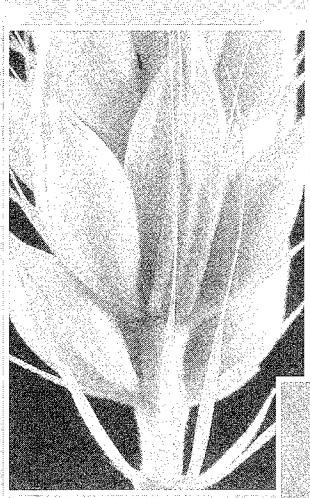
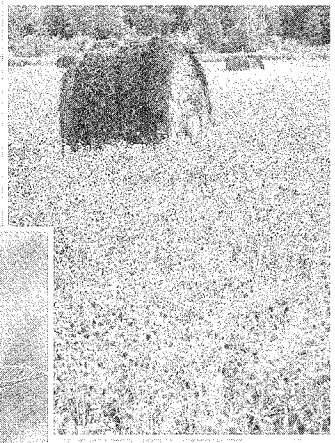
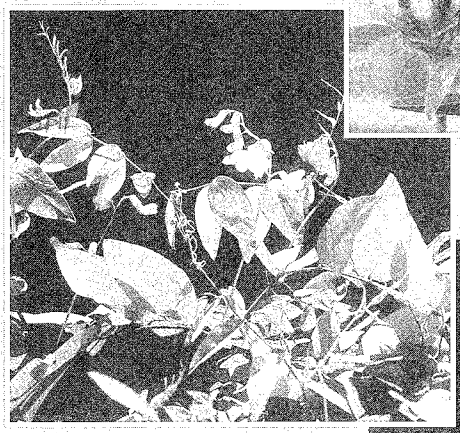
996 Edition

VARIETAL TRIALS

OF SELECTED FARM CROPS







FORAGE, GRAIN AND OILSEED CROPS PLANTING RATES, DATES

Minnesota Agricultural Experiment Station — University of Minnesota
Minnesota Report 239–1996 (MR–5615–F)

CONTENTS

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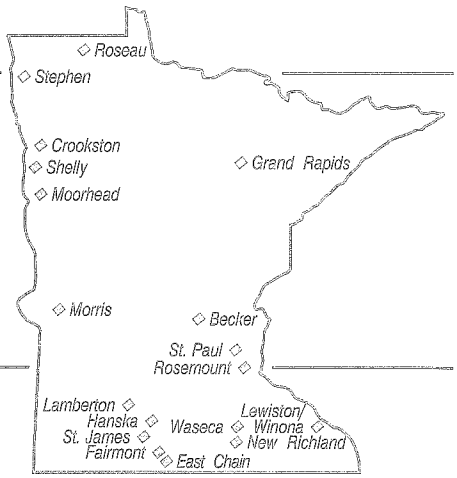

Locations of varietal trials reported in this publication.

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

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

Variety Classifications

Varieties of many of the evaluated crops are classed into groups under headings such as "recommended varieties," "varieties not adequately tested," "special purpose varieties", "other varieties," "privately developed varieties," etc. Some crops have further groupings within these categories. Varietal descriptions are arranged in alphabetical order within groups. "Public" and "private" designations are also attached to the group headings for some crops.

Classifications of varieties as "recommended," "other" and "special purpose" are determined each year by the 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 these 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 1996 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 agents' offices.

Interpreting the Tables

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

If the yield difference between two varieties equals or exceeds the LSD value listed at the bottom of each yield column, one can conclude that the higher yielding variety was superior in yield. If the difference is less, the yield difference was probably due to environmental rather than varietal differences. The notation "NS" in a column indicates no significant difference exists for that characteristic.

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

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

Protection Act Changes

Changes have been recently made to the U.S. Plant Variety Protection Act. As a result, varieties receiving their registration beginning in 1995 are identified by the code "PVP(94)." These varieties may *not* be sold by a producer, not even to a relative or neighbor, without the express permission of the variety's developer/owner.

Authors and Researchers

Authors of the crop sections are: E.A. Oelke (canola); N.P. Martin, N.J. Ehlke and C.C. Sheaffer (alfalfa, birdsfoot trefoil, orchardgrass, reed canarygrass, red clover, tall fescue and timothy); D.C. Rasmusson (barley); D.D. Stuthman (oat); J.H. Orf (soybean); R.H. Busch (durum, hard red spring, and winter wheat); R. Porter (wild rice).

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

Field work of the varietal trials at Waseca, Lamberton, Morris, Crookston-Stephen, and Grand Rapids was supervised by T. Hoverstad, S. Quiring, N. Barber, J.V. Wiersma, and R. Mathison, respectively.

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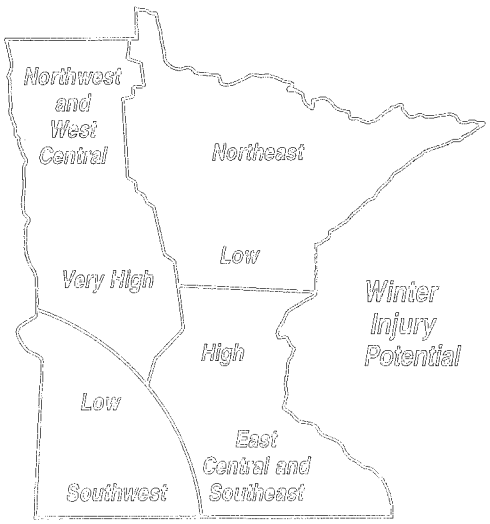
FORAGE CROPS

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, 1991-92, and 1994-95 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 experience frequent severe winters. Winter-hardy varieties with high levels of disease resistances should be selected for this area. The southwest area seldom experiences severe winter injury because of dry soils, high soil potassium levels and neutral soil pH. The northeast area 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, which is an indication of rate of growth after cutting and, to a lesser degree, winter hardiness. Very fall dormant varieties produce very little fall growth and are slow to recover after cutting. They usually are not high yielding, recover slowly for the second crop and produce only a small third crop because of early cessation of growth. Nevertheless, these 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 a 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. These latter reduced yields are usually associated with winter injury.

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

The Minnesota Agricultural Experiment Station and USDA released the non-dormant nonwinter-hardy variety, Nitro, in 1986. 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 was the first alfalfa variety selected for specialized nitrogen accumulation attributes.

Other nonwinter-hardy varieties not listed in the tables include 5715, 5888, 13R Supreme, Condor, DK 189, El Grande, Falcon, GT 13R Plus, Madera, Magna 8, Maricopa, Mesa, Moapa 69, Pierce, Prestige, WL 516, WL 525 HQ, Yolo, 5939, CUF 101, Florida 77, Mecca, Mecca II, Sundor, SW 14, UC Cibola, WL 605, and WL 612.

Forage Quality

Alfalfa varieties differ in forage quality or feeding value. Alfalfa varieties have been evaluated for forage quality at Rosemount on a fee basis since 1991 (Table 3). Varieties in the seeding year are evaluated on one cut taken in late August. Production year evaluation (first year after seeding only) is done by analyzing each of three cuttings taken at late bud to $^1/_{10}$ bloom stages of maturity.

Relative feed value index ranks varieties on their potential digestible dry matter intake. Milk per acre is estimated using a variety's crude protein and neutral detergent fiber concentrations to determine the amount of alfalfa needed to match the protein and energy needs of a 1,350 pound cow producing 60 pounds of milk per day with a diet including corn grain and minerals. Milk per acre combines quality (milk per ton) and yield estimates of an alfalfa variety.

Disease Resistance and Stand Persistence

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

is 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 after seeding. Stand reductions after winter are often due to a combination of wilt damage and winter injury.

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

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

Anthracnose—This fungus disease was first found in Minnesota in 1978 and has become more prevalent each year, but only in

Alfalfa is the mainstay of forage crops in Minnesota. Tours at the branch experiment stations regularly draw producers seeking the latest information from agronomist Craig Sheaffer.

Table 1. Fall dormancy score and disease resistance of alfalfa varieties eligible for certification and marketed in the Minnesota area. Order is alphabetical within each fall dormancy rating.

Variety	Developer or Marketer †	Fall Dormancy	Bacterial Wilt	Phytophthora Root Rot	Fusarium Wilt	Anthracnose	Verticillium Wilt	Aphanomyces Root Rot
		rating ‡	rating §					
Very Fall Dormant								
Runner	Geertson Seed Farms [19]	1	R	S	R	S	S	—
Spredor 3	Northrup King Co. [38]	1	HR	MR	HR	R	MR	S
Teton #	S.Dakota Agr.Exp.Sta. [1, 16]	1	LR	LR	MR	S	—	—
Travois #	S.Dakota Agr.Exp.Sta. [1, 16]	1	R	S	MR	S	—	—
Fall Dormant								
2555ML	Olds/Payco Seed Co. [27, 39]	2	HR	HR	HR	HR	R	R
5262	Pioneer Hi-Bred Int'l. [42]	2	HR	R	MR	—	LR	—
620	ICI Seeds [26]	2	HR	HR	HR	HR	R	R
A-295	PGI/MBS, Inc. [34]	2	HR	HR	HR	R	R	MR
ABT 205	ABI/Seed Mart [47]	2~	HR	HR	HR	HR	R	R
Agate	USDA/Minn. Agr. Exp. Sta. [1, 16, 32, 43, 45, 53]	2	HR	R	HR	MR	—	—
Alfagraze	America's Alfalfa [1, 5, 27, 39, 50]	2	MR	LR	R	MR	—	—
Alpine	Oasis/Spangler Seeds [6]	2	R	R	R	R	R	—
Avalanche +Z	America's Alfalfa [1, 5, 27, 39, 50]	2	HR	HR	HR	HR	HR	R
Bounty	PGI/MBS, Inc. [34]	2~	HR	HR	HR	HR	R	R
Clipper	Interstate/Payco Seed [27]	2	HR	R	HR	R	R	—
Dividend	Agway/Allied Seed [4]	2	HR	HR	HR	HR	R	R
DK 122	DEKALB Genetics Corp. [15]	2	HR	HR	R	HR	R	—
Evolution	Mycogen Plant Sciences [35]	2	HR	HR	HR	HR	R	R

the east central and southeast area. It infects stems and crowns and kills susceptible plants. The disease is favored by hot, moist conditions, and will therefore be most frequently observed in southeast Minnesota.

Verticillium Wilt—This potentially destructive fungus disease was first found in several eastern Minnesota fields in 1981. It has usually been found in 2- or 3-year-old fields. Its spread in the state has been slow. Planting resistant varieties will help provide insurance for long-lived stands. Varieties having at least a low level of resistance are indicated in Table 2.

Aphanomyces Root Rot—This is a relatively new disease associated with very slowly drained soils. It is easily confused with Phytophthora root rot. It stunts and kills seedlings as well as causing 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, then consider planting a variety with Aphanomyces resistance.

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 †	Fall Dormancy	Bacterial Wilt	Phytophthora Root Rot	Fusarium Wilt	Anthracnose	Verticillium Wilt	Aphanomyces Root Rot
		rating ‡	rating §					
Flagship 75	Peterson Seed Co. [43]	2	HR	HR	HR	R	R	LR
Forerunner	Research Seeds/Brown Seed [7]	2	HR	HR	HR	HR	HR	R
Garst 636	ICI Seeds [26]	2	HR	R	R	MR	R	—
GH 767	Golden Harvest [21]	2	HR	HR	HR	HR	R	R
Iroquois #	Cornell Univ. [1, 53]	2	HR	S	MR	S	S	—
Lactator	Peterson Seed/Elk Mound [17]	2~	HR	R	HR	HR	R	MR
LegenDairy	Cenex/Land O'Lakes [10]	2	HR	HR	HR	HR	HR	R
Milk Maker II	PGI/MBS, Inc. [29]	2	R	R	HR	—	—	—
Pacesetter	Research Seeds/Brown Seed [7]	2	HR	HR	R	HR	R	—
Profit	Ciba Seeds/Wensman [53]	2	HR	R	HR	MR	R	—
Sterling	Cargill Hybrid Seeds [9]	2	HR	HR	HR	HR	R	R
VERNAL	USDA/Wisc. Agr. Exp. Sta. [1, 16, 32, 43,45]	2	R	—	MR	—	—	—
Viking 1	Northrup King Co. [38]	2	R	R	HR	R	HR	—
WL 225	W-L Research, Inc. [3, 25, 30, 37]	2	HR	HR	HR	MR	R	—
WL 252 HQ	W-L Research, Inc. [3, 25, 30, 37]	2	HR	HR	HR	HR	R	LR
Wrangler	USDA/Nebr. Agr. Exp. Sta. [1, 16, 32, 41, 43, 45, 53, 54]	2	R	HR	R	LR	LR	—
Moderately Fall Dormant								
120	DEKALB Genetics Corp. [15]	3	HR	R	LR	LR	—	—
2833	Ciba Seeds [11]	3	HR	HR	HR	HR	R	—
3452-ML	Olds/Payco Seed [27, 39]	3	HR	HR	HR	HR	R	R
5246	Pioneer Hi-Bred Int'l. [42]	3	HR	HR	HR	HR	R	MR
5312	Pioneer Hi-Bred Int'l. [42]	3	HR	HR	HR	HR	HR	R
A-395	PGI/MBS, Inc. [34]	3~	HR	HR	HR	HR	R	R
Accolade	Chemgro/MBS [34]	3	R	R	R	R	HR	—
Achieva	Agway/Allied Seed [4]	3	R	HR	HR	HR	R	R
Allegiance	Keltgen Seed/Lynks Seed [31]	3	R	R	R	HR	R	—
Arrow	America's Alfalfa [1, 5, 50]	3	HR	HR	HR	MR	R	—
Blazer XL	Cenex/Land O'Lakes [10]	3	R	HR	HR	HR	R	R
Bolt ML	Research Seeds/Jung Seed [28]	3	R	HR	HR	HR	R	HR
break-thru	Custom Farm Seed [13]	3	HR	HR	HR	MR	R	—
Centurion	Agway/Allied Seed [4]	3	HR	R	R	R	R	—
CIBA 2888	Ciba Seeds [11]	3	HR	HR	HR	HR	R	R
Complete	Peterson Seed/Fontanelle [18]	3~	HR	HR	HR	HR	HR	R
Crown #	Cargill Hybrid Seeds [9]	3	R	R	R	HR	R	—
Crown II	Cargill Hybrid Seeds [9]	3	HR	HR	HR	HR	R	—
Cut 'N'Graze	AgriPro Seeds, Inc. [2]	3	R	R	HR	MR	LR	LR
Dart	AgriPro Seeds, Inc. [2]	3	HR	HR	HR	R	R	—
Dawn	AgriPro Seeds, Inc. [2]	3~	HR	HR	HR	R	R	MR
Demand	AgriPro Seeds, Inc. [2]	3	HR	HR	HR	HR	HR	R
DK 127	DEKALB Genetics Corp. [15]	3	HR	HR	R	HR	R	HR
Envy	Peterson Seed Co. [29]	3	HR	R	HR	HR	R	—
G 2841	Ciba Seeds [11]	3	HR	R	R	R	R	—
Garst 645	ICI Seeds [26]	3	HR	HR	R	HR	R	MR
GH 777	Golden Harvest Seeds [21]	3	HR	HR	HR	R	R	R
GH 787	Golden Harvest Seeds [21]	3	HR	HR	R	HR	R	R
Green Field	Hoegemeyer Hybrids [43]	3	HR	HR	HR	HR	R	R

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

Variety	Developer or Marketer †	Fall Dormancy	Bacterial Wilt	Phytophthora Root Rot	Fusarium Wilt	Anthracnose	Verticillium Wilt	Aphanomyces Root Rot
		rating ‡	rating §					
Guardian	AgVenture [3]	3	HR	HR	HR	HR	HR	R
Hyland	Oasis Seed [6]	3	HR	HR	HR	R	R	MR
Impact	Peterson Seeds [41]	3	HR	R	HR	MR	R	—
Imperial	Top Farm Hybrids [5]	3	HR	HR	HR	HR	R	R
Innovator +Z	America's Alfalfas [5, 27, 39]	3	HR	HR	HR	HR	R	R
LG 9323	Research Seeds/Shissler [33]	3	HR	HR	HR	R	R	HR
Lightning	Jung Seed Genetics [28]	3	HR	HR	HR	HR	R	HR
MagnaGraze	Dairyland Seed Co. [14]	3	HR	HR	HR	R	R	R
Magnum III-Wet	Dairyland Seed Co. [14]	3	R	R	R	MR	MR	MR
Majestic	Allied Seed Coop [4]	3	R	R	HR	HR	HR	—
Max 329	Seed Mart, Inc. [47]	3~	HR	HR	HR	HR	HR	R
Milk Maker #	Kaltenburg Seed Farms [29]	3	R	MR	HR	MR	—	—
MP2000	Cenex/Land O'Lakes [10]	3	HR	HR	HR	HR	R	HR
Multi-plier	Mycogen Plant Sciences [35]	3	HR	HR	HR	HR	R	—
MultiGem	Peterson Seed Co. [41]	3~	R	R	HR	R	R	—
MultiKing 1	Northrup King Co. [38]	3	HR	R	HR	R	R	—
Oneida #	Cornell Univ. [32]	3	HR	HR	HR	S	—	—
Oneida VR	N.Y.S.I.P. [32, 41, 53]	3	R	MR	HR	MR	HR	—
Proof	Keltgen Seed Co. [31]	3	HR	HR	HR	HR	R	R
Ranger #	USDA/Nebr. Agr. Exp. Sta. [1, 16]	3	MR	S	MR	S	S	—
Renegade	Geertson Seed Farms [19]	3	R	R	MR	—	LR	—
RFV-2000	Custom Farm Seed [13]	3	HR	HR	HR	HR	R	LR
Royalty	Cargill Hybrid Seeds [9]	3	HR	HR	HR	HR	R	LR
Sierra	NC+ Hybrids [36]	3	HR	HR	HR	R	R	MR
Stampede	Allied Seed Coop [41]	3	HR	HR	R	—	R	R
Surpass	R.J. Hunt Seed Co. [45]	3	HR	R	HR	MR	R	—
Synergy	Peterson Seed/Crow's [12]	3~	HR	HR	HR	HR	R	R
Thrive	Great Lakes Hybrids [22]	3	HR	HR	HR	HR	R	—
Total +Z	America's Alfalfa [5, 50]	3~	HR	HR	HR	HR	HR	R
Treasure	Clark Seeds [1]	3	HR	R	HR	HR	R	—
Trident II	Cargill Hybrid Seeds [9]	3	HR	HR	R	R	R	MR
UltraLeaf 87	La Crosse Seed Corp. [32]	3	HR	HR	HR	HR	R	R
Webfoot	Great Lakes Hybrids [22]	3	R	R	MR	—	—	—
Wetland	Great Lakes Hybrids [6]	3	R	HR	R	R	MR	MR
Wintergreen	Bio-Plant Research, Ltd. [46]	3	HR	HR	HR	HR	HR	R
WL 317	W-L Research, Inc. [3, 25, 30, 37]	3	HR	HR	HR	R	R	—
WL 324	W-L Research Inc. [3, 25, 30, 37]	3~	HR	HR	HR	HR	R	HR
5333	Pioneer Hi-Bred Int'l. [42]	4	HR	R	HR	HR	MR	—
5364	Pioneer Hi-Bred Int'l. [42]	4	R	MR	R	MR	MR	—
5454	Pioneer Hi-Bred Int'l. [42]	4	R	HR	HR	HR	MR	LR
630	ICI Seeds [26]	4	HR	R	R	MR	MR	—
631	ICI Seeds [26]	4	HR	HR	HR	R	R	MR
ABT 405	ABI/Seed Mart [47]	4~	HR	R	HR	HR	R	R
Aggressor	America's Alfalfa [1, 5, 50]	4	HR	HR	HR	HR	R	MR
AlfaStar	Hoffman Seeds/Sexauer [48]	4	HR	HR	HR	HR	R	R
Allegro	Keltgen Seed/Lynks Seed [31]	4	HR	HR	HR	HR	R	R
ALPHA 2001	Great Lakes Hybrids [22]	4	HR	HR	HR	HR	HR	R
Apollo Supreme	America's Alfalfa [1, 5, 50]	4	HR	R	HR	HR	R	—
Aspen	Brown Seeds/Seed Tec Int'l. [7]	4	HR	HR	HR	HR	R	R
Asset	Allied Seed Coop [4]	4	HR	HR	R	R	R	MR
BANQUET	W-L Research Inc. [51]	4~	HR	HR	HR	HR	HR	R
Cimarron VR	Great Plains Alfalfa Research [29]	4	HR	R	HR	HR	R	MR
Crystal	PGI/MBS, Inc. [34]	4	HR	HR	HR	R	R	LR
DK 133	DEKALB Genetics Corp. [15]	4	HR	HR	HR	HR	R	R
Dominator	AgriPro Seeds, Inc. [2]	4	HR	HR	HR	HR	R	R

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

Variety	Developer or Marketer†	Fall Dormancy	Bacterial Wilt	Phytophthora Root Rot	Fusarium Wilt	Anthracnose	Verticillium Wilt	Aphanomyces Root Rot
		rating‡	rating §					
Endure #	PAG Seeds/Cargill [9]	4~	R	MR	R	MR	R	—
Fortress	Northrup King Co. [38]	4	R	HR	R	—	R	—
GH 755	Golden Harvest Seeds [20]	4	HR	HR	HR	HR	R	R
Good as Gold	Top Farm Hybrids [34, 49]	4	HR	HR	HR	R	R	LR
Gourmet Hay	Fred Gutwein & Sons [23]	4	HR	R	HR	HR	R	—
Jade	NC+ Hybrids [36]	4	HR	HR	R	R	R	—
Key	Great Plains Alfalfa Research [29]	4	HR	HR	HR	HR	HR	MR
Laser	Patriot Seeds [40]	4	HR	HR	HR	R	R	MR
Legend	Cenex/Land O'Lakes [10]	4	HR	HR	HR	HR	R	—
Magnum III	Dairyland Seed Co. [14]	4	R	R	R	MR	MR	LR
Magnum IV	Dairyland Seed Co. [14]	4	HR	HR	HR	R	R	MR
MultiQueen	Fred Gutwein & Sons [24]	4	HR	HR	HR	HR	R	R
Ovation	Callahan Seeds [8]	4	HR	HR	HR	HR	HR	R
Persist	Kaltenberg Seed Farms [29]	4	HR	HR	HR	R	R	MR
Quest	Renk Seed Co. [46]	4	HR	HR	HR	R	R	—
Rushmore	Northrup King Co. [38]	4	HR	HR	HR	HR	R	HR
Sabre	Allied Seed Coop [4]	4	HR	R	HR	HR	HR	—
Saranac #	Cornell Univ. [16]	4	R	S	R	S	S	—
Saranac AR #	Cornell Univ.	4	R	LR	R	HR	—	—
SuperCuts	AgriBioTech [47]	4	HR	HR	HR	HR	HR	R
Target II	Bio-Plant Research Ltd. [44]	4	HR	R	R	R	R	—
TMF Generation	Mycogen Plant Sciences [35]	4	HR	HR	HR	HR	HR	R
Venture	Halsey Seed/Top Farm Hybrids [5, 49]	4	HR	R	R	HR	R	R
Voyager #	Ziller Seed Co. [54, 55]	4	HR	R	R	MR	MR	—
Voyager II	Bio-Plant Research Ltd. [54, 55]	4	HR	HR	HR	R	R	MR
Webfoot MPR	Great Lakes Hybrids Inc. [22]	4	HR	HR	HR	HR	HR	R
WL 320	W-L Research Inc. [3, 25, 30, 37]	4	R	R	R	MR	MR	—
WL 322 HQ	W-L Research Inc. [3, 25, 30, 37]	4	HR	R	HR	MR	R	—
WL 323	W-L Research Inc. [3, 25, 30, 37]	4	HR	HR	HR	HR	R	R
Belmont	Great Plains Alfalfa Research [29]	5	HR	R	HR	HR	R	—
Nondormant								
Nitro	USDA/Minn. Agr. Exp. Sta. [41]	8	—	R	—	—	—	—

† 1996 seed sources are listed at the end of the forage crops section; ‡ Based on fall growth in mid-October after cutting 1st week of September: 9=tallest (tend to be least winterhardy), 1=shortest (alphabetical order within each dormancy rating); § 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 reported to (~) or published by the Certified Alfalfa Seed Council (1995/96 Edition). # Varieties no longer in CASC listing, retained here as historical reference for remaining seed supplies.

