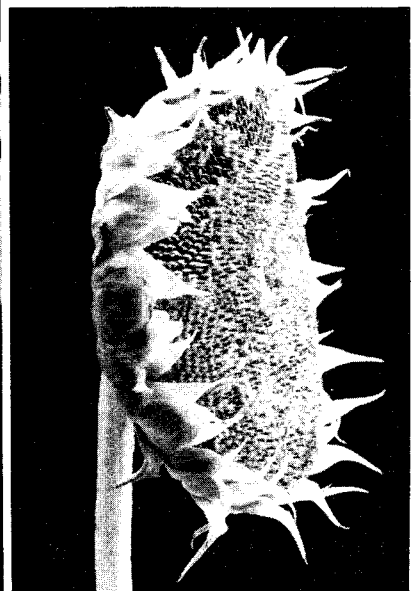
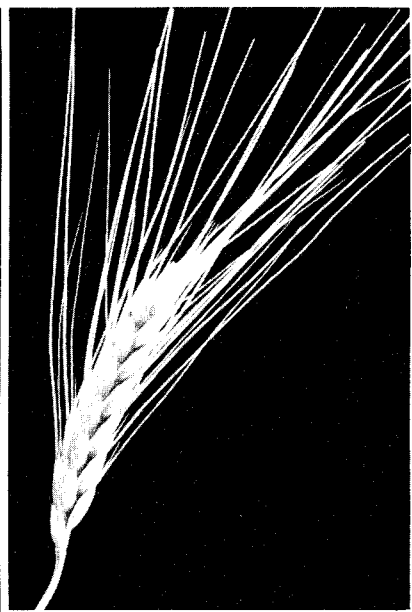
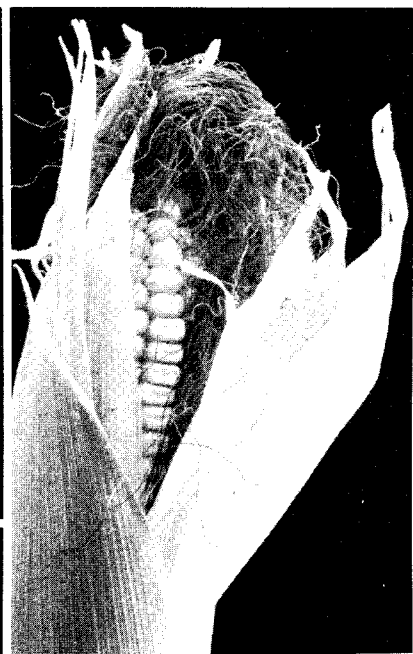


Varietal Trials OF FARM CROPS



1990 EDITION

Revised December
1989

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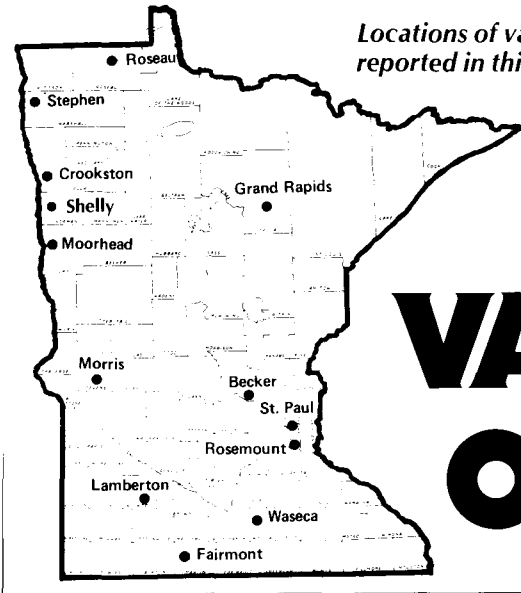
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This information is presented under authority granted to the Minnesota Agricultural Experiment Station, by the Hatch Act of 1887, to conduct performance trials of farm crops and interpret data to the public.

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Locations of varietal trials reported in this publication.



VARIETAL TRIALS OF FARM CROPS

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, Lambertton, 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.

VARIETY CLASSIFICATIONS

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

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

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

Varieties listed in the "other 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 Experiment Station does not make recommendations.

Seed of varieties in all three groups may be eligible for certification, and the use of certified seed is suggested. However, certification does not imply recommendation. Registered and certified seed of most varieties described in this report can be purchased from seed dealers or from growers listed in the Minnesota Registered and Certified Seed Directory for 1990 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 a genetic difference in the varieties or to other causes such as soil variability.

If the yield difference between two varieties equals or exceeds the LSD, one can conclude that the higher yielding variety was superior in yield. If the difference is less than the LSD, the yield difference was probably due to environmental rather than varietal differences. The 5 percent significance level used in this report indicates that in only 1 time out of 20 will the yield differences reported be achieved by chance, the remaining times the reported differences should be real.

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

Relative maturities of varieties are indicated in the tables as either date mature,

heading, or blooming; days to mature, heading, or blooming; or moisture percentage at harvest.

AUTHORS AND RESEARCHERS

Authors of the crop sections are: D.H. Putnam, L.A. Field (adzuki, amaranth, annual canarygrass, buckwheat, fieldbean, fieldpea, lupin, flax, grain sorghum, lentil, millet, mustard, canola-oilseed rape, sunflower, and rye); D.K. Barnes, N.P. Martin and N.J. Ehlke (alfalfa, birdsfoot trefoil, bromegrass, orchardgrass, red clover, reed canarygrass, tall fescue, and timothy); D.C. Rasmusson (barley); S.J. Openshaw, R.H. Peterson (corn); 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: J.A. Thies (alfalfa); A.P. Roelfs (wheat); R.D. Wilcoxson (barley and oat); K.J. Leonard (oat); B.W. Kennedy, W. Stienstra and D.H. MacDonald (soybean); D.V. McVey (wheat).

Field work of the varietal trials at Waseca, Lambertton, Morris, Crookston-Stephen, and Grand Rapids was supervised by W.E. Lueschen, J.H. Ford, D.D. Warnes, J.V. Wiersma, and D.L. Rabas, respectively.

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Alfalfa

Forage Crops

ALFALFA

Many alfalfa varieties are available from both private and public plant breeders. Certified seed should be used because it provides the best assurance of varietal purity and performance. For this reason only varieties that are eligible for certification or approved for Plant Variety Protection, and that will be sold in Minnesota in 1990, are listed in this report.

WINTER HARDINESS AND YIELD

Severe Minnesota winters make winter hardiness a primary consideration in variety selection. Greater winter hardiness is usually needed in southern and western Minnesota, and in the Red River Valley, than in other parts of the state.

The varieties listed in tables 1 and 2 are ranked according to amount of fall growth,

which in Minnesota is an indication of both rate of growth after cutting and degree of winter hardiness. Very winter-hardy varieties produce very little fall growth and are slow to recover after cutting. These varieties will survive nearly all winters. They usually are not high yielding, recovering slowly for the second crop and producing only a small third crop because of early dormancy.

Winter-hardy varieties are adapted to all areas of the state. Forage yields vary among varieties in this group, primarily because of disease and insect resistance. Three or four years of consistent production can be expected from most winter-hardy varieties.

Moderately winter-hardy varieties produce good fall growth, are characterized by rapid recovery after harvest, and usually reach 1/10 bloom several days earlier than

more winter-hardy varieties. The general pattern of production for moderately winter-hardy varieties under a four-harvest management has been to produce high yields during the first year after seeding, good yields—similar to winter-hardy varieties—for year two, and reduced yields in years three and four. Third and fourth year yields presented in Table 1 can help identify varieties that maintain high yields beyond the second year.

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

The Minnesota Agricultural Experiment Station and the 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 is the first alfalfa variety with specialized nitrogen accumulation attributes.

Other nonwinter-hardy varieties not listed in the tables include Amador, Ardiente, AS-13R, AS-49R, Caliente, Caliverde 65, CUF 101, Florida 77, Granada, Hayden, Joaquin II, Lew, Maxidor, Mesa Sirsa, Mesilla, Moapa 69, Pierce, Sonora 70, 183, WL 504, WL 508, WL 514, WL 515, WL 600, UC Cibola, UC Salton, Validor, 572, and 581.



The University of Minnesota's Nitro nondormant alfalfa (right) is distinct from dormant alfalfas, having been selected for increased root yield and increased root nitrogen concentration.

Asterisks under "test location" in Table 1 indicate that the variety yielded in the top 20 percent of entries for one or more tests at a given location.

DISEASE RESISTANCE AND STAND PERSISTENCE

Several alfalfa root and crown diseases occur in most Minnesota soils. The most important are: bacterial wilt, Phytophthora root rot, Fusarium wilt, anthracnose and Verticillium wilt. Plant resistance is available for all five diseases. The variety resistance ratings for each disease are presented in Table 2. Moderate resistance (MR) to a disease will provide protection to a variety under most conditions. However, either resistant (R) or high resistance (HR) are required for protection under severe disease conditions.

Winter injury is usually the result of a combination of injury from cold temperatures and of root and crown diseases. Disease resistance can often compensate for lesser levels of cold tolerance. All varieties can benefit from improved disease resistance. However, it is especially important

for moderately winter-hardy varieties to have at least R levels of disease resistance to stay productive, under an intensive management (four cuts/season), for more than two years after the seeding year.

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 wilt damage combined with winter injury.

Phytophthora Root Rot—This fungal disease is a major concern on poorly drained soils. 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. 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 relatively new, potentially destructive fungus disease was first found in several Minnesota fields in 1981. It has usually been found in two or three-year-old fields. Its spread in the state has been slow. Planting resistant varieties will help provide insurance for long-lived stands. Varieties having at least a low level of resistance are indicated in Table 2.

Table 1. Average yields of alfalfa varieties expressed as percentage of Vernal for all tests with one or more harvest years in Minnesota, 1967-89

Variety	Test Location ¹						Number tests	Year after seeding				Average over years	
	R	W	L	M	C	G		1st	2nd	3rd	4th	1-2	3-4
----- % of Vernal -----													
Very Winter-hardy													
Rambler	◆		◆	◆			4	85	86	83	85	86	84
Spredor 2	◆	◆		◆	◆	◆	5	96	93	94	86	94	92
Teton	◆		◆	◆			7	89	93	86	93	91	90
Travois	◆	◆	◆	◆			5	88	88	88	87	88	88
Winter-hardy													
Wrangler	*	◆	◆	◆	◆	◆	7	101	104	101	107	103	103
Vernal, tons/acre, 15% M	◆	◆	◆	*	◆	◆	51	5.5	5.4	5.0	4.9	5.5	4.9
Baker	*	◆	*	*	◆	◆	16	98	98	101	105	98	102
526	*	*	*	*	*	*	8	106	109	110	115	107	111
636	*	◆	◆	◆		◆	6	108	105	106	112	107	107
Clipper	*	◆				◆	3	105	103	—	—	104	—
Envy	◆						1	104	103	—	—	103	—
Profit	*	◆	◆	*		◆	5	109	106	108	115	108	109
Vancor	◆	*	*	◆	◆	◆	6	103	99	100	98	101	100
Agate	◆	◆	◆	◆	◆	◆	29	98	99	101	98	99	100
Iroquois	◆	◆	◆	◆	◆	*	15	106	105	101	107	105	104
Blazer	*	*	◆	◆	*	◆	10	103	106	111	109	104	110
5262	◆	◆					2	104	—	—	—	—	—
Thunder	*	◆	◆	◆	◆	◆	7	103	100	100	102	101	101
WL 225	◆	◆				◆	3	105	105	80	—	105	—
Break-Thru	◆	◆					3	99	103	—	—	100	—
DK-122	*						1	111	102	—	—	106	—
Surpass	*	◆	◆	*		◆	5	110	110	107	114	110	109
120	*	*	◆	*	*	*	11	107	110	110	109	109	110
A-54	◆	◆	*	*		◆	6	102	107	108	101	105	106
Ranger	◆	◆	◆	◆	◆	◆	26	97	98	97	99	97	97
Dart	*	◆	◆	*		*	6	110	110	109	109	110	109
Milkmaker	*	◆	◆	◆	◆		8	104	102	101	95	103	99
Arrow	*	◆	◆	◆		*	6	107	108	104	102	107	103
Sparta	*	◆	◆	◆	◆	◆	7	107	108	104	112	107	105
GH 715	*	◆				*	4	106	107	104	106	107	105
Impact	◆	◆	*	*		◆	5	109	107	100	—	108	—
Oneida	*	*	◆	◆	*	*	10	103	103	106	107	103	107
Royalty							0	—	—	—	—	—	—
AF21	◆	◆					2	100	102	95	81	101	88

Table 1 (continued). Average yields of alfalfa varieties expressed as percentage of Vernal for all tests with one or more harvest years in Minnesota, 1967-89

Variety	Test Location ¹						Number tests	Year after seeding				Average over years	
	R	W	L	M	C	G		1st	2nd	3rd	4th	1-2	3-4
----- % of Vernal -----													
Centurion	♦	♦	♦	♦		*	5	112	103	101	—	108	—
Ultra	*	♦				*	3	110	106	—	—	108	—
BellRinger	♦	♦	♦	♦		*	6	107	104	104	93	106	101
Salute	*	♦	♦	♦	*	*	7	106	109	108	113	107	109
98	♦	♦					2	99	96	—	—	98	—
Husky	♦	♦	*	♦	♦	♦	9	109	103	100	98	106	99
Kingstar	♦	♦				♦	4	106	103	106	94	104	100
Oneida VR	♦	♦				♦	3	103	103	107	103	103	106
Vernema	♦	♦	*	♦	♦	*	6	107	105	101	95	106	100
VIP	*						1	109	109	104	—	109	—
WL 317	♦						1	110	109	93	—	109	—
Apollo Supreme	*	♦				♦	3	111	107	107	100	109	103
Elevation	*	*	*	*	*	♦	7	109	107	112	115	108	113
G7730	♦	♦	♦	*	*	♦	8	102	103	106	107	103	106
Magnum	*	♦	*	♦	♦	♦	8	103	103	105	107	103	106
Perry	♦	♦	*	♦	♦		5	102	104	107	110	103	108
2833							0	—	—	—	—	—	—
5432	*	♦	♦	♦		*	5	104	109	108	101	106	106
Edge	♦	♦	♦	♦		♦	5	109	101	103	83	105	98
Endure	*	♦	♦	*	♦	♦	7	103	109	102	100	106	101
Fortress	♦	♦					4	105	101	91	75	103	85
<u>Moderately Winter-hardy</u>													
G2841	♦	♦				♦	2	98	99	—	—	98	—
Apollo II	♦	♦	♦	♦	♦	♦	8	103	103	94	93	103	94
Chief	*	♦				*	4	107	104	101	83	106	92
Duke	♦	♦	♦	*	♦	♦	7	101	104	100	101	103	100
DK 125	♦	♦	*	♦		♦	5	112	106	100	—	109	—
DK 135	♦	♦	*	♦	♦	♦	7	99	104	97	99	101	98
GH737	♦	♦	*	♦		♦	5	107	107	—	—	107	—
Legend	♦	♦					2	98	—	—	—	—	—
Multi-plier							0	—	—	—	—	—	—
Peak	*	*	♦	*	♦	♦	10	105	107	110	109	106	110
Saranac	♦	♦	♦	♦	♦	♦	39	104	103	101	102	103	102
Target II	♦	♦					1	103	104	—	—	104	—
Trident	♦	♦	♦	♦	♦	♦	8	101	103	104	107	102	105
Voyager	♦	*	♦	*		♦	5	109	108	111	—	109	—
630	*	♦	♦	♦		♦	7	106	110	111	111	108	111
Bronco	♦						1	107	—	—	—	—	—
Allegiance	♦	♦					2	92	—	—	—	—	—
Drummor	♦	♦	♦	♦	*	♦	8	101	102	92	87	101	90
Dynasty	♦	♦	♦	♦		♦	5	105	106	100	92	106	98
Target	♦	♦	♦	*	♦	♦	7	105	107	107	108	106	107
Trumpetor	♦	*	*	♦	*	♦	8	103	105	98	95	104	97
Vector	*	♦					2	110	109	108	111	110	109
5472							0	—	—	—	—	—	—
Verta +	*	♦	♦	♦		*	5	105	102	100	—	103	—
Aquarius	♦	♦			♦		5	97	101	94	89	99	92
Decathlon	♦	♦	♦	♦		♦	6	99	100	88	88	99	88
Premier	♦						1	96	—	—	—	—	—
Sure	*	♦	♦	♦		♦	5	107	102	105	—	105	—
Armor	♦	*	♦	♦	*	*	8	103	106	105	102	105	104
Crown	*	♦	*	♦		*	5	112	106	107	—	109	—
Echo							0	—	—	—	—	—	—
Excalibur	♦	♦	*	♦	♦	♦	6	104	102	90	86	103	89
Promise	♦						1	115	106	99	—	111	—
WL 320	*	*	♦	♦	♦	*	6	106	111	106	106	108	106
Anstar	♦	*	♦	♦		♦	5	108	102	106	86	105	101

