusen	–	–	4.0	4.7
LSD 5%	0.3	0.6	0.6	0.5

[1] 1994 seed sources are listed at the end of the forage crops section.

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

Varieties in these timothy trials were established in pure stands in August, 1989 at Grand Rapids and Rosemount, and in 1992 at Rosemount and Morris. Nitrogen was applied in the early spring and after each harvest at rates of between 40 and 50 pounds of nitro-

gen per acre. Early maturing varieties had greater forage production than the late maturing varieties at all locations over all harvest years.

Yields of timothy at Morris and Rosemount have been exceptionally high. That may be partly attributed to a mild winter, and to abundant rainfall and cool temperatures during the 1993 growing season. Timothy is normally less persistent than other cool season grasses such as reed canarygrass.

CROP NOT IN CURRENT TRIALS

Smooth Bromegrass

Bromegrass is generally grown for hay in mixture with alfalfa, or is used as pasture in mixture with other grasses and legumes. Varieties are classified as southern, intermediate and northern types. Southern type varieties may not be higher yielding, but are generally less susceptible to leaf diseases and earlier in maturity than northern types.

Varieties presently being sold in Minnesota are of the southern type. All varieties are winter-hardy. Some stand losses may occur when bromegrass is managed under three- and four-cut alfalfa harvest systems.

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

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

1994 FORAGE SEED SOURCES

A. Agassiz Seed & Supply, 4121-1/2 So. University Drive, Fargo, ND 58104
B. AgriPro, 824 2nd St. South, P.O. Box 250, Brookings, SD 57006
C. Allied Seed Cooperative, 1917 E. Fargo, Nampa, ID 83687
D. America's Alfalfa, 6700 Antioch, P.O. Box 2955, Shawnee Mission, KS 66201
E. Bio Plant Research, 110 E. State St., P.O. Box 300, Camp Point, IL 62320
F. Blaney Seeds, Inc., 5292 East Lacy Drive, Madison, WI 53711
G. Cargill Hybrid Seeds, 809 West 6th St. Litchfield, MN 55355
H. Cenex/Land O'Lakes, Station 680, P.O. Box 64089, St. Paul, MN 55164-0089
I. Ciba Seeds, P.O. Box 18300, Greensboro, NC 27419-2900
J. Cropmate Co., P.O. Box 978, Pekin, IL 61555
K. Custom Farm Seed, Box 160, Momence, IL 60954
L. Dairyland Seed Co., P.O. Box 958, West Bend, WI 53095
M. DeKalb Plant Genetics, 3100 Sycamore Rd., DeKalb, IL 60115
N. Discount Farm Center, West Hwy 212, P.O. Box 84, Watertown, SD 57201
O. Fred Gutwein & Sons, Inc., Rte. 1, Box 188, Profitstown, IL 61277
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, 9915 West M-21, P.O. Box 637, Ovid, MI 48866
T. Great Plains Research Co, Inc., 3624 Kildaire Farm Rd., Apex, NC 27502
U. ICI Seeds, 6945 Vista Drive, West Des Moines, IA 50266
V. International Seeds Inc., P.O. Box 168, Halsy, OR 97348
W. Interstate Payco Seed, Box 70, Dassel, MN 55325
X. J.C. Robinson Seed Co. (Golden Harvest), 100 J.C. Robinson Blvd., Waterloo, NE 68069
Y. Jung Farms Inc., 335 South High Street, Randolph, WI 53957
Z. Kaltenberg Seed Farms Inc., P.O. Box 278, Waunakee, WI 53597-0278
a. Keltgen Seed Co., Box 209, Olivia, MN 56277
b. LaCrosse Seed Corporation, 2615 Commerce St., LaCrosse, WI 54601
c. L. Herried Seeds, Inc., P.O. Box 216, Prescott, WI 54021
d. L.L. Olds Seed Co., Box 7790, Madison, WI 53707-7790
e. Lincoln Seed, Inc., 5600 Harbor Drive, P.O. Box 2803, Sioux City, IA 51106
f. MBS Inc. (PGI), P.O. Box 308, Ames, IA 50010-0308
g. Mycogen Plant Sciences (Jacques), 720 St. Croix, Prescott, WI 54021
h. NC+ Hybrids, 1209 4th St., Sibley, IA 51249
i. Northrup King Co., 7500 Olson Memorial Hwy., P.O. Box 959, Golden Valley, MN 55427
j. Peterson Seed Co., Inc., P.O. Box 346, Savage, MN 55378
k. Pioneer Hi-Bred Int'l, Inc., 7305 N.W. 62nd Ave., P.O. Box 287, Johnston, IA 50131
m. Premium Seed Co., Inc., 7800 E. State Hwy 101, Shakopee, MN 55379
n. Producers Hybrids, Inc., R.R.#1, Box C, Battle Creek, NE 68715
o. Ramy International Ltd.(Prairie Gold), 1329 N. Riverfront Drive, Mankato, MN 56001
p. Renk Seed Company, 6800 Wilburn Rd., Sun Prairie, WI 53590
q. R.J. Hunt Seed Co., R.R.1, Box 112, Wadena, MN 56482
r. The Sexauer Co., P.O. Box 58, Brookings, SD 57006
s. Top Farm Hybrids, Inc., Box 850, Cokato, MN 55321
t. Trelay, Inc., Route 1, Livingston, WI 53554
u. Twin City Seeds, 7263 Washington Ave South, Edina, MN 55439
v. Wensman Seed Co., 102 Aldrich Ave. S.E., Wadena, MN 56482
w. Werner Farm Seeds, 3104 Millersburg Blvd., Dundas, MN 55019
x. Wilbur-Ellis Co., 706 E. Second St., P.O. Box 130, Janesville, MN 56048
y. Ziller Seed Co., R.R.1, Box 122, Bird Island, MN 55310-9730

GRAIN CROPS

BARLEY

Recommended public varieties

Excel—High yield. Medium maturity. Similar in lodging resistance to Robust. 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 sisterline of Morex. Released 1990. Seed sale regulated by U.S. Variety Protection Act.

Robust—Medium yield. Medium maturity. Good lodging resistance and kernel plumpness. Six-rowed, semi-smooth awn, short rachilla hairs, colorless aleurone. Classified as a malting variety by AMBA. Resistant to spot blotch. Developed by the Minnesota Agricultural Experiment Station from a 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. 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.

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 that of Robust in Minnesota trials. Not recommended because of limited demand for a blue aleurone malting variety in Minnesota. Developed by North Dakota Agricultural Experiment Station from a cross involving Bonanza, Nordic and ND B130. Released 1982.

Development of newly released Stander barley was directed by Minnesota Agricultural Experiment Station agronomist Don Rasmusson. These trials are at Morris, Minn.

Table 9. Yields of barley varieties.[1]

Variety	Crookston	Morris	Stephen	St. Paul	Roseau	Mean
1988–1993			bu/A			
Number of trials:	*12*	*11*	*2*	*9*	*4*	*38*
Morex	90	67	56	84	76	79
Robust	99	74	67	89	91	87
Excel	110	81	76	93	96	94
Stander	110	76	75	95	101	94
LSD 5%	8	8	13	8	10	4
1993			bu/A			
Number of trials:	*3*	*1*		*1*	*1*	*6*
Morex	100	50	–	92	81	87
Robust	109	63	–	82	93	94
Excel	121	60	–	94	99	103
Stander	120	74-	–	107	112	109
LSD 5%	7	14	–	13	12	6

[1] Barley grain yields are presented separately as current year and multi-year groupings; year-to-year performance of varieties varies widely.

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

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

Table 10. Characteristics of barley varieties, 1989-93.

Variety	Heading	Height	Lodging	Plump Kernels	Net Blotch
	date	inches	%	%	score [1]
Number of trials:	*21*	*19*	*8*	*25*	*6*
Morex	6-19	34	50	65	4.8
Robust	6-20	34	38	73	3.8
Excel	6-20	32	40	62	3.8
Stander	6-21	32	27	72	3.7

[1] Rating 1 = resistant, 5 = susceptible.

OAT

Crown rust infection dramatically increased in many Minnesota oat fields during 1990, 1991 and 1993, and at least three new races have been identified. As a result, varieties previously considered to have good crown rust resistance are now known to be vulnerable. *Varieties with limited or no rust resistance should be grown with caution.*

Recommended varieties

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

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

Varieties not adequately tested

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

Bay—Late maturity, high yield, medium height, very good lodging resistance, fair test weight and groat percentage, ivory seed. Some resistance to crown rust, resistant to 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, high yield, medium height, good lodging resistance, medium test weight and groat percentage, dark ivory seed. Susceptible to crown rust, some resistance to smut and some tolerance to red leaf. Selected at the Illinois Agricultural Experiment Station. Released in 1993.

Ensiler—Late maturity, poor grain yield

Table 11. Oat yield by location, 1991-93.

Variety	Rosemount	Waseca	Lamberton	Morris	Crookston	Grand Rapids	Six location ave.	Roseau	Winona
	bu/A								
Dane	81	90	75	70	110	90	86	102	50
Don	71	62	60	60	108	86	75	91	49
Premier	58	60	52	68	104	69	66	85	43
Hazel	79	72	67	53	97	83	78	102	48
Armor [1]	83	65	46	59	101	90	74	111	26
Prairie [1]	86	82	61	62	101 [3]	90	80	113	56
Brawn [2]	79	70	56	85	128	89	84	124	69
Troy	92	114	73	88	116	82	94	111	58
Valley	67	60	52	66	117	90	75	119	65
Bay [2]	65	62	61	73	127	101	89	–	60
Ensiler [4]	48	32	22	27	116	97	57	100 [2]	47 [2]
LSD 5%	10	8	9	7	9	11	4	14	9

[1] 1992-93; [2] 1993 only; [3] 1992 only; [4] 1991 and 1993.

but excellent forage yield, tall, fair lodging resistance. Resistant to crown rust and smut, some tolerance to red leaf. Selected at the Wisconsin Agricultural Experiment Station from a cross involving Lodi and Otee. Released 1990. Foundation Seed available to Certified Seed producers only under a license/fee collection agreement. Application for Plant Variety Protection Certificate has been submitted. *Use for forage only.*

Prairie—Medium-late maturity, high 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 also regulated by U.S. Variety Protection Act. Because of smut susceptibility, planting only treated seed is recommended.

Other varieties

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

Hazel—Medium maturity, high yield, short, very good lodging resistance, high test weight, very high groat 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.

Horicon—Medium maturity, high yield, medium height, very good lodging resistance, medium test weight, high groat percentage, medium protein percentage, tan seed. Resistant to crown rust, susceptible to smut, some tolerance to red leaf. Selected at the Wisconsin Agricultural Experiment Station from a complex cross. Released 1989. Foundation Seed available to Certified Seed producers only under a license/fee collection agreement. Seed sale regulated by U.S. Variety Protection Act. Because of smut susceptibility, planting only treated seed is recommended.

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

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

Premier—Medium maturity, yield and height, good lodging resistance, medium test weight, groat percentage and protein percentage, yellow seed. Susceptible to crown

Closeup of a panicle (head) of an oat plant shows the beginning of kernal development in each spikelet.

Table 12. Characteristics of oat varieties, 1991-93.

Variety	Heading	Height	Lodging Score[1]	Test Weight	Groat	Reaction to Disease[2]		
						crown rust	smut	BYDV[3]
	date	inches	(1-5)	lbs/bu	%	rating		
Dane	22	35	1.8	38	73	MR-MS	MR	8.0
Don	23	35	2.3	37	71	S	MR	7.0
Premier	25	38	2.2	35	70	S	HR	6.0
Hazel	26	35	1.8	36	71	S	S	4.0
Armor	26	37	2.1	33	66	S	MS	4.5
Prairie	27	38	2.4	35	71	S	S	2.0
Brawn	27	35	1.9	34	71	S	MS	5.5
Troy	29	43	2.7	40	72	MR	HR	4.5
Valley	29	38	2.4	35	70	S	S	5.0
Bay	30	37	1.6	33	69	MS	R	4.0
Ensiler	30	44	2.4	34	68	MS	R	4.5

[1] 1 = erect, 5 = flat; [2] 1993 only. HR = highly resistant; R = resistant; MR = moderately resistant; MS = moderately susceptible; S = susceptible; [3] 1 = resistant, 9 = dead; data supplied by F. Kolb and A. Hewings, Univ. of Illinois and USDA-ARS.

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.

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

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

Starter—Early maturity, medium yield, short, fair lodging resistance, high test weight and groat percentage, medium protein percentage, yellow seed. Susceptible to crown rust, resistant to smut, some tolerance to red leaf. Selected at 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.*

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

Valley—Late maturity, high yield, short, fair lodging resistance, medium test weight, groat percentage and 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 within classes in maturity order. *All durum 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.

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

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

Table 13. Characteristics of durum wheat varieties, 1992-93.

				Rust Reaction[3]				Yield			
Variety	Heading	Height	Lodging[1]	stem	leaf	Seed[3]	Test Weight	Morris[3]	Crookston[5]	Stephen[3]	State Mean
	date	inches	score[2]	rating[4]		no/lb	lbs/bu	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
Medora	6-24	39	0.7	MR	R	10,800	61.4	60	35	91	55
Vic	6-25	40	1.0	MS	R	10,700	61.6	63	40	77	55
Lloyd	7-2	29	0.0	MS	R	11,100	58.5	60	40	91	58
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] 1993 Crookston data; [2] 1 = erect, 9 = flat; [3] 1992 data; [4] Reaction to prevalent races: R = resistant, MR = moderately resistant, MS = moderately susceptible, S = susceptible; [5] 1992 and 1993 data.

by North Dakota Agricultural Experiment Station 1979.