Table 2. Average yields of alfalfa varieties expressed as percentage of Vernal for all tests with one or more harvest years (1967-1995) in each of four climatological areas within Minnesota.†

	Average Yield for Years 1–2, 3 and 4 After Seeding															
	Rosemount & Waseca			Morris & Crookston			Lamberton			Grand Rapids			All Locations			
Variety	Yr1-2	Yr3	Yr4	Yr1-2	Yr3	Yr4	Yr1-2	Yr3	Yr4	Yr1-2	Yr3	Yr4	Yr1-2	Yr3	Yr4	Tests‡
	% of Vernal															
Very Fall Dormant																
Runner	—	—	—	98	95	88	—	—	—	—	—	—	98	95	88	1
Spredor 3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0
Teton #	—	—	—	102	102	95	—	—	—	—	—	—	102	102	95	1
Travois #	—	—	—	94	96	87	—	—	—	—	—	—	94	96	87	1

Table 2 (continued). Average yields of alfalfa varieties expressed as percentage of Vernal for all tests with one or more harvest years (1967-1995) in each of four climatological areas within Minnesota.[†]

	Average Yield for Years 1–2, 3 and 4 After Seeding															
	Rosemount & Waseca			Morris & Crookston			Lamberton			Grand Rapids			All Locations			
Variety	Yr1-2	Yr3	Yr4	Yr1-2	Yr3	Yr4	Yr1-2	Yr3	Yr4	Yr1-2	Yr3	Yr4	Yr1-2	Yr3	Yr4	Tests[‡]
	% of Vernal															
Fall Dormant																
2555ML	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
5262	108	105	—	106	107	114	103	113	101	108	107	—	106	108	111	15
620	115	—	—	110	—	—	—	—	—	—	—	—	113	—	—	3
A-295	110	95	—	—	—	—	—	—	—	—	—	—	110	95	—	1
ABT 205	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0
Agate	101	110	101	97	101	102	100	100	—	89	96	—	99	106	101	20
Alfagraze	104	85	99	97	106	102	101	117	—	103	94	—	100	99	101	7
Alpine	110	108	100	—	—	—	112	123	107	—	—	—	105	118	109	5
Avalanche +Z	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
Bounty	—	—	—	118	—	—	—	—	—	—	—		116	—	—	3
Clipper	104	96	84	102	107	109	100	91	100	106	102	103	103	101	102	10
Dividend	104	—	—	—	—	—	—	—	—	115	101	—	108	101	—	3
DK 122	106	60	82	102	108	116	107	120	101	105	100	—	105	103	106	17
Evolution	110	99	—	104	—	—	—	—	—	—	—	—	107	99	—	4
Flagship 75	101	92	—	—	—	—	—	—	—	—	—	—	101	92	—	1
Forerunner	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Garst 636	108	107	106	105	108	119	101	105	108	103	102	103	106	106	109	8
GH 767	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
Iroquois [#]	103	101	104	—	—	—	103	105	119	111	96	—	105	101	108	12
Lactator	107	97	—	—	—	—	—	—	—	—	—	—	107	97	—	1
LegenDairy	108	—	—	—	—	—	—	—	—	104	100	—	106	100	—	4
Milk Maker II	101	—	—	108	115	115	110	119	—	—	—	—	106	117	115	5
Pacesetter	104	—	—	—	—	—	—	—	—	112	93	—	107	93	—	3
Profit	107	111	108	104	93	105	106	112	106	101	111	114	105	106	108	13
Sterling	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
VERNAL	6.05	5.38	5.43	5.45	4.82	4.77	5.36	4.77	4.33	4.11	4.25	3.38	5.63	5.08	5.1	71
Viking 1	110	95	—	110	—	—	103	—	—	112	106	—	109	100	—	7
WL 225	103	90	—	87	98	109	101	101	105	107	107	102	98	97	107	6
WL 252 HQ	—	—	—	106	—	—	107	—	—	—	—	—	107	—	—	4
Wrangler	105	07	107	106	103	100	98	106	98	100	91	100	103	101	102	8
Moderately Fall Dormant																
120	111	115	111	103	107	106	103	—	—	112	107	—	109	112	110	10
2833	110	—	—	89	102	121	104	101	95	—	—	—	100	102	113	5
3452-ML	105	—	—	—	—	—	—	—	—	—	—	—	105	—	—	2
5246	108	98	—	115	—	—	106	—	—	107	109	—	109	103	—	11
5312	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3
A-395	110	—	—	—	—	—	—	—	—	—	—	—	110	—	—	1
Accolade	101	92	—	—	—	—	—	—	—	—	—	—	101	92	—	1
Achieva	107	91	—	111	—	—	—	—	—	—	—	—	108	91	—	4
Allegiance	95	101	—	97	107	111	111	118	123	104	109	—	100	107	114	7
Arrow	108	105	101	105	107	113	108	114	114	110	103	105	107	107	107	11
Blazer XL	101	—	—	101	98	102	105	103	—	—	—	—	103	101	102	3
Bolt ML	111	94	—	—	—	—	—	—	—	—	—	—	111	94	—	1
break-thru	103	95	92	88	97	111	102	93	121	103	93	—	99	95	109	8
Centurion	111	104	93	100	97	132	104	97	105	114	112	102	107	102	108	6
CIBA 2888	—	—	—	128	—	—	104	—	—	—	—	—	113	—	—	3
Complete	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Crown [#]	109	109	92	92	98	118	123	114	110	113	105	100	107	106	105	6
Crown II	112	—	—	96	107	111	110	124	98	—	—	—	106	116	107	6
Cut 'N'Graze	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1

Table 2 (continued). Average yields of alfalfa varieties expressed as percentage of Vernal for all tests with one or more harvest years (1967-1995) in each of four climatological areas within Minnesota.[†]

	Average Yield for Years 1–2, 3 and 4 After Seeding															
	Rosemount & Waseca			Morris & Crookston			Lamberton			Grand Rapids			All Locations			
Variety	Yr1-2	Yr3	Yr4	Yr1-2	Yr3	Yr4	Yr1-2	Yr3	Yr4	Yr1-2	Yr3	Yr4	Yr1-2	Yr3	Yr4	Tests[‡]
	% of Vernal															
Dart	108	108	105	104	113	112	104	112	110	109	108	102	106	111	107	13
Dawn	101	98	89	107	112	115	—	—	—	94	98	—	102	101	102	8
Demand	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
DK 127	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
Envy	111	92	88	101	112	112	102	110	113	—	—	—	105	107	107	7
G 2841	97	81	71	79	92	110	103	105	105	105	105	—	95	95	99	7
Garst 645	106	102	96	112	129	114	111	151	—	—	—	—	109	127	105	8
GH 777	110	99	—	—	—	—	—	—	—	—	—	—	110	99	—	1
GH 787	101	—	—	—	—	—	—	—	—	109	98	—	104	98	—	3
Green Field	106	100	—	—	—	—	106	—	—	—	—	—	106	100	—	2
Guardian	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0
Hyland	110	108	—	104	109	106	—	—	—	—	—	—	110	108	—	1
Impact	110	94	94	105	103	108	112	102	105	112	105	102	109	102	102	6
Imperial	107	103	—	—	—	—	—	—	—	—	—	—	107	103	—	3
Innovator +Z	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
LG 9323	108	—	—	—	—	—	—	—	—	115	92	—	111	92	—	3
Lightning	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
MagnaGraze	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Magnum III-Wet	112	—	—	111	—	—	—	—	—	—	—	—	112	—	—	4
Majestic	103	105	96	109	119	96	105	123	—	100	104	—	104	113	96	5
Max 329	—	—	—	108	—	—	107	—	—	—	—	—	105	—	—	3
Milk Maker #	106	103	96	100	95	90	98	104	98	104	104	108	103	101	97	8
MP2000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Multi-plier	109	99	86	99	109	112	103	83	93	100	100	—	103	101	103	14
MultiGem	103	—	—	—	—	—	—	—	—	—	—	—	103	—	—	1
MultiKing 1	101	—	—	109	119	108	117	141	—	96	87	—	105	116	108	5
Oneida #	105	104	107	102	114	100	94	97	—	105	107	—	103	107	105	10
Oneida VR	101	106	103	97	117	107	98	109	111	105	103	95	99	109	105	7
Proof	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3
Ranger #	98	101	100	125	117	91	97	100	99	—	—	—	100	102	99	13
Renegade	111	80	94	103	98	115	101	105	—	96	102	—	104	96	105	5
RFV-2000	112	—	—	107	—	—	101	—	—	—	—	—	107	—	—	3
Royalty	105	97	91	90	99	111	101	107	109	102	95	—	100	99	105	7
Sierra	112	—	—	—	—	—	—	—	—	—	—	—	112	—	—	1
Stampede	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0
Surpass	114	108	105	104	105	—	108	105	101	108	110	107	110	107	105	6
Synergy	103	—	—	—	—	—	—	—	—	—	—	—	103	—	—	1
Thrive	101	89	93	106	103	109	102	—	—	106	110	—	103	101	101	8
Total +Z	—	—	—	—	—	—	102	—	—	—	—	—	102	—	—	2
Treasure	105	104	100	—	—	—	—	—	—	—	—	—	105	104	100	1
Trident II	105	94	89	106	113	114	108	134	—	104	106	—	106	112	105	8
UltraLeaf 97	106	—	—	—	—	—	—	—	—	104	103	—	106	103	—	5
Webfoot	105	106	104	104	104	105	100	109	—	102	102	109	103	105	105	8
Wetland	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Wintergreen	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3
WL 317	114	93	—	86	95	110	104	111	112	105	105	—	101	100	111	6
WL 324	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0
5333	94	96	87	107	113	106	105	119	—	—	—	—	102	109	97	3
5364	—	113	—	93	104	121	103	107	116	99	109	—	101	107	119	6
5454	110	—	—	116	—	—	107	—	—	115	110	—	112	110	—	10

Table 2 (continued). Average yields of alfalfa varieties expressed as percentage of Vernal for all tests with one or more harvest years (1967-1995) in each of four climatological areas within Minnesota.[†]

	Average Yield for Years 1–2, 3 and 4 After Seeding															
	Rosemount & Waseca			Morris & Crookston			Lamberton			Grand Rapids			All Locations			
Variety	Yr1-2	Yr3	Yr4	Yr1-2	Yr3	Yr4	Yr1-2	Yr3	Yr4	Yr1-2	Yr3	Yr4	Yr1-2	Yr3	Yr4	Tests[‡]
	% of Vernal															
630	110	113	106	102	100	137	107	107	111	99	112	111	107	109	115	10
631	113	—	—	116	—	—	103	—	—	—	—	—	112	—	—	4
ABT 405	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0
Aggressor	101	95	88	103	109	115	102	126	—	99	107	—	101	109	106	10
AlfaStar	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Allegro	109	98	—	95	120	115	—	—	—	—	—	—	109	98	—	1
ALPHA 2001	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Apollo Supreme	106	108	100	95	103	110	101	99	87	107	112	104	101	105	102	10
Aspen	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Asset	—	85	—	69	99	97	105	109	93	—	—	—	93	98	95	3
BANQUET	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Cimarron VR	96	—	—	99	97	89	110	111	—	100	101	—	100	102	89	6
Crystal	100	95	103	104	112	112	117	144	—	—	—	—	106	112	109	5
DK 133	109	96	—	108	115	108	109	—	—	122	98	—	110	103	108	11
Dominator	108	108	97	—	—	—	99	—	—	—	—	—	106	108	97	4
Endure [#]	107	100	100	104	110	97	103	117	110	110	94	—	106	104	102	7
Fortress	102	84	71	80	98	98	106	89	92	103	98	—	97	90	86	8
GH 755	108	91	—	117	—	—	—	—	—	—	—	—	110	91	—	4
Good as Gold	108	99	100	113	117	131	104	135	—	108	115	—	110	117	121	6
Gourmet Hay	101	—	—	113	130	105	103	118	—	—	—	—	106	124	105	3
Jade	—	109	—	116	121	124	107	131	—	109	108	—	113	118	124	6
Key	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0
Laser	—	—	—	117	—	—	103	—	—	—	—	—	110	—	—	2
Legend	97	102	—	89	98	109	101	91	110	101	103	—	96	99	109	6
Magnum III	110	110	92	106	103	132	116	132	106	104	108	107	110	114	106	9
Magnum IV	112	107	—	114	—	—	107	—	—	—	—	—	111	107	—	5
MultiQueen	—	—	—	127	—	—	102	—	—	—	—	—	111	—	—	3
Ovation	103	98	—	113	—	—	—	—	—	—	—	—	107	98	—	3
Persist	113	—	—	121	—	—	105	—	—	—	—	—	113	—	—	5
Quest	—	96	—	113	121	108	102	112	—	—	—	—	106	109	108	3
Rushmore	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
Sabre	99	91	92	—	—	—	—	—	—	102	98	—	100	94	92	3
Saranac [#]	103	99	98	106	109	110	103	101	104	—	—	—	103	101	101	27
Saranac AR [#]	105	95	90	100	101	99	100	97	—	95	109	—	102	97	92	19
SuperCuts	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Target II	110	84	92	111	106	125	—	—	—	105	97	—	109	96	108	4
TMF Generation	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0
Venture	103	98	—	—	—	—	—	—	—	—	—	—	103	98	—	3
Voyager [#]	111	108	90	102	110	113	103	110	107	107	119	112	107	111	106	7
Voyager II	112	—	—	—	—	—	—	—	—	—	—	—	112	—	—	3
Webfoot MPR	102	—	—	108	—	—	100	—	—	—	—	—	103	—	—	5
WL 320	109	110	109	106	102	93	112	105	108	112	102	—	109	105	105	6
WL 322 HQ	94	104	98	110	121	106	92	113	—	—	—	—	99	112	102	3
WL 323	107	97	—	110	—	—	101	—	—	—	—	—	105	97	—	4
Belmont	94	97	94	105	108	108	94	83	—	—	—	—	97	96	101	3
Non-dormant																
Nitro	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0

[†] Order of entries in this table parallels the fall dormancy ratings in table 1. Reference: Certified Alfalfa Seed Council (1995/96 Edition). [‡] Number of tests. Data for varieties having fewer than three tests is insufficient for short-term or long-term yield comparison. [#] Varieties no longer in CASC listing, retained here as historical reference for remaining seed supplies.

Table 3. Forage quality evaluation (expressed as percent of Vernal) for RFV[†] index and milk per acre[‡] of alfalfa varieties marketed in Minnesota.

Variety	1991/1992		1992/1992		1992/1993		1993/1994		1994/1994		Rosemount, MN 1995/1995[§]		Arlington, WI 1995/1995[§]	
	RFV	Milk/Ac	RFV	Milk/Ac	RFV	Milk/Ac	RFV	Milk/Ac	RFV	Milk/Ac	RFV	Milk/Ac	RFV	Milk/Ac
2833	—	—	94	127	110	109	—	—	—	—	—	—	—	—
5246	104	107	93	108	104	106	—	—	—	—	—	—	—	—
5312	—	—	—	—	—	—	—	—	96	98	—	—	—	—
5454	—	—	95	113	102	105	—	—	—	—	—	—	—	—
630	—	—	94	108	107	109	—	—	—	—	—	—	—	—
Agate	—	—	97	100	109	103	107	105	—	—	—	—	—	—
Avalanche +Z	—	—	—	—	—	—	—	—	101	95	—	—	—	—
Ciba 2888	—	—	—	—	—	—	—	—	—	—	112	89	89	84
Dart	—	—	95	118	106	99	—	—	—	—	—	—	—	—
Dawn	102	110	—	—	—	—	—	—	—	—	—	—	—	—
Dividend	—	—	103	120	108	104	—	—	—	—	—	—	—	—
DK 122	106	102	100	117	107	109	—	—	—	—	—	—	—	—
DK 127	—	—	—	—	—	—	—	—	—	—	108	97	106	107
DK 133	—	—	92	120	107	107	107	106	102	100	—	—	—	—
Dominator	—	—	94	116	105	98	—	—	—	—	—	—	—	—
Flagship 75	—	—	—	—	109	101	—	—	—	—	—	—	—	—
Garst 645	106	105	—	—	—	—	—	—	—	—	—	—	—	—
GH755	—	—	90	121	108	102	—	—	—	—	—	—	—	—
GH767	—	—	—	—	—	—	—	—	—	—	107	89	97	96
GH787	—	—	—	—	—	—	—	—	—	—	108	89	101	101
Good As Gold	—	—	95	118	105	102	—	—	—	—	—	—	—	—
Imperial	102	109	—	—	—	—	—	—	—	—	—	—	—	—
Innovator +Z	—	—	—	—	—	—	—	—	99	96	—	—	—	—
LegenDairy	—	—	105	118	110	104	—	—	—	—	—	—	—	—
Lightning	—	—	—	—	—	—	—	—	—	—	105	94	96	94
Magnum III	—	—	89	120	102	105	—	—	—	—	—	—	—	—
Magnum III-Wet	—	—	95	111	111	102	—	—	—	—	—	—	—	—
Magnum IV	—	—	91	116	99	102	—	—	—	—	—	—	—	—
MultiGem	—	—	—	—	—	—	107	97	—	—	—	—	—	—
Multiking 1	108	104	103	112	112	106	106	96	—	—	—	—	—	—
Oneida	—	—	92	107	106	103	102	109	100	100	—	—	—	—
Profit	—	—	95	119	109	103	—	—	100	100	—	—	—	—
Renegade	—	—	94	107	107	105	—	—	—	—	—	—	—	—
Rushmore	—	—	—	—	—	—	—	—	109	96	—	—	—	—
Saranac	—	—	—	—	—	—	—	—	101	98	—	—	—	—
Saranac AR	106	103	94	117	111	104	106	100	—	—	—	—	—	—
Sierra	—	—	93	122	103	109	—	—	—	—	—	—	—	—
Sterling	—	—	—	—	—	—	—	—	109	89	—	—	—	—
Thrive	—	—	94	108	102	103	—	—	—	—	—	—	—	—
Ultraleaf 87	—	—	—	—	—	—	—	—	—	—	114	97	97	97
Vernal	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Viking 1	—	—	90	112	106	103	—	—	—	—	—	—	—	—
WL 252 HQ	—	—	—	—	—	—	108	105	—	—	111	98	99	98
WL 322 HQ	—	—	110	111	111	105	108	104	107	98	108	83	102	102
Vernal	128	18118	154	3403	128	11684	119	13461	148	2986	133	3469	153	1946
Test Mean	133	16742	147	3867	136	12162	126	13848	151	2946	146	3208	150	1909
LSD .05	6	1067	9	342	7	NS	8	NS	NS	323	14	434	17	
CV[#]	3	5	4	6	4	5	4	6	6	8	7	9	8	

Bold indicates values are not significantly different from best entry; [†] RFV = Relative Feed Value index; [‡] Milk per acre is calculated using season average quality and season average yield at Rosemount. [§] 1995 seedings duplicated at Rosemount, MN and Arlington, WI; [#] CV = Coefficient of Variation. Smaller number indicates less variation between replicates.

BIRDSFOOT TREFOIL

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

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

Performance trials of birdsfoot trefoil were reestablished at Rosemount and Grand Rapids in 1993. The trial was harvested twice at Grand Rapids and three times at Rosemount during 1994 and 1995. Yields were lower at Grand Rapids than Rosemount, due to less favorable growing conditions.

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

Table 4. Dry matter yield (1994-1995) of birdsfoot trefoil varieties seeded at Grand Rapids and Rosemount.

	Rosemount			Grand Rapids			
Variety †	1994 ‡	1995 ‡ §	1995 #	1994 ‡	1995 ‡	1995 #	Mean
	tons DM/A						
AU-Dewey [52]	3.8	0.9	—	2.6	2.3	—	2.4
Carroll	4.3	3.8	—	2.7	3.2	—	3.5
Dawn	—	—	—	2.5	2.5	—	2.5
Empire [1, 10, 29, 32, 39, 41, 43, 45, 54]	—	—	4.8	2.7	2.8	2.4	3.2
Fergus	3.9	4.0	—	2.8	2.9	—	3.4
Leo [54]	—	—	4.7	—	—	2.5	3.6
Norcen [1, 10, 29, 32, 39, 43, 45, 50, 54, 55]	3.9	3.7	4.9	2.9	2.7	2.3	3.4
Viking [41]	—	—	4.6	—	—	2.4	3.5
LSD (0.05)	NS	0.5	NS	0.4	0.2	0.2	

† 1996 seed sources are listed at the end of the forage crop section; ‡ Trials established in 1993; § Severe winter injury in 1995; # Trials established in 1994.

ORCHARDGRASS

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

Orchardgrass varieties were established in pure stands in August 1989 at Rosemount, Grand Rapids and Morris. Severe winter injury at Morris destroyed the trial at that location.

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

Few differences were observed for the forage yield of orchardgrass at either experi-

Orchardgrass evaluations are conducted at Grand Rapids, Morris and Rosemount. Problems with overwintering remain a roadblock to the wide adoption of this crop across the state.

ment station location. Varieties which showed significant winter injury in May 1990 produced adequate forage yields during the 1990 growing season. However, yields were lower in 1991 and 1992 at Grand Rapids.

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

Table 5. Winter injury (1990), maturity (1992) and dry matter yield (1990–1994) of orchardgrass varieties seeded at Grand Rapids and Rosemount. †

	Winter Injury			Forage Yield								
				Grand Rapids					Rosemount			
Variety ‡	Grand Rapids	Rosemount	Maturity	1990	1991	1992	1993	1994	1990	1991	1992	Mean
	score §		rating #	tons DM/A								
Ambassador [52]	2.6	1.8	7.9	4.6	2.6	2.6	4.2	3.6	5.4	4.5	4.2	4.0
Crown [39, 50]	2.4	1.5	6.8	4.6	2.7	2.6	4.3	3.4	5.1	4.5	4.1	3.9
Dawn [10]	2.3	2.0	4.5	4.7	2.9	2.6	4.0	3.7	5.5	4.4	3.8	4.0
Elsie	2.3	2.0	6.8	4.6	2.9	2.2	4.3	3.5	5.4	4.8	4.1	4.0
Justus [52]	2.8	3.8	6.0	4.5	2.4	2.3	4.2	3.4	5.2	4.6	4.2	3.8
Napier	2.4	2.0	7.0	5.0	2.9	2.5	4.1	3.4	5.0	4.5	4.3	3.9
Orbit	2.5	2.3	3.8	4.3	2.6	2.6	4.0	3.4	5.0	4.4	4.1	3.8
Orion [29, 39, 50]	2.6	1.0	4.3	4.8	2.9	2.7	4.4	3.5	5.8	4.9	4.3	4.1
Potomic [16, 29, 32, 39, 41, 43, 45, 47, 49, 54]	2.0	1.5	8.5	4.4	2.6	2.4	4.2	3.6	5.2	4.3	4.0	3.9
Shawnee	2.4	3.8	5.3	4.6	2.4	2.2	4.2	3.3	5.2	4.4	3.9	3.7
Sterling	2.1	2.3	7.5	4.1	2.4	2.7	4.3	3.4	5.4	4.6	4.5	3.8
LSD 5%	0.6	0.8	1.7	NS	NS	1.3	0.3	0.4	0.5	0.5	1.5	

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

RED CLOVER

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

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

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

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

Table 6. Percent stand (1992) and dry matter yield (1992-1994) of red clover varieties seeded at Grand Rapids and Rosemount.†

		Forage Yield					
		Grand Rapids		Rosemount			Mean
Variety	Stand‡	1992	1993	1992	1993	1994§	1992-93
	%	tons DM/A					
Acclaim [4]	79	3.2	3.0	5.4	4.5	1.3	4.0
Arlington [1, 10, 16, 29, 32, 39, 41, 43, 45, 54]	55	2.9	3.0	5.1	4.4	1.2	3.9
Marathon [1, 10, 29, 32, 39, 43, 45, 50, 54, 55]	68	2.9	3.2	5.1	4.7	1.5	4.0
Red Star [10]	68	3.1	3.4	5.3	4.8	1.0	4.2
LSD 5%	21	NS	NS	NS	NS	0.3	NS

† Trials established in 1991 at both locations and harvested 3 times during 1992 and 1993; ‡ Percent stand rated at Grand Rapids on June 9, 1992;§ Residual harvest taken at Rosemount on June 3, 1994.