Table 1 (continued). Average yields of alfalfa varieties expressed as percentage of Vernal for all tests with one or more harvest years in Minnesota, 1967-89

Variety	Test Location ¹						Number tests	Year after seeding				Average over years	
	R	W	L	M	C	G		1st	2nd	3rd	4th	1-2	3-4
	----- % of Vernal -----												
Commandor	*	◆	◆	◆		◆	6	106	106	107	103	106	106
Crown II							0	—	—	—	—	—	—
Procut 2	◆						1	100	—	—	—	—	—
Terminator	*	◆					2	109	110	99	—	109	—
Tomahawk	◆	*	*	*		◆	5	114	106	106	—	110	—
Eagle	◆	◆	*	◆	*	◆	7	105	106	85	77	106	83
Magnum Plus	*	◆			◆	◆	4	108	103	114	105	106	110
Magnum III	*	◆	*	*		◆	5	108	108	110	98	108	107
Pro-Cut	◆	◆					2	100	102	—	—	101	—
Epic	*	◆	*	*	◆	◆	10	102	106	104	109	104	106
G-2852	*	◆	◆	◆		*	6	109	103	97	72	106	92
Cimarron	◆	◆	*	◆	◆	◆	6	105	101	92	88	103	90
Shenandoah	◆	◆	◆	◆	*	*	6	105	103	93	83	104	89
Challenger	◆	◆	◆	*	◆	◆	7	102	103	91	90	102	90

Non-Winter-hardy

Nitro ----- not applicable—single season only -----

¹Test locations: R - Rosemount, W - Waseca, L - Lamberton, M - Morris, C - Crookston, G - Grand Rapids; ◆ = tested at location; * = tested at location and yielded in top 20 percent of entries after at least two harvest years for one or more tests.

Table 2. Winter hardiness as predicted by fall growth score and disease resistance of alfalfa varieties eligible for certification

Variety	Developer or Marketer ¹	Fall growth score ²	RESISTANT PLANTS ³				Verticillium wilt
			Bacterial wilt	Phytophthora root rot	Fusarium wilt	Anthracnose	
			----- rating ³ -----				
<u>Very Winter-hardy</u>							
Rambler	Agr. Canada ^V	8.0	MR	S	MR	S	S
Spredor 2	Northrup King Co. ^W	7.5	HR	S	MR	S	—
Teton	S. Dakota Agr. Exp. Sta. ^{IV}	7.4	LR	LR	MR	S	—
Travois	S. Dakota Agr. Exp. Sta. ^{ISVYf}	7.4	R	S	MR	S	—
<u>Winter-hardy</u>							
Wrangler	USDA & Nebraska Agr. Exp. Sta. ^{ISUVbfi}	7.0	R	R	R	LR	LR
Vernal	Wisconsin Agr. Exp. Sta. & USDA ^{EINSUVYbfi}	6.5	R	S	R	S	S
Baker	USDA & Nebraska Agr. Exp. Sta. ^{IV}	6.5	R	S	R	LR	—
526	Pioneer Hi-Bred International, Inc. ^a	6.5	HR	LR	LR	LR	—
636	Garst Seed Co. ^K	6.3	HR	HR	R	MR	R
Clipper	Payco Seeds ^X	6.3	HR	R	HR	R	R
Envy	Premium Seed Co., Inc. ^{Ob}	6.3	HR	R	HR	HR	R
Profit	Peterson-Biddick Co. ^Y	6.2	HR	R	HR	MR	R
Vancor	Northrup King Co. ^W	6.2	HR	MR	R	R	—
Agate	USDA & Minnesota Agr. Exp. Sta. ^{ISVYbfi}	6.0	HR	R	HR	MR	—
Iroquois	Cornell University ^{VYbfi}	6.0	HR	S	MR	S	S
Blazer	Cenex/Land O'Lakes ^E	5.9	HR	MR	MR	LR	LR
5262	Pioneer Hi-Bred International, Inc. ^a	5.7	HR	R	MR	—	LR
Thunder	ABI ^{Ugi}	5.7	R	R	HR	MR	—
WL 225	W-L Research, Inc. ^{NX}	5.7	HR	R	HR	MR	R
Break-Thru	Custom Farm Seed ^P	5.5	HR	MR	HR	MR	R
DK 122	DeKalb-Pfizer Genetics ^H	5.5	HR	HR	R	HR	R
Surpass	Cenex/Land O'Lakes ^E	5.5	HR	R	R	MR	R
120	DeKalb-Pfizer Genetics ^H	5.5	HR	R	MR	LR	—
A-54	Ramy Seed Co. ^d	5.4	MR	LR	MR	—	—
Ranger	USDA & Nebraska Agr. Exp. Sta. ^{EIV}	5.4	MR	S	MR	S	S
Dart	AgriPro ^A	5.3	HR	HR	R	R	R
Milkmaid	Lovelock Seed Co., Inc. ^{On}	5.3	R	R	HR	MR	—
Arrow	NAPB ^{Ugi}	5.2	HR	HR	HR	MR	R
Sparta	Cenex/Land O'Lakes ^E	5.2	R	MR	MR	S	R

Table 2 (Continued). Winterhardness as predicted by fall growth score and disease resistance of alfalfa varieties eligible for certification

Variety	Developer or Marketer ¹	Fall growth score ²	RESISTANT PLANTS ³				Verticillium wilt
			Bacterial wilt	Phytophthora root rot	Fusarium wilt	Anthracnose	
			rating ³				
GH715	J.C. Robinson Seed Co. ^l	5.1	HR	MR	R	MR	LR
Impact	Peterson Seed Co., Inc. ^{zbc}	5.1	HR	HR	R	MR	R
Oneida	Cornell University ^{ybi}	5.1	HR	HR	HR	S	—
Royalty	Cargill Seed Division ^D	5.1	HR	R	R	HR	R
AF21	Asgrow Seed Co. ^B	5.0	HR	R	R	HR	R
Centurion	Blue Chip Quality Seed ^C	5.0	HR	HR	R	R	R
Ultra	SeedTec Int'l ^A	5.0	HR	R	HR	HR	R
BellRinger	Lovelock Seed Co., Inc. ^L	4.9	R	LR	MR	LR	MR
Salute	United AgriSeeds, Inc. ^{8Rh}	4.9	HR	R	R	MR	MR
98	L.L. Olds Seed Co. ^U	4.8	HR	H	HR	—	—
Husky	Plant Genetics ⁿ	4.8	R	MR	R	MR	S
Kingstar	Dahlgren & Co. Inc. ^F	4.8	R	R	HR	MR	R
Oneida VR	Cornell University ⁱ	4.8	R	MR	HR	MR	HR
Vernema	USDA & Washington Agr. Exp. Sta. ^{vi}	4.8	MR	LR	R	LR	MR
VIP	SIGCO Research ⁹	4.8	HR	R	HR	R	R
WL 317	W-L Research Inc. ^{NX}	4.8	HR	R	HR	R	R
Apollo Supreme	ABI ^{Ugi}	4.7	HR	R	HR	HR	R
Elevation	Jacques Seed Co. ^O	4.7	HR	R	R	R	MR
G7730	CIBA-GIEGY Seed Div. ^{JY}	4.7	HR	HR	HR	LR	—
Magnum	Dairyland Seed Co., Inc. ^G	4.7	HR	S	R	MR	—
Perry	USDA & Nebraska Agr. Exp. Sta. ^S	4.7	R	LR	R	LR	—
2833	CIBA-GEIGY Seed Div. ^J	4.6	HR	HR	R	HR	R
5432	Pioneer Hi-Bred International Inc. ^a	4.6	HR	MR	HR	—	R
Edge	Payco Seeds ^X	4.6	HR	R	R	HR	R
Endure	PAG Seeds ^D	4.6	R	MR	R	MR	R
Fortress	Northrup King Co. ^W	4.6	R	R	R	R	R
Moderately Winter-hardy							
G2841	CIBA-GIEGY Seed Div. ^J	4.5	HR	R	HR	R	R
Apollo II	ABI ^{gi}	4.5	R	HR	R	MR	MR
Chief	Jacques Seed Co. ^O	4.5	HR	HR	R	R	R
Duke	AgriPro ^A	4.5	R	HR	R	MR	—
DK 125	DeKalb-Pfizer Genetics ^H	4.5	HR	R	R	HR	R
DK 135	DeKalb-Pfizer Genetics ^H	4.5	MR	MR	R	MR	MR
GH737	J.C. Robinson Seed Co. ^l	4.5	HR	MR	HR	MR	R
Legend	Cenex/Land O'Lakes ^E	4.5	HR	R	HR	HR	R
Multi-plier	Jacques Seed Co. ^O	4.5	HR	R	HR	HR	R
Peak	Premium Seed Co., Inc. ^b	4.5	HR	MR	MR	—	LR
Saranac	Cornell University ^{lb}	4.5	R	S	R	S	S
Target	Il Bio Plant Research ^G	4.5	HR	R	R	R	R
Trident	PAG Seeds ^D	4.5	R	HR	HR	MR	—
Voyager	Bio Plant Research ^e	4.5	HR	R	R	MR	MR
630	Garst Seed Co. ^K	4.5	HR	R	R	MR	MR
Bronco	Jung Farms' Inc. ^P	4.4	HR	HR	HR	HR	R
Allegiance	Keltgen Seed Co. ^{Rh}	4.4	HR	R	R	HR	R
Drummor	Northrup King Co. ^W	4.4	R	R	MR	MR	—
Dynasty	Dairyland Seed Co. Inc. ^G	4.4	HR	R	R	MR	R
Target	Ziller Seed Farm, Inc. ⁱ	4.4	HR	R	R	MR	MR
Trumpetor	Northrup King Co. ^W	4.4	MR	LR	HR	R	MR
Vector	ProfiSeed, Inc. ^c	4.4	HR	MR	HR	R	MR
Verta +	NC + Hybrids ^m	4.4	HR	R	R	HR	R
5472	Pioneer Hi-Bred International Inc. ^a	4.4	HR	HR	MR	MR	MR
Aquarius	Lincoln Seed & Feed Co. ^S	4.3	HR	S	R	HR	—
Decathlon	Cargill, Inc. ^D	4.3	HR	MR	R	MR	MR
Premier	Dahlgren & Co., Inc. ^F	4.3	HR	R	HR	HR	R
Sure	Cenex/Land O'Lakes ^E	4.3	HR	R	HR	HR	R
Armor	ABI ^{gi}	4.2	R	R	R	MR	—
Crown	Paymaster Seeds ^D	4.2	R	R	R	HR	R

Table 2 (Continued). Winterhardness as predicted by fall growth score and disease resistance of alfalfa varieties eligible for certification

Variety	Developer or Marketer ¹	Fall growth score ²	RESISTANT PLANTS ³				Verticillium wilt
			Bacterial wilt	Phytophthora root rot	Fusarium wilt	Anthraco-nose	
Echo	ProfiSeed, Inc. ^c	4.2	R	R	R	MR	R
Excalibur	Blue Chip Quality Seed ^c	4.2	R	LR	HR	MR	R
Promise	Super Crost Seeds, Inc. ^o	4.2	HR	R	R	HR	R
WL 320	W-L Research Inc. ^x	4.2	HR	R	HR	MR	MR
Anstar	NC + Hybrids ^m	4.1	MR	S	R	R	—
Commandor	Northrup King Co. ^w	4.1	HR	R	R	HR	MR
Crown II	Cargill Seed Div. ^d	4.1	HR	R	R	HR	R
ProCut 2	L. Herried Seed, Inc. ^t	4.1	HR	HR	HR	R	R
Terminator	Ramy Seed Co. ^d	4.1	HR	MR	HR	R	R
Tomahawk	Jung Farms, Inc. ^p	4.1	R	R	R	HR	MR
Eagle	Asgrow Seed Co. ^b	4.0	HR	R	R	R	MR
Magnum Plus	Dairyland Seed Co., Inc. ^g	4.0	R	R	R	MR	LR
Magnum III	Dairyland Seed Co., Inc. ^g	4.0	HR	MR	R	MR	MR
Pro-Cut	L. Herried Seed, Inc. ^t	4.0	HR	R	HR	R	R
Epic	Larry Peterson, Ltd. ^{rc}	3.9	HR	R	R	S	—
G 2852	CIBA-GEIEGY Seed Div. ^{xy}	3.8	HR	R	R	HR	R
Cimarron	Great Plains Research ^{mq}	3.6	R	MR	HR	R	LR
Shenandoah	Great Plains Research ^{mq}	3.6	HR	LR	R	HR	—
Challenger	Cargill, Inc. ^d	3.5	R	R	MR	R	—
Non-Winter-hardy							
Nitro	USDA & Minnesota Agr. Exp. Sta. ^{uzb}	2.4	S	R	HR	S	S

¹ 1990 seed sources are listed at the end of the forage crops section; ² Based on fall growth in mid-October after cutting 1st week of September: 1 = tallest (least winterhardy), 9 = shortest; ³ Resistance rating (percent resistant plants): HR = high resistance (51 +), R = resistant (31-50), MR = moderate resistance (16-30), LR = low resistance (6-15), and S = susceptible (0-5). Fall growth, bacterial wilt, Phytophthora root rot, and Fusarium wilt evaluations were conducted by University of Minnesota. Anthracnose and Verticillium wilt values were published by the Certified Alfalfa Seed Council.

BIRDSFOOT TREFOIL

Birdsfoot trefoil is primarily a pasture legume, but can also be harvested for hay. It is suitable on sandy soils of medium to low fertility, but is tolerant to a wide range in soil fertility, acidity, and drainage. It is persistent when grown with bluegrass, but is also suitable with timothy. This highly palatable forage will not cause bloat.