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

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.

This swathing operation is the first step in harvesting a quality forage crop.

WHEAT (HARD RED SPRING)

Varieties are described as "recommended," "other" or "privately developed." Specific varieties are listed in maturity order.

Severe *Fusarium* head blight (scab) conditions in 1993 production trials demonstrated that careful consideration should be given to planting at least three varieties differing in heading time. Although resistant varieties are not known, varieties do differ in their susceptibility to scab. In selecting varieties, this difference is indicated in the text as "more" or "less" susceptible, and should be considered along with other traits.

Recommended publicly developed varieties

Butte 86—Awned, early, medium height. Resistant to stem and moderately resistant to leaf rust. Moderately susceptible to scab. High yield and test weight. Medium protein percentage. *Less susceptible to scab.* 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 percentage. *Less susceptible to scab.* 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. High protein percentage. *Less susceptible to scab.* 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 percentage. Satisfactory milling and baking characteristics. *More susceptible to scab.* 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 rust, moderately resistant to leaf rust. High yield and test weight. Tolerant to loose smut. Good lodging resistance. Low to medium protein percentage. Low bake absorption,

Wheat research plots at Morris, Minn., include Norm, a high yielding 1992 release. Right is Bob Busch, USDA-ARS wheat breeder. Left is Don McVey, of the USDA-ARS cereal rust labortory.

Marshall wheat was rated "less" susceptible to scab in 1993 trials.

moderately susceptible to leaf spotting diseases. *More susceptible to scab.* Released by South Dakota Agricultural Experiment Station 1988.

Vance—Awned, midseason, semidwarf. Resistant to stem and leaf rust. Tolerant to loose smut. High yield and medium test weight. Medium protein percentage. *Susceptible to scab.* 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 percentage. Satisfactory milling. *Less susceptible to scab.* Fungicide required for optimum performance. Released by Minnesota Agricultural Experiment Station and USDA-ARS 1982. Seed sale regulated by U.S. Variety Protection Act.

Other public varieties

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

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

Minnpro—Awned, midseason, semidwarf. Resistant to stem and leaf rust. High yield and very high protein percentage. Low test weight and moderately susceptible to loose smut and lodging. *More susceptible to scab.* 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.

Table 14. Yields of hard red spring wheat varieties, 1991-93.

Variety	Crookston [1]	Stephen	Roseau [2]	Northern average	St. Paul	Morris [2]	Waseca	Southern average	State average
	bu/A								
PUBLICLY DEVELOPED VARIETIES									
Butte 86	56	47	33	43	56	40	49	46	44
Sharp	65	47	34	44	57	46	45	48	46
Grandin	61	46	31	42	64	34	46	46	44
Norm	65	52	38	48	64	38	44	47	47
Prospect	79	58	31	49	59	38	42	44	47
Vance	61	52	30	44	55	35	49	44	44
Marshall	54	50	29	42	53	28	43	39	40
Roblin	49	39	33	39	40	36	43	37	37
Stoa	63	55	38	47	53	38	48	43	46
Minnpro	66	50	34	46	50	30	41	40	42
Wheaton	65	55	29	46	62	37	46	46	45
Gus	67	55	38	49	51	34	41	40	44
Chris (check)	47	34	27	34	29	27	31	28	30
PRIVATELY DEVELOPED VARIETIES									
2375	62	54	38	49	60	43	52	51	50
2370	62	53	33	46	65	40	51	49	48
Dalen	59	58	29	46	63	36	44	44	45
Bergen	60	58	34	48	66	34	50	48	48
2371	61	47	28	42	59	35	44	45	43
Sonja [2]	69	51	28	45	62	41	45	48	47
Krona	81	56	29	48	63	36	48	45	47
Nordic	79	58	33	49	57	35	47	45	47
LSD 5%	8	12	7	7	12	6	8	6	4

[1] 1992 only; [2] Two year data, 1992 & 1993.

Table 15. Characteristics of hard red spring wheat varieties, 1991-93.

Variety	Heading	Height	Lodging	Rust reaction		Seeds[4]	Test weight	Wheat protein[4]	Milling baking	Scab
				leaf	stem					
	date	inches	score[1]	— rating[2] —		no/lb	lbs/bu	%[3]	quality[4]	reaction[5]
PUBLICLY DEVELOPED VARIETIES										
Butte 86	6-21	33	2.3	MR	R	13,300	56.9	14.9	Medium-High	LS
Sharp	6-21	33	2.8	MR	R	13,300	58.4	14.6	Medium-High	LS
Grandin	6-23	32	1.8	R	R	13,900	57.3	15.0	Medium	LS
Norm	6-25	32	1.5	R	R	13,200	55.9	14.0	Medium-High	MS
Propect	6-25	32	1.4	MR	MS	14,100	56.7	14.0	Medium-Low	MS
Vance	6-26	32	2.2	R	R	13,900	55.0	14.8	Medium-High	S
Marshall	6-27	31	1.8	MS	R	16,100	55.7	13.8	Medium-Low	LS
Roblin	6-20	34	2.2	MS	R	13,800	56.7	15.7	High	MS
Stoa	6-25	37	2.8	R	R	14,500	56.4	14.6	Medium-High	S
Minnpro	6-25	32	2.4	R	R	13,000	54.5	15.5	High-Medium	MS
Wheaton	6-25	30	2.1	R	R	14,400	53.5	13.8	Low-Medium	MS
Gus	6-25	33	2.6	R	R	15,400	56.5	15.5	High	MS
Chris (check)	6-26	37	3.4	MR	R	16,100	56.5	15.4	High	LS
PRIVATELY DEVELOPED VARIETIES										
2375	6-22	31	2.7	MR	R	13,300	58.2	14.6	Medium	LS
2370	6-22	31	1.9	MR	MR	15,700	56.5	14.3	Medium	S
Dalen	6-23	30	2.1	R	R	14,000	56.3	14.6	Low-Medium	MS
Bergen	6-24	30	1.3	R	R	13,500	55.7	13.9	Medium	MS
2371	6-24	30	1.4	R	R	13,400	55.5	14.6	High	MS
Sonja	6-24	31	2.0	R	R	14,400	53.4	14.0	Low-Medium	MS
Krona	6-25	31	1.5	R	R	14,900	52.8	13.6	Low	MS
Nordic	6-26	33	2.9	MS	R	13,100	55.9	13.0	Low	S

[1] 1 = erect, 9 = flat; [2] Reaction to prevalent races: R = resistant, MR = moderately resistant, MS = moderately susceptible, S = susceptible; [3] 12 percent moisture; [4] Data does not include 1993 due to scab; [5] LS = less susceptible, MS = more susceptible, S = susceptible.

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

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 percentage. *Susceptible to scab.* Higher potential for lodging. Released by North Dakota Agricultural Experiment Station 1984.

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 percentage. *Less susceptible to scab.* Moderately susceptible to lodging and shattering. Best adapted south of I-94. Released by Pioneer Hi-Bred in 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 and leaf rusts. High yield and medium test weight. Good lodging resistance. Medium protein percentage. *Susceptible to scab.* Released by Pioneer Hi-Bred in 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 percentage. *More susceptible to scab.* First released by AgriPro in 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 percentage. Susceptible to Ergot. *More susceptible to scab.* 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 percentage. Satisfactory milling and baking quality. *More susceptible to scab.* Released by North Dakota State University Research Foundation in 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 percentage. *More susceptible to scab.* Released by AgriPro in 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 percentage. *More susceptible to scab.* Low test weight. First released by AgriPro in 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. *Susceptible to scab.* Low protein percentage. Medium lodging resistance. First marketed 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 data are presented.

Cultural practices have a major effect on winter survival of all winter wheats. Planting into a firm seedbed with at least some stubble remaining to retain snow cover can reduce winterkill.

Recommended publicly developed varieties

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 percentage. Satisfactory quality. Released by the North Dakota Agricultural Experiment Station 1987.

Other public varieties

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

Brule—Awned, early, semidwarf with 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.

Closeup of a wheat head at polination time shows its small anthers, and the awns extending out from each floret.

Table 16. Yield and characteristics of winter wheat varieties, 1991-93.

Variety	Heading	Height	Winter Survival	Lodging	Rust Reaction		Test Weight	Protein	Yield			
					leaf	stem			Rosemount	Morris	Roseau[7]	Mean
	date[1]	inches	rating[2]	score[3]	— rating[4] —		lbs/bu[5]	%[6]	bu/A			
PUBLICLY DEVELOPED VARIETIES												
Arapahoe	6-7	35	H	3.1	R	R	57.6	12.6	53	52	34	46
Roughrider	6-9	39	VH	4.1	S	R	57.7	13.0	39	47	36	41
Seward	6-11	38	VH	3.4	MR	R	57.4	11.4	50	53	38	47
Siouxland	6-6	35	MH	3.0	S	R	57.4	12.1	49	47	25	40
Brule	6-7	37	MH	3.5	MS	R	57.6	11.9	47	50	29	42
Rose	6-8	35	H	3.6	S	MR	59.1	12.5	43	48	23	38
Agassiz	6-10	40	VH	4.3	S	R	57.0	12.9	37	40	32	36
Minter (check)	6-11	41	VH	4.7	MS	R	58.1	13.2	36	40	28	35
PRIVATELY DEVELOPED VARIETIES												
Abilene	6-7	24	MH	3.5	MS	MR	56.9	12.9	36	47	21	35
Bighorn	6-8	36	H	3.3	S	S	56.4	12.2	43	49	29	40
LSD 5%									6	9	9	7

[1] 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, 1991 and 1992. 1993 not used due to scab; [6] 12% moisture. Protein data does not include 1993 due to scab; [7] 1992 and 1993 data.

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.

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

Privately developed varieties

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

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

WILD RICE

Cultivated wild rice is grown on 20,000 acres in Minnesota. Most wild rice is produced from varieties with nonshattering tendency, although all varieties shatter to some extent. Some fields are, however, 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 are 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 1992 by the Minnesota Agricultural Experiment Station.

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

Petrowske bottlebrush—Medium height, medium to late maturity, and high yield. Up to 50% 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, and 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 in 1983.

Table 17. Yield and seed shattering characteristics of wild rice varieties.

	1993					
	Aitkin		Clearbrook		1991-93 mean [3]	
Variety	Yield	Shattering	Yield	Shattering	Yield	Shattering
	lb/A[1]	% [2]	lb/A	%	lb/A	%
Franklin	1,819	13	1,371	15	1,478	13
K2	1,488	22	1,414	25	1,490	19
Petrowske bottlebrush	1,862	14	1,447	18	1,468	26
Voyager	1,854	11	1,266	23	1,347	25
LSD 5%	363	6	273	3	134	3

[1] Adjusted to 40 percent moisture. [2] Expressed as percentage of harvested plus shattered grain. [3] Average of 6 trials.

Wild rice breeding, production research and performance trials are conducted at the Minnesota Agricultural Experiment Station, Grand Rapids.

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

Less than half of the U.S. grown rye is harvested for grain. The rest is used either for pasture or hay, or as 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.

Yield information provided here includes performance of several relatively new hybrids and advanced lines, some with excellent yield potential and winter hardiness. However, the availability of seed of some of these varieties continues to be limited.

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 & Animal Products, 340 Alderman Hall, University of Minnesota, St. Paul, MN 55108, for details about this publication.

Research using the natural weed suppressive characteristics of rye continues at several Minnesota Agricultural Experiment Station branch stations.

Variety descriptions

Amando—Hybrid variety developed by Hybro GbR, Saatzucht Langenbrüken, 7525 Bad Schönborn 2, Germany.

Dacold (ND-1)—Variety developed by the North Dakota Experiment Station, Fargo.

Danko (Dankowskie-Nowe)—Developed by DanKow-Laski and Choryn Experiment Stations, Poland. NorFarm Seeds, Inc., Box 725, Bemidji, MN 56601.

Frederick—Variety developed by South Dakota Agricultural Experiment Station. Released in 1984.

Halo—Variety developed by F. von Lochow-Petkus GMBH Postfach 1311, 3103

Table 18. Seed yield of winter rye varieties, 1991-92 season.

Variety	Rosemount	Becker	Morris	Mean
	bu/A			
Amando	74	48	–[1]	–
Dacold	78	41	63	61
Dankowski	68	48	65	60
Frederick	64	35	56	51
Halo	68	39	67	58
Kodiak	67	28	56	50
Luchs	57	–[1]	84	–
Marder	–[1]	–[1]	76	–
Mitzi	69	40	76	61
Musketeer	67	43	63	58
Pastar	77	47	68	64
Prima	77	43	76	65
Rapid	49	42	–[1]	–
X79-8	62	35	57	51
LSD 5%	15	9	12	

[1] Stand was reduced due to winterkill; therefore, yield data is not presented.

Bergen 1, Germany.

Hancock—Variety developed by Wisconsin Agricultural Experiment Station. Released in 1979.

Kodiak—Available from Alberta Wheat Pool, 505 2nd St. SW., Calgary, Canada T2P 2P5.

Luchs—Hybrid rye variety developed by F. von Lochow-Petkus GMBH Postfach 1311, 3103 Bergen 1, Germany.

Marder—Hybrid rye variety developed by F. von Lochow-Petkus GMBH Postfach 1311, 3103 Bergen 1, Germany.

Mitzi—Variety developed by Elliot Plant Breeding, Ottertail, MN.

Musketeer—Variety developed by Agriculture Canada. Licensed in 1980. Production of certified seed limited to Canada.