REED CANARYGRASS

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

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

The most recent developments in reed canarygrass breeding have been the release of several 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. Hay should be harvested between heading and early bloom because quality declines with maturity.

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

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

Table 7. Dry matter yields (1990-1992;1994) of reed canarygrass varieties seeded at Morris, Grand Rapids and Rosemount.†

	Morris			Grand Rapids		Rosemount		
Variety	1990-92	1994	1995	1994	1995	1990-92	1994	1995
	tons DM/A							
Lara	—	—	—	—	—	—	3.0	3.7
Palaton [1, 10, 29, 39, 41, 43, 45, 50, 54]	3.8	5.8	7.2	3.0	3.7	6.9	3.2	3.8
Rise	4.0	—	—	—	—	6.2	—	—
Vantage [41]	4.0	5.7	7.1	2.7	3.8	6.3	3.3	4.0
Venture [43, 45, 50, 55]	4.3	5.6	6.7	2.7	4.0	7.1	3.2	3.9
LSD (0.05)	NS	NS	0.5	NS	NS	0.8	NS	NS

† Trials were established in 1993 at Morris, Grand Rapids and Rosemount. Morris was harvested three times and Grand Rapids and Rosemount were harvested two times in 1994 due to slower establishment at those locations; ‡1996 seed sources are listed at the end of the forage crops section.

The newer low alkaloid varieties of reed canarygrass have dramatically improved livestock performance in rotational grazing trials.

TALL FESCUE AND WHEATGRASS

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

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

The wheatgrasses are valuable, native forage species. They are especially suitable for growing in the northern Great Plains area of the United States. Wheatgrasses can produce excellent forage yields and sustained productivity under hay and pasture management systems either in monoculture or in mixtures with alfalfa or other suitable legumes. Recent releases of improved varieties have prompted interest in these species, especially in western areas of Minnesota.

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

Yields were high in 1993 and 1994 probably due to mild winters, and abundant rainfall and cool temperatures during the growing season. Severe winter injury in 1995 reduced forage yields significantly at Rosemount. The wheatgrasses did yield less forage than the tall fescue varieties, however the wheatgrasses are better adapted to environments drier than the previous growing seasons.

Table 8. Dry matter yields (1993-1994) and maturity (1994) of tall fescue and wheatgrass varieties seeded at Morris, Rosemount and Grand Rapids.†

		Forage Yield								
		Morris			Rosemount			Grand Rapids		
Variety‡	Maturity rating§	1993	1994	1995	1993	1994	1995#	1994	1995	Mean
		tons DM/A								
Tall Fescue										
Barcel [41, 43]	1	6.6	5.6	4.4	6.1	6.1	3.8	4.4	2.7	5.0
Fawn [1, 39, 41, 43, 50]	8	7.7	5.5	4.8	5.2	5.5	3.9	4.2	3.2	5.4
Ky 31–endophyte infected	2	7.0	5.4	4.8	6.6	6.4	4.4	5.1	3.2	5.3
Ky 31–endophyte free [1, 10, 15, 29, 39, 43, 50, 55]	4	7.2	5.4	5.0	6.6	5.8	4.4	4.6	3.0	5.2
Martin [52]	7	6.7	5.3	5.1	5.9	5.8	4.3	4.8	3.5	5.2
Mozark	7	6.8	5.8	4.9	6.2	5.7	4.2	4.8	3.4	5.2
Mustang	2	—	—	—	5.3	5.3	3.6	3.7	2.5	4.1
Stef	0	6.8	5.5	4.8	5.5	6.0	4.5	4.5	3.3	5.1
Wheatgrasses										
Manska	0	5.6	6.0	5.0	4.2	4.0	3.7	3.4	3.1	4.4
Newhy	0	—	—	—	4.1	3.6	—	3.5	2.6	3.5
Reliant	0	5.6	6.1	5.4	4.5	4.1	3.9	3.5	3.1	4.5
LSD 5%	1	0.7	NS	0.7	0.8	0.6	0.6	0.6	0.5	

† Trials established in 1992 at Morris and Rosemount and in 1993 in Grand Rapids; ‡ 1996 seed sources are listed at the end of the forage crops section; § Rating: 0=no panicle emergence to 9=complete panicle emergence scored on June 3, 1994 at Rosemount. # Winter injury severe at Rosemount resulting in low yields and stand loss of Newhy.

TIMOTHY

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

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

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

Varieties in the experiment station timothy trials were established in pure stands in August, 1989 at Grand Rapids and Rosemount, in 1992 at Rosemount and Morris and again at Grand Rapids in 1993. Nitrogen was appliedat all locations in the early spring and after each harvest at a rate of 40 to 50 pounds per acre.

Early maturing varieties of timothy had greater forage production than the late maturing varieties at all locations over all harvest years. At Morris and Rosemount, the yields of timothy were exceptionally high in 1993 and 1994. These results may be partially attributed to mild winters, and abundant rainfall and cool temperatures during the growing seasons. Timothy is normally less persistent than other cool-season grasses such as reed canarygrass.

Table 9. Dry matter yields (1993-1995) of timothy varieties seeded at Grand Rapids, Rosemount and Morris. †

Variety ‡	Grand Rapids		Rosemount			Morris			Mean #
	1994	1995	1993	1994	1995 §	1993	1994	1995	
	tons DM/A								
Early - Intermediate Maturity									
Climax [1, 10, 16, 29, 32, 39, 41, 43, 45, 47, 49, 50, 54]	3.8	3.9	4.8	4.7	1.9	5.5	4.0	4.0	4.4
Comtal [39]	3.9	3.6	4.6	5.1	1.5	—	—	—	4.3
Goliath	3.8	3.7	4.3	4.5	1.5	—	—	—	4.1
Timfor [38]	4.0	3.6	4.5	4.8	2.0	—	—	—	4.2
Toro	4.2	3.9	4.8	5.0	2.0	—	—	—	4.5
Late Maturity									
Heidemij	3.7	3.8	4.1	3.6	1.3	4.1	3.9	3.7	3.8
Hokusen	3.6	3.5	4.0	4.4	1.8	4.7	3.7	3.6	3.9
LSD 5%	0.6	0.3	0.6	0.4	0.4	0.5	NS	NS	

† Trials established in 1992 at Morris and Rosemount, and in 1993 at Grand Rapids; ‡ 1996 Seed sources are listed at the end of the forage crops section; § One harvest at Rosemount in 1995; # Mean excludes Rosemount, 1995 data.

CROP NOT IN CURRENT TRIALS

Bromegrass is generally grown for hay in mixture with alfalfa, or is used as pasture in mixture with other grasses and legumes. Varieties are classified as southern, intermediate, and northern types.

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

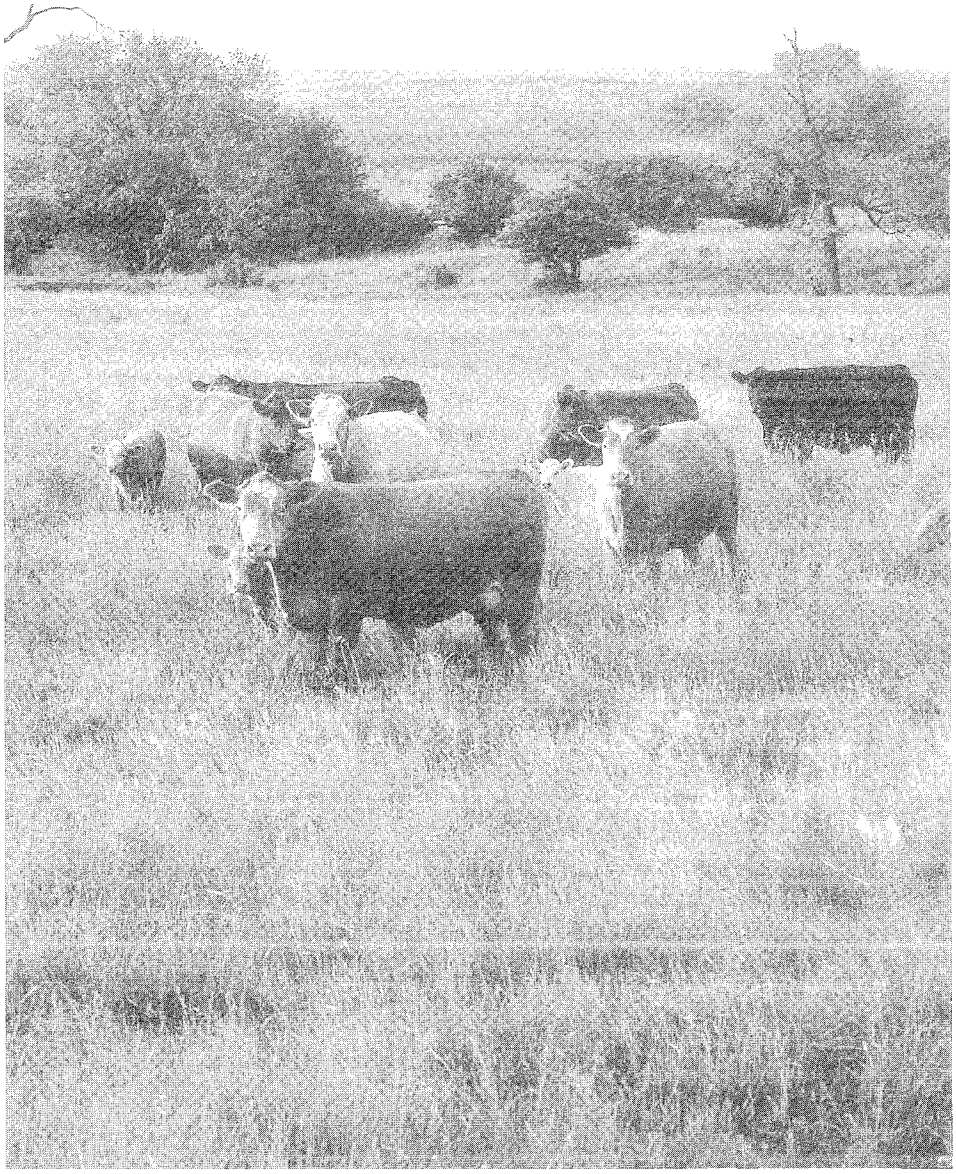
Varieties presently being sold in Minnesota are all of the southern type. All varieties are winter-hardy. Some stand losses may occur when bromegrass is managed under three- and four-cut alfalfa harvest systems.

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

1996 FORAGE SEED SOURCES

1. Agassiz Seed & Supply, 4121-1/2 S. University Drive, Fargo ND 58104, 701-241-9760
2. AgriPro Seeds, Inc., PO Box 2962, Shawnee Mission KS 66201, 913-384-4940
3. AgVenture East, Rte 2, Box 58, Kasson MN 55944, 800-657-4890
4. Allied Seed Cooperative, PO Box 945, Angola IN 46703, 800-813-5025
5. America's Alfalfa, PO Box 2962, Shawnee Mission KS 66201, 913-384-4940
6. Bio-Plant Research, Ltd., PO Box 320, Camp Point IL 62320, 800-593-7708
7. Brown Seed Farms, 1860 Woodland Dr., Red Wing MN 55066, 612-388-7824
8. Callahan Seeds, PO Box 367, Westfield IN 46074, 317-896-5551
9. Cargill Hybrid Seeds, Rte 1, Box 56, Plainview MN 55964, 507-534-2128
10. Cenex/Land O'Lakes, MS 680, PO Box 64089, St. Paul MN 55164-0089, 612-451-5490
11. CIBA Seeds, PO Box 6346, Rochester MN 55903, 507-280-0747
12. Crow's Hybrid Corn Co., Box 306, Milford IL 60953, 815-889-4151
13. Custom Farm Seed, Box 160, Momence IL 60954, 800-659-4307
14. Dairyland Seed Co., PO Box 958, West Bend WI 53095, 800-236-0163
15. DeKalb Genetics Corp., 7665 Commerce Way, Suite 101, Eden Prairie MN 55344, 612-934-0134
16. Discount Farm Center, PO Box 84, West Hwy 212, Watertown SD 57201, 605-886-5888
17. Elk Mound Seed & Farm Supply, PO Box 187, 308 Railroad Ave, Elk Mound WI 54739, 715-879-5556
18. Fontanelle Hybrids/Arrow Seed, Rte 1, Box 18, Nickerson NE 68044, 402-721-1410
19. Geertson Seed Farms, 1665 Burroughs Rd., Adrian OR 97901, 800-843-0390
20. Golden Harvest Seeds, Box A, Waterloo NE 68069, 402-779-2531

21. Golden Seed Co. LLC, 251 West Main St., Wabasha MN 55981, 612-565-2945
22. Great Lakes Hybrids, 19 Lamar Court, North Mankato MN 56003, 800-257-7333
23. Greenwald Elevator, 151 First Ave. S., Greenwald MN 56335, 612-937-3159
24. Gutwein/Blaney Seeds, RR1, Box 175, Sleepy Eye MN 56085, 507-794-4203
25. Harvest States Cooperatives/GTA Feeds,17944 82nd Way, Maple Grove MN 55311, 612-420-7712
26. ICI Seeds, PO Box 300, 615 Main St., Coon Rapids IA 50058, 800-831-1850
27. Interstate Payco Seed, 18597 555th Ave., Litchfield MN 55355, 612-857-2162
28. Jung Seed Genetics, 1229 NW 41st St, Rochester MN 55901, 507-288-1930
29. Kaltenberg Seed Farms Inc., 20155 Biscayne Ave. W., Farmington MN 55024, 612-463-8997
30. Kaystar Seed, Box 947, Huron SD 57350, 800-288-8791
31. Keltgen Seed Co., Box 209, Olivia MN 56277, 800-535-8436
32. La Crosse Seed Corp., 2615 Commerce St., LaCrosse WI 54601, 608-781-4848
33. LG Seeds, PO Box 216, 925 Dexter, Prescott WI 54021, 800-637-2887
34. MBS Inc., 225 West 1st St., Story City IA 50248, 515-733-5274
35. Mycogen Plant Sciences, 720 St. Croix, Prescott WI 54021, 800-321-2867
36. NC+ Hybrids, RR 2, Box 52, Sanborn MN 56083,507-648-3378
37. Norco Feeds, PO Box 56, Norfolk, NE 68702, 800-658-4388
38. Northrup King Co., PO Box 959, 7500 Olson Memorial Hwy, Golden Valley MN 55427, 612-593-7261
39. Olds/Payco Seed Co., Box 7790, Madison WI 53707-7790, 800-356-7333
40. Patriot Seed, Inc., 208 South Warrell, Bowen IL 62316, 217-842-5612
41. Peterson Seed Co., Inc., PO Box 346, Savage MN 55 378, 800-328-5898
42. Pioneer Hi-Bred Int'l., Inc., 130 Willmar Ave. SE, Willmar MN 56201-4582, 612-235-7420
43. Premium Seed Co., Inc., 7800 E. State Hwy 101, Shakopee MN 55379, 612-496-1783
44. Producers Hybrids, Inc., RR 1, Box C, Battle Creek NE 68715, 402-675-2975
45. R.J. Hunt Seed Co., RR 1, Box 112, Wadena MN 56482, 218-631-4190
46. Renk Seed Company, 6800 Wilburn Rd., Sun Prairie WI 53590, 800-289-7365
47. Seed Mart, Inc., PO Box 126, 110 N. Broad St., Prescott WI 54021, 800-206-5823
48. The Sexauer Co., PO Box 58, Brookings, SD 57006, 800-843-7929
49. Top Farm Hybrids, Box 850, 17177 60th St. SW, Cokato MN 55321, 612-286-5516
50. Trelay Inc., 11623 Hwy 80 N., Livingston WI 53554, 800-421-0397
51. Tri-State Seed, Box 354, Sleepy Eye MN 56085, 507-794-3078
52. Twin City Seeds, 7263 Washington Ave South, Edina MN 55439, 612-944-7239
53. Wensman Seed Co., 102 Aldrich Ave., SE, Wadena MN 56482, 800-456-4894
54. Werner Farm Seeds, 3104 Millersburg Blvd., Dundas MN 55019, 507-645-7995
55. Ziller Seed Co., RR 1, Box 122, Bird Island MN 55310-9730, 612-365-3674



GRAIN CROPS

BARLEY

Scab disease caused serious losses in barley in 1995, via reductions in yield and quality, and the production of vomitoxin. Until it reemerged and attacked Minnesota's barley crop in 1993, scab had not been a significant problem on barley since the 1940s.Currently recommended varieties appear to be equally susceptible to scab.

A significant recent change has been a decision by industry to add Stander to the list of approved malting varieties. Excel has recently been dropped from the list of varieties recommended by the University and Royal continues to be recommended as a forage companion crop and feed-grain variety.

Table 10. Long-term and recent yields of barley varieties (bushels per acre) at five locations.

Variety	Crookston	Morris	Stephen	St. Paul	Roseau	Mean
Long Term 1988-95 Trials						
Number of Trials:	*18*	*14*	*2*	*12*	*6*	*52*
Morex	88	71	56	84	79	80
Robust	95	77	67	88	92	87
Excel	108	85	76	94	100	96
Stander	107	82	75	97	105	96
LSD 0.05	3	3	10	3	8	2
Recent 1992-95 Trials						
Number of Trials:	*7*	*4*	—	*2*	—	*13*
Robust	90	90	—	86	—	90
Excel	105	100	—	97	—	102
Stander	105	103	—	105	—	104
Foster	98	90	—	99	—	96
LSD 0.05	4	5	—	7	—	3

Recommended Public Varieties

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

Stander—High yield. Superior in lodging resistance to Robust and Excel. Good kernel plumpness, similar to Robust. Six-rowed, semi-smooth awn, short rachilla hairs, colorless aleurone. Classified as a malting variety by AMBA. 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. Plant Variety Protection Act.

Special Purpose Varieties

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

Variety Not Adequately Tested

Foster—Medium yield. Maturity similar to Robust. Kernel plumpness similar to Stander. Intermediate in lodging between Robust and Stander. Resistant to spot blotch. Six-rowed, semi-smooth awns, colorless aleurone. Has long rachilla hairs allowing grain to be distinguished from that of Robust and Stander. Itchy like Excel. Malting quality status undetermined. Developed by North Dakota Agricultural Experiment Station from a cross involving Robust, ND 5570, Glenn and Karl. Released 1995. Seed sales regulated by the U.S. Plant Variety Protection Act, PVP(94).

Other 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. Yielded similar to Robust in Minnesota trials, but is not recommended because of limited Minnesota demand for a blue aleurone malting variety. Developed by North Dakota Agricultural Experiment Station from a cross

Table 11. Barley variety characteristics, 1992-95.

Variety	Heading (June)	Height (inches)	Lodging (%)	Plump Kernels (%)
Number of Trials:	*9*	*13*	*5*	*9*
Robust	21	33	32	82
Excel	21	30	30	74
Stander	22	30	24	88
Foster	21	31	33	87

Table 12. Characteristics of Royal barley compared to Robust and Stander, 1993-1995.

Variety	Height (inches)	Yield (bu/a)	Lodging (%)	Plump Kernels (%)
Number of Trials:	*12*	*15*	*8*	*10*
Robust	32	89	37	74
Stander	30	104	29	79
Royal	28	94	21	71

involving Bonanza, Nordic, and ND B130. Released 1982.

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

Excel—High yield. Medium maturity. Similar to Robust in lodging resistance. Kernel plumpness lower than Robust. Six-rowed, semi-smooth awn, colorless aleurone. Has long rachilla hairs allowing grain to be distinguished from that of Robust and Stander. Is an itchy barley. Classified as a malting variety by AMBA. Resistant to spot blotch. Developed by Minnesota Agricultural Experiment Station from cross involving Robust, Manker, and a sister-line of Morex. Released 1990. Seed sale regulated by U.S. Plant Variety Protection Act.

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

Lodging resistance is an important characteristic of high yielding malting barley varieties such as Morex and Robust. A more recently released variety, Stander, has surpassed these standbys with a "superior" lodging rating while retaining high yield.

Table 13. Forage composition (%) and yield (tons per acre) of Robust and Royal at soft dough stage of growth at St. Paul, Crookston, and Stephen.

Variety	Forage Composition † CP	NDF	ADF	ADL	Yield ‡
Robust	8.8	51.4	31.7	4.0	5.0
Royal	9.2	47.0	28.0	3.2	4.9
LSD 5%	NS	1.8	1.3	0.3	NS

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

OAT

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

Recommended Public Varieties

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

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

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

Special Purpose Varieties

Pal—Forage establishment only. Medium maturity, medium yield, very short, good lodging resistance, low test weight, medium groat percentage, yellow seed. Susceptible to crown rust and red leaf, resistant to smut. Selected at the Minnesota Agricultural Experiment Station and released in 1994 as a special purpose forage oat variety. It has good forage yield with high levels of crude protein and good relative feed value, although no forage data for Pal is provided in this publication.

Paul—Hulless. Late maturity, high yield for hulless cultivar, tall, good lodging resistance, hulless so very high test weight. Moderately resistant to crown rust, smut, and red leaf. Selected at North Dakota Agricultural Experiment Station. Released 1994. Seed sales regulated by the U.S. Plant Variety Protection Act, PVP(94).

Varieties Not Adequately Tested

INO 9201—Early maturity, very high yield, short, very good lodging resistance, high test weight, very high groat percentage, yellow seed. Moderately susceptible to crown rust and red leaf, susceptible to smut. Selected at the Purdue Agricultural Experiment Station. Released 1994. Foundation Seed available to Certified Seed producers only under a license/fee collection agreement. Application for Plant Variety Protection Certificate has been submitted. Because of smut susceptibility, planting only treated seed is recommended.

Jerry—Medium maturity, very high yield, tall, fair lodging resistance, very high test weight and groat percentage, ivory seed. Moderately resistant to crown rust, susceptible to smut, tolerant to red leaf. Selected at North Dakota Agricultural Experiment Station. Released 1994. Seed sales regulated by the U.S. Plant Variety Protection Act, PVP(94). Because of smut susceptibility, planting only treated seed is recommended.

Belle—Late maturity, high yield, tall, good lodging resistance, very high test weight and groat percentage, yellow seed, moderate resistance to crown rust and smut, good tolerance to red leaf. Selected at the Wisconsin Agricultural Experiment Station. Released 1995. Foundation Seed available to Certified Seed producers only under a license/fee collection agreement. Application forPlant Variety Protection Certificate has been submitted.

Classic—Early to medium maturity, high yield, medium height, good lodging resistance, medium test weight and groat percentage, yellow seed, moderately susceptible to crown rust, good resistance to smut, tolerant to red leaf. Selected at the Purdue Agricultural Experiment Station. Released 1995. Foundation Seed available to Certified Seed Producers only under a license/fee collection agreement. Application for Plant Variety Protection Certificate has been submitted.

Whitestone—Late maturity, medium yield, medium height, fair lodging resistance, fair test weight and groat percentage, white seed. Moderately susceptible to crown rust, susceptible to smut, some resistance to red leaf. Selected at North Dakota Agricultural

Table 14. Characteristics of oat varieties, 1995.

Variety	Heading	Height	Lodging	Test Weight	Groat	Reaction to Disease		
						crown Rust	Smut	red leaf
	DAP †	inches	score ‡	lbs/bu	percent	rating §	percent	rating #
Dane	47	30	1.9	37	71	MS	6	8.3
INO 9201	48	31	1.9	36	68	MS	40	6.0
Classic	50	33	1.8	35	67	MS	0	3.5
Jerry	51	34	2.5	38	69	MR	40	4.0
Pal	52	28	2.3	33	67	MS	0	6.5
Milton	52	33	2.1	35	69	MS	5	5.6
Troy	53	34	2.8	35	67	MS	0	5.2
Whitestone	55	33	3.0	35	65	MS	40	6.0
Belle	57	35	1.6	38	74	MR	1	5.0
Paul (hulless)	57	35	2.0	NA ††	NA ††	MR	0	4.5

† DAP = days after planting; ‡ 1= erect, 5 = flat; § MS = moderately susceptible, MR = moderately resistant; # 1 = no symptoms, 9 = dead; †† NA = Not applicable.