Varieties were evaluated for about 14 years in pure stands. Average hay yield for the variety Empire was 3.7, 3.2, and 3.0 tons acre for the first, second, and third years after seeding, respectively. The relative three-year yield of varieties sold in

Minnesota (percent of Empire) and 1990 sources of seed¹ are: Leo-112^{UVYbfi}, Dawn-108^g, Norcen-105^{EPUYbfi}, Empire-100^{EINSUVXYbdf} and Viking 100^b. No data is available on Fergus^{gl}.

Norcen was released in 1983 by the agricultural experiment stations of Minnesota and six other states. It has performed exceptionally well in grazing trials.

¹1990 seed sources are listed at the end of the forage crops section.

BROMEGRASS

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

Varieties were evaluated in pure stands for about 15 years at most Minnesota experiment stations. Average hay yields for Fox bromegrass were about 4.7 tons/acre at Grand Rapids and 3.6 tons/acre at the other locations. The relative yield of varieties sold in Minnesota (percent of Fox) and 1990 sources of seed¹ are: Barton-105^e and Lincoln-95^{INQSUUVbfi}

¹1990 seed sources are listed at the end of the forage crops section.



University of Minnesota grass and alternative forage crop breeder Nancy Ehlke is testing the performance of forages under irrigation at Staples, Minnesota.

ORCHARDGRASS

Orchardgrass is used with other grasses and legumes because it establishes rapidly and recovers quickly after grazing or harvest. Its chief limitation is lack of winter hardiness, but in areas with reliable snow cover it may persist and remain productive.

Varieties were evaluated in pure stands at Rosemount and Grand Rapids over a pe-

riod of 10 years. Average annual hay yield for the variety Hallmark was 3.4 tons/acre at Grand Rapids and 3.9 tons/acre at Rosemount, Minnesota. The relative yield of varieties sold in Minnesota (percent of Hallmark) and 1990 sources of seed¹ are: Dart-102^E, Hallmark-100, Sterling-100^I, Napier-100^D, Comet-98^W, and Potomac-

87^{IQTUVXYbijk}. No data is available on Crown^{QUfgj} and Dawn^E.

¹1990 seed sources are listed at the end of the forage crops section.

RED CLOVER

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

Varieties were evaluated at Rosemount, Grand Rapids, Lamberton, Morris, and Waseca, Minnesota, for about 13 years. Average hay yield for the variety Lakeland was 3.6, 3.5, and 2.2 tons/acre for the first, second, and third years after seeding, respectively. The relative two-year yield of varieties sold in Minnesota (percent of Lakeland) and 1990 sources of seed¹ are: Arlington-113^{EPQTUVXYhijk}, and Lakeland-100^{VI}. No data is available on: Atlas^W, Alta Swede^Y, Marathon^{PUYZi}, Redfield^D, Redland II^{QUg}, Ruby^G and Starglo Red^Q.



Tubes isolate individual plant roots of greenhouse grown plants, allowing detailed analysis of response to experimental treatments. Birdsfoot trefoil is examined here, by former agronomy graduate student Chris Boerboom.

¹1990 seed sources are listed at the end of the forage crops section.

REED CANARYGRASS

Reed canarygrass is adapted throughout Minnesota for use as hay, pasture, or silage. It is one of the best grass species for use on poorly drained soil, in swampy areas, and in areas subject to spring flooding. The species is also well adapted to upland soils. The seedling vigor is not as good as that of other commonly used forage grasses.

Prior to 1985, common reed canarygrass had been described as being less palatable than most species seeded for hay and pasture, but cattle produced well on the grass if it was used before it became mature.

TALL FESCUE

Tall fescue may be tried 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. This bunchgrass is subject to winter injury, but may persist and remain produc-

tive in areas with reliable snow cover.

Varieties were evaluated for about eight years at Grand Rapids and Rosemount, Minnesota. Average annual hay yields were about 4.2 tons/acre at both locations for the variety Kentucky-31. The relative yield of varieties sold in Minnesota (percent of Ken-

tucky-31) and 1990 sources of seed¹ are: Kentucky-31^{EIQUVXYbf} and Fawn-78^{Xf}. No data is available for Arid^b, Endo-Free^E, Falcon^f, Jaguar^b and Mustang^b.

able varieties are winterhardy and persistent.

Varieties were evaluated in pure stands at Grand Rapids, Lamberton, Morris, and Rosemount for 10 years. Average annual hay yields for all varieties were about 3.0 tons/acre at Lamberton and Morris and 4.4 tons/acre at Grand Rapids and Rosemount.

Seeds are available for low alkaloid varieties Palaton^{EUYZb} and Venture^{UXYZb}.

¹1990 seed sources are listed at the end of the forage crops section.

¹1990 seed sources are listed at the end of the forage crops section.

TIMOTHY

Timothy is adapted throughout Minnesota for use in hay and pasture mixtures. When timothy is the major component in hay, its stage of maturity affects yield and quality. Harvesting at early bloom stage is preferred to later harvesting.

Because timothy varieties differ in maturity, care should be taken in choosing varieties that will fit the management of the crop. Only very early varieties are adapted to a three-cut system with alfalfa. Varieties

presently available in Minnesota are of medium and medium-late maturity and should not be harvested more than twice during the growing season. Therefore, timothy and red clover are compatible in mixtures for hay production.

Varieties were evaluated in pure stands for about 13 years in Minnesota. Average annual hay yields were about 3.6 tons/acre for the variety Itasca.

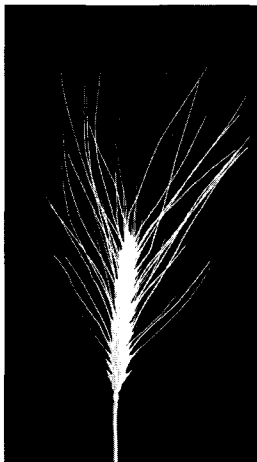
Relative yields of varieties sold in Min-

nesota (percent of Itasca) and 1990 sources of seed¹ are: Timfor-100^W and Climax-95^{ILNOPQUVXYZbijkl}. No data is available for Mor-Tim^D, Top-tim^E, and Toro^U.

¹1990 seed sources are listed at the end of the forage crops section.

1989 FORAGE SEED SOURCES

- A. AgriPro, 824 2nd St. South, P.O. Box 250, Brookings, SD 57006;
- B. Asgrow Seed Co., 7000 Portage Rd., Kalamazoo, MI 49001;
- C. Blue Chip Quality Seed, Abbottsford, WI 54405;
- D. Cargill Seed Div., P.O. Box 5645, Mpls., MN 55440;
- E. Cenex/Land O'Lakes, Station 680, P.O. Box 64089, St. Paul, MN 55164-0089;
- F. Dahlgren & Co., 1220 Sunflower Street, Crookston, MN 56716;
- G. Dairyland Seed Co., Inc., R.R. #1, P.O. Box 129, Clinton, WI 53525;
- H. DeKalb-Pfizer Genetics, 3100 Sycamore Rd., DeKalb, IL 60115;
- I. Discount Farm Center, Inc., P.O. Box 84, Watertown, SD 57201;
- J. CIBA-GIEGY Seed Div., P.O. Box 18300, Greensboro, NC 27419;
- K. Garst Seed Co., P.O. Box 300, Coon Rapids, IA 50058;
- L. George's Seeds, Inc., P.O. Box 155, Prescott, WI 54021;
- M. Great Plains Research, Inc., P.O. Box 1745, Stillwater, OK 74076;
- N. Interstate Seed Co., 1214 Prairie Parkway, West Fargo, ND 58078;
- O. Jacques Seed Co., 720 St. Croix, Prescott, WI 54021;
- P. Jung Farms' Inc., 335 South High, Randolph, WI 53957;
- Q. Kaltenberg Seed Farms, Inc., P.O. Box 278, Waunakee, WI 53597;
- R. Keltgen Seed Co., Box A, Olivia, MN 56277;
- S. Lincoln Seed, 211 Pearl St., Sioux City, IA 51101;
- T. L. Herried Seed, Inc., P.O. Box 216, Prescott, WI 54021;
- U. L.L. Olds Seed Co., Box 7790, 2901 Packers Ave., Madison, WI 53707;
- V. Mohn Seed Co., Rt. 1, Box 152, Cottonwood, MN 56229;
- W. Northrup King Co., 7500 Olson Memorial Hwy., Golden Valley, MN 55427;
- X. Payco Seeds, P.O. Box 70, Dassel, MN 55325;
- Y. Peterson-Biddick Co., Box 190, 102 Aldrich S.E., Wadena, MN 56482;
- Z. Peterson Seed Co., Inc., P.O. Box 346, Savage, MN 55378;
- a. Pioneer Hi-Bred Int'l, Inc., P.O. Box 287, 7305 N.W. 62nd Ave., Johnston, IA 50131;
- b. Premium Seed Co., Inc., 7800 E. State Hwy 101, Shakopee, MN 55379;
- c. ProfiSeed, Inc., Rt. 2, Hampton, IA 50441;
- d. Ramy Seed Company, 1329 N. Riverfront Drive, Mankato, MN 56001;
- e. Bio Plant Research, P.O. Box 253, Camp Point, IL 62320;
- f. The Sexauer Co., P.O. Box 58, Brookings, SD 57006;
- g. SIGCO Research, P.O. Box 289, Breckenridge, MN 56520;
- h. United Agriseeds, Inc., P.O. Box 4011, Champaign, IL 61820;
- i. Werner Farm Seeds, 3104 Millersburg Blvd., Dundas, MN 55019;
- j. Ziller Seed Farms, Inc., R.R.1, Box 122, Bird Island, MN 55310.
- k. Top Farm Hybrids, Inc., Box 850, Cokato, MN 55321;
- l. J.C. Robinson Seed Co. (Golden Harvest), Box A, Waterloo, NE 68069;
- m. NC + Hybrids, P.O. Box 4408, Lincoln, NE 68504.
- n. Plant Genetics, Inc., 1541 Berne Road, Fridley, MN 55241;
- o. Super Crost Seeds, Inc., 319 Beltline Hwy., Suite 100, Madison, WI 53713;
- p. Custom Farm Seed, Box 160, Mokense, IL 60954



Wheat

Grain Crops

AMARANTH

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

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

The crop is planted in late May or early June. Cultivation of wide rows is required in the absence of approved herbicides. Seed yields of 300 to 3,800 pounds per acre (hand harvested) have been reported in Minnesota. A killing frost followed by a week of drying weather is required before harvest can be accomplished by combine.

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

Additional information and seed sources

are provided in the "Amaranth Grain Production Guide" available from the American Amaranth Institute, Box 216, Bricelyn, MN 56097 (cost: \$5). A fact sheet, "Growing Grain Amaranth as a Specialty Crop," (item no. AG-FS-3458), is available from the Distribution Center, 1420 Eckles Avenue, 3 Coffey Hall, University of Minnesota, St. Paul, MN 55108.



Closeup of the terminal inflorescence (the flower cluster or head) of a grain amaranth plant. A crop once grown widely by Aztec and Mayan farmers, it is attracting interest in Minnesota.

Table 3. Seed yield and characteristics of amaranth lines, 1987 - 1989

Line	Seed yield						Characteristics				
	1987 ¹	Rosemount 1988	Albert Lea	G.Rapids 1989	Morris	Rosemount	100% Bloom ²	Lodge ³	Height ²	Seed Wt ⁴	Test Wt ⁴
	lbs/A						days	score ⁵	inches	g/1,000	lb/Bu
A200D	—	—	—	—	—	1264	—	4.5	—	0.947	60.4
K266	1173	1091	1306	—	—	—	75	7.0	63	0.687	56.5
K283	531	1168	1166	—	—	—	68	4.5	59	0.779	59.4
MT-3	—	1023	1076	—	—	1430	74	4.0	73	0.738	58.1
PI 477914	718	815	—	—	—	—	75	6.3	68	0.781	58.5
K343	1053	1076	1031	492	1071	1731	78	7.0	64	0.837	59.9
K432	—	1247	1570	1051	1171	1824	75	7.7	47	0.692	59.2
LSD 5%	132	297	349	137	641	437					

¹Rosemount, Lamberton and Waseca; ²3 year/location average; ³5 year/location average; ⁴2 year/location average; ⁵1 = erect, 9 = horizontal.

ANNUAL CANARYGRASS

Annual canarygrass is grown as a cash grain crop and used for feeding caged and wild birds. Kittson County is the North American production and processing center for the crop.

RECOMMENDED VARIETIES

Alden—Medium yield, medium maturity and height. Poor lodging resistance. Medium size seed of medium test weight. May outyield Keet in favorable environments for canarygrass. Developed cooperatively by Minnesota Agricultural Experiment Station and Minn-Dak Growers Association. Released in 1973.

Elias—High yield, medium maturity and height. Fair lodging resistance. Medium size seed of very high test weight. Released by Minnesota Agricultural Experiment Station in 1983.

Keet—High yield, early, medium height. Fair lodging resistance. Medium size seed of high test weight. Released by Minnesota Agricultural Experiment Station in 1979.

BARLEY

RECOMMENDED VARIETIES

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

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

OTHER VARIETIES

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

Bonanza—Medium yield. Medium maturity. Six-rowed, semi-smooth awn, long

Table 4. Yields of annual canarygrass varieties

Variety	Crookston 1979-85	Stephen 1979-84	Rosemount 1979-84	Becker ¹ 1982-84	Average 22 trials
----- lbs/A -----					
Alden	1516	1162	1081	910	1218
Elias	1810	1554	1224	918	1459
Keet	1660	1318	1142	925	1325
Checks ²	1454	1026	919	736	1093
LSD 5%	128	127	99	80	25

¹Irrigated. ²1984-85 data of progeny of seedlots and varieties imported 10 to 30 years ago.

Table 5. Characteristics of annual canarygrass varieties

Variety	Planting to heading days	Planting to maturity days	Lodging score ¹	Height inches	Seeds no./lb	Test weight/ bushel lbs/bu
Alden	66	107	3.9	36	60,500	48
Elias	64	106	2.6	36	58,200	51
Keet	63	104	2.8	35	61,300	49
Checks ²	64	107	3.9	34	56,000	49

¹1 = erect, 9 = flat. ²1984-85 data of progeny of seedlots and varieties imported 10 to 30 years ago.

rachilla hairs, blue aleurone. Classified as a malting variety by AMBA. Resistant to stem rust. Susceptible to spot blotch. Developed by Agriculture Canada, Brandon, from a cross involving Vantage, Jet, Vantmore, Parkland, and Conquest. Licensed in 1970.

Bowman—Medium yield. Medium maturity. Very good kernel plumpness. Medium lodging resistance. Two-rowed, smooth awns, long rachilla hairs, and colorless aleurone. Not approved for malting by AMBA. Limited demand for two-rowed malting type in Minnesota. Similar to Robust in resistance to leaf diseases; resistant

to stem rust. Susceptible to loose smut. Developed by North Dakota Agricultural Experiment Station from cross involving several parents. Released in 1984.