Pastar—Distributed by NorFarm Seeds, Inc., Box 725 Bemidji, MN 56601.

Prima—Variety developed by Agriculture Canada. Production of certified seed limited to Canada.

Rapid—Hybrid variety developed by Hybro GbR, Saatzucht Langenbrüken, 7525 Bad Schönborn 2, Germany.

Table 19. Characteristics of winter rye varieties, average of Rosemount and Becker, 1992.

Variety	Winterkill	Height	Lodging	Maturity	Test Weight
	%	inches	score [1]	July	lbs/bu
Amando	14	48	3	13	56
Dacold	1	49	5	12	55
Dankowski	5	53	3	11	58
Frederick	1	56	7	10	56
Halo	21	49	4	13	57
Hancock	–	47	3	17	–
Kodiak	1	59	8	12	53
Luchs	56	42	4	12	55
Marder	86	40	3	14	–
Mitzi	3	54	6	11	56
Musketeer	1	57	8	9	56
Pastar	2	63	7	11	57
Prima	2	57	7	9	57
Rapid	64	46	1	13	55
Rymin	1	40	2	18	–
X79-8	1	62	10	10	56
LSD 5%	10	3	1	2	1

[1] 1 = no lodging, 10 = severe lodging, average of Morris and Rosemount.

Rymin—Variety developed by Minnesota Agricultural Experiment Station. Released in 1973.

X79-8—Experimental line developed by the South Dakota Agricultural Experiment Station.

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 contract for the grain. Amaranth is used in various flour-based products. The grain can also be popped like popcorn or flaked like oatmeal. More than 40 products containing amaranth are currently on the market.

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 Agronomy, 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 hybrid 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 and 1993 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.

More extensive data on these trials will appear in next year's edition of this *Varietal Trials* publication.

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

Pearl or cattail millet *(Pennisetum glaucum)* is primarily grown in 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.

OILSEED CROPS

CANOLA

Canola (*Brassica napus* or *B. campestris*) is used for edible oil extraction and protein feed meal. Canola oil is considered one of the highest quality edible oils available. Considerable acreage of spring canola is grown in Canada, and a few thousand acres are now also grown in Minnesota. Interest in canola and other minor oilseeds has increased in recent years with the flexible crop opportunities for minor oilseeds in the 1990 Farm Bill.

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

The oil in canola seed contains less than 2 percent erucic acid. This compares with the 20 to 40 percent found in oilseed rape. And the meal remaining after oil extraction from canola contains less than 0.1 percent of glucosinolate (sulfur containing compounds) compared with about 1 percent in rapeseed

Table 20. Seed yield of spring canola (*Brassica napus*) varieties.

	1991				1992				1993	1991-93
	Crookston	Morris	Roseau	Average	Crookston	Morris	Roseau	Average	Morris	Average
	lb/A									
AG019	–	–	–	–	–	–	–	–	844	–
AG021	–	–	–	–	–	–	–	–	855	–
B2300	–	–	–	–	1,803	2,529	1,588	1,973	–	–
Bingo	1,122	1,579	2,152	1,618	1,648	2,605	1,769	2,007	–	1,813
Bounty	–	–	–	–	–	–	2,165	–	–	–
Celebra	1,166	1,202	2,392	1,587	1,702	2,625	1,548	1,958	–	1,773
Crusher	1,383	1,705	2,890	1,992	1,446	2,889	1,582	1,972	–	1,982
Cyclone	–	–	–	–	2,186	2,886	2,406	2,493	1,334	2203
Delta	–	–	–	–	–	–	1,845	–	–	–
Donna	–	–	–	–	1,757	2,681	1,628	2,022	–	–
Global	784	1,385	2,132	1,433	1,701	3,198	2,106	2,335	1,226	1,790 [1]
GSN024	–	–	–	–	2,254	3,068	2,246	2,523	1,630	2,344
GSN029	–	–	–	–	–	–	–	–	1,619	–
GSN038	–	–	–	–	–	–	–	–	1,460	–
Helios	–	–	–	–	1,624	2,994	2,156	2,258	770	1,886
Hyola 41	1,448	1,335	2,205	1,633	2,144	2,415	2,219	2,259	–	1,946
Hyola 401	1,213	1,382	2,330	1,642	2,452	2,809	2,895	2,719	2,070	2,164
Iris	849	1,472	2,244	1,522	1,402	3,122	2,438	2,321	950	1,782
Legacy	–	–	–	–	–	–	–	–	1,259	–
Legend	1,025	979	1,586	1,196	1,782	2,355	2,123	2,087	1,247	1,585
OAC Triumph	778	705	1,496	993	1,103	2,220	1,475	1,599	–	1,296
Polo	–	–	–	–	1,690	2,746	1,790	2,075	1,148	1,844
S1350	–	–	–	–	1,256	2,803	1,760	1,940	–	–
S1570	–	–	–	–	–	–	–	–	1,477	–
S1590	–	–	–	–	–	–	–	–	1,076	–
Springfield	–	–	–	–	–	–	–	–	1,262	–
ST89/213	–	–	–	–	2,117	2,906	1,862	2,295	–	–
Stallion	–	–	–	–	1,115	2,242	2,143	1,833	–	–
SV02416	–	–	–	–	–	–	–	–	1,348	–
SV02418	–	–	–	–	–	–	–	–	1,795	–
Tobin[2]	631	883	1,205	906	1,746	1,797	2,293	1,945	1,087	1,377
Trojan	–	–	–	–	1,845	2,733	2,034	2,204	1,589	1,897
Westar	1,127	1,141	1,539	1,269	1,580	2,323	1,809	1,904	1,073	1,513 [1]
LSD (P 0.05)	293	638	667	559	471	441	396	252	502	264

[1] Long-term average (16 location/years) for Global and Westar are 1,703 and 1,618, respectively; [2] Tobin is a *Brassica campestris* variety.

Table 21. Characteristics of spring canola (*Brassica napus*) varieties, 1992.

Variety	Crookston Planting to		Roseau Planting to		Morris Planting to		Lodging[2]		Plant Height		Test Weight		Oil [1]
	50% bloom	maturity	50% bloom	maturity	50% bloom	maturity	1992 [1]	1993	1992	1993	1992	1993	
	days		days		days		score [2]		inches		lbs/bu		% [3]
AG019	–	–	–	–	50	108	–	3.5	–	47	–	50	34.7
AG021	–	–	–	–	50	111	–	4.5	–	47	–	50	35.6
B2300	57	106	55	114	–	–	1.9	–	54	–	50	–	37.9
Bingo	63	116	56	124	–	–	2.4	–	56	–	52	–	35.8
Bounty	–	–	52	118	–	–	–	–	–	–	–	–	–
Celebra	61	115	55	120	–	–	2.0	–	54	–	49	–	36.1
Crusher	63	117	56	124	–	–	1.3	–	55	–	52	–	36.6
Cyclone	55	109	54	119	57	110	4.2	2.5	52	51	51	51	35.6 [5]
Delta	–	–	54	120	–	–	–	–	–	–	–	–	–
Donna	63	116	56	123	–	–	1.9	–	56	–	51	–	36.4
Global	55	117	56	124	54	110	2.7	3.5	57	51	50	51	35.6 [5]
GSN024	50	106	51	120	52	107	3.2	3.2	46	46	49	50	35.0 [5]
GSN029	–	–	–	–	49	108	–	9.2	–	42	–	52	34.5
GSN038	–	–	–	–	49	106	–	8.8	–	37	–	51	34.1
Helios	63	117	56	125	56	111	2.4	5.8	55	47	50	51	35.7 [5]
Hyola 40	53	111	51	120	–	–	3.3	–	46	–	50	–	35.6
Hyola 41	51	101	50	111	–	–	5.8	–	43	–	50	–	34.7
Hyola 401	52	107	51	121	44	96	2.8	9.0	46	36	51	51	35.3 [5]
Iris	63	118	56	124	54	106	2.6	9.5	57	43	51	52	36.3 [5]
Legacy	–	–	–	–	57	111	–	1.2	–	45	–	50	36.2
Legend	54	104	51	119	55	106	2.9	3.8	48	44	49	50	35.4 [5]
Polo	54	109	52	117	57	108	2.4	4.5	45	46	51	52	38.7 [5]
S1350	65	120	56	125	–	–	1.8	–	–	56	50	–	36.5
S1570	–	–	–	–	53	110	–	3.8	–	43	–	51	35.7
S1590	–	–	–	–	47	105	–	8.0	–	40	–	53	33.7
Springfield	–	–	–	–	48	102	–	7.0	–	40	–	51	36.0
ST89/213	60	111	55	121	–	–	1.9	–	57	–	50	–	36.8
Stallion	62	114	56	122	–	–	2.3	–	52	–	51	–	34.6
SV02416	–	–	–	–	50	106	–	2.5	–	42	–	52	36.0
SV02418	–	–	–	–	49	108	–	3.8	–	41	–	53	35.2
Taparoo	54	105	52	119	–	–	2.5	–	50	–	52	–	34.1
Tobin[4]	43	94	41	101	50	106	1.9	5.5	46	39	52	53	33.8 [5]
Triumph	63	117	56	123	–	–	3.2	–	54	–	50	–	34.2
Trojan	60	117	53	121	58	114	2.5	5.5	55	47	49	51	35.4 [5]
Westar	57	104	55	115	54	107	3.6	8.8	51	45	51	52	35.8 [5]
LSD (P 0.05)	2	5	7	13	1	6	1.0	1.2	2	2	1	0.4	0.9

[1] Average of Crookston, Roseau, and Morris, 1992; [2] 1 = no lodging, 10 = severe lodging; [3] 10 percent moisture basis; [4] Tobin is a *B. campestris* variety; [5] 1992-93 average.

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. Canola is rapidly replacing oilseed rape for food oil and livestock feed.

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. In trials over 15 year/locations, less than 30 percent of the trials successfully overwintered, making current varieties too risky for Minnesota's growing conditions.

Production information is provided in the canola chapter of the *Alternative Field Crops Manual*. Contact your county extension educator or the Center for Alternative Plant & Animal Products, 340 Alderman Hall, University of Minnesota, St. Paul, MN 55108 for details about this publication. Another publication "Prospects for Canola in Minnesota" is also available from the Center. It contains detailed information about canola production and processing, and costs $10.

Spring canola varieties

AG019—Developed by Mycogen Plant Sciences, 5649 E. Buckeye Rd., Madison, WI 53716.

AG021—Developed by Mycogen Plant Sciences, 5649 E. Buckeye Rd., Madison, WI 53716.

B2300—Variety developed by Alberta Wheat Pool, 505 2nd St. S.W., Box 2700, Calgary, Alberta, Canada T2P 2P5.

Bingo—Developed by ProDana, Denmark. Licensed to Amer-Can Pedigreed Seed Co., Raymond, OH 43067.

Bounty—Developed by Svalov-Weibull, Sweden, and Pioneer Hybrid Production Limited, Georgetown Research Station, 12111 Mississauga Rd., R.R. 4, Georgetown, Ontario, Canada L7G 4S7.

Celebra—Developed by Svalof AB, Sweden. Distributed by Agri-Tel Grain Ltd., Box 808, Beausejour, Manitoba, Canada R0E 0C0.

Crusher—Developed by Svalof AB Ltd., Sweden. Distributed by Interstate Payco Seed Co., Box 338, W. Fargo, ND 58078.

Cyclone—Developed by ProDana, Denmark. Licensed to Ameri-Can Pedigreed Seed Co., 1190-A, U.S. Rt. 19 South, Leesburg, GA 31763. Distributed by local seed dealers or Cenex/Land O'Lakes, P.O. Box 64089, St. Paul, MN 55164.

Delta—Developed by Svalov-Weibull, Sweden, and Pioneer Hybrid Production Limited, Georgetown Research Station, 12111 Mississauga Rd., R.R. 4, Georgetown, Ontario, Canada L7G 4S7.

Donna—Developed by NPZ, Germany. Licensed to Ameri-Can Pedigreed Seed Co., 1190-A, U.S. Rt. 19 South, Leesburg, GA 31763. Limited seed available in 1993.

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.

GSN024—Experimental hybrid developed by Zeneca Seeds, Winnipeg, and marketed by Kaystar Seeds, 702 3rd St. S.W., P.O. Box 947, Huron, SD 57350.

GSN029—Experimental hybrid developed by Zeneca Seeds, Winnipeg, and marketed by Kaystar Seeds, 702 3rd St. S.W., P.O. Box 947, Huron, SD 57350.

GSN038—Experimental hybrid developed by Zeneca Seeds, Winnipeg, and marketed by Kaystar Seeds, 702 3rd St. S.W., P.O. Box 947, Huron, SD 57350.

Helios—Marketed by SeedTec International, 12005 N. Burgard Rd., Portland, OR 97283.

Hyola 41—Hybrid developed by Zeneca Seeds, Winnipeg, and marketed in U.S. by Kaystar Seeds, 702 3rd St. S.W., P.O. Box 947, Huron, SD 57350.

Hyola 401—Hybrid developed by Zeneca Seeds, Winnipeg, and marketed in U.S. by Kaystar Seeds, 702 3rd St. S.W., P.O. Box 947, Huron, SD 57350.

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

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

Legend—Developed by Svalof AB, Sweden. Distributed by Interstate Payco Seed Co., Box 338, West Fargo, ND 58078.

OAC Triumph—Tolerant of triazine herbicides (Sencor, Lexone, Atrazine, etc). Originated at University of Guelph, Guelph, Ontario, Canada N1G 2W1.