Table 15. Oat yield by location, 1993-1995.

Variety	Rosemount	Waseca	Lamberton	Morris	Crookston	Grand Rapids	Six Location Average	Roseau	Winona	Wells
	bu/A									
Dane	78	61	52	76	105	92	77	107	40	52
INO 9201 †	78	79	45	83	121	86	82	111	39	59
Classic ‡	84	76	49	78	115	84	81	—	—	—
Jerry †	93	77	57	77	120	89	85	130	46	71
Pal	59	59	47	52	104	66	65	82	46	52
Milton	79	71	49	93	129	93	86	141	44	57
Troy	85	82	53	88	136	76	87	138	43	42
Whitestone ‡	67	80	65	56	108	113	81	141	55	69
Belle ‡	84	82	64	98	145	99	95	—	—	—
Paul (hulless) †, §	51	43	49	69	101	68	64	96	39	39
LSD 5%	17	12	13	16	14	17	6	15	16	13

† 1994-1995 only; ‡ 1995 only; § Yields of hulless varieties should be adjusted upward by about one-third when comparing to seed yield of standard varieties.

Experiment Station. Released 1994. Application for Plant Variety Protection Certificate has been submitted. Because of smut susceptibility, planting only treated seed is recommended.

Other Varieties

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

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

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

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

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

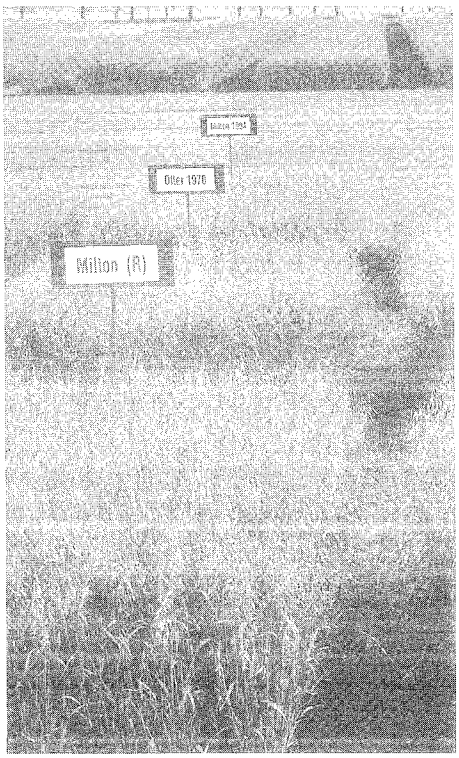
INO 9212—Medium maturity and yield, short, good lodging resistance, medium test weight, fair groat percentage, yellow seed. Susceptible to crown rust, smut and red leaf. Foundation Seed available to Certified Seed producers only under a license/fee collection agreement. Application for Plant Variety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

Premier—Medium maturity, yield and height, good lodging resistance, medium test weight, groat percentage and protein percentage, yellow seed. Susceptible to crown rust, resistant to smut, some tolerance to red leaf. Selected at the Minnesota Agricultural Experiment Station from a cross between Noble and an unreleased Wisconsin line. Released 1990. Seed sale regulated by U.S. Plant Variety Protection Act.

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

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

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



WHEAT (DURUM)

Only publicly developed varieties are currently being reviewed in experiment station trials. They are listed in maturity order in the table. *All durum varieties are very susceptible to scab.*

Publicly Developed Varieties

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.

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.

Munich—Awned, midseason to late, medium height and fair lodging resistance. Resistant to stem rust and moderately resistant to leaf rust. High yield, medium test weight, and high seed weight. Superior quality for export. Released by North Dakota Agricultural Experiment Station in 1995. Seed sales regulated by the U.S. Plant Variety Protection Act, PVP(94).

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.

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

Table 16. Characteristics of durum wheat varieties, 1993 and 1995. †

				Rust Reaction [4]				Yield			
Variety	Heading	Height	Lodging	Leaf	Stem	Seeds	Test Weight	Morris	Crookston	Stephen ‡	State Mean
	date	inches	score §	rating #		no/lb	lb/bu	(bu/A)			
Monroe	6-16	34	1.0	MR	R	10,700	58.7	26	33	31	30
Vic	6-18	36	1.0	MS	R	10,700	58.7	24	31	35	29
Mindum (check)	6-20	46	3.7	MS	S	10,700	58.4	24	31	30	28
Munich	6-21	35	0.8	MR	R	10,500	58.5	26	33	—	30
Renville	6-21	37	0.7	MR	R	10,500	58.3	29	33	32	31
Cando	6-22	28	0.3	S	R	10,800	57.3	21	28	29	25

† 1993 and 1995 data, 1994 data not usable due to scab; ‡ 1993 only; § 1 = erect, 9 = flat; # Reaction to prevalent races: R = resistant, MR = moderately resistant, MS = moderately susceptible, S = susceptible.

WHEAT (HARD RED SPRING)

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

The scab epidemics in hard red spring wheat growing areas have demonstrated the clear need to give greater weight to selecting varieties for their tolerance to this devastating disease. Consequently, only newly released varieties where reaction to scab has not been well documented, and older varieties with scab ratings better than susceptible, are tested and described. *Those varieties with seed available, but found to be susceptible are 2371, 2398, Bergen, Dalen, Gus, Krona, Minnpro, Norm, Prospect, Sonja, Vance, and Wheaton.*

Table17 presents long term grain yield for varieties grown at various locations in Minnesota. Other important agronomic, disease and bread-making quality characteristics are in table18.

Scab evaluations provide *severity ratings,* based on visual spread of the disease on the spike, and *tolerance scores,* which reflect the variety's ability to maintain plump seed. The accompanying tables should be used in conjunction with each other to reduce risk of loss. Use of more than one variety is also highly recommended to reduce risk.

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

Publicly Developed Varieties

Butte 86—Awned, early, medium height. Resistant to stem and moderately resistant to leaf rust. High yield and test weight. Medium protein percent. Moderately susceptible to tan spot, black chaff, and lodging. Best adapted south of I-94. Released by North Dakota Agricultural Experiment Station in 1986.

Grandin—Awned, early, semidwarf. Resistant to stem rust and leaf rust. High yield and test weight. Good lodging resis-

tance. Moderately tolerant to loose smut. High protein percent. Moderately susceptible to foliar diseases. Released by North Dakota Agricultural Experiment Station in 1989.

Kulm—Awned, early, medium height. Moderately resistant to leaf rust and resistant to stem rust. High yield and test weight. High protein percentage. Moderately susceptible to lodging. Released by North Dakota Agricultural Experiment Station in 1994. Seed sales regulated by the U.S. Plant Variety Protection Act, PVP(94).

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

Russ—Awned, early-midseason maturity, medium height. Moderately resistant to stem rust and leaf rust. High yield and medium test weight. Moderately susceptible to lodging. Medium protein percent. Moderately susceptible to foliar diseases. Released by South Dakota Agricultural Experiment Station in 1995.

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

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

Verde—Awned, midseason-late maturity, semidwarf. Resistant to stem rust and moderately resistant to leaf rust. High yield and medium test weight. Good lodging resistance. Medium to low protein percent. Moderately resistant to foliar diseases. Released by Minnesota Agricultural Experiment Station and USDA-ARS 1995. Seed sale regulated by the U.S. Plant Variety Protection Act, PVP(94).

Variety Not Adequately Tested

Trenton—Awned, early, medium height. Resistant to stem rust and moderately resistant to leaf rust. High yield and medium test weight. Moderately susceptible to lodging. Medium-high protein percent. Moderately susceptible to foliar diseases. Recommended by North Dakota State University for western and central North Dakota. Released by North Dakota Agricultural Experiment Station in 1995. Seed sale regulated by the U.S. Plant Variety Protection Act, PVP(94).

Privately Developed Varieties

2375—Awned, early, medium height. Resistant to stem rust and moderately resistant to leaf rust. Tolerant to loose smut. Very high yield and test weight. Medium to high protein percent. Moderately susceptible to lodging, shattering and foliar diseases. 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. Plant Variety Protection Act.

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

Hamer—Awned, early-midseason maturity, semidwarf. Resistant to stem rust and moderately resistant to leaf rust. High yield and medium test weight. Good lodging resistance. Medium to low protein percent. Moderately resistant to foliar diseases. Released by AgriPro 1995. Seed sale regulated by the U.S. Plant Variety Protection Act, PVP(94).

Table 17. Characteristics of hard red spring wheat varieties †, 1993-95.

Variety	Heading	Height	Lodging	Rust reaction		Test Weight	Wheat Protein	Scab		Milling/Baking
				Leaf	Stem			Severity §	Tolerance #	
	date	inches	score ‡	rating §		lbs/bu	% ††	rating		quality
Sharp	6-23	33	3.6	MR	R	58.5	15.0	MS	3	Medium-High
Kulm	6-23	35	3.0	MS	R	57.5	15.4	MS	3	High-Medium
Norlander ##	6-23	31	2.2	MR	MS	55.5	14.7	S	5	Medium
Butte 86	6-24	33	2.9	MR	R	57.0	15.1	MS	4	Medium-High
2370	6-25	31	2.6	MS	MR	56.0	14.7	MS	3	Medium
2375	6-25	31	4.5	MR	R	57.9	14.9	MR	1	Medium
Russ	6-25	33	3.9	MR	MR	56.2	14.7	MS	3	Medium
Grandin	6-25	32	2.7	R	R	57.3	15.5	MS	2	High
Hamer ##	6-26	31	2.0	MR	R	56.0	14.5	MS	3	Medium-Low
Trenton ##	6-26	36	3.4	R	MR	57.0	15.4	S	2	High-Medium
Lars ##	6-27	28	2.3	MR	R	54.6	14.2	MS	4	Medium-Low
Verde	6-27	31	2.2	MR	R	56.0	14.4	MS	2	Medium
Stoa	6-27	36	3.8	R	R	55.3	15.2	MS	3	Medium-High
Norm (scab susc. check)	6-27	31	2.3	R	R	54.2	14.1	S	5	Medium-High
Nordic	6-28	32	2.5	MR	R	55.1	13.5	MS	2	Low
Marshall	6-28	31	1.9	MR	R	56.1	14.1	MS	2	Medium-Low

† Only new varieties and older varieties with scab ratings better than susceptible are included in trials; ‡ Rated 1 = erect, 9 = flat; § R = resistant, MR = moderately resistant, MS = moderately susceptible; S = susceptible; # Tolerance to maintain plump kernels under scab epidemics; 1 = very well, 2 = well, 3 = moderate, 4 = fair, 5 = poor; †† 12% moisture; ## 1994 & 1995 data average adjusted to 1993-1995.

Table 18. Yields of hard red spring wheat varieties in Minnesota, 1993-95. †

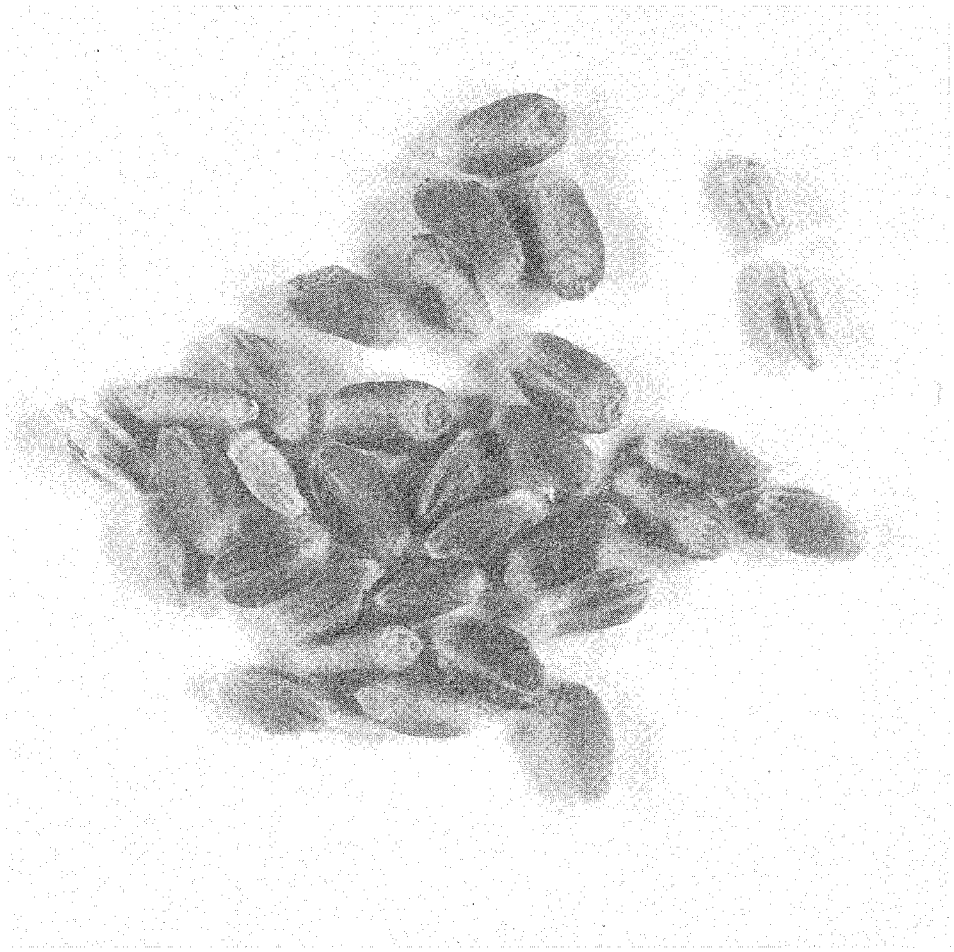
Variety	Crookston	Stephen	Roseau	Northern Average	St. Paul	Morris	Waseca	Southern Average	State Average
	bu/A								
Sharp	43	37	38	39	57	52	44	48	44
Kulm	42	39	38	40	54	59	49	51	46
Norlander ‡	43	—	46	42	63	52	45	52	48
Butte 86	39	31	37	36	55	54	44	48	43
2370	45	40	39	42	60	55	41	50	46
2375	43	41	44	43	56	58	48	52	48
Russ	40	38	44	41	59	59	50	53	48
Grandin	39	34	35	36	60	50	42	47	42
Hamer ‡	42	—	48	40	58	63	51	57	50
Trenton ‡	40	—	43	38	48	54	48	49	45
Lars ‡	43	—	42	41	57	59	48	54	49
Verde	44	37	38	40	60	56	41	50	46
Stoa	39	44	38	40	47	47	38	41	41
Norm (scab susc. check)	35	30	39	35	62	48	43	48	43
Nordic	38	37	39	38	53	44	39	42	40
Marshall	39	36	39	38	52	48	36	43	40
LSD 5%	NS	9	6	4	9	7	6	5	3

† Only new varieties and older varieties with scab ratings better than susceptible are included in trials; ‡ 1994 and 1995 data average adjusted to 1993-95.

Lars—Awned, midseason, semidwarf. Resistant to stem rust and moderately resistant to leaf rust. High yield and low test weight. Good lodging resistance. Low-medium protein percent. Moderately resistant to foliar diseases. Released by AgriPro in 1995. Seed sale regulated by the U.S. Plant Variety Protection Act, PVP(94).

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

Norlander-Awned—early, semidwarf. Moderately susceptible to stem rust and moderately resistant to leaf rust. High yield and medium test weight. Good lodging resistance. Medium protein percent. Moderately resistant to foliar diseases. Released by AgriPro 1995. Seed sale regulated by the 1995 U.S. Plant Variety Protection Act.



The two scab infected kernels at the upper right are characteristically whitish and shrunken. Severe infestations cause significantly reduced test weights, and can lead to rejection of a crop.

WHEAT (WINTER)

Publicly developed varieties are listed within classes in maturity order. 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.

Publicly Developed Varieties

Arapahoe—Awned, semidwarf, early and good lodging resistance. Winterhardy. 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. Plant Variety Protection Act.

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

Rose—Awned, medium height, medium maturity and good lodging resistance. Winterhardy. 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.

Elkhorn—Awned, tall, medium-late, and fair lodging resistance. Winter hardy. Moderately susceptible to leaf rust and resistant to stem rust. High yield and test weight. Medium protein percent. Satisfactory quality. Released by the North Dakota Agricultural Experiment Station 1995.

Plant pathologist Ruth Dill-Macky evaluates sensitivity of varieties to spread of scab within the seed head. Greenhouse studies allow several generations to be grown and evaluated each year.

Table 19. Yield and characteristics of publicly developed winter wheat varieties, 1993-95.

Variety	Heading	Height	Hardiness	Lodging	Rust reaction		Test Weight	Protein	Yield			
					Leaf	Stem			Rosemount	Morris	Roseau[§§]	Mean
	date[†]	inches	rating[‡]	score[§]	rating[#]		lbs/bu[††]	%[##]	bu/A			
Arapahoe	11	39	H	1.6	R	R	56.5	12.7	64	57	51	58
Roughrider	13	42	VH	2.3	S	R	57.3	13.3	48	47	45	47
Seward	15	41	VH	1.7	MR	R	56.5	11.5	61	53	54	56
Rose	12	39	H	1.6	MS	MR	58.2	12.5	52	50	43	49
Elkhorn	15	44	H	2.0	MS	R	57.7	12.8	59	48	--	--
LSD 5%									9	9	4	4

[†] Heading date data does not include Roseau; [‡] Winter survival, VH=very hardy, H=hardy, MH=moderately hardy, NH=not hardy; [§] 1=erect, 9=flat; [#] R=resistant, MR=moderately resistant, MS=moderately susceptible, S=susceptible; [††] 1994 and 1995 data; [##] 12% moisture; [§§] 1993 and 1994 data.

WILD RICE

Wild rice performance data for the 1995 growing season could not be obtained because all of the experiment station's variety test plots were severely damaged by numerous wind and rain storms which struck at critical times during the growing season. Aggragate performance data for the years 1991 through 1994 is presented in the table.

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

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

Varieties

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 percent of plants can have bottlebrush panicle type, depending on continued selection for the trait. Developed by K & D Wild Rice.

Voyager—Short to medium height, early maturity, 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 20. Yield and seed shattering losses of wild rice varieties, 1991-94.

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

† Means of trials at Grand Rapids in 1991 and 1992; Clearbrook, 1992 and 1993; Waskish, 1992 and 1994; Aitkin, 1993; and all 7 trials, respectively; ‡ Adjusted to 40% moisture; § Expressed as a percentage of harvested plus shattered grain.

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.

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 drought tolerant and grows best in warm, dry weather. It is widely adapted to many locations in the Midwest.

Amaranth 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. It is reasonable to expect a yield of 1,200 pounds per acre combine harvested.

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.

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

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

Annual Canarygrass

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

northern Red River Valley of Minnesota and the western provinces of Canada.

Production in the U.S. developed after World War II in 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 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 *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.

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.

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 Agron-omy, 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.

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.

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.

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

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

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

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

OILSEED CROPS

CANOLA

Canola (*Brassica napus* or *B. rapa*) 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 an increasing number of acres are being planted to the crop in Minnesota. In Roseau County alone, canola, which was grown on 9,300 acres in 1993, increased to 21,300 acres in 1994, and about 30,000 acres in 1995. About 40,000 acres in total were grown in Minnesota in 1995.

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

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

The canola varieties covered in this section are spring-sown types. Winter canolas were previously 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*. The cost of the manual is $45. Contact your county extension educator or the Center for Alternative Plant & Animal Products (352 Alderman Hall, University of Minnesota, St. Paul MN 55108) for more information about this publication.

A more detailed manual on canola production, *Canola Growers Manual,* is available from the Canola Council of Canada (400-167 Lombard Ave, Winnipeg, Manitoba R3B 0T6). It costs $68 (U.S.). The Canola Council also provides free annual updates to keep the information in the manual current. Those using this publication need to consider that not all pesticides used in Canada are legal in the United States. Always confirm the clearance of a pesticide with your local dealer or county extension educator.

Seed Sources

Seed source codes in table 21 are keyed to the letter ("D" for developer, "M" for marketer) and number sequences below.

Growing interest in canola is necessitating an increase in experiment station evaluations of varieties. David LeGare is part of the team of agronomists conducting these studies.

Developers:

D1. Agriculture Canada, Saskatoon, Saskatchewan, Canada

D2. Alberta Wheat Pool, Alberta, Canada

D3. Calgene Oils, Leesburg, Georgia

D4. Danish Plant Breeders and King Agro

D5. DLF Trifolium, Denmark

D6. DSV Deutsche Saapveredelung

D7. Hungnong Seed America, Inc., Gilroy, California

D8. InterMountain Canola-Cargill Foods, Idaho Falls, Idaho

D9. Limagrain Genetics,Saskatoon, Saskatchewan, Canada

D10. Maribo Seeds

D11. Mycogen Plant Sciences/Maribo Seeds

D12. Ontario Agriculture College, Guelph, Ontario, Canada

D13. Parson Seeds Ltd., Beeton, Ontario, Canada

D14. Pioneer Hi-Bred International, Georgetown, Ontario, Canada

D15. Svalof Weibull AB, Svalov, Sweden

D16. University of Manitoba, Winnipeg, Manitoba, Canada

D17. Zeneca Seeds, Winnipeg, Manitoba, Canada

Marketers:

M1. Agri-Tel Grain Ltd., Box 808, Beausejour, Manitoba R0E 0C0

M2. Brett-Young Seeds, Box 99, St. Norbert Postal Station, Winnipeg, MB, Canada R3V 1L5

M3. Cenex/Land O' Lakes, 2827 8th Ave. S., Ft. Dodge IA 50501

M4. InterMountain Canola-Cargill Foods, 2300 N. Yellowstone Hwy., Idaho Falls ID 83401

M5. Interstate Payco Seed, Box 338, West Fargo ND 58078

M6. Kaystar Seed, 702 3rd St. SW., PO Box 947, Huron SD 57350

M7. Limagrain Canada Seeds Inc., 4-411 Downy Road, Saskatoon, Saskatchewan, Canada S7N 4L8

M8. Marketing not determined

M9. Minnesota Crop Improvement Association, 1900 Hendon Ave., St. Paul MN 55108

M10. Mycogen Plant Sciences/Performance Seeds, 5649 E. Buckeye Rd., Madison WI 53716

M11. Northern Sales, 135 Lombard Ave., Winnipeg, Manitoba R3B 0T4

M12. Pioneer Hi-Bred International, RR 4, Georgetown, Ontario, Canada L7G 4S7

M13. Proseed, 110 E. 7th, Box 68, Harvey ND 58341

M14. Value Added Seed, PO Box 839, Grenfell, SK, Canada S0G 2B0

Table 21. Seed yield of canola (*Brassica napus* and *B. rapa*) varieties at Roseau, Crookston, and Morris, MN.