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

Table 6. Yields of barley varieties 1986-1989

Variety	Location					Average 5 locations
	Crookston ² 4 ¹	Morris ² 4	Stephen ³ 2	St. Paul ³ 2	Roseau ⁴ 1	
----- bu/A -----						
Morex	78	71	65	62	62	70
Robust	85	74	58	67	104	76
B1602	82	69	65	64	107	75
LSD 5%	6	6	12	7	19	5

¹Number of trials; ²1986-87, 1989; ³1988-89; ⁴1989.

Table 7. Characteristics of barley varieties, 1986-89

Variety	Heading date	Height inches	Lodging %	Plump *kernels %	Seeds no./lb	Stem ¹ rust ----rating ¹	Spot ¹ blotch ---	Net blotch score ²
Morex	6-22	31	32	67	13,264	R	MR	3.4
Robust	6-24	31	30	74	12,860	R	R	2.3
B1602	6-24	31	30	66	13,927	R	R	2.7

¹R = resistant, MR = moderately resistant, S = susceptible. ²1-5, 1 = most resistant.

PRIVATELY DEVELOPED VARIETIES

B1602—High grain yield and good lodging resistance in limited testing by the Minnesota Agricultural Experiment Station. Six-rowed, rough awn, long rachilla hairs.

Resistant to stem rust and spot blotch. Classified as a malting variety by Anheuser Busch Inc., but not by American Malting Barley Association (AMBA). B1602 will be grown under contract only. Developed and

marketed by Busch Agricultural Resources Inc./Anheuser Busch Inc. Parents include Bumper, Morex and 6B78-628.

BUCKWHEAT

RECOMMENDED VARIETIES

Mancan—High yield. Large seed. Low test weight but good market acceptability. Released by Agriculture Canada, Morden. Licensed in 1974.

Manor—High yield. Large seed. Low test weight but good market acceptability.

Released by Agriculture Canada, Morden. Licensed in 1980. Production of certified seed limited to Canada.

Winsor Royal—High yield. Large seed. Low test weight but good market acceptability. Released by Winsor Grain Co., Minneapolis, MN in 1982. Seed sale regulated by U.S. Variety Protection Act.

OTHER VARIETIES

Common—Seed lots tested under this name ranged from low to high yield. Small or medium seed of high test weight.

Table 8. Yields of buckwheat varieties

Variety	Morris 1983-85	Crookston 1983-85	Grand Rapids 1982-85	Waseca 1983-85	Lamberton 1982-84	Becker 1982-84, 87	Rosemount 1982,84	Average 7 locations
----- lbs/A -----								
Mancan	1511	809	418	1046	964	832	1442	1003
Manor	1832	765	393	952	1210	768	1569	1070
Winsor Royal	1716	859	389	1096	1262	887	1662	1124
LSD 5%	286	226	46	280	335	158	242	91

Table 9. Characteristics of buckwheat varieties, seven location average

Variety	Planting to bloom	Lodging	Height	Seeds	Test Weight
	<i>days</i>	<i>score¹</i>	<i>inches</i>	<i>no./lb</i>	<i>lbs/bu</i>
Mancan	32	4.6	40	15,770	44
Manor	32	4.5	40	16,256	44
Winsor Royal	32	4.1	40	15,230	44

Closeup of the flower clusters of buckwheat. Buckwheat is primarily grown for export, mostly to Japan.

¹1 = erect, 9 = flat.



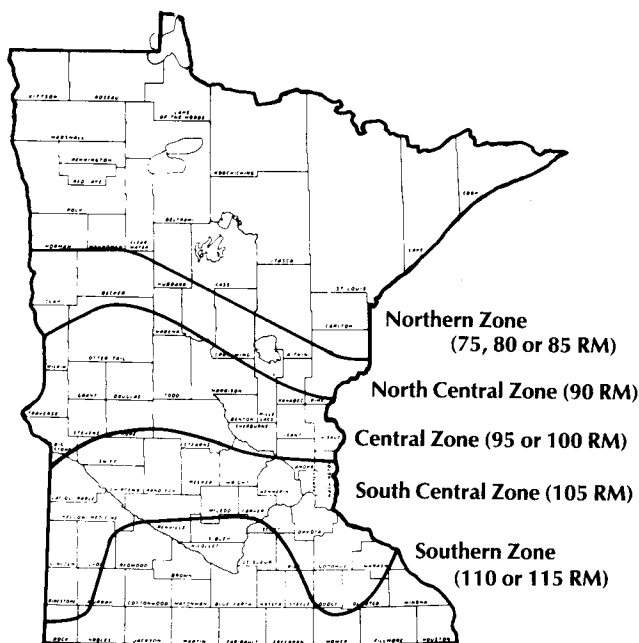
CORN

Many corn hybrids are sold by private companies. A total of 1,500 hybrids were registered for sale in Minnesota in 1988. Information on the performance of these closed-pedigree or private hybrids is usually available from the companies selling them.

The Minnesota Agricultural Experiment Station conducts research in corn breeding, including the development of inbred lines which are used as parents of hybrids. These Minnesota inbreds, designated by the letter "A", are released to private companies through the Minnesota Crop Improvement Association. Private companies may use these inbreds to produce hybrid seed corn for farmers. Information on the performance of these inbreds is available from the Corn Breeding Project, 411 Agronomy, University of Minnesota, 1991 Buford Circle, St. Paul, MN 55108.

Corn hybrids sold in Minnesota carry a "Minnesota Relative Maturity" (RM) rating. The zones of adaptation on the accompanying map show the areas for which hybrids of a particular RM rating are considered to be full-season.

Map 2: Relative maturity zones for corn hybrids in Minnesota.



Biotechnology is yielding new herbicide tolerant corn varieties. Plants grown from resistant cells found in tissue cultures (top) resist rates of herbicide that wither normal corn (bottom). Agronomist David Somers and research assistant Peter Dotray examine trials where up to five times the field rate have been applied.



GRAIN SORGHUM

Many hybrids are available. Most are too late for Minnesota. Even the earliest generally require drying after combine-harvest. Hybrids shown in the tables may be of acceptable maturity for southern Minnesota. The earliest hybrids usually are satisfactory for parts of central Minnesota. Late hybrids usually yield less than early hybrids in years with low temperatures in August or early September.

Trials were planted between May 21 and June 4 at the rate of 150,000 seeds per

acre in rows 30 inches apart. Sorghum was harvested when it was dry enough to combine but not dry enough to store without artificial drying. Consequently, these trials do not measure lodging that might occur during natural drying in the field. All hybrids were harvested the same day for relative moisture comparisons. Hybrids in the tables are ranked from earliest to latest based on head moisture in September.

Companies enter hybrids in these trials voluntarily, and adapted hybrids are usually

tested for three years. Data reported for hybrids not included in all trials are adjusted to be comparable with the average data of all hybrids tested.

Companies with hybrids in these trials include: Cargill Seed Division, Minneapolis, MN; DeKalb-Pfizer Genetics, Glenvil, NE; Jacques Seed Co., Prescott, WI; Northrup King Co., Minneapolis, MN; and Pioneer Hi-Bred International Inc., Johnston, IA.

Table 10. Yields and characteristics of grain sorghum hybrids at Lamberton

Hybrid and company	Grain yield ¹		Head moisture		Test weight ⁴	Seeds ⁴	Planting to heading ⁴	Height ⁵
	1984	1978-79, 81-84	September 15 ²	October 2 ³				
	----- lbs/A -----		----- percent -----					
M1, Minnesota AE	2813	4105	32	26	58	18,100	61	57
NK 1040, Northrup King ⁶	3502	4638	34	29	58	19,700	62	43
RS 455, Minnesota AES	3012	4969	38	30	58	17,400	65	58
DK-18, DeKalb ⁶	4129	5827	39	27	60	17,400	66	47
NK 1210, Northrup King ⁷	—	5240	40	36	58	23,900	71	44
8855, Pioneer ⁸	3622	4964	40	21	60	19,700	70	—
894, Pioneer ⁹	—	5251	41	33	58	21,600	71	43
8790, Pioneer ⁷	—	4895	43	36	59	22,700	73	45
PAG 2250, PAG Seeds ⁷	—	4526	44	38	57	22,700	74	45
NK 121A, Northrup King ¹⁰	—	6024	44	34	58	20,600	73	46
DK-28, DeKalb ⁶	2979	5024	45	33	60	18,900	72	45
J-150, Jacques ⁷	—	4912	45	40	59	26,700	74	47
NK 1580, Northrup King ⁹	—	5432	45	36	59	19,700	76	49
Cargill 22, Cargill ⁶	2927	4540	47	37	59	25,200	73	47
NK 180, Northrup King ¹⁰	—	5582	48	36	58	22,700	77	51
930, Paymaster ¹¹	1901	4378	51	39	57	21,600	74	45
PAG 3339, PAG Seeds ¹²	1337	—	63	40	55	30,200	77	—
LSD 5%	426	301	3	2				

¹Oven-dry; ²1978, 81-84; ³1978-79, 81, 82, 84; ⁴1978-79, 81-84; ⁵1978-79, 82; ⁶1982-84; ⁷1981-83; ⁸1983-84; ⁹1978-79, 81-82; ¹⁰1978-79, 81; ¹¹1982, 84; ¹²1984.

Table 11. Characteristics of grain sorghum hybrids in central and northern maturity zones, 1983-84

Hybrid and company	Grain yield ¹			Head moisture ²			Test weight	Planting to heading	Lodging
	Morris	Crookston	Grand Rapids	Morris	Crookston	Grand Rapids			
	----- lbs/A -----			----- percent -----			lbs/bu	days	%
MI, Minnesota AES	4563	4195	1206	21	27	27	57	69	53
NK 1040, Northrup King	5245	4849	1770	26	29	36	56	68	11
RS 455, Minnesota AES3	4828	4785	1315	28	27	30	56	71	20
DK-18, DeKalb	6016	4652	1059	30	38	32	56	73	4
LSD 5%	493	490	600	1	3	2			

¹Oven-dry; ²September 21-29; ³1984.

MILLET

Three types of millet are adapted in Minnesota: proso, foxtail, and barnyard (Japanese). Proso varieties are grown for bird or livestock feed. Foxtail varieties and Japanese are grown for silage or hay.

RECOMMENDED FORAGE VARIETY

Empire—Foxtail. Very late. Very tall. Poor lodging resistance. Very small, plump yellow seed of low test weight. Released by Agriculture Canada.

RECOMMENDED GRAIN VARIETIES

Cerise—Red proso. Very early. Medium height. Fair lodging resistance. Small, orange seed, high test weight. Released 1974 by Nebraska Agricultural Experiment Station.

Dawn—White proso. Very early. Short. Fair lodging resistance. Medium size, white seed of medium test weight. Released 1976 by Nebraska Agricultural Experiment Station.

Minco—White proso. Late. Medium height. Fair lodging resistance. Medium size, white seed of high test weight. Released by Minnesota Agricultural Experiment Station in 1976.

Minsum—White proso. Early. Medium height. Poor lodging resistance. Large, white seed of medium test weight. Open heads with long, spreading branches contrast with more compact heads of other white proso varieties. Released 1980 by Minnesota Agricultural Experiment Station.

Rise—White proso. Medium maturity. Short. Fair lodging resistance. Medium size, white seed of medium test weight. Released by Nebraska Agricultural Experiment Station in 1983.

OTHER VARIETIES

Barnyard or Japanese—Forage. Late. Very tall. Very good lodging resistance. Medium size, gray seed of low test weight. High yielding forage millet but very coarse.

Cope—White proso. Late. Very tall. Fair lodging resistance. Large, white seed of medium test weight. Released by Colorado Agricultural Experiment Station in 1978.

German, German R, and German No. 8—Foxtail. Very late. Very tall. Good lodging resistance. Very small, yellow seed of low test weight. High forage yield but too late for good seed production.

Panhandle—White proso. Early. Medium height. Poor lodging resistance. Large, white seed of medium test weight.

Lower yield than Minsum. Released 1967 by Nebraska Agricultural Experiment Station.

Red Leonard—Red proso. Very late. Tall. Fair lodging resistance. Medium size, orange seed of high test weight. Lower yield than Cerise in 1982 trials. Released 1983 by Colorado Agricultural Experiment Station.

Sno-Fox—Foxtail. Late. Medium height. Poor lodging resistance. Small, white seed, medium test weight. Released 1980 by Nebraska Agricultural Experiment Station.

Table 12. Yields of millet varieties, 1983-85

Type and variety	Grain ¹			Forage ²		
	Rosemount	Becker	Average	Rosemount	Becker	Average
	----- lbs/A -----					
Foxtail						
Empire	1950	570	1260	8837	6048	7443
Proso						
Dawn	3432	1588	2510	7022	3601	5312
Minco	3978	1537	2758	9937	3924	6931
Minsum	3602	1679	2641	8130	4140	6135
Rise	3936	1491	2714	8654	3676	6165
Cerise	3657	2005	2831	8740	4782	6761
LSD 5%	372	303	240	590	464	375

¹10 percent moisture basis; ²Dry matter basis and includes grain.

Table 13. Characteristics of millet varieties, two location average

Type and variety	Planting to		Lodging	Height	Seeds	Test weight
	heading	maturity				
	----- days -----	-----	score ¹	inches	1,000/lb	lbs/bu
Foxtail						
Empire	59	99	2.8	47	239	47
Proso						
Dawn	39	74	3.3	31	68	51
Minco	42	83	3.6	40	71	53
Minsum	39	78	4.8	38	66	51
Rise	42	81	3.2	35	73	51
Cerise	38	73	2.9	40	81	56

¹1 = erect, 9 = flat.

OAT

RECOMMENDED VARIETIES

Don—Early, very high yield, short, fair lodging resistance, very high test weight, high groat percent, low protein percent,

white seed. Resistant to crown rust and smut. Selected at the Illinois Agricultural Experiment Station. Released in 1985.

Hazel—Medium maturity, high yield, short, very good lodging resistance, high

test weight, very high groat percent, medium protein percent, ivory seed. Resistant to crown rust, susceptible to smut, tolerant to red leaf. Selected at the Illinois Agricultural Experiment Station from a cross

involving Clintford and Portal. Released in 1985. Because of smut susceptibility, planting only treated seed is recommended.

Starter—Early, medium yield, short, very good lodging resistance, high test weight and groat percent, medium protein percent, yellow seed. Some resistance to crown rust, resistant to smut, some tolerance to red leaf. Selected at the Minnesota Agricultural Experiment Station from a cross involving Noble and a Dal derivative. Released in 1986.

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

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

VARIETIES NOT ADEQUATELY TESTED

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

OTHER VARIETIES

Hamilton—Early-medium maturity, medium yield, short, good lodging resistance, medium test weight and groat percent, medium protein percent, yellow seed. Susceptible to crown rust and smut. Selected at the Iowa Agricultural Experiment Station. Released in 1988.

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

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

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

Noble—Early-medium maturity, medium yield and height, good lodging resistance, medium test weight and groat percent, medium protein percent, yellow seed. Susceptible to crown rust, resistant to smut, some tolerance to red leaf. Selected at Purdue Agricultural Experiment Station from a



Alternative technologies are not always high-tech. Balloons and noise producing wind ribbons protect experimental oat plots at Morris and St. Paul. An idea imported from the far east, the balloons "eyes" scare grain eating birds away from fields.