Polo—Developed and distributed by Mycogen Plant Sciences, 5649 E. Buckeye Rd., Madison, WI 53716.

S1350—Developed by ProDana, Denmark. Licensed to Ameri-Can Pedigreed Seeds, Inc., 1190-A, U.S. Rt. 19 South, Leesburg, GA 31763.

S1570—Developed by ProDana, Denmark. Licensed to Ameri-Can Pedigreed Seeds, Inc., 1190-A, U.S. Rt. 19 South, Leesburg, GA 31763.

S1590—Developed by ProDana, Denmark. Licensed to Ameri-Can Pedigreed Seeds, Inc., 1190-A, U.S. Rt. 19 South, Leesburg, GA 31763.

Springfield—Originated by Agriculture Canada, Saskatoon S7N 0X2. Distributed by Bonis and Co. Ltd., 28 David St., P.O. Box 217, Lindsay, Ontario, Canada K9V 5Z4.

SV02416—Developed by Svalof-Weibull Seed Ltd. Distributed by Bonis and Co. Ltd., P.O. Box 217, Lindsay, Ontario, Canada K9V 5Z4.

SV02418—Developed by Svalof-Weibull Seed Ltd. Distributed by Bonis and Co. Ltd., P.O. Box 217, Lindsay, Ontario, Canada K9V 5Z4.

Tobin—The only *Brassica campestris* variety tested. Originated by Agriculture Canada, Saskatoon S7N 0X2. Licensed in 1981. Distributed by Northern Sales, 135 Lombard Ave., Winnipeg, Manitoba, Canada R3B 0T4.

Trojan—Developed by Svalof-Weibull Seed Ltd. Distributed by Bonis and Co. Ltd., P.O. Box 217, Lindsay, Ontario, Canada K9V 5Z4.

Canola has been part of alternative crops demonstrations at several branch stations of the Minnesota Agricultural Experiment Station. This plot was at Grand Rapids, Minn.

Stallion—Tolerant of triazine herbicides (Sencor, Lexone, Atrazine, etc.). Product of Svalof AB, Sweden. Distributed by Agri-Tel Grain Ltd., Box 808, Beausejour, Manitoba, Canada R0E 0C0.

ST89/213—Marketed by SeedTec International, 12005 N. Burgard Rd., Portland, OR 97283.

Westar—Originated by Agriculture Canada, Saskatoon S7N 0X2. Licensed in 1982. Distributed by Northern Sales, 135 Lombard Ave., Winnipeg, Manitoba, Canada R3B 0T4.

SOYBEAN

Many soybean varieties are available in Minnesota, developed by a variety of public and private organizations. The important characteristics of these soybean varieties are presented in the tables of this section.

Tables 23 to 26 deal with varieties developed by publicly supported institutions and are considered for recommendation by Minnesota Agricultural Experiment Station. Tables 27 to 30 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 (see map). Specific test locations for each zone are indicated in each table. Becker was the only irrigated test site. Trials were planted between May 5 and May 25 unless otherwise indicated. Row spacings vary in some tables.

There are several major factors to be considered in selecting soybean varieties, including maturity, yield, row spacing, plant height and lodging, chlorosis response, protein and oil values, and 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.

Varieties that mature before the fall killing frost should be selected to obtain high yield and quality. A soybean variety is considered mature when 95 percent of the pods have reached their mature color. Harvesting would normally be done one to two weeks after this stage is reached, depending on drying conditions.

Table 22. Genes for resistance to races of Phytophthora root rot.

Gene	Races																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Rps1																									
Rps1b																									
Rps1c																									
Rps1k																									
Rps3																									
Rps4																									
Rps6																									

Maturity dates were not obtained for many of the varieties in 1993, because of delayed plant development due to the cool, damp growing conditions. Those varieties which were not mature or near maturity at the time of the killing frost are indicated by an * in the table. The arrangement of varieties in each table is based on our estimate of the stage of development at the time of the frost. The accompanying map shows maturity zones.

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

The LSD (least significant difference) figures listed at the bottom of table yield columns are measures of variability within the trials. If the yield difference between two varieties within a column exceeds 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, the remaining 20 percent of the time the differences are due to chance.

Row Spacing—Research over many years and at many locations has shown that yields from narrow rows (10 inches to 18 inches) are higher than wide rows (20 inches to 40 inches). Although rankings of varieties can change with row spacing, top performers in a wide spacing should also be among the top performers in a narrow spacing.

Plant Height and Lodging—These measurements indicate stem strength and standability of varieties. They relate somewhat to ease of combining. Actual height and lodging scores are influenced by environmental conditions, so values may vary from year to year. Use these values by comparing scores of newer varieties to scores of a familiar variety.

Chlorosis—This score is a measure of how much leaf yellowing occurred in variety tests conducted each year on a high lime (high pH) soil near Lamberton. It indicates how well varieties perform relative to each other on such soils. These scores are annual ratings and can change from year to year due to environmental conditions.

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

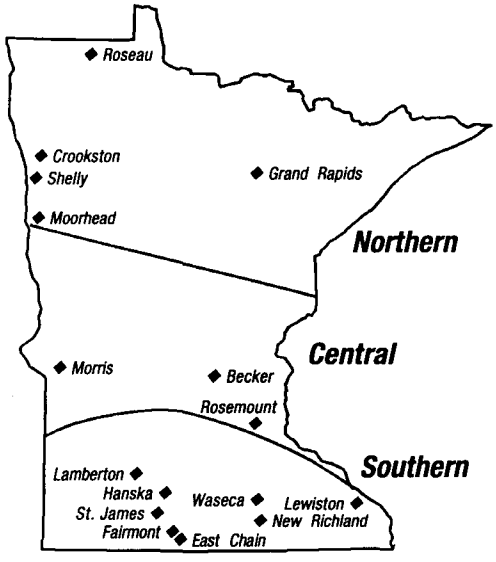
Some information refers to "tolerance" or "field resistance" which is not race-specific and should not be confused with race specific resistance. Reliable tests for tolerance have not yet been developed.

The genes present were determined using data either from greenhouse plants grown by scientists in the University of Minnesota Department of Plant Pathology, or from information supplied by the companies.

Soybean Cyst Nematode—SCN was first identified in Minnesota in 1978 and is now found in 30 Minnesota counties, according to Cooperative Pest Survey Program data. Both the amount of area infested and numbers of nematodes present appear to be increasing. When SCN numbers are high, significant yield losses can occur.

Several races of soybean cyst nematode are known to occur in Minnesota. Rotations to nonhost crops and planting resistant varieties aid in managing nematode populations.

Soybean Maturity Zones



Results of a special performance test of public and private varieties resistant to soybean cyst nematode are shown in Table 29. These trials were conducted on known infested sites near East Chain, Hanska, St. James and New Richland, and on non-infested sites at Fairmont, Lamberton and Waseca. SCN was present at moderate levels at the infested sites.

The soybean cyst nematode susceptibility ratings listed in Table 29 are based on greenhouse tests using a Minnesota isolate of SCN Race 3. A variety was rated resistant (R) if it showed less than 10 percent SCN reproduction compared to a susceptible check, moderately resistant (MR) if reproduction was between 10 and 30 percent, moderately susceptible (MS) for 30 to 60 percent, and susceptible (S) for greater than 60 percent reproduction.

Additional details on the soybean cyst nematode and management of infested fields can be found in the publication *The Soybean Cyst Nematode* (AG-FO-3935), 1990, Minnesota Extension Service, University of Minnesota. It is available from county extension offices or the Distribution Center, 20 Coffey Hall, 1420 Eckles Ave., University of Minnesota, St. Paul, MN 55108-6064.

Nematode cysts on soybean roots are each about the size of a small pinhead.

Brown Stem Rot—Brown stem rot is a fungal disease that can cause yield losses in certain situations. The disease occurs most frequently when soybeans follow soybeans, but can occur where soybeans are planted every other year. Planting resistant varieties, or using longer rotations out of soybeans, aids in the management of this disease. See text descriptions of public varieties for information about their resistance to this fungus.

Protein and Oil—Protein and oil values were determined using near-infrared reflectance analysis. Protein and oil values are expressed on a 13 percent moisture basis.

You can use the following formula to convert the protein and oil value to another moisture basis:

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

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

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

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:

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

Recommended public varieties

Agassiz—Northern zone. Matures about six days later than McCall. Very good yield potential. Good lodging resistance. *Rps1 gene for resistance to Phytophthora.* Developed by Minnesota Agricultural Experiment Station. Released in 1992. Seed sale regulated by U.S. Variety Protection Act.

Alpha—Central and southern zones. One to two days earlier than Parker. *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 in 1992. Seed sale regulated by U.S. Variety Protection Act.

Archer—Southern zone. Similar in maturity to BSR 101 and Corsoy 79. Yield, brown stem rot resistance and iron chlorosis resistance similar to BSR 101. *Rps1k and Rps6 genes for resistance to Phytophthora.* Released 1989 by Iowa Agricultural Experiment Station. Seed sale regulated by U.S. Variety Protection Act.

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

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

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

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

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

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

Hardin—Southern zone. Earlier than Corsoy 79. Good yield performance. *Rps1 gene for resistance to Phytophthora.* Developed by Iowa Agricultural Experiment Station. Released 1980. Seed sale regulated by U.S. Variety Protection Act.

Hardin 91—Southern zone. Slightly later in maturity than Hardin. Similar in other respects to Hardin except it has the *Rps1k gene for resistance to Phytophthora.* Developed by Iowa Agricultural Experiment Station. Released 1991.

Hodgson 78—Central and southern zones. Similar to Hodgson, except it has the *Rps1 gene for resistance to Phytophthora.*

Table 23. Yields of publicly developed soybean varieties in northern zone, 1989-93.

Variety	Crookston	Grand Rapids	Moorhead	Roseau	Shelly
	bu/A				
McCall	28	22	28	33	25
Agassiz[1]	30	27	30	34	25
Ozzie	29	–	32	–	26
Proto	–	–	28	–	22
Glenwood	–	–	33	–	28
Evans	27	–	32	–	25
Dawson	30	–	35	–	29
Dassel	–	–	32	–	24
Lambert	–	–	34	–	31
LSD 20%	2	1	2	2	2

[1] 1990-93 data adjusted to 5 year average.

Table 24. Yields of publicly developed soybean varieties in central zone, 1989-93.

Variety	Rosemount (10-inch)	Morris (10-inch)	Becker (30-inch)	Average
	bu/A			
Ozzie	39	33	45	39
Evans	40	40	44	42
Dassel	41	37	48	42
Dawson	40	37	46	41
Glenwood	40	39	46	42
Lambert	46	45	53	48
Hodgson 78	42	42	51	45
Kato	42	46	50	46
LSD 20%	2	2	2	2

Developed by Minnesota Agricultural Experiment Station. Released 1978. Seed sale regulated by U.S. Variety Protection Act.

IA2008—Southern zone. Similar in maturity to Corsoy 79. High yield potential. Resistant to brown stem rot. *Rps1 gene for resistance to Phytophthora.* Released 1991. Developed by Iowa Agricultural Experiment Station.

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

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

Lambert—Central zone. About one day later than Glenwood. Excellent yield potential. Good lodging resistance. *Rps1 gene for resistance to Phytophthora.* Developed by Minnesota Agricultural Experiment Station. Released in 1992. Seed sale regulated by U.S. Variety Protection Act.

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

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

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

Hundreds of soybean trial plots are planted each year under the supervision of soybean breeder Jim Orf, an agronomist for the Minnesota Agricultural Experiment Station.

Parker—Southern zone. About two days earlier than Hardin. Excellent yield potential. Lodging resistance similar to Corsoy 79. *Rps1 gene for Phytophthora resistance.* Developed by Minnesota Agricultural Experiment Station. Released in 1992. Seed sale regulated by U.S. Variety Proection Act.

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

Not adequately tested

AC Harmony—Northern zone. Maturity similar to McCall. Very high yield for its maturity. Low protein but high oil content. Susceptible to *Phytophthora.* Developed by Agriculture Canada, Ottawa. Licensed 1992.

Other public varieties

Corsoy 79—Southern zone. Very good yield performance. *Rps1c gene for Phytophthora resistance.* Poor chlorosis ratings, somewhat lodging susceptible. Developed by Illinois Agricultural Experiment Station. Released 1979.

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

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

Weber 84—Southern zone. Similar to Hardin in maturity. Good tolerance to high lime soils. *Rps1 gene for resistance to Phytophthora.* Lodging similar to Corsoy 79. Developed by the Iowa Agricultural Experiment Station. Released in 1984.

Special purpose public varieties

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

Grande—Relatively large seeded variety for specialty markets. Three to four days later

Table 25. Yields of publicly developed soybean varieties in southern zone, 1989-93.