		1995					1994-95	
Variety	Seed Sources †	Roseau	Crookston	North Average	Morris	State Average	North Average ‡	State Average §
		lb/A #						
45A58	D14 / M12	1343	1704	1524	1473	1507	—	—
46A05	D14 / M12	1700	1974	1837	1589	1755	—	—
47A57	D14 / M12	1776	1786	1781	1193	1585	—	—
Battalion	D15 / M8	1362	—	—	—	—	—	—
Brigade	D15 / M5	1710	1840	1775	—	—	—	—
Bullet	D15 / M6	1594	1478	1536	—	—	—	—
Crusher	D15 / M5	1920	1712	1816	1295	1642	2105	1753
Cyclone	D4 / M7	1490	2026	1758	1071	1529	1960	1653
Defender	D15 / M5	1626	1539	1583	—	—	1933	1712
DP 7/92	D5 / M13	1501	1752	1626	—	—	—	—
Ebony	D9 / M7	1584	1738	1661	1272	1531	—	—
EXP001	D8 / M4	1284	1845	1564	—	—	—	—
EXP002	D8 / M4	1542	1691	1616	—	—	—	—
EXP003	D8 / M4	1374	1845	1609	—	—	—	—
EXP004	D8 / M4	1538	1721	1629	—	—	—	—
Frontier (S9420)	D2 /M8	1639	—	—	—	—	—	1722
Global ††	D15 / M11	973	1772	1373	1234	1327	—	—
HN 9363	D7 / M8	1557	1733	1645	1537	1609	—	—
HN 9452	D7 / M8	1513	1657	1585	1540	1570	—	—
HN 9455	D7 / M8	1310	1749	1530	1527	1529	—	—
HN 9463	D7 / M8	1191	1573	1382	1158	1307	—	—
HN 9465	D7 / M8	1312	1724	1518	1264	1433	—	—
HN 9466	D7 / M8	1533	1713	1623	1193	1460	—	—
Hyola 308 ††	D17 / M6	2135	1975	2055	2140	2084	2375	2316
Hyola 401 ††, †††	D17 / M6	2219	2279	2249	1719	2072	2561	2147
Hyola 420 (X-045) ††	D17 / M6, M9	2009	2245	2127	2001	2085	—	—
Hyola X-052 ††	D17 / M6	1993	2171	2082	1897	2021	—	—
Hyola X-055 ††	D17 / M6	2382	2354	2368	2095	2277	—	—
Hysin 110 ‡‡	D17 / M6	1387	2021	1704	1265	1558	—	—
IMC 144	D8 / M4	1153	1828	1490	—	—	—	—

Table 21 (continued). Seed yield of canola (*Brassica napus* and *B. rapa*) varieties at Roseau, Crookston, and Morris, MN.

Variety	Seed Sources †	1995 Roseau	1995 Crookston	1995 North Average	1995 Morris	1995 State Average	1994-95 North Average ‡	1994-95 State Average §
		lb/A #						
Impact	D15 / M3	1425	—	—	—	—	—	1569
IP 35-89 §§	D13 / M5	997	1703	1351	1102	1268	1758	1523
Jewel §§	D9 / M8	1771	1762	1766	1350	1627	—	—
Legacy	D15 / M8	1730	—	—	—	—	—	—
Legend	D15 / M5	1628	1990	1809	1584	1734	1918	1694
LG 3310 §§	D9 / M7	1685	2037	1861	1352	1691	—	—
Liasison §§	D6 / M2	1637	1730	1683	1239	1535	—	—
Licolly §§	D6 / M2	1918	1842	1880	1114	1625	—	—
Licosmos §§	D6 / M2	1757	1771	1764	1247	1591	—	—
M1-9099	D10 / M2	1830	2105	1967	1633	1856	—	—
Magnum (PR3096)	D9 / M14	1936	2133	2035	1454	1841	—	—
Mari §§	D10 / M2	1379	2111	1745	1962	1817	—	—
Norseman	D15 / M5	1352	1706	1529	—	—	1806	1635
OAC Springfield	D12 / M1	1749	1866	1807	1459	1691	2054	1766
OAC Summit	D12 / M1	1593	1960	1776	1581	1711	2040	1897
Ole	D5 / M13	810	1689	1250	—	—	—	—
Oscar §§	D3 / M3	1453	—	—	—	—	—	—
Patriot	D14 / M12	1606	2097	1851	1477	1727	—	—
Pearl	D9 / M7	1329	1815	1572	1282	1475	—	—
Polo	D11 / M10	1715	1916	1816	—	—	2016	—
Reward ‡‡	D16 / M11	1145	1541	1343	1176	1287	1511	1427
S95220 ##	D3 / M8	784	—	—	—	—	—	—
Spok	D5 / M13	1613	1950	1781	—	—	—	—
Sponsor	D15 / M1	1871	1965	1918	—	—	2213	2004
SW 02737	D15 / M8	1777	—	—	—	—	—	—
Tobin ‡‡	D1 / M11	1014	1403	1209	999	1139	1406	1304
Topscore (DP 6/91)	D5 / M13	2034	1985	2010	—	—	—	—
Trojan	D15 / M5	1261	1705	1483	1116	1361	1872	1553
Unica	D5 / M13	1172	1789	1480	—	—	—	—
Victor (DP 5/91)	D5 / M11	1981	—	—	—	—	—	—
LSD (0.05)		366	248	220	243	167	195	—

† Developer (D) and marketer (M), keyed to alpha-numeric lists under "Seed Sources" in the canola report text; ‡ Average yield including Roseau (1994) and Roseau and Crookston (1995); § Average yield of all locations tested in 1994 and 1995; # Yields are reported on a 10% moisture basis; †† Hybrid; ‡‡ Hysin 110, Reward, and Tobin are *Brassica rapa* varieties; §§ Available for 1996 planting; ## Specialty oil variety; ††† Long-term averages at three locations for Global (1991-93, 95) and Hyola 401 (1991-95) are 1,479 and 2,098, respectively.

Table 22. Plant characteristics of canola (*Brassica napus* and *B. campestris*) varieties at Roseau, Crookston, and Morris, MN, 1995.

Variety	Planting to 90% Bloom Roseau	Planting to 90% Bloom Crookston	Planting to 90% Bloom Morris	Planting to Maturity Roseau	Planting to Maturity Crookston	Planting to Maturity Morris	Lodging Roseau	Lodging Crookston	Lodging Morris	Height Roseau	Height Crookston	Height Morris
	days			days			score †			inches		
45A58	69	65	66	87	78	86	6.3	5.0	8.3	50	46	41
46A05	67	65	66	94	82	88	4.0	4.0	5.5	50	42	43
47A57	68	69	67	91	83	88	1.3	2.8	3.3	53	52	42
Battalion	72	—	—	93	—	—	1.8	—	—	56	—	—
Brigade	71	72	—	93	83	—	3.3	2.5	—	57	51	—
Bullet	68	68	—	82	79	—	2.8	3.3	—	53	49	—
Crusher	70	75	69	93	87	89	1.0	1.5	1.5	59	55	47
Cyclone	70	71	67	93	84	89	2.3	3.0	3.5	53	54	45
Defender	69	68	—	85	79	—	2.5	2.8	—	52	47	—
DP 7/92	70	74	—	96	86	—	1.0	2.0	—	57	50	—

Table 22 (continued). Plant characteristics of canola (*Brassica napus* and *B. campestris*) varieties at Roseau, Crookston, and Morris, MN, 1995.

Variety	Planting to 90% Bloom			Planting to Maturity			Lodging			Height		
	Roseau	Crookston	Morris	Roseau	Crookston	Morris	Roseau	Crookston	Morris	Roseau	Crookston	Morris
	days			days			score †			inches		
Ebony	70	70	67	94	83	90	1.3	2.0	2.0	63	51	47
EXP001	70	65	—	93	81	—	3.8	4.0	—	55	47	—
EXP002	67	66	—	93	81	—	1.3	3.0	—	54	50	—
EXP003	66	65	—	88	81	—	6.3	3.8	—	48	41	—
EXP004	66	64	—	89	81	—	7.0	3.8	—	50	44	—
Frontier	68	—	—	91	—	—	2.3	—	—	49	—	—
Global	72	74	68	96	86	90	1.0	2.3	3.3	65	55	49
HN9363	68	62	64	84	78	87	3.3	4.3	7.5	50	38	43
HN9452	71	72	66	91	83	87	7.0	4.5	6.8	51	48	42
HN9455	72	71	67	91	82	90	7.3	2.5	6.8	54	53	43
HN9463	72	73	69	89	82	90	5.3	3.3	5.0	55	52	47
HN9465	74	73	68	97	85	91	3.0	1.8	5.3	57	51	46
HN9466	73	73	69	94	84	89	1.5	2.0	4.0	60	49	47
Hyola 308	65	60	61	77	75	84	2.0	5.0	8.0	42	32	39
Hyola 401	66	61	61	91	82	89	1.5	4.3	6.5	47	40	40
Hyola 420	66	63	62	91	81	88	1.5	4.3	7.0	51	44	42
Hyola X-052	69	63	63	93	80	88	4.0	3.0	7.0	47	42	40
Hyola X-055	64	59	61	84	80	86	2.3	4.8	7.8	45	33	38
Hysin 110 †	61	61	59	69	73	79	2.0	3.8	7.0	51	46	41
IMC 144	70	67	—	93	81	—	2.8	3.5	—	51	49	—
Impact	72	—	—	91	—	—	3.5	—	—	55	—	—
IP 35-89	73	74	70	94	88	90	2.8	2.3	5.5	56	50	46
Jewel	70	71	67	96	84	90	1.0	2.5	4.0	56	51	47
Legacy	70	—	—	91	—	—	3.3	—	—	50	—	—
Legend	70	69	65	91	82	86	4.3	4.3	5.3	53	48	42
LG 3310	71	73	67	92	84	89	1.3	3.5	4.0	58	50	46
Liaison	71	75	68	95	87	90	1.0	2.5	3.5	65	57	49
Licolly	70	72	67	93	84	89	1.3	2.8	4.0	59	53	46
Licosmos	70	74	69	93	86	91	1.5	2.5	4.5	61	56	54
M1-9099	67	67	64	83	80	85	4.0	3.8	6.0	49	47	42
Magnum	69	67	66	90	81	88	2.5	3.0	5.3	51	53	46
Mari	68	66	62	86	82	86	6.3	4.3	5.5	53	49	42
Norseman	72	73	—	93	83	—	3.0	2.3	—	59	52	—
OAC Springfield	65	62	62	85	79	88	6.3	3.5	7.5	48	42	39
OAC Summit	69	66	67	85	79	89	2.3	4.0	6.8	56	47	46
Ole	73	75	—	99	88	—	1.0	2.0	—	64	56	—
Oscar	70	—	—	92	—	—	1.0	—	—	56	—	—
Patriot	68	66	66	92	82	90	3.0	3.0	6.3	51	49	43
Pearl	71	72	70	94	84	89	2.3	3.0	5.3	59	54	46
Polo	68	66	—	91	84	—	4.0	3.3	—	49	47	—
Reward †	59	56	59	68	71	79	3.3	4.5	7.3	51	38	37
S95220	69	—	—	90	—	—	4.3	—	—	54	—	—
Spok	71	76	—	95	89	—	1.0	2.3	—	59	54	—
Sponsor	68	71	—	86	84	—	1.5	2.0	—	59	56	—
SW 02737	70	—	—	93	—	—	1.0	—	—	61	—	—
Tobin †	60	56	58	67	70	79	2.8	3.5	6.8	48	38	37
Topscore	68	69	—	90	81	—	1.5	2.8	—	54	50	—
Trojan	70	73	68	94	83	89	3.3	3.0	4.3	52	55	45
Unica	72	75	—	98	89	—	1.0	1.8	—	63	52	—
Victor	67	—	—	85	—	—	2.0	—	—	53	—	—
LSD (0.05)	1.9	2.3	1.6	3.9	2.6	1.4	2.3	1.2	1.8	6	6	4

† Lodging score: 1=erect, 9=flat, scoring dates, Roseau 7-6, Crookston 8-1, Morris 7-12; † Hysin 110, Reward, and Tobin are *Brassica rapa* varieties.

Table 23. Yield characteristics and disease susceptibilities of canola (Brassica napus and B. campestris) varieties at Roseau, Crookston, and Morris, MN , 1995.

Variety	Test weight			Oil			Alternaria	White Mold
	Roseau	Crookston	Morris	Roseau	Crookston	Morris	Roseau	Crookston
	lbs/bu †			% ‡			score §	%
45A58	50.0	50.5	50.0	38.5	40.5	37.7	2.5	1.3
46A05	50.0	51.5	47.5	38.2	42.5	37.9	2.5	0.3
47A57	49.5	50.5	47.5	38.1	42.4	38.4	2.5	0.0
Battalion	50.0	—	—	37.5	—	—	2.0	—
Brigade	50.5	51.0	—	37.9	42.1	—	2.0	0.0
Bullet	51.5	51.5	—	37.3	40.4	—	2.0	0.5
Crusher	51.0	51.5	50.5	38.9	41.4	38.5	2.3	0.0
Cyclone	49.5	51.5	48.0	37.7	40.0	38.1	2.0	0.3
Defender	51.5	51.0	—	38.1	41.7	—	1.8	0.5
DP 7/92	49.5	51.0	—	38.1	41.4	—	2.3	0.0
Ebony	49.5	51.0	49.5	39.0	42.6	39.5	2.0	0.0
EXP001	50.0	51.5	—	39.4	43.3	—	2.3	1.3
EXP002	50.0	51.5	—	37.5	42.6	—	2.0	2.0
EXP003	49.5	50.5	—	39.3	42.7	—	2.5	2.5
EXP004	49.5	51.0	—	38.6	42.5	—	2.3	1.5
Frontier	51.0	—	—	37.9	—	—	2.0	—
Global	47.0	50.5	48.0	37.4	42.1	38.2	2.3	0.0
HN9363	50.0	51.5	50.5	37.2	40.3	37.7	2.5	0.3
HN9452	49.0	51.5	50.5	37.7	39.2	37.0	2.0	0.3
HN9455	49.5	51.0	46.0	37.3	40.3	36.3	2.3	0.3
HN9463	49.5	52.0	48.0	36.9	40.9	37.7	2.0	0.0
HN9465	49.0	51.5	48.0	37.6	41.4	37.7	2.0	0.3
HN9466	49.0	52.0	48.5	38.3	42.0	38.2	1.8	0.0
Hyola 308	52.5	52.0	50.5	37.9	39.1	37.5	1.0	0.8
Hyola 401	50.5	51.5	48.0	38.1	41.2	38.9	2.0	0.3
Hyola 420	50.0	51.0	47.0	39.1	42.1	38.9	2.0	0.5
Hyola X-052	49.5	51.0	47.0	38.2	42.3	39.1	2.0	0.1
Hyola X-055	50.5	51.5	50.5	39.4	40.9	38.7	2.0	0.5
Hysin 110 #	53.5	52.5	50.5	35.8	37.5	37.2	1.3	0.5
IMC 144	49.5	51.5	—	37.1	42.1	—	2.3	0.3
Impact	50.5	—	—	38.2	—	—	2.3	—
IP 35-89	49.0	50.5	48.5	38.2	43.8	38.3	3.0	0.0
Jewel	49.0	51.0	48.0	38.7	42.4	38.3	1.8	0.0
Legacy	50.5	—	—	38.0	—	—	2.8	—
Legend	49.5	51.5	50.0	37.9	41.5	37.4	2.5	0.8
LG 3310	49.5	51.5	47.5	38.0	40.7	38.2	2.0	0.3
Liaison	49.5	51.0	49.5	38.0	41.5	38.9	2.0	0.0
Licolly	49.0	51.0	48.0	38.8	41.7	38.2	2.0	0.0
Licosmos	49.5	50.0	49.0	38.6	43.4	38.6	2.0	0.0
M1-9099	50.5	51.0	51.5	38.6	41.0	37.9	2.8	0.5
Magnum	49.0	51.0	47.5	39.0	42.0	38.8	2.0	1.3
Mari	51.0	51.5	51.5	38.7	42.5	39.0	2.0	0.8
Norseman	50.5	51.5	—	37.9	42.1	—	1.8	0.0
OAC Springfield	50.0	50.5	47.0	39.0	41.9	39.7	2.0	0.3
OAC Summit	52.0	52.0	48.5	37.5	41.7	38.3	2.0	1.3
Ole	46.0	50.5	—	38.3	41.5	—	1.8	0.0
Oscar	50.0	—	—	35.7	—	—	2.3	—
Patriot	50.0	51.5	47.5	37.4	42.1	37.7	2.3	0.3
Pearl	51.5	51.5	48.5	36.6	41.1	37.5	2.3	0.5
Polo	51.0	50.5	—	40.9	45.2	—	2.3	1.0
Reward #	52.5	51.5	51.0	37.1	39.6	37.6	1.0	0.0
S95220	52.5	—	—	34.7	—	—	3.0	—
Spok	48.5	51.5	—	38.3	40.2	—	1.8	0.0
Sponsor	52.0	52.0	—	38.1	40.9	—	2.5	0.3
SW 02737	50.5	—	—	38.2	—	—	2.3	—

Table 23 (continued). Yield characteristics and disease susceptibilities of canola (Brassica napus and B. campestris) varieties at Roseau, Crookston, and Morris, MN, 1995.

Variety	Test weight			Oil			Alternaria	White Mold
	Roseau	Crookston	Morris	Roseau	Crookston	Morris	Roseau	Crookston
	lbs/bu †			% ‡			score §	%
Tobin #	53.0	52.0	51.5	35.9	37.4	36.9	1.3	0.0
Topscore	50.5	51.5	—	38.5	42.5	—	2.0	1.0
Trojan	50.5	51.5	47.0	36.5	39.1	37.2	2.5	0.3
Unica	46.5	50.5	—	39.0	42.9	—	2.0	0.0
Victor	51.0	—	—	37.9	—	—	2.3	—
LSD (0.05)	0.6	0.7	1.2	1.0	2.3	1.3	0.9	0.8

† Test weight is at 6% moisture; ‡ Oil percentage is corrected to a 10% moisture basis; § Alternaria black spot scores: 1=none, 6=severely infected; # Hysin 110, Reward, and Tobin are *Brassica rapa* varieties.

SOYBEAN

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

Tables 25 to 28 deal with varieties developed by publicly supported institutions and are being considered for recommendation by Minnesota Agricultural Experiment Station. Tables 29 to 31 show performance characteristics of privately developed varieties as well as several public varieties.

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

The plots located at Shelly were not harvested in 1995 due to severe flooding.

There are many factors which need to be considered in selecting soybean varieties. These include 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 to be 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.

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

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

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

Yield—*Varieties in each table are listed in order of their actual 1995 maturity date and not on the basis of their long term relative maturity designation.* Later maturing varieties are normally expected to have higher yield potential than earlier maturing varieties.

Soybean yields should be compared by looking at varieties with a similar maturity rating. Yield comparisons are more reliable if data are available for several years. Data from different tables should not be compared. All yield data reported in these tables were obtained from replicated tests harvested with a plot combine.

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

Row Spacing—Research over many years and at many locations has shown that yields from narrow rows (10 inches to 18 inches) are higher than wide rows (20 inches to 40 inches). Although rankings of varieties

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

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

Chlorosis—Ratings for chlorosis are an indication of how much leaf yellowing occurs in tests conducted on a high lime (high pH) soil near Lamberton. They indicate how well varieties perform relative to each other on such soils. How these ratings relate to the numerical values used in editions of this publication previous to 1995 is indicated by the following:

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

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

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

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

Soybean Cyst Nematode—This nematode pest was first identified in Minnesota in 1978 and is now known to occur in 32 Minnesota counties, according to Cooperative Pest Survey Program data. Areas infested and numbers of nematodes both appear to be increasing. When SCN numbers are high, significant yield losses can occur. Several races of SCN are known to occur in Minnesota. Rotations to non-host crops and planting resistant varieties assist in managing nematode populations.

Table 24. Genes for resistance to races of Phytophthora root rot (shaded box indicates resistance is present).

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

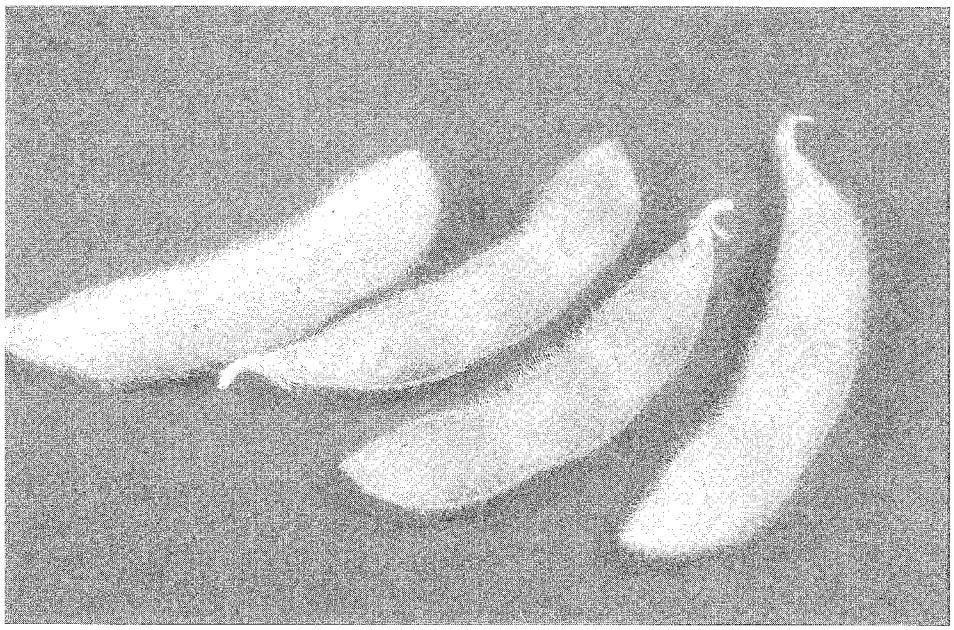
Results of a special performance test of public and private varieties resistant to soybean cyst nematode are provided in Table 32. These trials were conducted on "infested" sites near East Chain, New Richland and St. James and on "non-infested" sites at Fairmont, Lamberton and Waseca.

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

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

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.

White Mold—Sclerotinia stem rot was less damaging to the 1995 crop than it was in 1994. Ratings of varieties for resistance to Sclerotinia are difficult to obtain because infection is dependent on environmental conditions during and after flowering. Varieties that appear to be resistant one year can be devastated by the disease the next, if conditions are right for the disease to spread. Growers should expect that varieties which have consistently less disease over several



The two middle pods are gray to brown in color. This indicates their being nearly mature. Rapid moisture loss occurs from this point forward. Pods at this stage are relatively safe from killing frosts and could be harvested within another 10 to 14 days.

years will be the best performers under high disease pressure. A reliable test for resistance is not yet available.

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

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

Value of a bushel of soybeans, based on oil and protein content, is 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 Publicly Developed Varieties

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

Archer—Southern zone. Relative maturity 1.9. *Yield, brown stem rot resistance and iron chlorosis resistance similar to BSR 101. Rsp1k and Rps6 genes for resistance to phytophthora.* Released 1989 by Iowa Agricultural Experiment Station. Seed Sale regulated by U.S. Plant Variety Protection Act.

BSR 101—Southern zone. Relative maturity 1.9. High yield potential, resistant to brown stem rot. Acceptable iron chlorosis score. *Rps1 gene for resistance to phytophthora.* Developed by Iowa Agricultural Experiment Station. Released 1985.

Bell—Southern zone. Relative maturity 2.2. *Resistant to race 3 and race 14 (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. Plant Variety Protection Act.

Bert—Southern zone. Relative maturity 1.8. High yielding with taller than average plant height. *Rps1 gene for resistance to phytophthora.* Developed by Minnesota Agricultural Experiment Station. Released 1991. Seed sale regulated by U.S. Plant Variety Protection Act.

Evans—Central zone. Relative maturity 0.6. *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. Plant Variety Protection Act, PVP(94).

Faribault—Central and southern zones. Relative maturity 1.4. Resistant to race 3 and moderately resistant to race 1 of soybean cyst nematode. Different source of soybean cyst nematode resistance than Alpha and Bell. Recommended as part of a management

Table 25. Yields of publicly developed soybean varieties in northern zone, 1991-95.

Variety	Crookston	Grand Rapids	Moorhead	Roseau	Shelly †
	bu/A				
McCall	37	21	29	29	33
Glacier	—	22	30 ‡	32	—
Agassiz	44	23	31	29	36
Ozzie	39	—	38	—	36
Council	—	—	40 §	—	41 #
Glenwood	41	—	40	—	36
Evans	38	—	38	—	32
Dawson	41	—	39	—	37
Lambert	42	—	37	—	40
Proto	—	—	33	—	30
Hendricks	36 ‡	—	41 ‡	—	—
LSD 20%	2	1	2	2	1

† 1991-1994 data; ‡ 1994-95 data adjusted to 5 year average; § 1993-1995 data adjusted for 5 year average; # 1993-1994 data adjusted for 4 year average.

Table 26. Yields of publicly developed soybean varieties in central zone, 1991-95.