Table 14. Yields of oat varieties, 1987-89

Variety	Rosemount	Waseca	Lamberton	Morris	Grand Rapids	5 loc. ave. ¹	Stephen	Roseau	7 loc. ave. ²	Crookston ³
	----- bu/A -----									
Starter	74	79	54	85	65	71	78	72	72	92
Preston	71	83	54	77	65	70	61	65	68	87
Don	87	91	65	100	77	84	73	82	82	91
Hamilton	66	86	59	81	66	72	—	—	—	85
Hazel	79	98	58	93	75	81	68	85	79	95
Horicon	80	96	69	90	73	82	—	—	—	91
Steele	77	84	51	78	79	74	77	93	77	81
Trucker ⁴	55	78	46	68	70	63	—	—	—	89
Valley	84	94	55	110	84	86	85 ²	107 ²	88	91
Moore	69	78	42	76	72	67	75	81	71	102
LSD%	6.9	9.1	8.0	6.9	8.8	3.1	9.7	12.3	3.4	14.1

¹ Compares yields of all varieties at five locations to the left where all were tested; ² Averages for those varieties grown at seven locations; ³ No 1988 data, so not included in averages; ⁴ 1988-89 only.

cross involving many lines. Released in 1973. Seed sale regulated by U.S. Variety Protection Act.

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

Preston—Early, medium yield, short, fair lodging resistance, high test weight, medium groat percent, very high protein percent, ivory seed. Some resistance to crown rust, resistant to smut, some toler-

ance to red leaf. Selected at Minnesota Agricultural Experiment Station from a cross between Dal and Otee. Released in 1982.

Proat—Late, high yield, medium height, fair lodging resistance, high test weight, medium groat percent, very high protein percent, ivory seed. Some resistance to crown rust, resistant to smut. Selected at the Minnesota Agricultural Experiment Station from a cross between Dal and Lyon. Released in 1985.

Rodney—Late, medium yield, tall, poor lodging resistance, medium test weight, white seed. Some resistance to crown rust, susceptible to smut. Selected by Agriculture Canada, Winnipeg, from a cross involving

several lines. Licensed in 1952.

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

Trucker—Late, low yield, medium height, good lodging resistance, medium test weight and groat percent, high protein percent, white seed. Susceptible to crown rust and red leaf, some resistance to smut. Selected at the South Dakota Agricultural Experiment Station from the same cross that produced Hytest. Released in 1988.

Table 15. Characteristics of oat varieties, 1986-89¹

Variety	Heading <i>date</i>	Height <i>inches</i>	Lodging <i>score</i> ²	Test		Protein ³		Protein <i>lbs/A</i>	Reaction to disease		
				Weight <i>lbs/bu</i>	Groat <i>percent</i>	groat <i>lbs/A</i>	seed <i>lbs/A</i>		crown rust <i>rating</i> ⁴	smut	BYDV
Starter	6-14	28	1.1	39	73	19.4	14.2	353	MS	HR	6.0
Preston	6-15	30	1.3	38	72	20.9	15.0	352	MS	MR	4.8
Don	6-15	27	1.3	39	73	16.7	12.3	355	R	R	7.3
Hamilton	6-16	28	1.2	37	72	18.0	13.2	325	S	S	6.8
Hazel	6-17	28	1.1	38	74	18.7	13.9	381	R	S	4.0
Horicon	6-18	30	1.1	37	74	18.0	13.2	374	R	S	5.8
Steele	6-19	33	1.2	38	73	19.1	14.0	353	MS	MS	4.0
Trucker ⁵	6-20	32	1.2	37	72	19.6	14.2	288	S	MS	7.0
Valley	6-20	29	1.1	39	73	18.2	13.3	340	MS	S	5.0
Moore	6-20	33	1.2	36	72	18.2	13.1	286	MS	MS	6.8

¹Does not include Stephen and Roseau; ²1 = erect; 5 = flat; ³All protein data from 1986-1988; ⁴Disease data from 1989 only. For crown rust and smut HR = highly resistant; R = resistant; MR = moderately resistant; MS = moderately susceptible; and S = susceptible. For BYDV (Barley Yellow Dwarf Virus: Red Leaf) 1 = no symptoms; 9 = dead; data supplied by A. Hewings, USDA-ARS and F. Kolb, Univ. of Illinois. ⁵1988-89 only.

DURUM WHEAT

Publicly developed varieties are classed into Recommended, or Other Varieties categories and listed within classes in maturity order. Privately developed varieties are listed and described in maturity order.

RECOMMENDED PUBLICLY DEVELOPED VARIETIES

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

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 in 1988.

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

OTHER PUBLICLY DEVELOPED VARIETIES

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

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

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

Mindum—Awned, late, tall, and poor lodging resistance. Susceptible to stem rust and moderately susceptible to leaf rust. Low yield, high test weight, medium seed weight. Satisfactory quality. A durum type

selected from a bread wheat field. Released by Minnesota Agricultural Experiment Station in 1917.

PRIVATELY DEVELOPED VARIETIES

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

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

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

Table 16. Characteristics and yields of durum wheat varieties, 1987-89

Variety	Heading date	Height inches	Lodging score ¹	Rust reaction		Seeds no./lb	Test Weight lbs/bu	Yield			
				leaf ---- rating ² ----	stem			Morris ³	Crookston	Stephen ⁴	Average
PUBLICLY DEVELOPED VARIETIES											
Monroe	6-21	30	1.7	MR	R	10,200	61.0	34	41	48	41
Renville	6-24	31	1.6	MR	R	11,200	61.2	32	41	46	39
Cando	6-25	25	1.2	S	R	13,300	60.6	24	37	45	35
Medora	6-23	32	1.3	MR	R	11,500	61.7	35	42	48	41
Vic	6-23	31	1.5	MS	R	10,700	61.2	32	39	43	38
Lloyd	6-25	25	1.3	MS	R	11,200	59.1	22	39	47	36
Mindum	6-26	36	3.3	MS	S	11,500	61.8	26	36	39	34
PRIVATELY DEVELOPED VARIETIES											
Fjord	6-23	30	1.4	MR	R	11,100	61.9	33	36	49	39
Stockholm	6-24	25	1.3	MS	R	11,600	60.9	25	40	51	38
Laker	6-25	27	1.3	MR	R	11,100	60.6	28	38	45	37
LSD 5%								9	—	—	5

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

HARD RED SPRING WHEAT

Publicly developed varieties are classed into Recommended, Not Adequately Tested, and Other Varieties categories and listed within classes in maturity order. Privately developed varieties are listed and described in maturity order.

RECOMMENDED PUBLICLY DEVELOPED VARIETIES

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

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

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

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

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

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

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

NOT ADEQUATELY TESTED PUBLICLY DEVELOPED VARIETY

Grandin—Awned, midseason, semidwarf. Resistant to stem rust and moderately susceptible to leaf rust. Moderately tolerant to loose smut. High yield and test weight. Medium to high



Minnpro is one of two new hard red spring wheat recommended releases from the Minnesota Agricultural Experiment Station. Vance is the other. Both are high yielding, well adapted varieties.

protein percent. Satisfactory milling and baking characteristics. Released by the North Dakota Agricultural Experiment Station in 1989.

OTHER PUBLICLY DEVELOPED VARIETIES

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

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

Amidon—Awnless, midseason, medium height. Resistant to stem and leaf rust. Moderately tolerant of loose smut. Medium yield, high test weight. Tolerant to sawfly. Medium percent protein. Satisfactory milling, baking. Disadvantages—High po-

tential for lodging. Released by North Dakota Agricultural Experiment Station in 1988 and suggested for western North Dakota.

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

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

Era—Awned, late to midseason, semidwarf. Resistant to stem rust and moderately resistant to leaf rust. Tolerant of loose smut and ergot. Medium lodging resistance. High yield and medium test weight. Low protein percent. Satisfactory milling. Disadvantages—Low bake absorption. Because of later maturity, less suitable for late seeding in southern Minnesota. Released by Minnesota Agricultural Experiment Station in 1970.

PRIVATELY DEVELOPED VARIETIES

2385—Awned, early, semidwarf. Moderately susceptible to stem and resistant to leaf rust. Moderately susceptible to loose smut. Medium to low yield and medium test weight. Medium to high percent protein. Released by Pioneer Hi-Bred in 1987. Variety protection pending.

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

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

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

Fjeld—Awned, midseason, semidwarf. Resistant to stem rust and moderately sus-

Table 17. Yields of hard red spring wheat varieties, 1987-89

Variety	Crookston	Stephen	Roseau ¹	Northern average	St. Paul	Morris	Lamberton	Waseca	Southern average	State average
----- bu/A -----										
PUBLICLY DEVELOPED VARIETIES										
Butte 86	43	50	46	46	39	40	29	38	37	40
Prospect	39	51	42	44	39	36	36	41	38	40
Minnpro	41	46	50	45	36	33	32	32	33	37
Stoa	46	53	54	51	38	41	39	42	40	43
Wheaton	42	55	41	47	37	41	38	36	38	41
Marshall	43	50	38	44	34	37	36	34	35	38
Vance	42	51	43	46	38	36	31	34	35	38
Shield	37	38	49	41	42	40	42	42	41	40
Guard	42	49	38	43	40	38	39	34	38	39
Amidon	44	49	42	46	34	36	30	35	34	38
Chris	33	37	36	35	28	32	28	30	29	31
Grandin ²	41	53	37	44	39	35	32	34	35	38
Len	42	47	40	43	30	32	31	30	31	35
Era	43	52	37	45	33	32	32	33	32	36
PRIVATELY DEVELOPED VARIETIES										
2385	34	42	40	38	36	36	32	32	34	35
2375 ²	42	51	50	48	43	40	39	39	40	43
2369	38	49	42	43	38	36	34	35	36	38
Celtic	43	48	41	44	38	36	33	37	36	39
Fjeld ²	41	52	37	43	40	39	38	37	39	40
Telemark	40	51	36	43	36	36	34	38	36	38
Leif	43	48	32	42	33	29	30	34	32	35
A99 AR	32	47	43	41	32	34	26	31	31	34
Nordic	44	56	43	48	37	39	38	39	38	42
Norseman	45	49	43	46	36	35	36	34	35	39
Tammy	41	53	46	47	38	31	33	32	33	38
LSD 5%	6	7	7	5	6	6	8	6	3	3

¹ 1987, 1989. ² 1988-89. Data adjusted to 3-year average.

Table 18. Characteristics of hard red spring wheat varieties, 1987-89

Variety	Heading date	Height inches	Lodging score ¹	Rust reaction		Seeds no./lb	Test Weight lbs/bu	Wheat Protein % ³	Milling baking quality rating
				leaf	stem				
PUBLICLY DEVELOPED VARIETIES									
Butte 86	6-14	27	3	MR	R	13,800	60.3	14.8	Medium-High
Prospect	6-17	26	1	MR	MR	14,300	60.0	14.6	Medium-Low
Minnpro	6-18	25	2	R	R	13,600	57.8	16.4	High-Medium
Stoa	6-18	30	2	MR	R	14,900	59.6	14.7	Medium-High
Wheaton	6-18	23	1	R	R	14,100	57.8	14.1	Low-Medium
Marshall	6-19	24	1	MR	R	15,600	59.3	14.4	Medium-Low
Vance	6-19	25	1	R	R	14,400	58.5	14.8	Medium-High
Shield	6-14	28	2	R	MS	13,500	59.1	14.6	Medium
Guard	6-16	25	1	R	MR	14,800	59.8	14.4	Medium-Low
Amidon	6-18	31	2	R	R	15,200	59.9	15.0	High-Medium
Chris	6-18	30	3	MR	R	16,600	59.4	15.8	Very High
Grandin ⁴	6-18	26	1	MS	R	14,400	59.5	15.2	High
Len	6-19	26	1	MS	R	14,800	59.4	15.6	High-Medium
Era	6-21	24	1	MR	R	15,900	59.5	13.9	Low-Medium
PRIVATELY DEVELOPED VARIETIES									
2385	6-15	27	1	R	MS	14,100	59.2	15.2	Medium
2375 ⁴	6-17	28	2	MR	R	13,800	60.4	15.6	Medium
2369	6-17	25	1	MS	MR	13,600	59.8	15.0	Low-Medium
Celtic	6-18	27	1	R	R	13,700	59.2	15.0	Medium
Fjeld ⁴	6-18	25	1	MS	R	14,400	58.9	14.2	Low-Medium
Telemark	6-18	23	1	R	R	14,700	58.1	15.2	High-Medium
Leif	6-18	27	2	R	R	14,800	59.6	15.4	Medium
A99 AR	6-19	30	2	MS	R	11,900	54.6	15.2	Low
Nordic	6-19	26	1	MS	R	12,700	60.4	13.6	Low
Norseman	6-19	23	1	R	R,S	13,900	58.2	15.1	Medium-Low
Tammy	6-19	26	2	MS	S	12,900	58.9	15.0	Medium-Low

¹1 = erect, 9 = flat; ²Reaction to prevalent races: R = resistant, MR = moderately resistant, MS = moderately susceptible, S = susceptible; ³12 percent moisture; ⁴2 years data.

ceptible to leaf rust. Moderately tolerant of loose smut. High yield and medium test weight. Low protein percent. Satisfactory milling characteristics. Disadvantages—Lower flour water absorption. Released by AgriPro, 1989. Variety protection pending.

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

Leif—Awned, midseason, semidwarf. Resistant to stem and leaf rust. Medium lodging resistance. Moderately susceptible to loose smut. Medium yield and test weight. Low to medium protein percent. Disadvantages—Low bake absorption. First marketed by Rohm and Haas in 1984. Seed sale regu-

lated by U.S. Variety Protection Act.

A99AR—Awnless, late to midseason, tall. Resistant to stem rust and moderately susceptible to leaf rust. Tolerant of loose smut. High yield. Low to medium protein percent. Disadvantages—Moderately susceptible to ergot and lodging. Low test weight. Very long and strong dough mixing requirements. Released by Weather Master in 1982. Seed sale regulated by U.S. Variety Protection Act.

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

Norseman—Awned, midseason, semidwarf. Mixed resistant-susceptible to stem

rust, and resistant to leaf rust. Good lodging resistance. Moderately susceptible to loose smut. Very high yield and low test weight. Low to medium protein percent. Disadvantage—Low bake absorption. First marketed by Agripro in 1984. Seed sale regulated by U.S. Variety Protection Act.

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

WINTER WHEAT

Publicly developed varieties are classed into Recommended, Not Adequately Tested, and Other Varieties categories and listed within classes in maturity order. Privately developed varieties are listed and described in maturity order after a minimum of two years testing. Cultural practices have a major effect on winter survival of all winter wheats. Planting into a firm seedbed with at least some stubble remaining to retain snow cover can reduce winterkill.

RECOMMENDED PUBLICLY DEVELOPED VARIETIES

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

Rose—Awned, medium height, medium maturity and good lodging resistance. Moderately winter-hardy. Moderately suscepti-

ble to leaf rust and moderately resistant to stem rust. High yield and test weight. Satisfactory quality. Released by South Dakota Agricultural Experiment Station in 1981.

NOT ADEQUATELY TESTED PUBLICLY DEVELOPED VARIETY

Seward—Awned, late, tall, and fair lodging resistance. Winter-hardy. Moderately resistant to leaf rust and resistant to stem rust. High yield and test weight. Low

protein percent. Satisfactory quality. Released by the North Dakota Agricultural Experiment Station in 1987.