	Waseca and Lamberton		Fairmont	Waseca	Lamberton	Lewiston [4]	Average
	mid-May	mid-June	mid-May planting				
Variety	planting	planting	30-inch	10-inch	10-inch	10-inch	
	bu/A						
McCall	–	25	–	–	–	35	–
Agassiz	–	–	–	–	–	33	–
Ozzie	44	31	30	42	45	38	39
Proto	41	–	31	38	43	31	37
Dawson	49	32	33	48	50	44	44
Evans	47	35	32	45	49	45	42
Glenwood	47	34	32	46	48	46	42
Lambert	53	38 [2]	39	53	57	48	50
Dassel	51	36	35	51	51	42	46
Kato	53	38	43	56	51	50	50
Hodgson 78	51	36	40	53	49	51	47
Bert	56	33	44	56	56	54	52
Bell	50 [3]	–	42	46 [2]	55	44	48
Hardin	56	38	39	58	54	47	50
Alpha	50	32 [3]	38	52	48	43	46
Parker	62	39 [1]	46	64	61	53	57
Archer	55 [1]	33 [2]	40 [1]	57 [1]	53 [1]	47	50 [1]
Hardin 91	57 [3]	35 [3]	43 [2]	57 [3]	55 [3]	48	52 [3]
Kasota	52	36	43	54	50	48	49
Weber 84	54	38	43	54	54	53	54
Leslie [1]	56	33	43	57	55	50	52
BSR 101	55	36	43 [1]	57	53	50	51
IA2008	61	34	42 [2]	55	65	56	54
Corsoy 79	57	33	41	57	56	51	51
Sturdy	58	33	46	58	57	49	54
LSD 20%	1	1	1	1	1	4	1

[1] 1990-93 data adjusted to 5 year average; [2] 1991-93 data adjusted to 5 year average; [3] 1992-93 data adjusted to 5 year average; [4] 1993 data only, not included in 5 year average.

Table 26. Characteristics of publicly developed soybean varieties, 1993.

	Mature							
	mid-May	mid-June			Phyto-			
Variety	planting	planting	Lodging	Height	phthora	Protein	Oil	Chlorosis
	date		score [1]	inches	gene	% [2]	% [2]	score [1]
Northern Zone (Crookston and Moorhead)								
McCall	9-12	–	1.0	29	S	30.5	21.3	3.5
Agassiz	9-21 [3]	–	1.0	27	Rps1	30.6	21.3	4.0
Ozzie	9-25 [3]	–	1.0	30	Rps1	33.1	19.3	4.0
Chico	9-25 [3]	–	1.0	30	Rps1	31.3	20.5	4.5
Proto	* [4]	–	1.0	27	S	34.9	17.7	4.5
Glenwood	* [4]	–	1.0	30	Rps1	32.2	20.0	3.5
Evans	* [4]	–	1.0	32	Rps1	29.2	22.3	3.5
Dawson	* [4]	–	1.0	32	Rps1	30.0	21.7	2.5
Lambert	* [4]	–	1.0	31	Rps1	30.8	21.2	3.0
Dassel	* [4]	–	1.0	33	Rps6	30.5	21.4	3.0
Minnatto	* [4]	–	1.0	32	Rps1	32.2	19.8	3.0
Central Zone (Morris and Rosemount)								
McCall	9-5	–	2.0	19	S	33.0	19.4	3.5
Agassiz	9-8	–	1.8	21	Rps1	35.1	17.9	4.0
Chico	9-8	–	1.8	21	Rps1	34.6	17.5	3.5
Ozzie	9-10	–	1.5	23	Rps1	36.5	16.8	4.0
Glenwood	9-18	–	1.5	23	Rps1	34.7	18.2	3.5
Dawson	9-19	–	2.0	25	Rps1	34.6	18.3	2.5
Evans	9-22	–	1.5	29	Rps1	34.9	17.9	3.5

Table 26 (continued). Characteristics of publicly developed soybean varieties, 1993.

Variety	Mature: mid-May planting	Mature: mid-June planting	Lodging	Height	Phytophthora gene	Protein	Oil	Chlorosis
	date		score [1]	inches		% [2]	% [2]	score [1]
Proto	9-22	–	1.8	22	S	38.9	14.7	4.5
Lambert	9-22	–	1.8	24	Rps1	35.7	17.7	3.0
Minnatto	9-24 [3]	–	1.5	25	Rps1	36.6	16.4	3.0
Dassel	9-25 [3]	–	1.8	26	Rsp6	35.5	17.5	3.0
Hardin	9-28 [3]	–	1.8	26	Rps1	34.9	17.8	4.0
Kato	9-29 [3]	–	1.8	28	Rps1	37.6	16.0	3.5
Hodgson 78	* [4]	–	2.0	29	Rps1	34.8	18.0	3.0
Parker	* [4]	–	2.0	32	Rps1	34.0	18.7	5.0
Kasota	* [4]	–	1.5	28	Rps1c	35.9	17.2	2.5
Bert	* [4]	–	2.0	34	Rps1	33.8	18.7	4.0
Leslie	* [4]	–	1.5	30	Rps1	33.7	19.0	4.0
Corsoy 79	* [4]	–	2.0	34	Rps1c	34.3	18.3	4.5
Sturdy	* [4]	–	1.5	31	Rps1	34.6	18.2	3.5
Southern Zone (Lamberton and Waseca)								
McCall	9-4	9-28 [3]	1.8	18	S	31.8	20.2	3.5
Agassiz	9-6	9-28 [3]	1.5	21	Rps1	33.8	18.8	4.0
Ozzie	9-13	9-29 [3]	1.8	24	Rps1	35.6	17.5	4.0
Dawson	9-16	* [4]	2.0	25	Rps1	33.3	19.1	2.5
Glenwood	9-16	* [4]	1.8	23	Rps1	34.3	18.3	3.5
Proto	9-17	* [4]	2.0	23	S	37.8	15.8	4.5
Evans	9-18	* [4]	2.0	27	Rps1	33.0	19.5	3.5
Lambert	9-20	* [4]	1.8	24	Rps1	34.4	18.4	3.0
Dassel	9-21	* [4]	2.0	24	Rps6	34.7	18.1	3.0
Kato	9-21	* [4]	1.8	28	Rps1	36.6	16.8	3.5
Hodgson 78	9-26 [3]	* [4]	2.5	30	Rps1	34.2	18.3	3.0
Bert	9-28 [3]	* [4]	2.5	32	Rps1	32.5	19.7	4.0
Hardin	9-28 [3]	* [4]	2.8	28	Rps1	33.7	18.8	4.0
Alpha	9-28 [3]	* [4]	2.5	29	S	34.3	18.0	3.5
Parker	9-29 [3]	* [4]	2.8	31	Rps1	33.6	19.0	5.0
Kasota	9-29 [3]	* [4]	2.0	28	Rps1c	35.1	18.0	3.5
Hardin 91	9-30 [3]	* [4]	2.8	28	Rps1k	33.6	18.9	4.0
Leslie	9-30 [3]	* [4]	2.0	30	Rps1	33.0	19.5	4.0
Weber 84	* [4]	* [4]	2.5	33	Rps1	32.9	19.2	4.0
Archer	* [4]	* [4]	2.3	31	Rps1k+Rps6	32.5	19.8	3.0
BSR 101	* [4]	* [4]	2.5	30	Rps1	32.4	19.7	3.0
IA2008	* [4]	* [4]	2.5	31	Rps1	32.3	19.7	3.5
Corsoy 79	* [4]	* [4]	2.5	31	Rps1c	33.7	18.8	4.5
Sturdy	* [4]	* [4]	2.3	31	Rps1	33.8	18.7	3.5
Kenwood	* [4]	* [4]	2.5	33	S	31.8	20.3	5.0
Bell	* [4]	* [4]	2.3	28	S	33.5	19.0	4.5

[1] 1 = excellent, 5 = very poor; [2] 13 percent moisture; [3] Not mature at frost, estimated maturity date; [4] Not mature at frost, unable to estimate date.

than Evans. Seed weight about 6 grams per 100 seeds greater than Evans. Yields less than Evans. Developed by Minnesota Agricultural Experiment Station. Released 1976.

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

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

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

Privately developed varieties

The private companies entering varieties in the 1993 Minnesota tests and the brand names were:

AgriPro Seeds, 824 2nd St. South, Box 250, Brookings, SD 57006 (AgriPro)
Applied Genetics, 551 N. 700 E Rd., Gibson City, IL 60936 (AG)
Asgrow Seed Co., P.O. Box 460, Parkersburg, IA 50665 (Asgrow)
Cenex/Land O'Lakes, 2827 8th Ave. South, Fort Dodge, IA 50501 (Cenex/LOL)
Ciba Seeds, P.O. Box 18300, Greensboro, NC 27419 (Ciba)
Custom Farm Seed, P.O. Box 160, Momence, IL 60954 (CFS)
Dahlgren & Company, Inc., 1220 Sunflower Street, Crookston, MN 56716 (Dahlgren)
Dairyland Seed Company, Inc., P.O. Box 958, 3570 Hwy. H, West Bend, WI 53095 (DSR)
DeKalb Plant Genetics, 3100 Sycamore Rd., Dekalb, IL 60115 (DeKalb)
Dennis Ewing Farm Seed, Route 4, Ames, IA 50010 (Yield King)
Domestic Seed (Mustang Soybeans), Box 466, Madison, SD 57042 (Mustang)
Dunn International, Ltd., 4734 Sergeant Road, Waterloo, IA 50701 (Dunn)
Ehrich Seed Farms, RR 1, Box 47, Elmore, MN 56027 (Ehrich)
Gold Country Seed, 3374 80th Street, Plato, MN 55370 (GCS)
Golden Harvest Seeds, 100 J.C. Robinson Boulevard, Waterloo, NE 68069-0301 (Golden Harvest)
Great Lakes Hybrids, 9915 W. M-21, Ovid, MI 48866 (GL)
Helena Chemical Co./HyPerformer Seeds, Route 3, Box 135, Marshall, MN 56258 (HyPerformer)
ICI Seeds, 6945 Vista Drive, West Des Moines, IA 50266 (ICI), (Diamond)
Interstate Payco Seed Co., Box 338, West Fargo, ND 58078 (Payco)
Kaltenberg Seed Farms, 5506 State Rd. 19, P.O. Box 278, Waunakee, WI 53597-0278 (Kaltenberg)
Kruger Seed Company, Hwy. 20 East, Box A, Dike, IA 50624 (Kruger)
KSC/Challenger, Box 747, Cedar Falls, IA 50613 (KSC/Challenger)
Latham Brothers Farm, R.R. 1, Alexander, IA 50420 (Latham)
Latham Seed Company, R.R. 1, Box 12, Alexander, IA 50420 (Latham)
L. Herried Seeds, 925 Dexter St., P.O. Box 216, Prescott, WI 54021 (L. Herried)
Mark Seed Company, 823 W. 2nd. St., P.O. Box 67, Perry, IA 50220 (Mark)
Midwest Oilseeds, Inc., 2225 Laredo Trail, Adel, IA 50003 (M.O.)
Midwest Seed Genetics, Inc., P.O. Box 518, Carroll, IA 51401 (M/W Genetics)
Mycogen Plant Sciences, 720 St. Croix St., Prescott, WI 54021 (Jacques); (Sigco Res.)
Northrup King, 7500 Olson Mem. Hy., Golden Valley, MN 55427 (NK)

Table 27. Yields and characteristics of public and private soybean varieties, northern zone, 1993 (Crookston, Moorhead, Shelly).

Brand or Originator	Variety	Matures	Yield			Phyto-	Chlorosis	Protein			Oil		
			1991-1993	1992-1993	1993	phthora gene [1]	score [2]	1991-1993	1992-1993	1993	1991-1993	1992-1993	1993
		date	bu/A					% [3]			% [3]		
Agric. Canada	Maple Ridge	9-5	25	25	27	S	3.0	34.0	34.3	34.0	18.7	18.4	18.3
Minn. A.E.S.	McCall	9-10	32	29	29	S	4.5	32.8	33.1	33.2	19.3	19.1	18.6
Minn. A.E.S.	Agassiz	9-15 [5]	34	30	29	Rps1	5.0	34.8	34.9	35.3	18.0	17.9	17.1
Dahlgren	D3883	9-16 [5]	–	–	33	S	3.5	–	–	32.9	–	–	19.1
Dunn	905	9-16 [5]	–	–	32	S	2.5	–	–	35.5	–	–	17.1
Sigco Research	34	9-17 [5]	33	31	31	S	3.5	32.9	32.7	32.5	19.3	19.5	19.3
Dairyland	DSR-045	9-18 [5]	35	33	34	S	4.0	33.4	33.4	33.5	19.0	19.0	18.6
Agric. Canada	Maple Glen	9-18 [5]	32	31	34	S	5.0	34.7	34.2	35.2	18.0	18.3	17.2
Minn. A.E.S.	Ozzie	9-18 [5]	34	31	34	Rps1	3.5	34.9	34.7	34.5	17.9	18.1	17.9
GCS	Hunter	9-19 [5]	35	34	35	S	3.5	33.5	33.3	33.3	19.0	19.2	18.7
Sigco Research	44	9-19 [5]	35	32	33	S	4.5	33.8	33.7	34.0	18.7	18.8	18.1
Jacques	J-033	9-19 [5]	37	34	32	S	4.0	33.9	33.6	33.2	18.7	18.9	18.9
Pioneer	9041	9-19 [5]	–	–	32	Rps1	2.5	–	–	33.6	–	–	18.4
Dahlgren	D3023	9-20 [5]	–	–	32	S	4.5	–	–	33.8	–	–	18.3
Dyna-Gro	3030	9-20 [5]	–	–	32	S	3.5	–	–	33.4	–	–	18.7
Ciba	3033	9-22 [5]	–	–	35	S	4.5	–	–	33.3	–	–	18.9
Minn. A.E.S.	Evans	9-22 [5]	31	29	31	Rps1	4.5	32.7	32.2	32.7	19.5	19.8	19.1
Pioneer	9071	* [6]	–	–	36	Rps1c	4.0	–	–	31.6	–	–	20.1
Pioneer	9061	* [6]	35	33	35	Rps1	5.0	32.0	31.5	33.1	20.0	20.4	18.9
Minn. A.E.S.	Lambert	* [6]	–	34	34	Rps1	3.5	–	32.9	34.1	–	19.4	18.2
Minn. A.E.S	Dawson	* [6]	34	31	30	Rps1	4.0	32.6	32.0	32.5	19.5	20.0	19.3
GCS	Tracker	* [6]	–	33	33	S	4.0	–	32.6	33.0	–	19.6	19.0
Sexauer	SX0332 [4]	* [6]	–	–	32	S	4.5	–	–	33.5	–	–	18.5
Minn. A.E.S.	Glenwood	* [6]	35	32	31	Rps1	4.5	34.2	33.7	33.4	18.5	18.8	18.6
Dyna-Gro	E-133	* [6]	–	–	33	Rps1	4.0	–	–	33.3	–	–	18.7
Dekalb	CX076	* [6]	–	31	32	S	4.0	–	33.5	32.6	–	18.9	19.2
Golden Harvest	H-1075	* [6]	33	30	31	S	5.0	33.4	32.6	32.8	19.0	19.6	19.2
Kaltenberg	KB053	* [6]	–	–	34	S	5.0	–	–	34.3	–	–	18.0
Dairyland	DSR-068 [1]	* [6]	–	–	33	S	4.5	–	–	33.9	–	–	18.4
Sexauer	SX0690	* [6]	–	–	29	S	5.0	–	–	33.6	–	–	18.4
Great Lakes	GL1013	* [6]	–	–	32	S	4.5	–	–	34.0	–	–	18.2
Kaltenberg	KB092	* [6]	–	–	31	S	4.5	–	–	34.1	–	–	18.2
Dekalb	CX096	* [6]	–	27	28	Rps1	3.5	–	32.2	33.6	–	19.9	18.5
MO	EX0560	* [6]	–	–	33	S	5.0	–	–	31.8	–	–	19.9
Great Lakes	GL1315	* [6]	–	–	32	S	4.5	–	–	32.4	–	–	19.5
Stine	0380	* [6]	35	31	28	S	4.5	33.4	32.5	33.3	19.0	19.6	18.6
LSD 20%			2	2	2								