Variety	Rosemount (10-inch)	Morris (10-inch)	Becker (30-inch)	Average
	bu/A			
Ozzie	42	38	43	41
Evans	45	45	45	45
Dawson	46	44	44	45
Lambert †	50	48	51	50
Hendricks †	49	48	51	49
Hodgson 78	46	47	48	47
Kato	46	47	47	46
Kasota	46	50	45	47
Parker †	50	51	50	50
Hardin †	51	50	46	49
Bert	48	50	49	49
LSD 20%	2	2	2	2

† 1992-1995 data adjusted to 5 year average.

package for producers with a soybean cyst nematode problem. Good yield potential. Resistant to brown stem rot. *Rps1* gene for resistance to phytophthora. Developed by Minnesota Agricultural Experiment Station. Released in 1994. Seed sales regulated by U.S. Plant Variety Protection Act, PVP(94).

Freeborn—Central and southern zones. Relative maturity 1.7. Resistant to race 3 of soybean cyst nematode. Good yield potential. Resistant to brown stem rot. *Rps1* gene for resistance to phytophthora. Recommended as part of a management package for producers with a soybean cyst nematode problem. Developed by Minnesota Agricultural Experiment Station. Released 1995. Seed sales regulated by U.S. Plant Variety Protection Act, PVP(94).

Glacier—Northern zone. Relative maturity 00.8. High yield. *Rps6* gene for resistance to phytophthora. Developed by Minnesota Agricultural Experiment Station. Released 1995. Seed sales regulated by U.S. Plant Variety Protection Act, PVP(94).

Granite—Central and southern zones. Relative maturity 1.7. High yield. Resistant to brown stem rot. *Rps1* gene for resistance to phytophthora. Developed by Minnesota Agricultural Experiment Station. Released 1995. Seed sales regulated by U.S. Plant Variety Protection Act, PVP(94).

Hardin—Southern zone. Relative maturity 1.8. Good yield performance. *Rps1 gene for resistance to phytophthora.* Developed by Iowa Agricultural Experiment Station. Released 1980. Seed sale regulated by U.S. Plant Variety Protection Act.

Hardin 91—Southern zone. Relative maturity 2.0. Released under royalty agreement by Iowa State University Research Foundation, 1991. License required for seed production.

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

Hodgson 78—Central and southern zones. Relative maturity 1.4. Similar to Hodgson, except *Rps1gene for resistance to phytophthora.* Developed by Minnesota Agricultural Experiment Station. Released 1978.

IA2008—Southern zone. Relative maturity 2.1. High yield potential. *Rps1 gene for resistance to phytophthora.* Released 1991. Released under royalty agreement by Iowa State University Research Foundation, 1991. License required for seed production.

Kasota—Central and Southern zones. Relative maturity 1.3. Very good yield potential. High protein level. Good lodging resistance. *Rps1c gene for resistance to phytophthora.* Developed by Minnesota Agricultural Experiment Station. Released 1990. Seed sale regulated by U.S. Plant Variety Protection Act.

Kato—Central and southern zones. Relative maturity 1.4. Outstanding protein level. Very good lodging resistance. Good iron chlorosis resistance. *Rps1 gene for resistance to phytophthora.* Developed by Minnesota Agricultural Experiment Station. Released 1989. Seed sale regulated by U.S. Plant Variety Protection Act.

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

McCall—Northern zone. Relative maturity 00.7. High yield. Tall. Good lodging resistance in its maturity class. Susceptible to phytophthora. Developed by Minnesota Agricultural Experiment Station. Released 1978.

Ozzie—Northern and central zones. Relative maturity 0.3. High yield. Good lodging resistance for its maturity. *Rps1 gene for resistance to Phytophthora.* Developed by Minnesota Agricultural Experiment Station. Released 1983. Seed sale regulated by U.S. Plant Variety Protection Act.

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

Sturdy—Southern zone. Relative maturity 2.1. 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. Plant Variety Protection Act.

Table 27. Yields of publicly developed soybean varieties in southern zone, 1991-1995.

Variety	Waseca and Lamberton Mid-May Planting	Waseca and Lamberton Mid-June Planting	Fairmont 30-inch	Waseca 10-inch	Lamberton Mid-May Planting 10-inch	Lewiston† Mid-May Planting 10-inch	Average
	bu/A						
McCall	—	28	—	—	—	—	—
Agassiz	—	33‡	—	—	—	—	—
Ozzie	44	31	29	43	45	—	39
Dawson	49	32	30	47	51	48	44
Glenwood	46	35	39	45	48	48	45
Evans	48	34	31	47	49	49	44
Lambert	54	40	34	51	56	53	48
Toyopro	48	—	—	46	51	—	—
Hendricks	54	39†	36§	51	56	53†	49
Kato	54	37	41	52	56	55	51
Hodgson 78	52	36	33	50	55	52	48
Hardin	56	37	35	56	56	59	52
Parker	62	43	40	59	66	55	55
Kasota	52	35	38	50	54	51	48
Freeborn	54	—	42	52	55	56†	51
Hardin 91	57‡	36‡	40	57[1]	57‡	60	54
Leslie	57	35	41	56	58	52	52
Bert	56	39	39	53	58	60	52
Granite	58‡	36†	40	58	61‡	58†	54
Faribault	54	35†	40	49	60	57†	52
BSR101	58	37	40	58	57	56	53
Sturdy	58	33	42	54	61	62	55
IA2008	61‡	35‡	42	58‡	64‡	64	57
Bell	53‡	—	42	49‡	57‡	51	50
LSD 20%	1	1	1	2	2	3	1

† 1994-1995 data, adjusted to 5 year average; ‡ 1992-1995 data, adjusted to 5 year average; § 1993-1995 data, adjusted to 5 year average.

Not Adequately Tested Publicly Developed Varieties

Council—Northern zone. Relative maturity 0.4. High yield. *Rps1* gene for resistance to phytophthora. Developed by North Dakota Agricultural Experiment Station. Released 1995. Seed sales regulated by U.S. Plant Variety Protection Act, PVP(94). Seed will be widely available in 1997.

IA2008R—Southern zone. Relative maturity 2.1. High yield potential. Resistant to brown stem rot. Similar to IA2008 except *RPS1k* gene for resistance to phytophthora. Developed by Iowa Agricultural Experiment Station. Released 1995. Seed will be widely available in 1997.

IA2021—Southern zone. Relative maturity 2.1. High yield potential. *Rps1k* gene for resistance to phytophthora. Developed by Iowa Agricultural Experiment Station. Released 1995. Seed will be widely available in 1997.

Other Publicly Developed Varieties

Corsoy 79—Southern zone. Relative maturity 2.2. Very good yield performance. *Rps1-c gene for phytophthora resistance.* Poor chlorosis ratings, somewhat lodging susceptible. Developed by Illinois Agricultural Experiment Station. Released 1979.

Dassel—Central zone. Relative maturity 0.9. Yield similar to Evans. Good lodging resistance. *Rps6 gene for resistance to phytophthora.* Highly susceptible to the herbicide metribuzin. Developed by Minnesota Agricultural Experiment Station. Released 1986. Seed sale regulated by U.S. Plant Variety Protection Act.

Dawson—Central zone. Relative maturity 0.7. Very good tolerance to iron chlorosis on high lime soils. Higher yielding than Swift. Good lodging resistance. *Rps1 gene for resistance to phytophthora but quite susceptible to race 3 of phytophthora.* Developed by Minnesota Agricultural Experiment Station. Released 1983. Seed sale regulated by U.S. Plant Variety Protection Act.

Glenwood—Central zone. Relative maturity 0.4. Good yield. Good lodging resistance. Outstanding protein level. *Rps1 gene for resistance to phytophthora.* Developed by Minnesota Agricultural Experiment Station. Released 1987. Seed sale regulated by U.S. Plant Variety Protection Act.

Hodgson—Central and southern zones. Relative maturity 1.4. Largely superseded by phytophthora-resistant Hodgson 78. Developed by Minnesota Agricultural Experiment Station. Released 1974.

Leslie—Southern zone. Relative maturity

Table 28. Characteristics of publicly developed soybean varieties, 1995.

Variety	Mature: Mid-May Planting	Mature: Mid-June Planting	Lodging	Height	Phytophthora	Protein	Oil	Chlorosis[§]
	------ date ------		score[†]	inches	gene	%[‡]	%[‡]	rating
Northern Zone								
McCall	9-6	—	1.0	30	S	35.3	15.2	MR
Harmony	9-9	—	1.0	29	S	32.2	18.0	R
Glacier	9-12	—	1.0	31	Rps6	36.6	15.9	R
Chico	9-12	—	1.3	28	Rps1	36.2	15.3	MS
Agassiz	9-14	—	1.0	32	Rps1	35.3	16.9	R
Ozzie	9-19	—	1.0	32	Rps1	37.6	15.5	R
Evans	9-20	—	1.0	39	Rps1	34.8	16.5	MS
Proto	9-21	—	1.0	28	S	40.4	15.2	S
Glenwood	9-22	—	1.0	31	Rps1	34.8	16.5	S
Council	9-22	—	1.0	34	Rps1	38.2	16.1	MR
Dawson	9-24	—	1.0	33	Rps1	35.2	16.9	R
Lambert	9-25	—	1.0	33	Rps1	35.4	17.0	S
Toyopro	9-27	—	1.0	32	S	40.2	15.2	MS
Hendricks	9-28	—	1.0	33	Rps1	36.2	16.8	MR
Central Zone								
McCall	9-3	—	1.8	29	S	35.1	16.8	MR
Glacier	9-5	—	2.5	30	Rps6	37.4	15.7	R
Agassiz	9-7	—	1.7	32	Rps1	36.6	16.9	R
Chico	9-7	—	2.3	31	Rps1	35.1	16.7	MS
Ozzie	9-10	—	1.7	34	Rps1	38.4	15.3	R
Glenwood	9-13	—	1.7	34	Rps1	37.5	15.8	S
Proto	9-13	—	1.8	28	S	40.4	15.0	S
Council	9-14	—	1.7	34	Rps1	35.8	16.2	MR
Evans	9-15	—	1.8	39	Rps1	36.3	16.1	MS
Dawson	9-15	—	2.0	37	Rps1	36.3	16.1	R
Toyopro	9-17	—	1.7	33	S	40.1	15.1	MS
Lambert	9-17	—	1.3	33	Rps1	35.9	16.4	S
Hendricks	9-18	—	1.8	33	Rps1	36.2	16.1	MR
Minnato	9-19	—	1.7	32	Rps1	38.3	14.9	R
Kato	9-21	—	1.7	39	Rps1	40.6	14.7	R
Hodgson 78	9-22	—	2.2	42	Rps1	36.5	15.8	MR
Parker	9-22	—	2.7	39	Rps1	36.7	15.9	S
Kasota	9-23	—	1.8	38	Rps1c	38.1	15.7	R
Freeborn	9-23	—	1.8	38	Rps1	39.1	14.4	R
Hardin	9-23	—	2.5	43	Rps1	36.5	15.9	MR
Granite	9-25	—	2.5	42	Rps1	37.0	15.2	R
Hardin 91	9-25	—	2.2	40	Rps1k	37.0	15.7	MS
Leslie	9-25	—	2.2	42	Rps1	36.4	15.7	MR
Faribault	9-26	—	2.5	39	Rps1	34.6	16.4	MR
Bert	9-26	—	3.2	45	Rps1	35.6	15.7	MR
Sturdy	9-28	—	2.0	41	Rps1	38.3	15.0	MR
Marcus 95	9-29	—	2.3	38	Rps1k+6	37.0	15.3	S
IA2021	9-29	—	2.3	40	S	36.0	16.0	MS
Southern Zone								
McCall	8-28	9-15	3.3	28	S	36.2	16.8	MR
Glacier	8-29	9-17	2.8	27	Rps6	37.7	15.9	R
Agassiz	9-1	9-19	1.7	26	Rps1	37.5	16.1	R
Ozzie	9-3	9-22	1.2	29	Rps1	38.4	15.6	R
Proto	9-5	9-23	2.3	27	S	39.9	15.6	S
Evans	9-5	9-23	2.8	33	Rps1	35.8	16.6	MS
Dawson	9-5	9-23	3.0	33	Rps1	36.8	16.0	R
Toyopro	9-5	—	1.2	29	S	38.8	15.9	MS
Council	9-5	—	1.8	31	Rps1	36.7	16.1	MR

Table 28 (continued). Characteristics of publicly developed soybean varieties, 1995.

Variety	Mature: Mid-May Planting	Mature: Mid-June Planting	Lodging	Height	Phyto-phthora	Protein	Oil	Chlorosis §
	------ date -------		score †	inches	gene	% ‡	% ‡	rating
Hendricks	9-5	9-27	2.0	31	Rps1	35.5	16.6	MR
Glenwood	9-6	9-24	1.8	30	Rps1	36.7	16.4	S
Lambert	9-6	9-25	2.0	31	Rps1	36.4	16.9	S
Minnatto	9-7	—	1.7	30	Rps1	37.9	15.4	R
Kato	9-11	9-27	1.7	39	Rps1	40.0	15.2	R
Hodgson 78	9-12	9-26	3.0	39	Rps1	36.6	16.1	MS
Faribault	9-12	9-30	1.8	35	Rps1	35.8	16.2	MR
Kasota	9-13	9-27	1.7	35	Rps1c	37.1	16.1	R
Hardin	9-14	9-30	2.8	38	Rps1	36.6	15.7	MS
Parker	9-14	9-28	3.0	39	Rps1	37.0	16.0	S
Freeborn	9-15	—	1.5	36	Rps1	37.2	15.4	R
Leslie	9-15	9-30	1.8	39	Rps1	36.1	15.9	MS
Bert	9-15	9-29	3.0	41	Rps1	35.8	16.0	MR
Granite	9-15	10-1	2.3	40	Rps1	37.1	15.3	R
Archer	9-16	9-30	2.5	40	Rps1k+6	36.6	15.9	R
Hardin91	9-16	10-1	3.0	37	Rps1k	37.6	15.8	MS
BSR101	9-17	9-30	2.0	40	Rps1	36.6	15.8	MS
Sturdy	9-17	9-30	2.8	39	Rps1	37.0	15.7	MR
Bell	9-17	—	2.5	35	S	37.4	15.7	R
IA2021	9-17	—	2.0	35	Rps1k	35.4	16.4	MS
Marcus 95	9-18	—	2.0	36	Rps1k+6	35.7	16.2	S
IA2008	9-19	10-1	3.2	40	Rps1	36.3	15.6	R
IA2008R	9-19	—	3.2	40	Rps1k	36.3	15.7	R

† 1=excellent, 5=very poor; ‡ 13% moisture; § R = resistant, MR = moderately resistant, MS = moderately susceptible, S = susceptible.

1.8. High yield potential. Good lodging resistance. *Rps1 gene for resistance to phytophthora.* Developed by Minnesota Agricultural Experiment Station. Released 1991. Seed sales regulated by U.S. Plant Variety Protection Act.

Weber 84—Southern zone. Relative maturity 1.8. Good tolerance to high lime soils. *Rps1 gene for resistance to phytophthora.* Lodging similar to Corsoy 79. Developed by Iowa Agricultural Experiment Station. Released 1984.

Special Purpose Publicly Developed Varieties

Chico—Small-seeded variety for specialty markets. Relative maturity 0.2. Seed weight is about 5 grams per 100 seeds less than Clay. Yields less than Clay. *Rps1 gene for resistance to phytophthora.* Developed by Minnesota Agricultural Experiment Station. Released 1983.

Grande—Relatively large seeded variety for specialty markets. Relative maturity 0.6. Seed weight about 6 grams per 100 seeds greater than Evans. Yields less than Evans. Developed by Minnesota Agricultural Experiment Station. Released 1976.

Minnatto—Small-seeded variety for specialty markets. Relative maturity 0.7. Seed weight about 4 grams per 100 seeds less than Chico. Similar in yield to Chico. *Rps1 gene for phytophthora resistance.* Developed by Minnesota Agricultural Experiment Station. Released 1989. Seed sale regulated by U.S. Plant Variety Protection Act. (Contact Sigco Sun Products, Inc., Breckenridge, MN, for information).

Proto—Very high protein variety for specialty markets. Relative maturity 0.6. Protein content 3 to 5 percent higher than other varieties. Yields less than Evans. Susceptible to phytophthora. Developed by Minnesota Agricultural Experiment Station. Released 1989.

Toyopro—Very high protein variety for specialty markets. Relative maturity 0.8. Protein content 3 percent to 5 percent higher than other varieties. Yields less than Lambert. Developed by Minnesota Agricultural Experiment Station. Released 1995. Seed sale regulated by U.S. Plant Variety Protection Act, PVP(94) (contact Northland Organic Foods, St. Paul, MN for information).

Vinton 81—Large-seeded, special purpose variety. Relative maturity 1.8. Seed weight 6 to 8 grams per 100 seeds greater than Hardin. *Rps1 gene for resistance to phytophthora.* Developed by Iowa Agricultural Experiment Station. Released 1981.

Privately Developed Varieties

The private companies and the brand names of varieties in the 1995 Minnesota tests were:

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

Cenex/Land O'Lakes, 2827 8th Ave. S., Fort Dodge IA 50501 (Cenex/LOL)

Ciba Seeds, 211 Landmark Dr., Ste. D-4, Normal IL 61761 (Ciba)

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

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

Dennis Ewing, 3903 Squaw Rd., Ames IA 50014 (Yield King)

Domestic Seed & Supply, Box 466, Madison SD 57042 (Mustang)

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

Gold Country Seed, 3374 80th St., Box 176, Plato MN 55370 (GCS)

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

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

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

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

Interstate Payco Seed Company, Box 338, 1215 Prairie Parkway, West Fargo ND 58078 (Payco)

Kaltenberg Seed Farms, Inc., 5506 Hwy. 19, PO Box 278, Waunakee WI 53597 (Kaltenberg)

Jacobsen Hybrid Corn Company, Inc., 129 9th St., Box 379, Lake View IA 51450 (Jacobsen)

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

KSC/Challenger, Box A, Dike IA 50624 (KSC/Challenger)

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

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

Midwest Seed Genetics, 213 East 6th St., PO Box 518, Carroll IA 51401 (Midwest Seed Genetics)

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

Northrup King, 7500 Olson Memorial Hwy., Golden Valley MN 55427 (NK)

Patriot Seed, Inc., 1411 N. Kickapoo, Lincoln IL 62656 (Patriot)

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

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

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

Ramy International, LTD., 1329 N. Riverfront Dr., Mankato MN 56001 (Ramy)

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

Semences Prograin, Inc., 145 Bas Riviere Nord St.-Cesaire, Quebec, Canada T0L

Table 29. Yields and characteristics of public and private soybean varieties, northern zone, 1993-95 (Crookston, Moorhead, Shelly).

Brand or Originator	Variety	Relative Maturity	Yield 1993-1995	Yield 1994–1995	Yield 1995	Phytophthora gene ‡	Chlorosis 1993-1995	Protein 1993–1995	Protein 1994–1995	Protein 1995	Oil 1993–1995	Oil 1994–1995	Oil 1995
		rating †	bu/A				rating §	% #			% #		
Pioneer	9004	00.4	—	—	37	S	R ††	—	—	35.0	—	—	16.9
Minn. A.E.S.	McCall	00.7	31	33	33	S	MR	33.0	32.8	36.9	18.7	18.7	15.7
Agric. Canada	Harmony	00.9	—	36	36	S	MR ##	—	31.7	33.3	—	19.3	17.6
Pioneer	9007	00.7	—	35	37	Rps1	MR ##	—	32.2	35.2	—	19.0	16.6
Dyna-Gro	3001	00.9	—	41	40	S	R ##	—	33.2	35.2	—	18.3	16.4
Minn. A.E.S.	Glacier	00.8	—	39	36	Rps6	MS ##	—	32.8	36.7	—	18.7	15.9
NK	S00-66	00.6	—	—	41	Rps1	R ††	—	—	36.5	—	—	16.0
Minn. A.E.S.	Agassiz	0.0	36	41	42	Rps1	MR	34.5	34.1	36.8	17.8	18.2	16.5
Dyna-Gro	3030	0.3	38	42	41	S	MS	33.0	32.7	34.7	18.8	18.9	17.4
NK	Solano	00.9	—	42	40	Rps1	S ##	—	32.2	36.9	—	18.9	15.1
Semences Prog. Inc.	Korada	0.0	—	—	48	S	MR ††	—	—	37.0	—	—	16.7
Jacques	013	0.1	—	—	46	Rps1	S ††	—	—	37.3	—	—	15.8
GCS	Tracker	0.5	40	44	48	S	MS	33.6	34.0	35.2	18.2	17.7	16.4
Minn. A.E.S.	Ozzie	0.3	39	42	45	Rps1	MS	34.5	34.6	37.6	17.7	17.6	15.3
Dairyland	DST0704	0.3	—	42	40	S	MR ##	—	33.9	37.5	—	18.4	16.1
Pioneer	9042	0.4	—	42	37	Rps1	MR ##	—	33.8	34.8	—	17.9	16.9
Ciba	3056	0.5	—	—	45	Rps1c	MR ††	—	—	38.2	—	—	15.6
Minn. A.E.S.	Evans	0.6	40	46	46	Rps1	MS	32.6	32.6	35.3	18.9	18.7	16.5
DeKalb	CX 046	0.4	—	—	40	S	R ††	—	—	37.8	—	—	14.8
Dyna-Gro	UAPX147	0.5	—	—	39	Rps1	MR ††	—	—	36.0	—	—	16.5
Minn. A.E.S.	Dawson	0.7	38	43	45	Rps1	MS	31.9	31.6	34.8	19.3	19.3	16.5
Pioneer	9071	0.7	42	47	50	Rps1c	MS	31.1	30.7	33.7	19.8	19.7	17.4
ND A.E.S.	Council	0.5	—	—	42	Rps1	MR ††	—	—	35.3	—	—	16.5
Jacques	040	0.4	—	47	49	Rps1c	MS ##	—	31.7	34.4	—	19.2	16.9
Minn. A.E.S.	Lambert	0.8	40	46	43	Rps1	MR	33.9	33.8	34.5	18.1	18.0	17.0
DeKalb	CX 076	0.7	40	45	42	S	MS	33.8	34.5	36.6	18.3	17.8	16.3
Prairie Brand	PB-094	0.9	—	—	51	Rps1c	MR ††	—	—	36.2	—	—	16.7
Dairyland	DSR-068 §§	0.3	40	44	46	S	MS	34.0	34.1	36.8	18.1	18.0	15.9
DeKalb	CX096	0.9	37	42	45	Rps1	MS	33.6	33.6	35.8	18.0	17.8	16.1
Ciba	3033	0.3	41	45	44	Rps1	S	33.8	34.1	36.4	18.4	18.1	16.3
GCS	Ashby	0.6	—	—	41	S	MR ††	—	—	38.8	—	—	15.4
Stine	0653	0.3	—	52	51	Rps1c	MS ##	—	34.8	36.2	—	17.5	16.5
Ciba	3075	0.7	—	—	48	Rps1c	MS ††	—	—	36.7	—	—	16.4
GL	GL0735	0.7	—	50	45	Rps1c	MS ##	—	33.6	35.5	—	18.2	16.4
ICI	D088	0.8	—	—	44	Rps1c	MR ††	—	—	35.0	—	—	16.8
Minn. A.E.S.	Glenwood	0.4	37	41	43	Rps1	MS	33.3	33.3	35.5	18.5	18.4	16.5
Cenex/LOL	L0704	0.7	—	—	44	S	MR ††	—	—	37.1	—	—	16.0
Stine	0670	0.3	44	50	48	S	S	32.1	32.3	34.3	19.3	18.9	17.1
Stine	EX1083	0.5	—	—	42	Rps6+1k	MR ††	—	—	36.3	—	—	15.8
Hy-Vigor	Ex:1134	0.3	—	—	41	S	MS ††	—	—	35.2	—	—	16.7
LSD 20%				1	1	2							

† Provided by originator; ‡ Specific genes noted, S = susceptible; § R = Resistant, MR = Moderately Resistant, MS = Moderately Susceptible, S = Susceptible; # 13% moisture; †† 2 yr average; ## 1 year data; §§ Blend (information furnished by originator);

1T0 (Semences)

Sand Seed Service, Inc., 4765 Hwy. 143, Marcus IA 51035 (Sands)

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

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

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

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

Thompson Agronomics, Inc., 40321 130th Ave., Leland IA 50453 (Thompson)

Thompson Seeds, Inc., 40321 130th Ave., Leland IA 50453 (Thompson)

UAP Seed Company/Dyna-Gro, PO Box 5015, Fargo ND 58105 (Dyna-Gro)

UAP Seeds Dyna-Gro, Box 80, Wall Lake IA 51466 (Dyna-Gro)

Ziller Seed Company, Inc., Rte. 1, Box 122, Bird Island MN 55310 (Ziller)

Table 30. Yields and characteristics of public and private soybean varieties, central zone, 1993-95 (Becker, Morris, Rosemount).