OTHER PUBLICLY DEVELOPED VARIETIES

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

Agassiz—Awned, tall, medium maturity and fair lodging resistance. Winter-hardy. Susceptible to leaf rust and resistant to stem rust. Medium yield and test weight. Satisfac-

tory quality. Released by North Dakota Agricultural Experiment Station in 1983.

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

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

PRIVATELY DEVELOPED VARIETIES

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

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

Table 19. Characteristics and yields of winter wheat varieties, 1987-89

Variety	Heading date	Height inches	Winter		Rust reaction		Test		Yield				Avg.
			Survival %	Lodging score ¹	leaf	stem	Weight lbs/bu	Protein ⁴ %	Rosemount	Morris	Crookston ³	Roseau ⁴	
													bu/A
PUBLICLY DEVELOPED VARIETIES													
Roughrider	6-11	34	87	2.7	S	R	55.9	13.8	30	32	39	37	34
Rose	6-12	31	72	1.2	MS	MR	55.5	13.2	35	29	36	33	33
Siouxland	6-10	30	54	2.7	MR	R	55.9	13.0	43	18	32	49	36
Agassiz	6-12	35	77	2.4	S	R	55.5	13.2	25	30	34	46	34
Brule	6-12	31	63	1.4	MS	R	55.0	12.4	36	28	29	34	32
Seward ⁶	6-14	34	77	2.5	MR	R	55.8	12.4	35	30	41	48	39
Minter	6-15	35	85	4.1	MS	R	55.1	13.6	22	24	33	39	30
PRIVATELY DEVELOPED VARIETIES													
Thunderbird	6-9	29	39	1.1	MR	MS	56.3	13.3	36	22	17	30	27
Bighorn	6-13	30	60	2.1	S	S	54.6	13.0	33	28	22	42	32
LSD 5%									10	—	—	—	—

¹ 1 = erect, 9 = flat; ² Reaction to prevalent races: R = resistant, MR = moderately resistant, MS = moderately susceptible, S = susceptible; ³ 12 percent moisture; ⁴ 1987, 1988; ⁵ 1988, 1989 only. ⁶ 2 year data.

WILD RICE

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

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

VARIETIES

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

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

Meter—Short height, very early maturity, and low to medium yield. Large seed size. Reduced foliage in the canopy compared to other varieties. Developed by Min-

nesota Agricultural Experiment Station and released in 1985.

Netum—Medium height, early maturity, and low to medium yield. Developed by Minnesota Agricultural Experiment Station and released in 1978.

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 characteristics of wild rice varieties.

Variety	Yield		Shattering Loss 1989	Harvest 1981-1986 ¹	Height 1981-1988	Seeds
	1989 ¹	1981-1989 ¹				
----- lbs/A ² -----						
			% ³	date	inches	no./lb ⁴
K2	1083	1434	37	8-23	72	7300
M3	649	1416	55	8-27	74	9460
Meter	1070	1052	21	8-2	53	6880
Netum	728	1387	27	8-17	68	8300
Voyager	1082	1398	31	8-18	66	8600
LSD 5%			9	—	4	—

¹ 1989 data from Grand Rapids, and Gully, MN (on-farm); yield data from 1988 and harvest dates for 1987-1989 were not included because of test conditions; ² Green weight of harvested grain adjusted to 40% moisture; ³ Expressed as percent of total possible yield, which was estimated by adding harvested yield (one week after optimal harvest date) and collected shattered seed; only one year's data has been obtained and should be used with caution; ⁴ Seeds per pound based on wet, stored seed. Because seed size will vary from year to year and seed-lot to seed-lot, these data should be used with caution.

WINTER RYE

Spring rye varieties are not recommended because they yield much less than recommended winter ryes.

RECOMMENDED VARIETIES

Hancock—High yield, fair winter hardiness, medium late, medium height, and good lodging resistance. Large seed of predominantly tan color and high test weight. Originated by Wisconsin Agricultural Experiment Station from crosses involving Von Lochow and Wisconsin synthetics of tan seed color. Released in 1979.

Musketeer—High yield, good winter hardiness, medium late, medium height, and poor lodging resistance. Large seed of green color and medium test weight. Originated by Agriculture Canada, Swift Current, from crosses of Harrach, Petkus, and Dakold. Licensed in 1980. Production of certified seed limited to Canada.

Rymin—High yield, fair winter hardiness, medium late, medium height, and good lodging resistance. Large seed of predominantly greenish-gray color and high test weight. Originated by Minnesota Agricultural Experiment Station from a cross of Von Lochow and WR5. Released in 1973.

OTHER VARIETIES

Aroostook—Low yield, good winter hardiness, very early, tall, and poor lodging resistance. Small seed of brown and tan color, and low test weight. Selected from Balbo by USDA Soil Conservation Service in New York. Released by USDA, Cornell University, and Maine Department of Agriculture in 1981.

Cougar—Medium yield, winter-hardy (only fair hardiness in eastern Minnesota trials), late, medium height. Fair lodging resistance. Small green and tan seed, medium test weight. Originated by University of Manitoba from an open-pollinated selection in a composite cross of European and Canadian varieties. Licensed 1967.

Dankowskie Nowe (Danko)—Medium yield, poor winter hardiness, late, medium height, and good lodging resistance. Very large predominantly green seed, high test weight. Developed by Dankow-Laski and Choryn experiment stations. Reported to be the leading variety in Poland. Seed distributed by Northern Farm and Garden Inc., Bemidji and Roseau, MN.

Frederick—Medium yield, good winter hardiness, medium late, medium height, and poor lodging resistance. Medium size seed of predominantly tan color and high test weight. Selected from Von Lochow by South Dakota Agricultural Experiment Station. Released in 1984.

Puma—Medium yield, good winter hardiness, medium late, medium height, and

poor lodging resistance. Small predominantly green seed, medium test weight. Winter-hardy selection from Dominant by University of Manitoba. Licensed 1972.

Von Lochow—Medium yield, fair to poor winter hardiness, medium late,

medium height, and good lodging resistance. Large seed of predominantly green color and high test weight. Obtained from F. Von Lochow-Petkus Ltd. of Germany in 1958. Released by Minnesota Agricultural Experiment Station in 1964.



Soybeans planted in rye residue. As rye residues break down, they produce some natural herbicidal activity. Tests are under way at several experiment station sites.

Table 21. Yields of winter rye varieties

Variety	Rosemount	Becker	Morris Average	Crookston	Grand Rapids	
	1981-85	1982-85	1982-86	1982-86	1982-86	5 locations
	----- bu/A -----					
Hancock	59	46	57	62	48	54
Musketeer	58	47	60	72	47	57
Rymin	58	50	60	67	50	57
LSD 5%	2	4	3	5	4	2

Table 22. Characteristics of winter rye varieties, average five locations

Variety	Winterkill	Heading	Mature	Lodging	Height	Seeds	Test weight
	%	-----date	-----	score ¹	inches	no./lb	lbs/bu
Hancock	9	30	23	2.9	53	15,600	55
Musketeer	4	29	22	3.1	53	16,200	56
Rymin	6	30	23	2.7	52	16,200	56

¹1 = erect, 9 = flat.



Soybean

Oilseed Crops

FLAX

RECOMMENDED VARIETIES

Dufferin—High yield when sown early, not recommended for late sowing. Very late, brown seed, blue flowers, variable plant height. High oil percent. Resistant to rust and wilt. Licensed in 1975 by Agriculture Canada, Ottawa.

Rahab—High yield. Medium maturity, good lodging resistance. Brown seed, blue flowers. High oil percent. Resistant to rust, moderately susceptible to wilt and pasmo. Released in 1985 by South Dakota Agricultural Experiment Station.

Verne—High yield, particularly when sown late. Early maturity, good lodging resistance. Blue flowers, brown seed. Excellent resistance to rust and wilt, moderately resistant to pasmo. Released in 1987 by Minnesota Agricultural Experiment Station.

VARIETY NOT ADEQUATELY TESTED

Linton—Medium yield. Medium maturity, medium lodging resistance. Brown seed, blue flowers. Medium oil percent. Resistant to rust and wilt, moderately susceptible to pasmo. Released by North Dakota Agricultural Experiment Station in 1985.

OTHER VARIETIES

Clark—Medium yield. Early. Brown seed, blue flowers. Medium oil percent. Resistant to rust, moderately resistant to wilt and pasmo. Released in 1983 by South Dakota Agricultural Experiment Station.

Culbert and Culbert 79—Medium yield. Early maturity, good lodging resistance. Brown seed, blue flowers. High oil percent. Resistant to rust, moderately resistant to wilt, moderately susceptible to pasmo. Culbert released in 1975 by Minnesota Agricultural Experiment Station. Culbert 79 selected from Culbert and released in 1979 by South Dakota Agricultural Experiment Station. The two varieties do not differ significantly.

Flor—Medium yield. Medium maturity. Brown seed, blue flowers. High oil percent. Resistant to rust, susceptible to wilt, moderately susceptible to pasmo. Released in 1981 by North Dakota Agricultural Experiment Station.

Linott—Medium yield. Early maturity. Brown seed, blue flowers. High oil percent. Resistant to rust (has a trace of susceptible plants), moderately susceptible to wilt and

pasmo. Licensed in 1967 by Agriculture Canada, Ottawa.

McGregor—High yield when sown early. Very late, very resistant to lodging. Brown seed, blue flowers. Medium oil percent. Resistant to rust, moderately resistant to wilt, and susceptible to pasmo. Licensed in 1981 by Agriculture Canada, Ottawa. Production of certified seed limited to Canada.

NorLin—High yield. Medium maturity. Brown seed, blue flowers. Medium oil percent. Resistant to rust, moderately susceptible to wilt and pasmo. Licensed in 1982 by Agriculture Canada, Ottawa. Production of certified seed limited to Canada.

NorMan—High yield. Late maturity. Brown seed, blue flowers. High oil percent. Resistant to rust, moderately susceptible to wilt and pasmo. Licensed in 1984 by Agriculture Canada, Morden. Production of certified seed limited to Canada.

Table 23. Yields of flax varieties

Variety	Lamberton 1981-85	Crookston 1981-85	Stephen 1981-85	Roseau 1984-85	Grand Rapids 1984-85	St. Paul 1981-84	Morris 1982-83	Average 25 trials
----- bu/A -----								
Dufferin	25	16	15	15	31	19	34	20.7
Rahab	26	17	14	18	31	18	34	20.7
Verne	26	16	16	17	29	19	34	20.8
Clark	23	15	13	16	27	17	33	18.9
Culbert	24	14	13	17	26	18	33	19.1
Culbert 79	24 ¹	13 ¹	12 ¹	19 ³	22 ¹	16 ⁴	30	18.1
Flor	24	16	14	13	29	17	33	19.5
Linton	24 ¹	15 ¹	14 ¹	13	24 ¹	20 ⁴	33	19.3
McGregor	28 ¹	16 ¹	14 ¹	17 ³	26 ¹	17 ⁴	34	20.2
NorLin	24 ¹	19 ¹	16 ¹	18 ³	28 ¹	17 ⁴	34	20.9
NorMan	24 ²	17 ²	15 ²	21	31 ²	19 ⁵	34	21.0
LSD 5%	2	2	2	4	4	2	2	0.4

¹1981-82, 85. ²1982-85. ³1985. ⁴1981-82. ⁵1982-84.

Table 24. Characteristics of flax varieties

Variety	Oil % ¹	Test weight lbs/bu	Seeds no./lb	Planting to bloom			Height inches	Disease reaction		
				first -----days-----	full	Lodging score ²		Wilt -----score ³ -----	Pasmo	Rust rating ⁴
Dufferin	42	53	82,470	56	61	2.7	24	2.0	5.2	R
Rahab	41	53	78,210	54	58	2.9	23	3.7	3.0	R
Verne	41	53	82,470	51	56	3.3	22	1.6	3.1	R
Clark	40	54	79,580	51	56	3.6	22	3.3	3.4	R
Culbert	41	54	76,880	50	56	2.6	21	2.6	3.1	R
Culbert 79	41	54	76,880	51	57	2.5	21	2.5	3.1	R
Flor	41	53	82,470	54	58	3.7	22	4.7	3.3	R
Linton	40	54	81,000	54	59	3.3	22	1.4	3.6	R
McGregor	40	54	87,230	56	62	1.8	24	3.2	4.2	R
NorLin	40	54	78,210	53	59	3.2	22	3.7	3.4	R
NorMan	41	53	79,580	55	60	4.0	22	3.8	4.0	R

¹Oven-dry. ²1 = erect, 9 = flat. ³1 = best, 9 = poorest. ⁴R = resistant.

MUSTARD

Mustard seed is produced for condiment food markets and specialty products. Production of mustard on Minnesota farms began nearly 30 years ago. Unlike commodity grains (such as soybean or canola), which have a broad and stable market, mustard is grown as a specialty grain, mostly under contract and occasionally on greater acreages when market prices are high. Three types of mustard are grown in Minnesota: Yellow, Brown and Oriental.

YELLOW MUSTARD VARIETIES

Gisilba—Similar to Ochre in field performance. Originated in Germany. Distributed by Northern Sales Co. Ltd., Winnipeg, Manitoba. Licensed in 1974.

Kirby—Released by Colman Foods, Norwich, England in 1970. Distributed by Minn-Dak Growers Association, Grand Forks, ND.

Ochre—Originated by Agriculture Canada, Saskatoon. Licensed in 1981.

Tilney—Similar to Kirby in field performance but has a high mucilage content desired by processors. Released by Colman Foods of Norwich, England in 1978. Dis-



tributed by Minn-Dak Growers Association, Grand Forks, ND.

BROWN MUSTARD VARIETY

Blaze—Released by Agriculture Canada, Saskatoon. Licensed in 1976.

ORIENTAL MUSTARD VARIETIES

Carrow 85—Undesirably small seed. Released by Colman Foods of Norwich, England about 1980.

Domo—Originated by Agriculture Canada, Saskatoon. Licensed in 1977.

Lethbridge 22A—Released by Agriculture Canada, Lethbridge, in 1967. Licensed in 1974.

Student employees lay out small grids within larger test plots to detail seedling emergence, with counts of plants or weeds, or to evaluate plant growth.

Table 25. Yield and characteristics of yellow, oriental and brown mustard varieties.

Crop and variety	Roseau	Crookston	Rosemount	Test			Planting to		Lodging	Height
	1981-82,84-85	1980-81,85	1979-83	Oil	weight	Seeds	bloom	maturity		
	----- lbs/A -----			% ⁵	lbs/bu	1,000/lb	-----days-----		score ⁶	inches
Yellow mustard										
<i>(Brassica hirta)</i>										
Kirby	1524	868	1144	27	55	89	43	94	3	41
Ochre	1494	927	1222 ³	27	55	91	41	92	4	39
Tilney	1861 ¹	1473 ¹	1041 ¹	31 ²	54	94	42	94	2	45
Oriental mustard										
<i>(Brassica juncea)</i>										
Domo	1437	1204 ²	1626 ³	38 ³	52	168	45	94	4	45
Brown mustard										
<i>(Brassica juncea)</i>										
Blaze	1585	973	1466 ³	35	53	189	47	94	4	45
LSD 5%	275	225	117							

¹One year data; ²Two year data; ³Three year data; ⁴Oven-dry basis, four year/location average; ⁵1 = erect, 9 = horizontal.