[1] 1 = excellent, 5 = very poor; [2] Specific genes noted; S = susceptible; [3] 13 percent moisture; [4] Blend (information furnished by originator); [5] Not mature at frost; estimated maturity date; [6] Not mature at frost, unable to estimate date.

Pioneer Hi-Bred International, Inc.,130 Willmar Ave. South East, Willmar, MN 56201 (Pioneer)
Prairie Brand Research, 15 X Avenue, Story City, IA 50248 (Prairie Brand)
Prairie Brand Seed Company, Inc., 15 X Avenue, Story City, IA 50248 (Prairie Brand)
ProfiSeed Inc., Route 2, Hampton, IA 50441 (ProfiSeed)
Ramy International Ltd., 1329 N. Riverfront Dr., Mankato, MN 56001 (Ramy)
Sand Seed Service, Inc., 4765 Highway 143, Marcus, IA 51035 (Sands)
Sansgaard Seed Farms, Inc., 15 X Avenue, Story, IA 50248 (Sansgaard)
The Sexauer Company, P.O. Box 58, Brookings, SD 57006 (Sexauer)
Star Brand Seed, 4765 Highway 143, Marcus, IA 51035 (Star)
Stine Seed Company, 2225 Laredo Trail, Adel, IA 50003 (Stine)
Terra International, Inc., 600 Fourth Street, Sioux City, IA 51101 (Terra)
Thompson Agronomics, Inc., RR 1, Box 34, Leland, IA 50453 (Thompson)
Thompson Seeds, Inc., RR 1, Box 34, Leland, IA 50453 (Thompson)
UAP Seed Company, 1230 40th St. N.W., P.O. Box 5015, Fargo, ND 58105-5015 (Dyna-Gro)
UAP Seed, P.O. Box 288, Independence, IA 50644 (Dyna-Gro)
Wilson Seeds, Inc. P.O. Box 391, Harlan, IA 51537 (Wilson)
Ziller Seed Co., Inc., RR 1, Box 122, Bird Island, MN 55310 (Ziller)

Table 28. Yields and characteristics of public and private soybean varieties, central zone, 1993 (Becker, Morris, Rosemount).

Brand or Originator	Variety	Matures	Yield			Phyto-		Protein			Oil		
			1991-1993	1992-1993	1993	phthora	Chlorosis	1991-1993	1992-1993	1993	1991-1993	1992-1993	1993
		date	bu/A			gene [1]	score [2]	% [3]			% [3]		
Minn. A.E.S.	Ozzie	9-11	39	38	32	Rps1	3.0	35.9	36.0	35.7	17.4	17.6	17.6
Minn. A.E.S	Dawson	9-15	43	40	36	Rps1	4.0	34.6	34.8	34.2	18.3	18.4	18.7
Minn A.E.S	Lambert	9-16	–	44	39	Rps1	2.5	–	36.7	36.2	–	17.3	17.4
Mustang	M-0770	9-16	–	–	38	Rps1	4.0	–	–	34.4	–	–	18.3
CFS	055 [4]	9-16	–	–	36	Rps1	3.5	–	–	34.4	–	–	18.6
Sigco Research	54	9-17	–	–	39	Rps1	4.0	–	–	34.3	–	–	18.5
Ciba	3072	9-17	–	42	37	Rps1	4.5	–	35.6	36.3	–	17.8	17.2
Jacques	J-083	9-18	46	42	38	Rps1	4.5	34.8	35.0	34.4	18.3	18.3	18.6
Minn. A.E.S.	Evans	9-18	43	40	37	Rps1	4.5	34.8	35.1	34.9	18.1	18.1	18.2
Minn A.E.S.	Dassel	9-18	42	39	34	Rps6	4.0	36.3	36.8	35.9	17.2	17.1	17.6
Pioneer	9091	9-19	47	44	38	S	3.5	35.3	35.2	34.7	17.9	18.2	18.5
NK	S07-80	9-20	48	44	39	S	3.5	34.3	34.3	33.9	18.8	19.0	19.1
Sigco Research	74	9-21	–	43	41	S	4.0	–	35.5	35.9	–	17.9	17.6
Thompson	Ex1181	9-21	–	–	41	Rps1	4.0	–	–	35.2	–	–	18.1
Prairie Brand	PBX-110	9-21	–	–	40	S	4.5	–	–	34.5	–	–	18.2
Golden Harvest	H-1112	9-22	–	44	41	S	3.5	–	35.6	34.8	–	17.9	18.4
AG	AG-090	9-22	–	–	35	Rps1	4.0	–	–	33.7	–	–	19.3
Sexauer	SX0832 [4]	9-22	–	–	34	Rps1	4.0	–	–	35.3	–	–	18.1
DeKalb	CX 121	9-23	–	43	42	Rps1	4.5	–	35.0	34.6	–	18.4	18.7
L. Herried	3143	9-23	–	–	40	S	4.0	–	–	34.1	–	–	19.2
Sexauer	SX1232 [4]	9-23	–	–	39	S	5.0	–	–	33.8	–	–	19.3
CFS	120 [4]	9-23	–	–	38	Rps1	4.5	–	–	35.4	–	–	17.5
DeKalb	CX096	9-23	45	40	38	S	3.5	35.9	36.0	35.3	17.6	17.6	17.9
Dyna-Gro	DGX104	9-23	–	–	38	S	3.0	–	–	34.0	–	–	18.8
Mustang	M-1000	9-24	45	42	42	Rps1	3.0	36.7	37.0	36.3	17.1	17.0	17.3
Pioneer	9111	9-24	48	44	41	S	4.5	36.5	37.0	36.2	17.1	16.9	17.3
Star	Exp 9312	9-24	–	–	40	Rps1k	4.0	–	–	35.2	–	–	18.0
Dahlgren	KG62	9-24	48	45	40	S	4.5	34.7	34.7	34.3	18.2	18.4	18.8
Pioneer	9141	9-24	–	–	37	Rps1c	4.0	–	–	34.7	–	–	18.4
ICI	D138	9-25	–	47	44	S	5.0	–	36.9	35.8	–	16.9	17.5
DeKalb	CX 117	9-25	49	45	40	S	4.5	35.6	36.0	33.9	17.9	17.9	19.2
Dairyland	DSR-109	9-25	–	–	40	S	4.5	–	–	33.6	–	–	19.2
HyPerformer	HSC098	9-25	–	–	40	Rps1	2.5	–	–	35.9	–	–	17.4
Sexauer	SX1432 [4]	9-25	–	–	40	S	5.0	–	–	35.0	–	–	18.2
Thompson	T-3140	9-25	48	44	39	Rps1	5.0	35.9	36.0	35.5	17.6	17.6	17.7
Sigco Research	80	9-25	44	39	35	Rps1	2.5	36.1	36.2	36.0	17.5	17.7	17.3
Ciba	3103	9-26	–	–	44	S	4.0	–	–	36.0	–	–	17.4
Ziller	Exp 962	9-26	52	48	43	S	5.0	36.3	36.7	35.9	17.1	17.0	17.2
Minn. A.E.S	Kato	9-26	45	40	42	Rps1	4.5	38.0	37.8	37.2	16.0	16.1	16.0
NK	S12-22	9-26	48	44	41	S	3.5	34.4	34.4	34.1	18.6	18.8	19.0
Iowa A.E.S	Hardin	9-26	–	42	40	Rps1	5.0	–	36.1	35.6	–	17.4	17.7
HyPerformer	HSC 140	9-26	–	–	40	Rps1c	4.5	–	–	35.3	–	–	17.6
Profiseed	1422	9-26	–	45	39	Rps1	4.5	–	35.8	35.4	–	17.7	17.7
Mustang	M-1050	9-26	49	44	38	Rps1	5.0	35.7	35.5	35.5	17.6	17.9	17.7
Great Lakes	GL 1315	9-27	52	49	43	S	4.5	35.0	35.0	34.9	18.1	18.3	18.1
Asgrow	A 1395	9-27	–	–	42	Rps1k	4.0	–	–	34.8	–	–	18.3
Dairyland	DSR-173	9-27	–	44	42	Rps1	5.0	–	36.9	36.4	–	16.9	17.1
Thompson	Ex7735	9-27	–	–	42	S	5.0	–	–	33.1	–	–	19.4
Mustang	M-1040	9-27	–	44	39	Rps1	4.5	–	35.6	35.2	–	17.8	18.0
Prairie Brand	PB-137	9-28	–	50	48	S	3.5	–	35.2	34.8	–	18.0	18.5
Kaltenberg	KB151	9-28	51	48	44	S	3.5	34.8	34.8	34.7	18.2	18.3	18.2
Sands	SOI113	9-28	51	47	43	S	4.0	35.0	34.9	35.0	18.0	18.2	18.2
Profiseed	1487	9-28	–	–	42	S	3.5	–	–	35.3	–	–	18.2
GCS	Kandi	9-28	–	46	42	Rps1k	5.0	–	38.0	38.0	–	16.1	15.7
Latham	170 Brand	9-28	–	–	41	S	3.5	–	–	35.1	–	–	18.2
HyPerformer	HSC 119	9-28	–	–	40	S	5.0	–	–	36.3	–	–	16.8
Kruger	K1515	9-28	–	–	39	S	4.0	–	–	35.2	–	–	18.2
Stine	0380	9-28	–	46	38	S	4.5	–	36.7	36.2	–	17.1	17.3
Minn. A.E.S.	Hodgson 78	9-28	45	42	38	Rps1	4.5	34.5	34.6	34.2	18.5	18.6	18.9
Payco	9314	9-29	–	–	44	S	3.0	–	–	34.4	–	–	18.5
AgriPro	AP1440	9-29	–	44	42	S	3.5	–	35.7	34.8	–	17.8	18.2
Kruger	K1313	9-29	–	47	42	S	4.0	–	34.2	33.7	–	18.8	18.8

Table 28 (continued). Yields and characteristics of public and private soybean varieties, central zone, 1993 (Becker, Morris, Rosemount).