Brand or Originator	Variety	Relative Maturity	Yield			Phytophthora	Chlorosis	Protein			Oil		
			1993–1995	1994–1995	1995		1993-1995	1993–1995	1994–1995	1995	1993–1995	1994–1995	1995
		rating †	bu/A			gene ‡	rating §	% #			% #		
Golden Harvest	X064	0.6	—	—	45	S	MR ††	—	—	38.3	—	—	16.2
Minn AES	Ozzie	0.3	41	45	44	Rps1	MS	36.9	37.5	38.9	16.6	16.1	14.8
Mycogen	040	0.3	—	—	49	Rps1c	S ††	—	—	36.8	—	—	16.1
Pioneer	9071	0.7	—	—	57	Rps1c	MR ††	—	—	35.7	—	—	16.9
Golden Harvest	H-1078	0.8	—	52	51	Rps1	MR ‡‡	—	35.1	36.2	—	17.6	16.5
N. Dakota A.E.S.	Council	0.5	—	—	50	Rps1	MR ††	—	—	36.2	—	—	16.3
DeKalb	CX046	0.4	—	—	47	S	R ††	—	—	39.5	—	—	14.2
KSC/Challenger	K0808	0.6	—	—	55	S	MR ††	—	—	37.7	—	—	16.3
Golden Harvest	X082	0.8	—	—	53	Rps1c	MR ††	—	—	37.1	—	—	16.5
Payco	9508	0.8	—	—	52	M	MR ††	—	—	36.6	—	—	16.8
Dyna/Gro	3033	0.8	—	47	50	Rps1	S ‡‡	—	35.2	36.6	—	17.5	16.3
Minn. A.E.S.	Evans	0.6	45	48	49	Rps1	MS	35.6	35.9	36.8	17.5	17.1	16.3
Pioneer	9091	0.9	46	50	51	S	MS	35.5	35.9	36.8	17.6	17.1	16.3
Terra	E084	0.8	—	—	51	Rps1c	MR ††	—	—	37.2	—	—	16.4
Mustang	M-0830	0.8	—	—	51	M	MR ††	—	—	37.1	—	—	16.4
NK	S09-95	0.9	—	54	57	S	MR ‡‡	—	36.0	37.4	—	17.2	16.2
Minn. A.E.S.	Lambert	0.8	49	54	55	Rps1	MR	36.2	36.2	37.0	17.1	16.9	16.0
Ziller	Exp11522	0.9	—	—	53	S	MR ††	—	—	37.2	—	—	16.3
Minn. A.E.S.	Hendricks	0.9	47	51	52	Rps1	MS	35.4	35.6	36.5	17.6	17.4	16.5
Ciba	3075	0.7	—	—	51	Rps1c	MS ††	—	—	37.0	—	—	16.3
Minn. A.E.S.	Dawson	0.7	44	48	50	Rps1	MS	35.1	35.5	36.7	17.8	17.3	16.3
Kruger	K0999	1.7	—	59	59	S	MS ‡‡	—	34.8	36.1	—	17.9	16.8
AgriPro	AP1394	1.3	—	—	57	Rps1c	MR ††	—	—	37.0	—	—	16.6
Ciba	3096	0.9	—	—	55	M	MS ††	—	—	36.1	—	—	17.0
Ciba	3103	1.0	51	55	55	S	MS	36.9	37.4	38.8	16.7	16.3	15.3
ICI	D138	1.3	52	57	55	S	MS	36.7	37.1	38.2	16.8	16.5	15.7
Payco	9610	1.0	—	—	58	S	MR ††	—	—	37.2	—	—	16.7
DeKalb	CX145	1.4	—	—	57	S	MS ††	—	—	38.3	—	—	16.1
Ziller	BT1510	1.1	52	56	56	S	MS	37.0	37.6	38.2	16.6	16.3	15.9
DeKalb	CX121	1.2	51	56	55	Rps1	MS	34.6	34.6	35.6	18.0	17.7	16.4
Mustang	M-0995	0.9	—	—	54	S	MS ††	—	—	36.7	—	—	16.7
Mycogen	111	1.1	—	—	54	Rps1	MR ††	—	—	35.7	—	—	16.4
Pioneer	9132	1.3	—	—	53	Rps1c	MR ††	—	—	36.0	—	—	16.7
Terra	TS093	0.9	—	—	53	Rps1	MR ††	—	—	36.1	—	—	16.5
Payco	0010	1.0	—	48	51	Rps1	MR ‡‡	—	37.0	38.3	—	16.4	15.3
Cenex/LOL	L1093	1.0	—	—	48	Rps1k	R ††	—	—	36.9	—	—	16.3
ICI	D111	1.1	—	55	59	Rps1	MR ††	—	35.1	36.6	—	17.6	16.2
Pioneer	9151	1.3	—	—	56	Rps1k	MR ††	—	—	37.3	—	—	16.1
Yield King	K1313	1.2	—	—	55	S	MR ††	—	—	38.7	—	—	15.9
Prairie Brand	PB144	1.4	—	—	55	S	S ††	—	—	38.2	—	—	15.9
Prairie Brand	PB104	1.0	—	55	54	S	MS ‡‡	—	34.9	36.5	—	17.9	16.7
GCS	Goodwin	1.2	—	52	53	Rps1k	S ‡‡	—	34.6	35.4	—	17.8	16.8
Mycogen	S74	1.0	49	53	52	S	MR	36.4	36.7	38.3	17.1	16.9	15.9
DeKalb	CX096	0.9	46	51	51	Rps1	MS	36.3	36.9	38.2	17.0	16.5	15.4
Dyna/Gro	3038	1.0	—	50	47	S	MS ‡‡	—	36.8	38.4	—	16.9	15.9

Table 30 (continued). Yields and characteristics of public and private soybean varieties, central zone, 1993-95 (Becker, Morris, Rosemount).

Brand or Originator	Variety	Relative Maturity	Yield 1993–1995	Yield 1994–1995	Yield 1995	Phyto-phthora	Chlorosis 1993-1995	Protein 1993–1995	Protein 1994–1995	Protein 1995	Oil 1993–1995	Oil 1994–1995	Oil 1995
		rating †	bu/A			gene ‡	rating §	% #			% #		
Dairyland	DSR133	1.3	50	54	57	Rps1	MS	35.2	35.5	36.5	17.7	17.3	16.2
KSC/Challenger	K-1414	1.2	—	—	57	S	MR ††	—	—	37.6	—	—	15.7
Prairie Brand	PB-147	1.4	—	—	56	S	MR ††	—	—	38.4	—	—	15.8
Stine	0380	0.8	—	—	56	S	MS ††	—	—	38.5	—	—	15.6
Kaltenberg	KB145	1.4	—	—	60	Rps1	MS ††	—	—	37.7	—	—	15.8
Profiseed	145	1.5	—	—	59	Rps1	MS ††	—	—	37.6	—	—	16.0
Mustang	M-1133	1.3	—	—	58	Rps1	S ††	—	—	37.9	—	—	15.4
Sands	EXP165	1.5	—	—	57	Rps1k	MR ††	—	—	37.6	—	—	16.1
Stine	1610	1.1	—	58	57	S	MS ‡‡	—	37.1	38.0	—	16.3	15.5
NK	S12-49	1.3	—	—	55	Rps1c	MS ††	—	—	37.0	—	—	15.9
Golden Harvest	H-1140	1.4	—	56	52	Rps1k	S ‡‡	—	38.0	38.4	—	16.1	15.9
Minn. A.E.S.	Hodgson78	1.4	46	50	52	Rps1	MS	35.2	35.7	37.2	17.8	17.3	16.2
Latham	170 Brand	1.3	48	51	49	S	MS	35.7	36.1	37.4	17.6	17.2	16.3
Minn A.E.S.	Kato	1.4	47	49	49	Rps1	MS	36.2	36.8	38.9	15.8	15.7	15.9
Thompson	T-3172	1.4	—	—	59	S	MR ††	—	—	37.2	—	—	16.1
Midwest Seed Genetics	G-1400	1.4	—	—	58	S	MR ††	—	—	39.1	—	—	15.2
PBR	127X	1.2	—	—	57	S	MR ††	—	—	37.1	—	—	16.3
Stine	1470	1.4	—	57	55	S	MR ‡‡	—	36.9	38.0	—	16.5	15.6
Mustang	M-1122	1.2	—	—	54	S	MR ††	—	—	37.5	—	—	15.8
Minn. A.E.S.	Parker	1.5	48	51	54	Rps1	S	35.3	35.3	36.4	17.7	17.5	16.6
Prairie Brand	PB137	1.3	52	54	54	S	MR	35.5	35.9	37.0	17.6	17.1	16.2
Thompson	EX1166	1.4	—	55	53	Rps1	MS ‡‡	—	36.1	37.3	—	16.8	15.6
GL	GL1315	1.3	51	54	51	S	MR	35.6	35.9	37.0	17.5	17.3	16.3
Terra	TS140	1.4	—	—	51	S	MR ††	—	—	38.0	—	—	15.6
PBR	166X	1.6	—	—	58	S	MS ††	—	—	37.6	—	—	16.0
Dairyland	DSR173	1.5	50	54	57	Rps1	MS	36.7	36.9	37.8	16.9	16.8	16.3
Iowa AES	Hardin	1.6	50	56	57	Rps1	S	35.4	35.4	36.6	17.4	17.3	16.0
Yield King	K-1515	1.3	—	—	56	S	MR ††	—	—	37.9	—	—	15.6
AgriPro	AP1880	1.8	53	57	55	S	MS	35.3	35.6	36.7	17.3	16.9	15.6
Thompson	EX1183	1.5	—	—	55	Rps1	MR ††	—	—	37.7	—	—	15.3
GCS	X80053	1.8	—	—	54	Rsp1c	R ††	—	—	36.7	—	—	16.2
KSC/Challenger	K-1888	1.5	—	—	54	S	MS ††	—	—	38.6	—	—	15.6
Sands	SOI-113	1.4	50	53	52	S	MS	35.4	35.7	37.3	17.7	17.4	16.2
Ciba	3144	1.4	—	52	51	S	MR ‡‡	—	36.4	37.4	—	16.9	16.1
Payco	9314	1.4	49	51	50	S	MR	35.5	36.1	37.9	17.6	17.2	16.0
Thompson	EX1903	1.4	—	—	50	Rps1k	MS ††	—	—	36.5	—	—	16.6
Minn. A.E.S.	Kasota	1.6	47	49	46	Rps1c	MR	37.3	37.5	38.0	16.3	16.1	15.4
AgriPro	EX1618	1.6	—	—	56	Rps1c	MS ††	—	—	37.5	—	—	15.7
GCS	Highland	1.7	—	—	58	S	S ††	—	—	37.2	—	—	16.0
Sands	SOI-260	1.5	—	62	61	S	S ‡‡	—	35.6	36.2	—	17.1	16.2
Kruger	K-1909	1.5	55	58	58	Rps1k	MS	36.0	36.7	37.6	17.1	16.6	15.6
AgriPro	AP1995	1.9	—	57	57	Rps1c	MR ‡‡	—	34.5	36.6	—	17.6	15.5
Minn. A.E.S.	Bert	1.3	48	52	54	Rps1	MS	33.7	33.7	34.9	18.4	17.9	16.4
Kruger	K-1717+	1.4	52	55	53	S	MS	36.3	36.4	37.0	17.1	17.0	16.5
Dairyland	DSR-178	1.5	—	—	52	RPS1c	S ††	—	—	37.4	—	—	16.0
Minn. A.E.S.	Granite	1.8	—	—	51	Rps1	MR ††	—	—	37.1	—	—	15.5
Minn. A.E.S.	Freeborn	1.7	—	—	50	Rps1	MR ††	—	—	37.9	—	—	15.4
Yield King	K-1819	1.5	56	62	62	S	S	36.6	36.6	36.8	16.9	16.8	16.5
Yield King	K-2222	1.6	54	58	60	S	S	35.7	35.9	36.0	17.3	16.9	16.4
Kruger	K-1990	1.5	—	—	60	S	S ††	—	—	36.9	—	—	15.6

Table 30 (continued). Yields and characteristics of public and private soybean varieties, central zone, 1993-95 (Becker, Morris, Rosemount).

Brand or Originator	Variety	Relative Maturity	Yield 1993–1995	Yield 1994–1995	Yield 1995	Phytophthora gene ‡	Chlorosis 1993-1995 rating §	Protein 1993–1995 % #	Protein 1994–1995 % #	Protein 1995 % #	Oil 1993–1995 % #	Oil 1994–1995 % #	Oil 1995 % #
		rating †	bu/A	bu/A	bu/A			% #	% #	% #	% #	% #	% #
Profiseed	1504	1.5	—	57	58	S	MR ‡‡	—	36.0	37.4	—	17.0	15.8
Stine	1580	1.5	—	—	58	S	S ††	—	—	35.6	—	—	17.2
GL	GL1593	1.5	53	56	57	S	MR	34.7	35.0	36.5	18.1	17.8	16.7
PBR	154X	1.5	—	—	57	S	MS ††	—	—	36.3	—	—	16.6
Midwest Seed Genetics	G-1885	1.5	—	—	56	S	S ††	—	—	36.3	—	—	16.5
PBR	178X	1.8	—	—	56	S	MS ††	—	—	37.1	—	—	16.0
Thompson	EX1987	1.5	—	—	55	M	MR ††	—	—	37.0	—	—	15.8
Hy-Vigor	2002	1.5	—	—	53	Rps1	R ††	—	—	36.6	—	—	15.7
KSC/Challenger	K-1616	1.4	—	—	52	S	R ††	—	—	38.6	—	—	15.1
Dairyland	DST 1313	1.5	—	—	52	S	R ††	—	—	37.4	—	—	15.6
LSD 20%				1	1	2							

† Provided by originator; ‡ Specific genes noted, S=Susceptible, M=Mixture Resistant and Susceptible; § R = Resistant, MR = Moderately Resistant, MS = Moderately Susceptible, S = Susceptible; # 13% moisture; †† 1 year data.; ‡‡ 2 year average.

Table 31. Yields and characteristics of public and private soybean varieties, southern zone, 1993-95 (Fairmont, Lamberton, Waseca).

Brand or Originator	Variety	Relative Maturity	Yield 1993–1995	Yield 1994–1995	Yield 1995	Phytophthora gene ‡	Chlorosis rating §	Protein 1993–1995 % #	Protein 1994–1995 % #	Protein 1995 % #	Oil 1993–1995 % #	Oil 1994–1995 % #	Oil 1995 % #
		rating †	bu/A	bu/A	bu/A			% #	% #	% #	% #	% #	% #
Patriot	6147 ††	1.4	—	—	57	Rps1c	R ‡‡	—	—	36.4	—	—	17.8
Minn. A.E.S.	Kato	1.4	47	51	53	Rps1	MS	37.8	37.8	39.8	16.5	16.6	16.0
Patriot	6131	1.3	—	—	54	Rps1k	MS ‡‡	—	—	37.2	—	—	16.1
Minn. A.E.S.	Hodgson 78	1.4	47	51	51	Rps1	MS	35.0	35.1	37.3	17.9	17.5	16.0
Minn. A.E.S.	Kasota	1.6	45	49	49	Rps1c	MR	36.2	36.3	36.9	17.3	17.2	17.0
Minn. A.E.S.	Parker	1.5	52	57	57	Rps1	S	35.3	35.3	37.5	17.8	17.5	16.0
Pioneer	9172	1.7	—	—	62	Rps1k	S ‡‡	—	—	36.7	—	—	16.1
AgriPro	AP1880	1.8	—	—	61	S	MR ‡‡	—	—	36.8	—	—	16.2
DeKalb	CX173	1.7	—	—	61	Rps1c	MR ‡‡	—	—	35.6	—	—	16.3
Stine	1470	1.4	—	—	60	S	R ‡‡	—	—	37.5	—	—	16.3
Stine	1570	1.7	—	—	60	S	MR ‡‡	—	—	37.2	—	—	16.5
Pioneer	9204	2.0	—	62	59	Rps1	MS §§	—	34.9	36.7	—	17.6	16.4
Iowa A.E.S.	Hardin 91	2.0	—	54	56	Rps1k	MS §§	—	35.1	36.4	—	17.5	16.5
Minn. A.E.S.	Bert	1.8	50	55	55	Rps1	MS	33.9	34.0	36.0	18.5	18.2	16.8
Minn. A.E.S.	Freeborn	1.7	—	—	52	Rps1	MR ‡‡	—	—	38.5	—	—	15.2
Minn. A.E.S.	Fairbault	1.6	—	52	49	Rps1	MR §§	—	34.0	34.4	—	17.9	17.3
NK	S16-60	1.6	—	63	63	S	MR §§	—	36.6	38.8	—	16.9	15.8
Mycogen	181 Brand ††	1.8	—	—	61	S	MR ‡‡	—	—	36.3	—	—	16.5
Thompson	EX1183	1.5	56	61	61	Rps1	MS	34.8	35.1	37.9	18.0	17.4	15.4
Pioneer	9163	1.6	—	—	60	Rps1c	R ‡‡	—	—	35.9	—	—	17.1
Minn. A.E.S.	Leslie	1.8	50	56	58	Rps1	S	34.5	34.6	36.8	18.3	17.8	16.2
Profiseed	2224E	2.0	—	—	64	S	MR ‡‡	—	—	33.1	—	—	17.1
Kaltenberg	KB175	1.7	—	—	62	S	S ‡‡	—	—	37.4	—	—	16.1
Sansgaard	S-187	1.9	—	—	62	S	S ‡‡	—	—	38.0	—	—	15.7
AgriPro	AP1995	1.9	—	—	61	Rps1c	MR ‡‡	—	—	36.8	—	—	15.8
Jacobson	J658	1.8	—	—	60	S	MR ‡‡	—	—	37.7	—	—	15.9
Iowa A.E.S.	BSR101	1.9	—	—	59	Rps1	MR ‡‡	—	—	36.9	—	—	16.0
Stine	EX1880	1.8	—	—	59	S	MR ‡‡	—	—	3.58	—	—	16.8
Minn. A.E.S.	Sturdy	2.1	54	58	57	Rps1	MR	34.6	35.1	36.7	18.3	17.6	16.7
Iowa A.E.S.	Archer	1.9	52	56	56	Rps1k	MR	34.7	34.9	36.6	18.0	17.5	16.1

Table 31 (continued). Yields and characteristics of public and private soybean varieties, southern zone, 1993-95 (Fairmont, Lamberton, Waseca).

Brand or Originator	Variety	Relative Maturity	Yield 1993–1995	Yield 1994–1995	Yield 1995	Phytophthora gene ‡	Chlorosis rating §	Protein 1993–1995	Protein 1994–1995	Protein 1995	Oil 1993–1995	Oil 1994–1995	Oil 1995
		rating †	bu/A					% #			% #		
Minn. A.E.S.	Granite	1.8	—	—	55	Rps1	MR‡‡	—	—	37.2	—	—	15.6
Illinois A.E.S.	Corsoy 79	2.2	50	54	54	Rps1c	S	35.1	35.6	36.8	17.7	17.0	16.1
Ziller	EXP11927	1.7	—	—	68	S	MS‡‡	—	—	37.3	—	—	16.5
Ramy	1995	2.0	—	—	66	S	MS‡‡	—	—	35.7	—	—	16.7
KSC/Challenger	K-2021	1.8	60	65	66	S	S	35.3	35.5	37.2	17.8	17.4	16.3
Sands	SOI260	1.9	—	—	66	S	S‡‡	—	—	36.9	—	—	16.4
KSC/Challenger	K-2101	1.9	—	—	65	S	MS‡‡	—	—	37.1	—	—	16.4
Golden Harvest	X194	1.9	—	—	65	S	MR‡‡	—	—	35.2	—	—	16.7
Sands	EXP168	1.8	—	—	64	S	MR‡‡	—	—	38.0	—	—	15.7
GCS	Odin	1.9	—	—	64	S	S‡‡	—	—	36.1	—	—	16.4
Thompson	T-3190	2.0	57	62	64	S	S	35.6	35.9	37.5	17.5	17.0	15.9
Latham	480 Brand	2.1	—	—	63	S	S‡‡	—	—	35.2	—	—	17.1
Thompson	EX 1987	1.5	—	—	63	M	MR‡‡	—	—	37.0	—	—	15.9
Mustang	M-1175	1.7	—	—	63	S	MR‡‡	—	—	37.5	—	—	15.6
Terra	TS 194	2.0	—	62	63	S	MS §§	—	35.5	37.6	—	17.1	15.6
Iowa A.E.S.	IA2008	2.1	56	61	62	Rps1	MS	33.4	34.0	35.9	18.5	17.8	16.1
ICI	D213	2.1	54	59	61	Rps1	MS	34.4	34.8	36.3	18.5	17.9	17.1
Golden Harvest	H-1228	2.2	54	60	61	Rps1	S	33.5	33.7	34.9	18.9	18.3	17.3
Stine	1690	1.6	—	—	60	S	MS‡‡	—	—	35.4	—	—	16.9
NK	S19-90	1.9	52	59	60	Rps1c	MS	34.2	35.2	37.4	18.5	17.5	16.0
Latham	390 Brand	2.1	—	62	59	S	MS §§	—	35.4	37.0	—	17.7	16.9
Ehrich	1398	1.9	—	60	58	S	S §§	—	36.3	38.4	—	17.0	16.0
ICI	D190	1.9	—	56	58	S	S §§	—	35.9	38.8	—	16.7	14.6
Dyna-Gro	DG3170	1.7	—	—	58	S	MR‡‡	—	—	36.8	—	—	16.3
Latham	280 Brand	1.9	—	60	57	S	MS §§	—	35.5	36.9	—	17.2	16.2
AgriPro	EX2000	2.0	—	—	57	Rps1k	MR‡‡	—	—	35.8	—	—	16.2
Sands	SOI 169	2.0	—	68	70	S	MS §§	—	35.5	37.0	—	17.3	16.5
Jacobson	J750	2.0	—	—	69	S	MR‡‡	—	—	36.6	—	—	16.8
Prairie Brand	PB-197	1.9	58	67	69	S	S	35.3	35.5	37.2	17.8	17.5	16.5
Latham	660 Brand	2.4	59	66	67	S	S	34.6	34.7	36.2	18.1	17.8	16.7
Payco	9419	1.9	—	65	66	S	S §§	—	35.4	37.3	—	17.4	16.4
PBR	194	1.9	—	61	65	S	S §§	—	34.0	35.6	—	18.0	16.7
Jacobson	J742	2.1	—	—	65	S	MS‡‡	—	—	35.8	—	—	16.6
KSC/Challenger	K-2131	1.9	—	—	65	S	MR‡‡	—	—	37.5	—	—	16.2
Sansgaard	S-214	2.1	—	64	65	S	MR §§	—	34.1	35.5	—	18.0	16.7
Stine	1590	1.9	59	64	64	S	S	35.3	35.5	36.9	18.0	17.6	17.0
DeKalb	CX232	2.3	58	64	64	S	S	35.5	35.5	37.2	17.8	17.6	16.7
Dyna-Gro	DG3200	2.0	—	—	64	S	R‡‡	—	—	36.2	—	—	16.4
Dyna-Gro	DG3210	2.1	—	—	64	S	MS‡‡	—	—	37.5	—	—	15.7
Terra	E174	1.7	—	—	64	S	S‡‡	—	—	38.0	—	—	15.6
Kruger	K-1990	1.5	—	—	64	S	S‡‡	—	—	37.2	—	—	16.1
Kaltenberg	KB-184	1.8	—	64	64	S	MS §§	—	35.2	37.0	—	17.5	16.4
Mustang	M-2215	2.1	—	—	64	S	MR‡‡	—	—	36.3	—	—	16.6
Prairie Brand	PB-212E	2.1	—	64	64	S	S §§	—	34.4	35.8	—	18.3	17.5
NK	S24-92	2.4	57	63	64	S	S	34.7	34.9	36.3	18.3	17.8	17.0
Profiseed	2000	2.1	—	—	63	S	MS‡‡	—	—	36.8	—	—	16.6
Midwest Seed Genetics	G2100	2.1	—	—	63	S	MR‡‡	—	—	38.1	—	—	16.0
Sands	SOI 252	2.1	57	62	63	S	MS	35.8	36.2	38.0	17.5	16.9	15.8
Mycogen	200	2.1	—	—	62	S	MS‡‡	—	—	35.9	—	—	16.6
PBR	217	2.1	—	—	62	S	MS‡‡	—	—	37.2	—	—	16.2

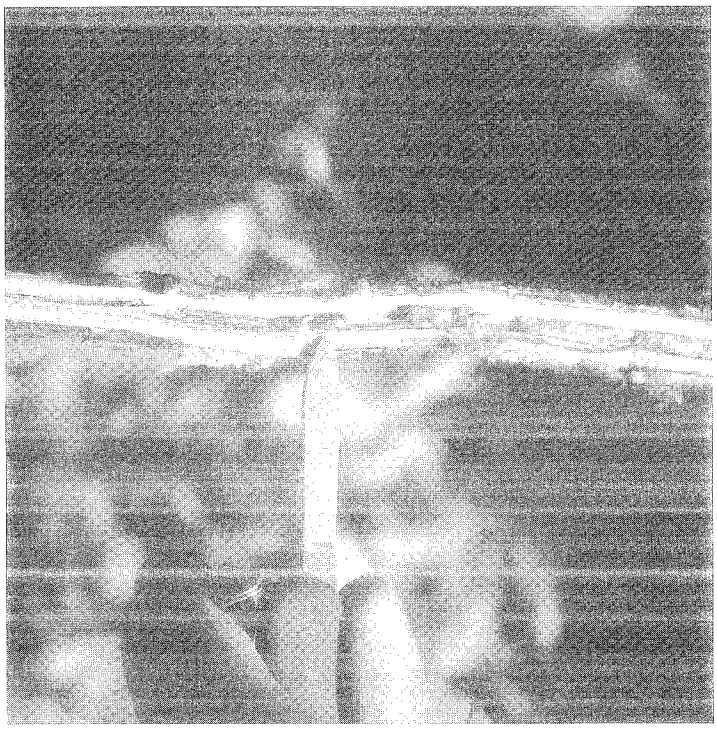
Table 31 (continued). Yields and characteristics of public and private soybean varieties, southern zone, 1993-95 (Fairmont, Lamberton, Waseca).