CANOLA AND OILSEED RAPE

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

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

Canola seed oil contains less than 2 percent erucic acid compared with 20 to 40 percent in oilseed rape varieties. The meal remaining after oil extraction from canola contains less than 0.1 percent of glucosinolate (sulfur-containing compounds) compared with about 1 percent in rapeseed meal. Therefore, canola is also referred to as double low or 00 rapeseed.

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

Oilseed rape contains high levels of erucic acid and is needed for certain industrial purposes. Canadian plant breeders have developed varieties with oil containing over 40 percent erucic acid. These are grown under contract so that they can not be marketed as canola. Oilseed rape is occasionally grown under contract in Minnesota.

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

SPRING CANOLA VARIETIES

(*Bassica napus*)

AU154—Developed by Weibulls, AB, Landskrona, Sweden. Distributed by Allelix Crop Technologies, Inc., Clarksville, TN. Limited availability.

Celebra—Developed by Svalof, AB,

Sweden. Distributed by Bonis and Company Ltd., Lindsay, Ontario, Canada.

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

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

Hyola 40—Hybrid variety marketed in U.S. by Garst Seed Co., Hutchinson, MN.

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

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

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

Stallion—Product of Svalof, AB, Sweden. Distributed by Bonis and Co., Lindsay, Ontario, Canada.



Agronomist Dan Putnam maneuvers a small-plot combine harvesting spring planted canola. Student technicians on the ground assure that the plant material feeds smoothly and is completely harvested.

Table 26. Seed yield of spring canola (*Brassica napus*) varieties

Variety	Roseau 1985	Crookston 1985	Lamberton 1987	Grand Rapids 1988	Grand Rapids 1989	Morris 1989	Roseau 1989	Avg. 1989
----- lbs/A -----								
AU 154	—	—	—	—	1315	1837	1400	1517
Celebra	—	—	—	—	1047	1487	1727	1420
Delta	—	—	—	—	1439	1823	1788	1683
Global	2505	1051	665	1063	772	884	1485	1047
Hyola 40	—	—	1087	595	1465	1945	1286	1565
Legend	—	—	—	—	1158	2064	1775	1666
OAC Triumph	—	—	—	—	450	993	1192	878
OAC Triton	1583	954	510	208	462	1029	1077	856
Stallion	—	—	—	—	567	1016	1403	995
Topas	1651	1058	604	996	938	1368	1708	1338
Westar	2149	1377	1220	1285	1477	1391	1255	1374
LSD 5%	558	225	276	358	260	426	476	387

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

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

Westar—Originated by Agriculture Canada, Saskatoon. Licensed in 1982. Pro-

duction of certified seed limited to Canada.

SPRING CANOLA VARIETY
(*Brassica campestris*)

Tobin—Originated by Agriculture Canada, Saskatoon. Licensed in 1981. Production of certified seed limited to Canada.

OILSEED RAPE VARIETY (*Brassica napus*)

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

OILSEED RAPE VARIETY
(*Brassica campestris*)

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

Table 27. Characteristics of spring canola (*Brassica napus*) varieties

Variety	Oil ¹	Test weight ²	Seed weight ²	Planting to		Lodging ³	Plant height ³
	%	lbs/bu	1000/lb	50% bloom ³	maturity ³	score ⁴	inches
				days -----			
AU154	37.7	50	154	58	99	3.4	47
Celebra	39.3	49	153	56	101	3.4	45
Delta	37.2	51	179	57	98	3.4	48
Global	37.3	46	127	60	102	3.3	49
Hyola 40	38.7	52	152	53	97	3.8	46
Legend	38.7	51	163	53	99	3.7	45
OAC Triumph	35.7	51	155	59	101	3.0	47
OAC Triton	34.2	46	153	58	102	4.3	45
Stallion	35.9	48	138	56	102	3.7	46
Topas	37.3	49	182	58	99	3.8	49
Westar	39.2	52	148	53	98	3.5	44

¹10 percent moisture basis; Grand Rapids, Roseau; ²Roseau; ³Grand Rapids, Roseau; ⁴1 = erect, 10 = horizontal.

SOYBEAN

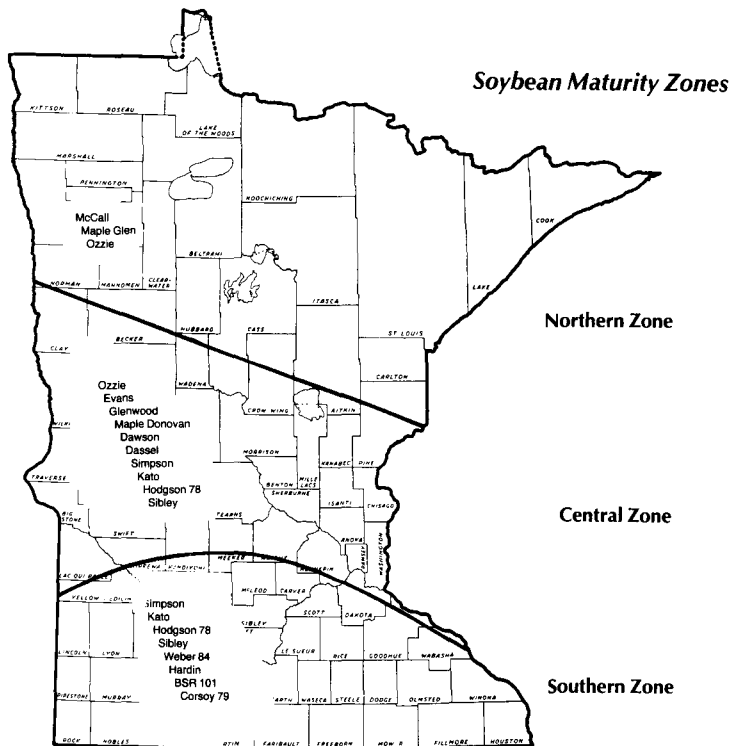
Many different soybean varieties are available in Minnesota. These varieties have been developed by public and/or private organizations. The important characteristics of these soybean varieties are presented in this section's tables.

Tables 30 to 36 deal with varieties that were developed by publicly supported institutions and are being considered for recommendation by Minnesota Agricultural Experiment Station.

Tables 37 to 39 show performance characteristics of privately developed varieties as well as several public varieties. Recommendations are not made for private varieties because they are voluntarily submitted by the companies and long term performance data (3 years or more) are not available on many of them.

Performance data for public and private soybean varieties are presented in northern, central and southern zone tables. Test locations for each zone are indicated in each table. Becker was the only irrigated test location. All tests were planted between May 5 and May 25 unless otherwise indicated. Row spacings vary in some tables. The Moorhead location was not harvested in 1988 due to severe hail damage.

Many factors need to be considered in selecting varieties. The major ones are listed on the following page.



Map 3: Recommended public varieties of soybeans for various maturity zones in Minnesota. Varieties are listed in order of maturity within each zone.

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

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

Row Spacing—Research conducted over many years and many locations has shown that yields from narrow rows (10 inches to 18 inches) are higher than wide rows (20 inches to 40 inches). These yield differences between narrow and wide row spacing for the two early planting dates at Waseca and Lamberton have not been as pronounced in most recent years of testing. Although rankings of varieties can change with row spacing, top performers in a wide spacing should be among the top performers in a narrow spacing.

Plant Height and Lodging—These measurements give an indication of the stem strength and standability of a variety, and relate somewhat to ease of combining. The actual height and lodging score is influenced by environmental conditions, so values may vary from year to year. A good way to use these values is to compare scores of newer varieties to a familiar variety.

Chlorosis—The chlorosis score listed for each variety is a measure of how much leaf yellowing occurred in tests conducted in 1989 on a high lime (high pH) soil near Lamberton. This score indicates how well a variety will perform on high lime soils.

Phytophthora—Phytophthora root rot can cause significant yield losses when susceptible varieties are planted in poorly drained fields. Since there are several races of this fungus, 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 non 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's De-



Soybean meal samples are run through a near infra-red analyzer to determine oil and protein content. Technician Neal Batt fills sample cells from 65-gram portions of ground soybean seed.

partment of Plant Pathology, and on information supplied by the companies.

Soybean Cyst Nematode (SCN)—SCN was first identified in Minnesota in 1978 and is now known to occur in 16 counties of southern Minnesota according to Cooperative Pest Survey Program data. The areas infested and numbers of nematodes appear to be increasing. When SCN numbers are high, significant yield losses can occur. Several races of SCN are known to occur in Minnesota, however, Race 3 appears to be the predominant race. Planting resistant varieties (currently only Bell) and rotations to non-host crops can assist in managing nematode populations.

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, (currently BSR101 and BSR201) or longer rotations out of soybeans, assist in the management of this disease.

Table 28. Genes for resistance to races of Phytophthora root rot.

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

Powdery Mildew—In 1985 conditions were favorable for the development of powdery mildew. The reactions to powdery mildew, reported in the table of public varieties, were determined on field grown plants under natural infestations by members of the Department of Plant Pathology.

Protein and Oil—Protein and oil values are determined using near infrared reflectance analysis. Protein and oil values are expressed on a 13% moisture basis. A formula is available to convert the protein and oil value to another moisture basis:

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

The value of a bushel of soybeans, based on oil and protein content, can be calculated with this formula:

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

Where:

APV = Approximate value of a bushel of soybeans

Po = soybean oil price (\$/lb)

Pm = price of 44% meal (\$/lb)*

X = oil content at 13% moisture (in decimals)

Y = protein content at 13% moisture (in decimals)

And:

$$* \frac{\text{price of meal } (\$/\text{ton})}{2000} = \$/\text{lb}$$

RECOMMENDED VARIETIES

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

Corsoy 79—Southern zone. Very good yield performance. *Rps1-c gene for phytophthora resistance*. Has poor chlorosis ratings and is somewhat lodging susceptible. Released by Illinois Agricultural Experiment Station in 1979.

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

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

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

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

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

Hodgson 78—Central and southern zones. Similar to Hodgson, except *Rps1 gene for resistance to phytophthora*. Released by Minnesota Agricultural Experiment Station in 1978. Seed sale regulated by U.S. Variety Protection Act.

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

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

Maple Glen—Northern zone. Matures about six days later than McCall but earlier than Ozzie. Very good yield potential. Sus-

ceptible to phytophthora. Developed by Agriculture Canada, Ottawa. Licensed in 1987.

McCall—Northern zone. High yield, tall and good lodging resistance in its maturity class. Susceptible to phytophthora. Released by Minnesota Agricultural Experiment Station in 1978.

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

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

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

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

VARIETIES NOT ADEQUATELY TESTED

Bell—Several days later than Hardin in maturity. *Resistant to race 3 and race 14 (originally reported as race 4) of the Soybean Cyst Nematode*. Fair yield potential. Susceptible to phytophthora. Released by Illinois Agricultural Experiment Station in 1989. Seed sale regulated by U.S. Variety Protection Act.

Burlison—About six days later than Corsoy 79. Very good yield performance. Very good protein level. Good lodging and iron chlorosis resistance. *Rps1-b and Rps3 genes for resistance to phytophthora*. Released by Illinois Agricultural Experiment Station in 1988. Seed sale regulated by U.S. Variety Protection Act.

Sturdy—Matures slightly later than Hardin but earlier than Corsoy 79. High yield potential. Good lodging resistance and iron chlorosis resistance. *Rps1 gene for resistance to phytophthora*. Developed by Minnesota Agricultural Experiment Station. Released in 1989 but sufficient quantities of certified seed are not available until 1991 planting season. Seed sale regulated by U.S. Variety Protection Act.

OTHER VARIETIES

Bicentennial—Matures about six days later than McCall. Medium yield potential. *Rps1 gene for resistance to phytophthora*. Developed by University of Guelph. Licensed in 1985.

Elgin 87—Matures several days later than Corsoy 79. *Rps1-k gene for resistance to phytophthora*. Has poor iron chlorosis ratings. Fair lodging resistance. Released by Iowa Agricultural Experiment Station in 1987. Seed sale regulated by U.S. Variety Protection Act.

Hack—Matures several days later than Corsoy 79. High yield potential but not tolerant to iron chlorosis on high lime soils. Good lodging resistance. *Rps1 gene for resistance to phytophthora*. Released by Illinois Agricultural Experiment Station in 1984.

Haroson—Matures one to two days earlier than Hodgson 78, but similar in other respects except *Rps1-c gene for resistance*



Experiment stations are diverse farming operations. Multiple crop species are visible in all directions on any of the stations. These soybeans test rows are planted in close proximity to corn and small grains at the West Central Experiment Station, Morris.

to *phytophthora*. Developed by Agriculture Canada, Harrow. Licensed in 1987.

Hodgson—A leading variety in central Minnesota for several years. Now largely superseded by phytophthora-resistant Hodgson 78. Released by Minnesota Agricultural Experiment Station in 1974. Seed sale regulated by U.S. Variety Protection Act.

Hoyt—Matures about three days later than Corsoy 79. Good lodging resistance. Determinate variety. *Rps1 gene for resistance to phytophthora*. Released by Ohio Agricultural Experiment Station in 1986.

Maple Amber—Matures six days earlier than McCall. High percentage of oil and protein for its maturity. *Rps6 gene for resistance to phytophthora*. Developed by Agriculture Canada, Ottawa. Licensed in 1982.

Maple Arrow—Matures about six days later than McCall. *Rps1 gene for resistance to phytophthora*. Developed by Agriculture Canada, Ottawa. Licensed in 1976.

Maple Isle—Matures about two days earlier than McCall. Yields less than McCall. *Rps1 gene for resistance to phytophthora*. Developed by Agriculture Canada, Ottawa. Licensed in 1984.

Maple Ridge—Matures about seven days earlier than McCall. Yield similar to Maple Amber. Susceptible to phytophthora. Developed by Agriculture Canada, Ottawa. Licensed in 1985.

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

Vickery—Essentially the same as Corsoy 79. *Rps1-c gene for resistance to phytophthora*. Developed jointly by the Iowa and Ohio Agricultural Experiment Stations. Released in 1978. Seed sale regulated by U.S. Variety Protection Act.

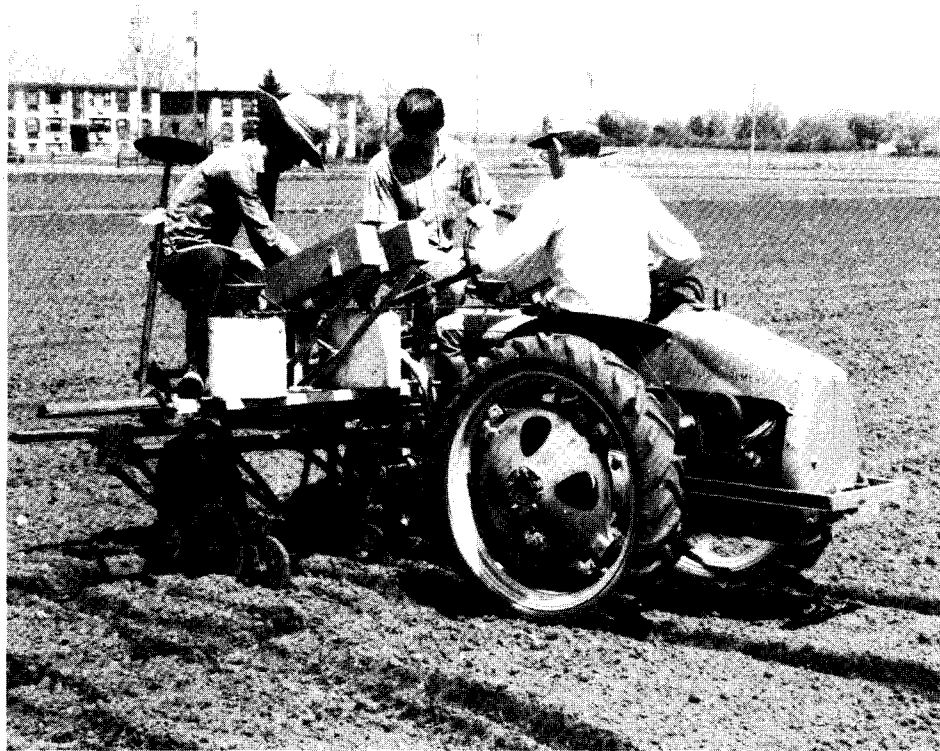
Weber—Similar to Corsoy 79 in yield and lodging. Good tolerance to high lime soils. Susceptible to phytophthora. Released by Iowa Agricultural Experiment Station in 1979. Seed sale regulated by U.S. Variety Protection Act.