Brand or Originator	Variety	Matures	Yield 1991-1993	Yield 1992-1993	Yield 1993	Phytophthora gene[1]	Chlorosis score[2]	Protein 1991-1993	Protein 1992-1993	Protein 1993	Oil 1991-1993	Oil 1992-1993	Oil 1993
		date	bu/A					% [3]			% [3]		
Sansgaard	S-136EXP	9-29	–	–	41	S	5.0	–	–	33.7	–	–	19.2
ICI	D162	9-29	47	43	40	S	4.0	36.8	36.5	36.7	16.9	17.2	17.0
Jacques	J-145	9-29	47	42	40	Rps1	5.0	37.1	37.4	36.6	16.6	16.5	16.7
Minn. A.E.S	Alpha	9-29	–	38	35	S	3.5	–	36.9	35.9	–	17.0	17.4
Kruger	K1404	9-30[5]	–	–	46	S	5.0	–	–	36.0	–	–	17.3
Prairie Brand	PB-154EXP	9-30[5]	–	–	44	S	4.0	–	–	36.4	–	–	17.2
Payco	9115	9-30[5]	49	45	43	Rps1k	4.5	34.9	35.1	35.1	18.1	18.0	17.9
Minn. A.E.S	Kasota	9-30[5]	46	42	43	Rps1c	4.0	37.6	37.5	36.8	16.3	16.5	16.8
Dairyland	DSR-133	9-30[5]	–	–	42	Rps1	3.0	–	–	34.4	–	–	18.5
Kaltenberg	KB154	9-30[5]	–	–	42	S	3.5	–	–	34.7	–	–	18.1
Minn. A.E.S.	Bert	9-30[5]	48	44	41	Rps1	5.0	33.8	33.9	33.6	18.9	19.1	19.3
Minn. A.E.S.	Parker	9-30[5]	–	47	41	Rps1	4.0	–	35.4	35.1	–	18.0	18.1
Thompson	T-3160	9-30[5]	–	–	39	S	4.0	–	–	33.4	–	–	19.4
Agri Pro	AP 1880	10-1[5]	–	47	46	S	4.5	–	35.2	34.7	–	18.0	18.1
Diamond	D150	10-1[5]	–	–	42	S	4.5	–	–	33.6	–	–	19.2
Kruger	K1414	10-1[5]	–	–	42	S	5.0	–	–	34.8	–	–	18.2
Dairyland	DSR-189	10-1[5]	–	44	39	Rps1c	4.5	–	34.1	33.7	–	18.9	19.1
Great Lakes	GL1593	10-2[5]	–	–	45	S	4.5	–	–	34.2	–	–	18.7
Prairie Brand	PB-177	10-2[5]	–	48	45	S	5.0	–	37.2	36.0	–	16.8	17.7
Yield King	K-1828	10-2[5]	–	–	43	S	5.0	–	–	35.3	–	–	17.7
HyPerformer	HY191	10-2[5]	–	–	41	Rps1c	4.0	–	–	35.1	–	–	17.7
DeKalb	CX187	10-2[5]	49	45	40	S	4.0	34.4	34.2	33.3	18.6	18.9	19.5
Golden Harvest	H-1150	10-2[5]	46	41	40	S	5.0	34.6	34.3	34.2	18.4	18.8	18.8
Thompson	T-3177[4]	10-2[5]	49	44	39	S	4.5	34.7	34.6	34.0	18.3	18.6	19.0
Stine	EX1570	10-3[5]	–	–	46	S	5.0	–	–	35.8	–	–	17.5
Yield King	K-1718	10-3[5]	–	–	45	S	4.5	–	–	36.8	–	–	17.0
GCS	Bixby	10-3[5]	–	–	44	S	4.5	–	–	33.6	–	–	19.4
Ciba	3172	10-3[5]	–	43	43	S	5.0	–	35.2	34.5	–	18.1	18.5
Yield King	D-191	10-4[5]	–	–	48	S	5.0	–	–	34.8	–	–	18.2
Kaltenberg	KB171	10-4[5]	51	48	46	S	5.0	33.8	33.4	33.2	18.9	19.4	19.6
Kaltenberg	KB162	10-4[5]	–	44	43	S	4.5	–	36.1	34.8	–	17.6	18.5
Minn. A.E.S.	Leslie	10-4[5]	48	42	41	Rps1	4.0	35.3	35.1	34.3	17.9	18.1	18.7
Sexauer	SX 1890	10-4[5]	–	43	41	S	5.0	–	34.9	35.2	–	18.2	18.0
Iowa A.E.S	Archer	10-4[5]	–	–	39	Rps1k+6	3.0	–	–	34.2	–	–	18.9
Yield King	D-199	10-6[5]	–	–	46	S	5.0	–	–	35.3	–	–	17.9
Payco	9318	10-6[5]	–	–	39	S	4.0	–	–	34.6	–	–	18.6
LSD 20%			1	1	2								

[1] Specific genes noted, S = Susceptible; [2] 1 = excellent, 5 = very poor; [3] 13 percent moisture; [4] Blend (information furnished by originator); [5] Estimated, not mature at frost.

Size of seed is one of the criteria used to rate the desirability of soybean lines being developed by Minnesota Agricultural Experiment Station agronomists.

Table 29. Yields and characteristics of public and private soybean varieties from tests on soybean cyst nematode infested (East Chain, Hanska, New Richland and St. James) and noninfested (Fairmont, Lamberton and Waseca) sites.

Brand or Originator	Variety	Matures	Infested Yield 1992-1993	Infested Yield 1993	Matures	Noninfested Yield 1992-1993	Noninfested Yield 1993	Phytophthora	Chlorosis	SCN	Protein 1992-1993	Protein 1993	Oil 1992-1993	Oil 1993
		date	bu/A		date	bu/A		gene [1]	score [2]	race(s) [3]	% [4]		% [4]	
Ciba	1812Y	9-30 [6]	–	21	9-30	–	37	S	3.0	MS	–	38.5	–	15.5
Latham	EX360CN	9-30	–	19	9-30	–	37	S	4.5	MR	–	39.2	–	15.1
Thompson	T-3162CN	9-30	–	17	9-29	–	36	Rps1	3.5	R	–	33.1	–	19.9
Prairie Brand	PB-175BN [5]	* [7]	–	20	9-30	–	43	S	4.0	S	–	36.6	–	16.9
Kaltenberg	KB183	* [7]	–	21	10-2	–	42	S	4.5	MS	–	36.3	–	17.2
Minn. A.E.S.	Alpha	* [7]	28	19	9-30	39	37	S	3.5	R	36.0	34.6	17.5	18.4
Minn. A.E.S.	Parker	* [7]	31	19	10-1	–	47	Rps1	4.0	S	36.1	35.8	17.5	17.6
Latham	550CN Brand	* [7]	–	23	10-2	50	41	S	4.0	MR	–	35.5	–	17.7
Dairyland	DSR-143 N	* [7]	–	21	9-30	–	44	S	3.5	MR	–	37.3	–	16.4
ICI	EX31902N	* [7]	–	20	10-4	–	40	Rps1k	4.5	MS	–	38.2	–	16.0
Pioneer	9221	* [7]	29	19	10-3	40	40	Rps1	4.0	R	33.6	32.6	19.2	19.9
Golden Harvest	H-1199	* [7]	–	20	10-2	–	38	S	4.0	R	–	33.2	–	19.3
Thompson	T-3198CN [5]	* [7]	33	22	10-4	49	46	S	5.0	MS	35.6	35.2	17.8	17.8
GCS	78604C	* [7]	–	19	10-2	–	42	S	3.0	MS	–	37.4	–	16.4
Thompson	EX1244	* [7]	–	22	10-3	–	41	S	4.5	R	–	32.0	–	20.4
Minn. A.E.S.	Sturdy	* [7]	30	20	10-5	48	44	Rps1	3.0	S	36.0	34.9	17.7	18.3
Illinois A.E.S.	Bell	* [7]	28	15	10-6	38	32	S	4.0	R	36.5	35.9	17.2	17.4
NK	S25-07	* [7]	29	22	10-7	44	42	Rps1	4.0	MS	34.7	33.1	18.4	19.5
Iowa A.E.S.	Newton	* [7]	26	17	10-7	–	36	Rps1	4.0	R	32.8	31.0	20.3	21.2
LSD 20%			2	1		2	2							

[1] Specific gene noted, S = susceptible; [2] 1 = excellent, 5 = poor; [3] Reaction to Minnesota isolate of Race 3, R = resistant, MR = moderately resistant, MS = susceptible, S = susceptible. [4] 13 percent moisture; [5] Blend (information supplied by originator); [6] Not mature at frost, estimated maturity date; [7] Not mature at frost, unable to estimate maturity date.

Table 30. Yields and characteristics of public and private soybean varieties, southern zone, 1993 (Fairmont, Lamberton, Waseca).

Brand or Originator	Variety	Matures	Yield 1991-1993	Yield 1992-1993	Yield 1993	Phytophthora	Chlorosis	Protein 1991-1993	Protein 1992-1993	Protein 1993	Oil 1991-1993	Oil 1992-1993	Oil 1993
		date	bu/A			gene [1]	score [2]	% [3]			% [3]		
Minn. A.E.S.	Kato	9-24	45	42	39	Rps1	4.5	38.6	38.5	37.8	15.9	16.2	16.4
Minn. A.E.S.	Hodgson 78	9-26	44	40	40	Rps1	4.5	35.5	35.3	34.9	17.8	18.2	18.6
Latham	170 Brand	9-27	46	42	42	S	3.5	35.3	34.6	34.0	18.2	18.9	19.3
Pioneer	9162	9-27	46	42	41	S	3.5	35.2	35.1	34.2	18.3	18.6	19.3
Iowa A.E.S.	Hardin	9-28 [5]	47	43	42	Rps1	5.0	35.5	35.2	34.5	17.9	18.4	18.9
Pioneer	9171	9-28 [5]	46	43	40	S	5.0	34.5	34.5	33.9	18.6	19.0	19.4
ICI	D162	9-28 [5]	–	42	39	S	4.0	–	36.8	36.5	–	17.1	17.2
Thompson	Ex1773	9-29 [5]	–	–	48	S	5.0	–	–	31.9	–	–	20.9
Dairyland	DSR-173	9-29 [5]	48	45	43	Rps1	5.0	36.4	36.3	36.3	17.1	17.4	17.3
Dairyland	DSR-189	9-29 [5]	–	45	43	Rps1c	4.5	–	34.0	33.0	–	19.0	20.0
Minn. A.E.S.	Bert	9-29 [5]	46	43	40	Rps1	5.0	34.2	33.8	33.8	18.6	19.2	19.3
Mustang	M-1170	9-29 [5]	–	–	39	S	3.5	–	–	34.5	–	–	19.0
Minn. A.E.S	Kasota	9-29 [5]	43	40	38	Rps1c	4.0	36.8	36.4	36.0	17.1	17.5	17.7
Sand	SOI 242	9-30 [5]	–	46	45	Rps1k	3.5	–	36.6	36.2	–	17.3	17.5
Dahlgren	D3151	9-30 [5]	–	43	40	S	3.5	–	36.0	35.0	–	17.8	18.5
Asgrow	A1900	* [6]	–	–	46	Rps1k	4.5	–	–	33.9	–	–	19.4
Sigco Research	94	* [6]	48	46	44	S	3.5	36.8	36.5	36.2	16.9	17.3	17.6
Minn. A.E.S	Parker	* [6]	–	48	43	Rps1	4.0	–	35.0	35.3	–	18.4	18.4
Sand	SOI 119	* [6]	51	47	42	Rps1	4.0	35.3	34.8	34.6	18.1	18.8	19.0
Terra	RunnerIII	* [6]	46	42	38	S	4.5	35.0	34.4	33.5	18.2	18.9	19.6
Sexauer	SX1991 [4]	* [6]	–	43	38	Rps1	4.0	–	35.0	34.9	–	18.6	18.6
DeKalb	CX232	* [6]	–	–	46	S	5.0	–	–	35.5	–	–	18.3
ICI	D213	* [6]	–	–	44	Rps1	5.0	–	–	33.8	–	–	19.5
Dahlgren	D3213	* [6]	–	–	43	S	5.0	–	–	34.7	–	–	18.9
HyPerformer	HY191	* [6]	–	–	43	Rps1c	5.0	–	–	34.0	–	–	19.3

Table 30 (continued). Yields and characteristics of public and private soybean varieties, southern zone, 1993 (Fairmont, Lamberton, Waseca).