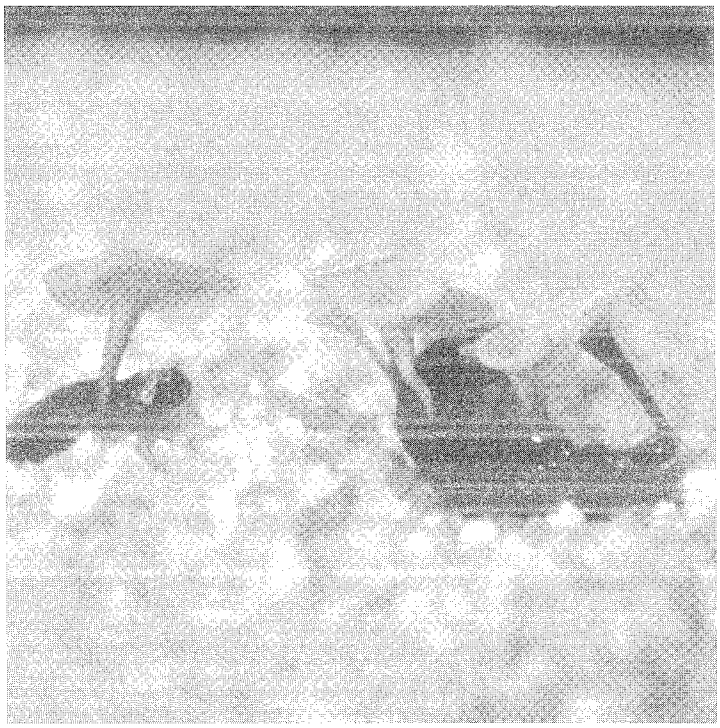
Brand or Originator	Variety	Relative Maturity	Yield			Phyto-phthora	Chlorosis	Protein			Oil		
			1993–1995	1994–1995	1995			1993–1995	1994–1995	1995	1993–1995	1994–1995	1995
		rating †	bu/A			gene ‡	rating §	% #			% #		
Patriot	225	2.2	—	—	62	Rps1	MS‡‡	—	—	35.3	—	—	16.8
Hy-Vigor	2050	2.2	—	63	62	S	S §§	—	35.7	37.4	—	17.1	15.9
Profiseed	2555	2.4	60	64	62	S	S	34.5	34.5	36.5	18.2	18.0	16.8
Ciba	3202	2.0	52	59	62	S	MS	35.7	35.9	37.8	17.7	17.3	16.2
Pioneer	9254	2.5	—	—	62	S	MR‡‡	—	—	36.8	—	—	16.3
Iowa A.E.S.	IA2021	2.0	—	—	62	Rps1k	S‡‡	—	—	34.3	—	—	17.6
Kaltenberg	KB245	2.4	—	—	62	S	S‡‡	—	—	37.0	—	—	16.1
Mustang	M-1200	2.0	57	62	61	S	S	35.2	35.5	36.9	17.8	17.4	16.5
PBR	232	2.3	54	61	60	S	S	33.8	34.1	35.4	18.5	17.9	16.6
Profiseed	2134	2.2	—	61	60	S	MR §§	—	36.1	37.8	—	17.0	15.7
NK	S20-91	2.1	—	—	60	Rps1c	MS‡‡	—	—	37.4	—	—	16.2
Latham	610 Brand	2.1	—	—	59	S	MR‡‡	—	—	38.8	—	—	15.3
Thompson	EX1335 ††	2.1	—	—	58	S	MS‡‡	—	—	37.0	—	—	16.1
Latham	580 Brand	2.2	51	55	57	Rps1	MS	33.0	33.5	35.3	19.2	18.3	16.9
Illinois A.E.S.	Bell	2.4	—	—	55	S	MR‡‡	—	—	37.0	—	—	16.5
KSC/Challenger	K-2343	2.1	—	—	69	S	S‡‡	—	—	36.5	—	—	16.6
Yield King	K-2323+	2.1	—	67	67	S	MR §§	—	36.4	37.4	—	16.8	16.1
Mustang	M-2200	2.0	—	—	67	S	MS‡‡	—	—	36.8	—	—	16.3
Stine	2500	2.4	—	66	66	S	S §§	—	35.5	37.6	—	17.3	15.8
Midwest Seed Genetics	G2440	2.4	59	65	66	S	MS	35.0	35.0	36.4	17.9	17.5	16.4
Kruger	K-2324	2.1	—	—	66	S	MR‡‡	—	—	37.4	—	—	16.1
Prairie Brand	PB-2120	2.4	58	65	66	S	S	34.4	34.5	35.9	18.3	17.9	17.0
Latham	410 Brand	2.0	—	—	65	S	S‡‡	—	—	35.9	—	—	17.1
Payco	9023	2.2	58	64	65	S	S	35.1	35.0	37.0	17.9	17.6	16.2
Terra	E210	2.1	—	—	65	S	MS‡‡	—	—	37.6	—	—	15.9
Yield King	K-2515	2.3	—	—	65	S	MS‡‡	—	—	37.8	—	—	15.6
GL	GL2415	2.4	58	64	64	S	MS	34.4	34.5	35.6	18.2	17.8	16.7
Jacobson	J659	1.9	—	—	64	S	S‡‡	—	—	37.5	—	—	15.6
Yield King	K-2404	2.2	—	—	64	S	MS‡‡	—	—	36.8	—	—	16.6
GCS	X3522	2.2	—	—	63	S	R‡‡	—	—	37.5	—	—	16.3
Ziller	BT2911	1.9	—	—	61	S	S‡‡	—	—	37.7	—	—	15.7
DeKalb	CX228	2.2	—	61	61	Rps1c	MS §§	—	33.7	35.2	—	17.9	16.3
Ehrich	E-298	2.2	56	62	61	S	MS	35.3	35.4	37.3	17.8	17.4	16.3
Thompson	EX1331	2.1	—	—	61	S	MR‡‡	—	—	36.8	—	—	15.7
Ramy	2525	2.4	—	—	59	S	MS‡‡	—	—	37.5	—	—	15.5
AgriPro	EX2380	2.3	—	—	59	S	MS‡‡	—	—	37.8	—	—	15.8
Iowa A.E.S.	IA 2008R	2.1	—	—	59	Rps1k	MR‡‡	—	—	36.2	—	—	16.5
Thompson	T-3220	2.2	—	—	59	S	MS‡‡	—	—	38.3	—	—	15.5
Dairyland	DSR-217	2.1	53	58	58	S	MS	34.1	34.1	35.6	18.4	17.9	16.7
Dairyland	DSR-220/sts	2.2	—	—	57	S	MR‡‡	—	—	37.3	—	—	16.4
GL	GL2045	2.0	—	—	57	S	R‡‡	—	—	38.3	—	—	15.4
Payco	9225	2.4	60	67	70	S	S	34.8	35.1	36.7	18.0	17.5	16.3
Ramy	2220	2.2	—	—	69	S	MS‡‡	—	—	35.9	—	—	16.9
ICI	D260	2.5	58	65	68	S	S	34.8	34.9	36.6	18.0	17.6	16.3
Kruger	K-2625	2.4	—	—	67	S	S‡‡	—	—	37.3	—	—	15.9
Latham	590 Brand	2.2	—	63	65	S	MR §§	—	36.2	37.5	—	16.9	15.9
Mycogen	251	2.4	59	65	64	S	MS	34.8	35.0	36.4	18.0	17.5	16.4
Golden Harvest	H-1218	2.1	—	—	64	S	MS‡‡	—	—	36.9	—	—	15.7
Cenex/LOL	L2494	2.4	—	—	63	S	MS‡‡	—	—	36.0	—	—	16.5
Ciba	3215	2.1	—	—	62	S	MR‡‡	—	—	37.9	—	—	15.8

Table 31 (continued). Yields and characteristics of public and private soybean varieties, southern zone, 1993-95 (Fairmont, Lamberton, Waseca).

Brand or Originator	Variety	Relative Maturity	Yield 1993–1995	Yield 1994–1995	Yield 1995	Phytophthora gene ‡	Chlorosis rating §	Protein 1993–1995	Protein 1994–1995	Protein 1995	Oil 1993–1995	Oil 1994–1995	Oil 1995
		rating †	bu/A			gene ‡	rating §	% #			% #		
ICI	D236	2.3	—	—	62	S	MS‡‡	—	—	37.9	—	—	15.6
Ciba	3253	2.5	—	61	61	S	MS §§	—	34.9	35.9	—	17.4	16.4
Ziller	Exp 12028 ††	2.1	—	—	61	S	MR‡‡	—	—	37.9	—	—	15.7
Thompson	T-3227 ††	2.3	—	—	61	S	S‡‡	—	—	36.0	—	—	17.0
Dairyland	DSR-222	2.2	54	59	60	S	MR	33.5	33.8	35.8	18.7	18.0	16.3
Iowa A.E.S.	Marcus 95	2.3	—	—	56	Rps1k+6	MR‡‡	—	—	35.9	—	—	16.7
Prairie Brand	PB-201	2.0	59	65	67	S	MS	35.8	36.3	37.7	17.3	16.8	15.8
PBR	247	2.4	59	65	66	S	S	34.5	34.7	36.5	18.2	17.8	16.6
Kruger	K-2525	2.3	58	64	65	S	S	34.5	34.8	36.0	18.2	17.8	16.9
Patriot	6247	2.4	—	—	63	S	S‡‡	—	—	36.2	—	—	17.0
Sansgaard	S-236X	2.4	—	—	63	S	MS‡‡	—	—	37.0	—	—	15.6
Golden Harvest	H-1263	2.4	57	62	62	S	S	34.6	34.7	35.4	18.1	17.6	16.9
Payco	9421	2.1	—	62	61	S	MS §§	—	35.8	37.7	—	16.9	15.5
Yield King	K-2666	2.4	59	65	64	S	MS	34.4	34.6	36.4	18.4	18.0	16.8
Stine	2621	2.4	—	61	62	S	MS §§	—	36.4	37.6	—	16.6	15.8
Sansgaard	S-242X	2.4	—	—	55	S	MS‡‡	—	—	37.8	—	—	16.1
DeKalb	CX250b	2.5	—	59	55	Rps1	MS §§	—	35.5	36.6	—	16.9	15.8
Thompson	EX2007	2.4	—	—	54	S	R‡‡	—	—	36.3	—	—	16.0
Dairyland	DSR-244	2.4	—	—	60	Rps1c	MS‡‡	—	—	35.8	—	—	15.9
LSD 20%				1	2	2							

† Information furnished by originator; ‡ Specific genes noted, S=Susceptible, M=Mixture Resistant and Susceptible; § R = Resistant, MR = Moderately Resistant, MS = Moderately Susceptible, S = Susceptible; # 13% moisture; †† Blend (information furnished by originator); ‡‡ 1 year data; §§ 2 year average.





This section of a soybean stem is severly infected with white mold. Blade points to the spore masses (sclerotia) which overwinter in plant residues. These sclerotia produce the inverted funnel/parasol like organs which release new spores that infect subsequent crops.

Table 32. Yields and characteristics of public and private soybean varieties from tests on soybean cyst nematode infested (East Chain, New Richland, and St. James) and non-infested (Fairmont, Lamberton, and Waseca) sites, 1993-95.

Brand or Originator	Variety	Relative Maturity	Infested Yield 1993–1995	Infested Yield 1994-1995	Infested Yield 1995	Matures	Noninfested Yield 1993–1995	Noninfested Yield 1994-1995	Noninfested Yield 1995	Phyto-phthora	Chlorosis	SCN
		rating †	bu/A			date	bu/A			gene ‡	rating §	rating #
Minn. A.E.S.	Parker	1.5	34	39	42	9-16	52	55	54	Rps1	S	S
Dairyland	DSR-143N	1.5	32	37	39	9-18	49	52	52	S	MR	MR
Thompson	T-3171CN	1.7	—	—	35	9-16	—	—	52	Rps1	MR ##	MR
Minn. A.E.S.	Alpha	1.4	30	35	35	9-18	42	45	42	S	MR	R
Minn. A.E.S.	Faribault	1.6	30	35	33	9-19	47	52	51	Rps1	MS	R
Minn. A.E.S.	Freeborn	1.7	31	37	40	9-18	45	50	50	Rps1	MS	R
Minn. A.E.S.	Sturdy	2.1	34	40	40	9-22	50	53	51	Rps1	MR	S
Patriot	EX7227N	2.2	—	—	43	9-25	—	—	51	Rps1	MR ##	R
Latham	522CN Brand	2.1	—	—	44	9-23	—	—	50	S	MR ##	MR
Kruger	KB-2120B ††	1.9	—	—	43	9-23	—	—	60	S	MR ##	—
Kruger	K-1919+SCN	1.7	—	42	41	9-22	—	54	50	S	MR §§	R
Thompson	T-3198CN ††	2.0	34	42	44	9-25	54	58	56	S	S	—
Cenex/LOL	L2069SCN	2.0	—	—	40	9-24	—	—	52	S	MR ##	MR
Pioneer	9221	2.2	32	36	36	9-20	46	48	48	Rps1	MR	R
ICI	EX5203N	2.0	—	—	43	9-23	—	—	48	S	MR ##	MR
Kruger	K-2120 SCN	1.9	—	—	42	9-20	—	—	57	Rps1k	MR ##	MR
Illinois A.E.S.	Bell	2.2	32	39	39	9-23	46	53	49	S	MS	MR
Iowa A.E.S.	Marcus 95	2.3	—	—	43	9-25	—	—	57	Rps1k	MR ##	S
Iowa A.E.S.	IA2021	2.4	—	—	43	9-24	—	—	56	Rps1k	S ##	S
Iowa A.E.S.	Newton	2.6	34	40	38	9-29	43	46	41	Rps1	MR	R
DeKalb	CX260C	2.6	—	43	42	9-31	—	54	51	S	MS §§	R
LSD 20%			1	1	2		1	1	2			

† Information supplied by originator; ‡ Specific gene noted, S = susceptible; § R = resistant, MR = moderately resistant, MS = moderately susceptible, S = susceptible; # Reaction to Minnesota isolate of Race 3, R = resistant, MR = moderately resistant, MS = moderately susceptible, S = susceptible; †† Blend (information supplied by originator); ## 1 year data; §§ 2 year average.

CROPS NOT IN CURRENT TRIALS

Crambe and oilseed rape

Crambe (*Crambe abyssinica*) and oilseed rape (*Brassica napus* or *B. campestris*) are grown for their high-erucic acid industrial oil. Substantial acreage of crambe has been contracted in North Dakota in recent years. The oil is used in producing 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.

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.

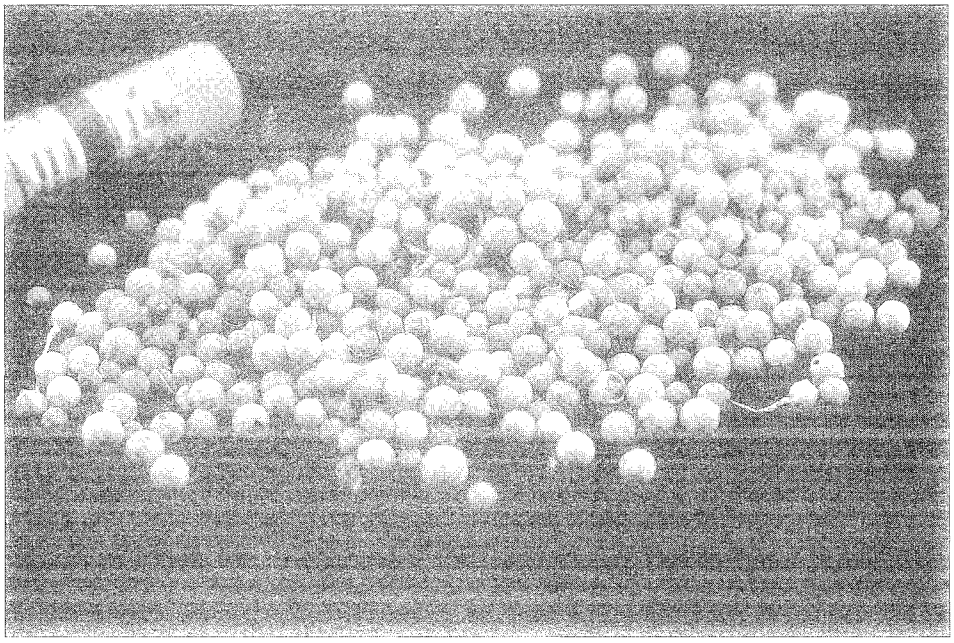
Minnesota Agricultural Experiment Station scientists are not currently conducting performance trials of flax. If you want information from the most recent report of tests of this crop, contact Extension Agronomy, 411 Borlaug Hall, 1991 Buford Circle, University of Minnesota, St. Paul, MN 55108.

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.



Crambe seed.

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.

Adzuki flower and developing pods. Each pod has up to ten seeds.

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.

Lupin in flower. Leaflets fold inward during mid-day heat to conserve moisture. This trait also allows a lot of sunlight through the plant canopy, which is used by competing weeds.

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) †	Seeds/pound (number)	Rate/acre (pounds)	Rate (seeds)	Planting Date
Barley		48	14,300	85	28/square foot	Early spring
Corn		56	1,400	17	24,000/acre	Late April or early May
Fieldbean	Black turtle soup	60	2,300	45	105,000/acre	May 20 to June 15
	Great northern		1,000	100	90,000/acre	
	Kidney		900	90–115	90,000/acre	
	Navy		2,500	42	105,000/acre	
	Navy 6– to 14–inch rows			60	150,000/acre	
	Pink		1,700	60	105,000/acre	
	Pinto		1,300	80	90,000/acre	
	Small Red		1,400	75	100,000/acre	
	Small White		3,000	35	105,000/acre	
Flax		56	88,000	42	85/square foot	April 15 to May 15
Forage Grasses (perennial)	If mixed with legume, sow at time indicated for the legume					
	Bromegrass alone	14	136,000	16	50/square foot	Early spring or summer
	in mixtures			10	31/square foot	
	Orchardgrass in mixtures	14	653,000	2	30/square foot	Early spring or summer
	Reed canarygrass alone	46	526,000	7	85/square foot	Early spring or summer
	in mixtures			5	60/square foot	
	Tall fescue in mixtures	25	229,000	4	21/square foot	Early spring or summer
	Timothy in mixtures	45	1,234,000	3	85/square foot	Early spring or summer
Forage Legumes (perennial)						
	Alfalfa alone	60	199,000	11	50/square foot	Early spring to August 10
	with grass			7	32/square foot	
	Alsike clover in mixtures	60	653,000	2	30/square foot	Early spring to August 10
	Birdsfoot trefoil alone	60	372,000	7	60/square foot	Early spring or summer
	with grass			4	34/square foot	
	Ladino clover in mixtures	60	784,000	1	18/square foot	Early spring to August 10
	Red clover alone	60	252,000	9	50/square foot	Early spring to August 10
	with grass			5	30/square foot	
Oat		32	16,200	80	28/square foot	Early spring
Rye		56	18,200	60	25/square foot	September
Sorghum	18– to 40–inch rows	56	15,000	10	150,000/acre	May 20 to June 5 for grain
	6– to 14–inch rows			15	5/square foot	
Soybean	10-inch rows	60	2,800	56	3/foot of row	May 5 to May 25
	20–inch rows			56	6/foot of row	
	30–inch rows			56	9/foot of row	
	40–inch rows			56	12/foot of row	
Sunflower	Nonoilseed	24	4,300	4	17,000/acre	May 1 to June 15
	Oilseed	27	7,700	3	23,000/acre	
Wheat	Durum	60	12,100	90	25/square foot	Early spring
	Hard red spring		15,200	80	28/square foot	Early spring
	Winter		14,500	75	25/square foot	August 20 to September 20
Other Crops	Adzuki	60	3,500	40–60	150,00–200,000/acre	May 20 to June 10
	Annual canarygrass	50	58,000	30	40/square foot	Early spring
	Buckwheat	48	14,900	50	17/square foot	June 15 to July 20
	Canola *B napus*	50	140,000	8	25/square foot	May
	Canola *B campestris*	50	210,000	5	25/square foot	May
	Crambe	22	65,000	15	23/square foot	Late April to early May
	Fieldpea	60	2,300	180	9/square foot	Early spring
	With 1½ to 2 bushels of oat			70	4/square foot	
	Fababean-medium size	60	1,300	180	5/square foot	Early spring
	With 2 bushels of oat			60	2/square foot	
	Lentil-small	60	15,600	55	20/square foot	Early spring
	Lupine 6– to 8–inch rows	60	1,500	170	6/square foot	Early spring
	30–inch rows			70	6/foot of row	
	Millet Foxtail	48	218,000	15	75/square foot	June 15 to July 15
	Proso	56	65,000	20	30/square foot	June 15 to July 15
	Mustard Yellow	56	90,000	12	25/square foot	May
	Oriental, Brown	50	180,000	6	25/square foot	May
	Rape Forage	50	145,000	6	20/square foot	Early spring with oat
	Oilseed	50	136,000	8	25/square foot	May
	Sudangrass 18– to 40–inch rows	40	44,000	10	25/foot of row	May 20 to June 10
	6– to 14–inch rows			20	20/square foot	
	Sweetclover	60	240,000	10	55/square foot	Early spring
	Tangierpea	60	4,500	85	9/square foot	Early spring
	Wild rice (wet)	25	7,900	33	6/square foot	Late fall

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