Brand or Originator	Variety	Matures	Yield			Phyto-		Protein			Oil		
			1991-1993	1992-1993	1993	phthora	Chlorosis	1991-1993	1992-1993	1993	1991-1993	1992-1993	1993
		date	bu/A			gene [1]	score [2]	% [3]			% [3]		
Terra	TS175	* [6]	–	46	43	S	3.5	–	36.0	35.4	–	17.7	18.2
Ziller	BT2494	* [6]	–	–	42	S	4.5	–	–	34.3	–	–	19.1
Latham	200B Brand [1]	* [6]	49	45	41	S	4.0	34.8	34.5	34.4	18.3	18.9	19.1
DeKalb	CX187	* [6]	48	45	39	S	4.0	35.1	34.9	33.9	18.1	18.6	19.4
Great Lakes	GL1593	* [6]	–	44	38	S	4.5	–	34.4	33.6	–	19.0	19.7
Minn. A.E.S.	Leslie	* [6]	45	42	37	Rps1	4.0	35.1	34.5	34.1	18.2	18.9	19.4
AG	AG 180	* [6]	–	35	35	Rps1	4.0	–	–	35.1	–	–	18.4
Sand	SOI214	* [6]	52	49	49	S	5.0	35.2	34.7	34.2	18.0	18.6	19.2
Thompson	Ex 3188 [4]	* [6]	–	48	48	S	5.0	–	–	33.7	–	–	19.4
Asgrow	A 2012	* [6]	–	47	47	Rps1k	3.5	–	–	34.2	–	–	19.1
Kaltenberg	KB220	* [6]	52	51	47	S	4.5	35.6	35.1	35.0	17.7	18.3	18.5
Mustang	M-1200	* [6]	53	49	47	S	5.0	35.5	35.3	34.6	17.9	18.3	18.7
Profiseed	1807	* [6]	–	48	46	S	4.5	–	32.8	32.2	–	20.0	20.9
Sexauer	SX1941	* [6]	–	–	46	Rps1k	3.0	–	–	36.3	–	–	17.6
M.O.	2250	* [6]	–	47	46	S	5.0	–	35.2	35.0	–	18.4	18.7
Latham	440 Brand	* [6]	50	47	46	S	5.0	34.6	34.3	33.5	18.5	19.0	19.6
Agri Pro	AP2122	* [6]	–	–	46	Rps1c	4.5	–	–	35.1	–	–	18.7
Thompson	Ex 1183	* [6]	–	–	46	Rps1	4.0	–	–	34.3	–	–	19.1
CFS	180 [4]	* [6]	–	–	45	S	4.5	–	–	32.4	–	–	20.5
Stine	Ex 1580	* [6]	–	–	45	S	5.0	–	–	33.2	–	–	19.9
Golden Harvest	H-1196	* [6]	48	47	45	S	5.0	35.3	34.8	34.0	17.9	18.6	19.1
Dairyland	DSR-217	* [6]	48	45	44	S	4.5	34.6	34.5	33.9	18.4	18.7	19.3
Kruger	K1818	* [6]	51	47	44	S	5.0	34.1	33.5	33.6	18.8	19.5	19.7
Kruger	K2121	* [6]	53	50	44	S	5.0	35.1	34.8	34.2	18.1	18.6	19.0
Ciba	3172	* [6]	–	45	43	S	5.0	–	34.6	33.7	–	18.8	19.5
AgriPro	AP2040	* [6]	48	46	42	S	4.5	35.8	35.3	35.0	17.7	18.2	18.5
Illinois A.E.S.	Corsoy 79	* [6]	47	43	42	Rps1c	4.5	35.6	35.4	34.3	17.9	18.4	19.1
Ramy	Preferred II Plus	* [6]	48	45	42	Rps1k	4.0	37.0	36.7	36.4	16.8	17.2	17.5
Sexauer	SX1890	* [6]	–	45	42	S	4.0	–	35.4	35.0	–	18.2	18.3
DeKalb	CX210	* [6]	46	43	41	S	5.0	34.3	34.0	33.8	18.6	19.1	19.3
M/W Genetics	G2200	* [6]	–	–	41	S	4.0	–	–	35.2	–	–	18.2
Mark	MRK9318	* [6]	–	–	41	S	5.0	–	–	32.1	–	–	20.8
Jacques	J-204	* [6]	–	44	39	S	4.5	–	34.7	34.1	–	18.8	19.2
KSC/Challenger	K2021	* [6]	–	–	51	S	5.0	–	–	34.8	–	–	18.7
Sansgaard	S 221	* [6]	–	–	50	S	5.0	–	–	33.7	–	–	19.4
Sexauer	SX2390 [4]	* [6]	–	51	49	S	5.0	–	34.6	33.8	–	18.8	19.4
M/W Genetics	G2440	* [6]	–	–	48	S	5.0	–	–	35.0	–	–	18.6
HyPerformer	HSC223	* [6]	–	–	47	S	4.5	–	–	34.6	–	–	18.8
Mustang	M-1188	* [6]	–	–	46	S	4.5	–	–	34.8	–	–	18.7
Mark	MRK9225	* [6]	–	–	46	S	5.0	–	–	33.9	–	–	19.2
NK	S24-92	* [6]	–	49	46	S	5.0	–	35.1	34.1	–	18.6	19.2
Minn. A.E.S. 4	Sturdy	* [6]	51	49	46	Rps1	3.0	35.3	34.4	33.5	18.0	19.0	19.7
Wilson	1993 [4]	* [6]	–	47	45	Rps1	4.0	–	34.4	34.0	–	18.9	19.3
GCS	Hadley	* [6]	–	47	45	S	4.0	–	35.3	34.7	–	18.3	18.7
Payco	9023	* [6]	53	49	45	S	5.0	35.8	35.5	35.2	17.6	18.1	18.4
Terra	TS205	* [6]	–	48	45	S	4.0	–	35.5	35.2	–	18.3	18.5
Latham	660 Brand	* [6]	–	–	44	S	5.0	–	–	34.5	–	–	18.7
Ehrich	E-298	* [6]	52	48	44	S	4.5	35.7	35.4	35.2	17.8	18.4	18.5
Iowa A.E.S.	IA2008	* [6]	–	48	44	Rps1	4.0	–	33.0	32.0	–	19.7	19.9
Thompson	T-3197 [4]	* [6]	49	47	44	S	5.0	35.8	35.0	34.5	17.8	18.5	18.9
Asgrow	A2396	* [6]	49	47	43	Rps1	4.5	34.0	33.4	32.7	19.0	19.7	20.3
Ziller	BT2919	* [6]	50	47	43	S	3.5	–	35.2	34.7	–	18.3	18.7
Mark	MRK 9418	* [6]	–	–	43	S	4.5	–	–	34.9	–	–	18.7
NK	S 20-20	* [6]	47	44	43	Rps1c	3.5	34.7	34.2	32.6	18.4	19.2	20.4
Latham	240 Brand	* [6]	47	44	42	S	5.0	34.0	33.1	32.6	19.0	19.9	20.3
Profiseed	2350	* [6]	53	49	41	S	4.5	36.2	35.7	35.1	17.5	18.2	18.6
Sigco Research	95	* [6]	–	–	41	S	4.0	–	–	34.7	–	–	18.7
M/W Genetics	G1995	* [6]	–	–	41	S	5.0	–	–	32.0	–	–	20.9
Prairie Brand	PB197	* [6]	–	–	40	S	5.0	–	–	35.0	–	–	18.5
M.O.	EX1590	* [6]	–	52	49	S	4.5	–	35.3	35.1	–	18.3	18.6
Star	EXP9321	* [6]	–	–	49	S	4.5	–	–	35.0	–	–	18.6
Sansgaard	S237	* [6]	–	–	49	S	5.0	–	–	33.9	–	–	19.4

Table 30 (continued). Yields and characteristics of public and private soybean varieties, southern zone, 1993 (Fairmont, Lamberton, Waseca).

Brand or Originator	Variety	Matures	Yield			Phyto-		Protein			Oil		
			1991-1993	1992-1993	1993	phthora	Chlorosis	1991-1993	1992-1993	1993	1991-1993	1992-1993	1993
		date	bu/A			gene [1]	score [2]	% [3]			% [3]		
Kaltenberg	KB241	*[6]	–	50	48	S	5.0	–	35.0	34.6	–	18.5	18.8
Prairie Brand	PB225	*[6]	54	51	48	S	5.0	35.5	35.0	34.2	17.9	18.5	19.1
Sansgaard	S201	*[6]	–	–	48	S	5.0	–	–	34.8	–	–	18.5
Great Lakes	GL2415	*[6]	–	–	47	S	5.0	–	–	34.3	–	–	19.0
Kruger	K2525	*[6]	53	52	47	S	5.0	35.3	35.1	34.0	18.1	18.6	19.2
CFS	215 [4]	*[6]	–	–	47	S	4.5	–	–	34.2	–	–	19.2
Profiseed	2555	*[6]	–	–	47	S	5.0	–	–	34.7	–	–	18.8
Dairyland	DSR-222	*[6]	–	–	46	S	4.5	–	–	33.0	–	–	20.1
Thompson	EX1071	*[6]	–	47	46	S	5.0	–	33.4	33.0	–	19.6	20.2
Golden Harvest	H-1263	*[6]	–	48	46	S	5.0	–	34.6	34.5	–	18.9	19.0
Jacques	J-251	*[6]	–	48	46	S	5.0	–	35.2	34.3	–	18.5	19.0
Yield King	K-2202A	*[6]	–	–	46	S	4.5	–	–	33.7	–	–	19.5
KSC/Challenger	K2232	*[6]	–	–	46	S	3.5	–	–	35.6	–	–	18.0
Payco	9225	*[6]	–	–	46	S	5.0	–	–	34.2	–	–	19.1
Thompson	T-3190	*[6]	50	49	46	S	5.0	35.6	35.2	34.9	17.8	18.3	18.5
ICI	D260	*[6]	–	–	45	S	5.0	–	–	34.7	–	–	18.8
Kruger	K2242	*[6]	–	–	45	Rps1	3.5	–	–	33.3	–	–	19.7
Pioneer	9241	*[6]	–	–	45	S	4.0	–	–	33.8	–	–	19.5
Ehrich	E-201	*[6]	–	–	44	Rps1	3.5	–	–	33.9	–	–	19.2
Yield King	K-2212	*[6]	–	–	44	S	4.0	–	–	31.8	–	–	21.0
Prairie Brand	PB2120	*[6]	52	47	44	S	5.0	35.6	35.2	34.2	17.9	18.3	19.3
Prairie Brand	PBX219	*[6]	–	–	44	S	4.0	–	–	32.8	–	–	20.2
Payco	9318	*[6]	–	–	44	S	4.5	–	–	35.2	–	–	18.4
ICI	SC232	*[6]	52	50	44	S	5.0	35.2	34.9	34.4	18.2	18.6	18.9
Dyna-Gro	DG3180	*[6]	–	–	43	S	4.5	–	–	35.1	–	–	18.3
Iowa A.E.S.	Archer	*[6]	45	43	42	Rps1k+6	3.0	35.0	34.7	34.3	18.3	18.8	19.0
Prairie Brand	PBX 188	*[6]	–	–	41	S	3.0	–	–	32.8	–	–	20.2
DeKalb	CX259	*[6]	45	45	39	S	5.0	34.2	33.8	32.7	18.9	19.5	20.3
Asgrow	A2242	*[6]	–	50	49	Rps1k	4.0	–	34.2	33.6	–	19.1	19.6
Thompson	T-3230	*[6]	–	–	47	S	5.0	–	–	32.7	–	–	20.4
Latham	661 Brand [4]	*[6]	–	49	46	S	5.0	–	34.9	34.7	–	18.5	18.9
GCS	Dundee	*[6]	50	48	46	Rps1	5.0	36.2	35.9	35.9	17.5	18.0	18.0
Sansgaard	S247	*[6]	–	–	46	S	5.0	–	–	34.3	–	–	19.1
Yield King	K-2202	*[6]	–	–	45	Rps1k	3.5	–	–	35.2	–	–	18.3
Mustang	M-1222	*[6]	–	–	45	S	5.0	–	–	32.9	–	–	20.1
Profiseed	2355	*[6]	–	–	44	S	4.5	–	–	33.9	–	–	19.3
KSC/Challenger	K2101	*[6]	–	–	44	S	5.0	–	–	34.7	–	–	18.9
Cenex/LOL	L2494	*[6]	–	–	44	S	5.0	–	–	34.4	–	–	19.0
Prairie Brand	PB 214 Exp.	*[6]	–	–	44	S	4.5	–	–	34.7	–	–	18.8
Star	Exp 9422	*[6]	–	–	42	Rps1k	4.0	–	–	35.5	–	–	18.2
KSC/Challenger	K2333	*[6]	–	–	42	Rps1	5.0	–	–	32.8	–	–	20.3
Kaltenberg	KB224	*[6]	–	–	42	S	5.0	–	–	34.9	–	–	18.6
Latham	EX480	*[6]	–	–	41	S	3.5	–	–	31.9	–	–	20.9
Prairie Brand	PBX 232	*[6]	–	–	41	Rps1c	5.0	–	–	33.3	–	–	19.8
Thompson	EX 1193	*[6]	–	–	40	S	5.0	–	–	35.0	–	–	18.4
Ciba	3202	*[6]	–	42	39	S	4.5	–	35.4	35.2	–	18.3	18.4
Mark	MRK9423	*[6]	–	–	39	S	4.5	–	–	34.4	–	–	18.8
NK	S19-90	*[6]	47	45	39	Rps1c	4.5	34.2	33.3	32.2	18.6	19.5	20.4
Yield King	K-2555	*[6]	–	–	46	S	5.0	–	–	34.0	–	–	19.3
Cenex/LOL	L2233	*[6]	–	–	46	Rps1k	3.5	–	–	36.0	–	–	17.7
Stine	Ex 2550	*[6]	–	–	44	S	3.5	–	–	33.2	–	–	19.9
Great Lakes	GL2237	*[6]	–	–	44	Rps1k	4.0	–	–	35.8	–	–	17.9
Prairie Brand	PBX 252	*[6]	–	–	43	S	4.5	–	–	33.4	–	–	19.7
Golden Harvest	X228	*[6]	–	–	42	Rps1	5.0	–	–	33.2	–	–	20.0
Ramy	R2393	*[6]	–	–	41	Rps1k	5.0	–	–	33.8	–	–	19.2
Pioneer	9231	*[6]	47	44	40	Rps1k	4.0	35.9	35.2	34.7	17.5	18.2	18.6
Dyna-Gro	DG3240	*[6]	–	–	42	S	5.0	–	–	33.8	–	–	19.3
HyPerformer	Hy271	*[6]	–	–	41	S	5.0	–	–	33.7	–	–	19.3
LSD 20%			1	2	2								

[1] 1 = excellent, 5 = poor, see text for additional explanation; [2] Specific genes noted, S = susceptible; [3] 13 percent moisture; [4] Blend (information furnished by originator); [5] Not mature at frost, estimated maturity date; [6] Not mature at frost, unable to estimate date.

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.

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 1 1/2 to 2 bushels of oat			70	4/square foot	
	Fababean-medium size	60	1,300	180	5/square foot	Early spring
	With 2 bushels of oat			60	2/square foot	
	Lentil-small	60	15,600	55	20/square foot	Early spring
	Lupine 6– to 8–inch rows	60	1,500	170	6/square foot	Early spring
	30–inch rows			70	6/foot of row	
	Millet Foxtail	48	218,000	15	75/square foot	June 15 to July 15
	Proso	56	65,000	20	30/square foot	June 15 to July 15
	Mustard Yellow	56	90,000	12	25/square foot	May
	Oriental, Brown	50	180,000	6	25/square foot	May
	Rape Forage	50	145,000	6	20/square foot	Early spring with oat
	Oilseed	50	136,000	8	25/square foot	May
	Sudangrass 18– to 40–inch rows	40	44,000	10	25/foot of row	May 20 to June 10
	6– to 14–inch rows			20	20/square foot	
	Sweetclover	60	240,000	10	55/square foot	Early spring
	Tangierpea	60	4,500	85	9/square foot	Early spring
	Wild rice (wet)	25	7,900	33	6/square foot	Late fall

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