SPECIAL PURPOSE VARIETIES

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

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

Minnatto—A small-seeded variety for specialty markets. Matures slightly later than Evans. Seed weight about 4 grams per 100 seeds less than Chico. Similar in yield to Chico. *Rps1 gene for phytophthora resistance*. Released by Minnesota Agricultural Experiment Station in 1989. Seed sale regulated by U.S. Variety Protection Act. (Con-



A small tractor with special seed delivery apparatus (top) is used to plant large seeded crops, such as soybeans, for seed germination and vigor studies. But, in certain experiments where uncommon spacing is required, hand planting equipment (right) is used.

tact Sigco Sun Products, Inc., Box 331, Breckenridge, MN 56520 for information concerning seed)

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

Vinton 81—Large seeded special purpose variety. Maturity similar to Hardin. Seed weight 6 to 8 grams per 100 seeds greater than Hardin. Released by Iowa Agricultural Experiment Station in 1981.

PRIVATELY DEVELOPED VARIETIES

The private companies entering varieties in the 1989 Minnesota tests and the brand names were:

AgriPro, Route 2, Hwy 30 East, Ames, IA 50010 (AgriPro);
Asgrow Seed Company, P.O. Box 7570, Des Moines, IA 50322 (Asgrow);
Atlas Seed Company, R.R. 3, Box 204, Adel, IA 50003 (Atlas);



Cenex/Land O'Lakes, 2827 8th Avenue South, Fort Dodge, IA 50501 (C/LOL);
Custom Farm Seed, P.O. Box 160, Mokense, IL 60954 (CFS);
Dahlgren & Company, Inc., 1220 Sunflower Street, Crookston, MN 56716 (Dahlgren);
Dahlman Seed Company, Route 1, Box 116, Dassel, MN 55325 (Dahlman);

Dairyland Seed Co., Inc., P.O. Box 958, 3570 Hwy. H., West Bend, WI 53095 (DSR);
 DeKalb-Pfizer Genetics, 3100 Sycamore Road, DeKalb, IL 60115 (DeKalb);
 Diamond Brand Seed, 1127 Plaza Drive, Carroll, IA 51401 (Diamond); Ehrich Seed Farms, Inc., Route 1, Elmore, MN 56027 (Ehrich);
 Funk Seeds International, P.O. Box 18300, Greensboro, NC 27419-8300 (Funk);
 Gold County Seed, Box 144, Delavan, MN 56023 (GCS);
 Green Field Seed, P.O. Box 56, Comfrey, MN 56019-0056 (GFS);
 Hyland Seeds, Division of W.G. Thompson and Sons Ltd., 145 Marlborough St., P.O. Box 130, Blenheim, Ontario, Canada N0P 1A0 (Hyland);
 Hy-Vigor Seeds, Inc., Route 1, Box 77, Paullina, IA 51046 (Hy-Vigor);
 Interstate Seed Company, Box 338, West Fargo, ND 58078 (IS);
 ISGO, P.O. Box 671, New Ulm, MN 56073 (ISGO);
 Jacques Seed Company, 720 St. Croix St., Prescott, WI 54021 (Jacques);
 J.C. Robinson Seed Co., The, 3rd and Hwy. 64, Box A, Waterloo, NE 68069-0301 (Golden Harvest);
 Kaiser Estech, 2007 W. Highway 50, Box 4139, Fairview Heights, IL 62208 (KE);
 Kaltenberg Seed Farms, P.O. Box 278, Waunakee, WI 53597 (Kaltenberg);
 Kruger Seed Company, P.O. Box A, Dike, IA 50624 (Kruger);
 Latham Brothers Farms, Rt. 1, Box 12, Alexander, IA 50420 (Latham);
 Latham Seed Company, Rt. 1, Box 12, Alexander, IA 50420 (Latham);
 Lundquist Seed Inc., 15 N. 10th St., Wheaton, MN 56296 (LS);
 McCurdy Seed Co., 522 East Main St., Fremont, IL 52561 (Riverside);
 Midwest Oilseeds, Inc., Route 3, Box 204, Adel, IA 50003 (MO);
 Mustang Brand Seed, Box 466, Madison, SD 57042 (Mustang);
 NC + Hybrids, 3820 North 56 St., P.O. Box 4408, Lincoln, NE 68504 (NC +);
 Northrup King, P.O. Box 959, Minneapolis, MN 55440 (NK);
 Pioneer, 130 SE Willmar Ave., Willmar, MN 56201, (Pioneer);
 Prairie Brand Seed, Inc., Rte. 1, Box 201, Gowrie, IA 50243 (Prairie Brand);
 ProfiSeed, Route 2, Hampton, IA 50441 (Profiseed);
 Rossbach Lakeside Seeds, Route 1, Box 70, Hanska, MN 56041 (Lakeside);
 Sand Seed Service, Inc., P.O. Box 648, Marcus, IA 51035 (SOI);
 Sansgaard Seed Farms, Inc., RR 1, Box 76, Story City, IA 50248 (Sansgaard);
 Schechinger Seed Company, Route 1, Box 149, Harlan, IA 51537 (S Brand);
 Schwitters Seed Inc., RR 2, Box 102, Raymond, MN 56282 (SSI);
 Sexauer Company, The, P.O. Box 58, Brookings, SD 57006-0058 (Sexauer);
 Sigco Research, Box 289, Breckenridge, MN 56520 (Sigco);

Table 29. Yields of publicly developed soybean varieties in northern zone, 1985-89

Variety	Crookston	Grand Rapids	Moorhead ¹	Roseau
----- bu/A -----				
Maple Ridge	25	27	29	28
Maple Isle	23	28	29	27
Maple Amber	—	23	—	25
Maple Belle	—	32	—	29 ²
McCall	26	33	32	29
Maple Glen	26 ³	34 ⁴	—	31 ²
Bicentennial	25	30	32	29 ²
Chico	—	—	35	—
Maple Arrow	23	—	26	—
Ozzie	24	—	39	—
Evans	23	—	36	—
Proto	—	—	29	—
Dawson	27 ⁴	—	38	—
Dassel	—	—	37	—
Glenwood	—	—	37	—
Maple Donovan	26 ⁴	—	37	—
Simpson	—	—	38	—
LSD 5%	2	3	2	2

¹1986-87, 89; ²1987-89, data adjusted to five year average; ³1988-89, data adjusted to five year average; ⁴1986-89, data adjusted to five year average.

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

Variety	mid-May planting		late-May planting		mid-June planting	
	10 inch	30 inch	10 inch	30 inch	10 inch	30 inch
----- bu/A -----						
McCall	—	—	41	34	35	30
Ozzie	45	38	46	37	32	28
Evans	48	40	48	39	35	33
Dawson	—	—	45	42	34	34
Hodgson 78	49	44	—	—	—	—
LSD 5%	5	5	5	5	5	5

Table 31. Yields of publicly developed soybean varieties in central zone, 1985-89

Variety	Rosemount 10-inch	Morris 10-inch	Becker 30-inch	Average
----- bu/A -----				
McCall	36	36	—	36
Ozzie	39	35	46	40
Evans	36	37	47	40
Dawson	40	43	44	42
Dassel	42	37	46 ¹	42
Glenwood	42	44	48	45
Simpson	43	38	47	43
Hodgson 78	43	43	48	45
Haroson	43	36	46 ²	43
LSD 5%	4	4	3	2

¹1986-89, data adjusted to 5-year average; ²1987-89, data adjusted to 5-year average.

Soybean Research Foundation, 115 N. Perry St., Mason City, IL 62664 (SRF);
 Star Brand Seed, P.O. Box 648, Marcus, IA 51035 (Star);
 Stine Seed Farm, Inc., Route 3, Box 204, Adel, IA 50003 (Stine);
 Terra International, Inc., 950 South Broadway, Lima, OH 45804 (Terra);
 Thompson Agronomics, Inc., Route 1, Leland, IA 50453 (Thompson);
 Thompson Seeds, Inc., Route 1, Leland, IA 50453 (Thompson);
 Tilney Farms, P.O. Box 115, Lewisville, MN 56060 (Tilney Farms);
 Willette Seed Farm, Inc., P.O. Box 391, Delavan, MN 56023 (Willette Seed Farm);
 Wilson Hybrids, Inc., P.O. Box 391, Harlan, IA 51537 (Wilson Blend³);
 Ziller Seed Company, Route 1, P.O. Box 122, Bird Island, MN 55310 (Ziller).

Table 32. Yields of publicly developed soybean varieties in 10 inch and 30 inch spacings and 5 planting dates at Waseca and Lamberton, 1986-87, 89

Varieties	early-May planting		mid-May planting		late-May planting		mid-June planting		late-June planting	
	10-inch	30-inch	10-inch	30-inch	10-inch	30-inch	10-inch	30-inch	10-inch	30-inch
-----bu/A-----										
Evans	—	—	—	—	—	—	42	39	34	29
Sibley	50	46	49	48	46	44	42	39	34	31
Hardin	50	54	51	51	51	47	44	41	35	30
Corsoy 79	52	51	54	51	45	45	—	—	—	—
BSR 101	52	53	51	51	46	45	—	—	—	—
LSD 5%	3	3	3	3	3	3	3	3	3	3

Table 33. Yields of publicly developed soybean varieties in southern zone, 1985-89.

Variety	Waseca and Lamberton		Fairmont planting 30-inch	Waseca planting 10-inch	Lamberton planting 10-inch	Average mid-May planting
	mid-May planting	mid-June planting				
-----bu/A-----						
McCall	—	36	—	—	—	—
Ozzie	40	41	41	38	41	40
Evans	40	41	41	38	42	40
Dawson	45	43	43	45	46	45
Glenwood	45	39	44 ³	45	43	44
Kato	47	43	49	46	48	47
Dassel	46	41	43	47	44	44
Simpson	47	41	42	49	46	46
Hodgson 78	48	41	43	47	47	46
Sibley	49	43 ²	45	46	42	44
Weber 84	50	43	46	50	50	49
Hardin	51	43	47	48	53	49
Sturdy	53	41	48	51	55	51
BSR 101	48	39	45	49	47	47
Corsoy 79	48	40	45	46	50	47
Elgin 87 ¹	48	36 ³	50	48	48	49
Hack	49	—	47	50	48	48
LSD 5%	2	2	2	3	2	1

¹Elgin 1985-86; ²1986-89 data, adjusted to 5-year average; ³1987-89 data; adjusted to 5-year average.

Table 34. Field characteristic of publicly developed soybean varieties, 1989.

Variety	Mature		Lodging	Height	Phytophthora	Powdery mildew	Chlorosis
	mid-May Planting	mid-June Planting					
	----- date -----						
Northern Zone (Crookston and Moorhead)							
Maple Ridge	9-8	—	1.0	15	S	S	2.0
Maple Amber	9-8	—	1.0	14	Rps6	S	4.5
Maple Isle	9-10	—	1.0	18	Rps1	S	4.0
McCall	9-12	—	1.0	17	S	S	2.5
Chico	9-18	—	1.0	15	Rps1	R	2.0
Maple Glen	9-18	—	1.0	15	S	—	5.0
Maple Arrow	9-20	—	1.0	15	Rps1	S	3.0
Ozzie	9-24	—	1.0	16	Rps1	S	3.0
Evans	9-26	—	1.0	19	Rps1	R	2.5
Bicentennial	9-27	—	1.0	17	Rps6	S	4.0
Proto	9-27	—	1.0	14	S	—	4.0
Minnatto	9-27	—	1.0	12	Rps1	—	2.5
Simpson	9-28	—	1.0	13	Rps1	S	4.5
Glenwood	9-29	—	1.0	14	Rps1	R	2.0
Maple Donovan	9-30	—	1.0	16	Rps1 + Rps4	S	3.0
Dawson	9-31	—	1.0	15	Rps1	S	2.0
Dassel	9-31	—	1.0	13	Rps6	R	2.0

Table 34 (Continued). Field characteristic of publicly developed soybean varieties, 1989.

Variety	Mature		Lodging	Height	Phytophthora	Powdery mildew	Chlorosis
	mid-May Planting	mid-June Planting					
	----- date -----		score ¹	inches	gene	reaction ²	score
Central Zone (Morris and Rosemount)							
McCall	9-3	—	2.0	26	S	S	2.5
Chico	9-5	—	2.0	26	Rps1	S	2.0
Ozzie	9-12	—	1.2	29	Rps1	S	3.0
Evans	9-15	—	2.0	32	Rps1	R	2.5
Glenwood	9-15	—	2.2	29	Rps1	R	2.0
Proto	9-15	—	2.4	25	S		4.0
Dawson	9-16	—	2.0	32	Rps1	S	2.0
Simpson	9-16	—	1.8	30	Rps1	S	4.5
Swift	9-16	—	2.4	34	S	R	2.0
Maple Donovan	9-17	—	2.0	30	Rps1 + Rps4	S	3.0
Dassel	9-17	—	2.0	27	Rps6	R	2.0
Haroson	9-18	—	2.3	34	Rps1-c	—	2.0
Kato	9-19	—	1.4	34	Rps1	—	2.5
Hodgson 78	9-20	—	2.2	34	Rps1	S	2.5
Sibley	9-22	—	2.4	32	Rps1	S	4.0
Weber 84	9-22	—	2.8	35	Rps1	R	2.5
Hardin	9-22	—	2.4	36	Rps1	S	5.0
Sturdy	9-24	—	1.8	34	Rps1	—	2.5
Corsoy 79	9-24	—	2.4	38	Rps1-c	S	4.5
Southern Zone (Lamberton and Waseca)							
McCall	8-30	9-11	1.5	27	S	S	2.5
Ozzie	9-4	9-14	1.5	29	Rps1	S	3.0
Evans	9-4	9-20	1.5	34	Rps1	R	2.5
Dawson	9-4	9-19	1.5	32	Rps1	S	2.0
Proto	9-4	—	1.5	27	S	—	4.0
Dassel	9-5	9-19	1.5	28	Rps6	R	2.0
Glenwood	9-6	9-17	1.5	30	Rps1	R	3.0
Simpson	9-6	9-17	1.5	32	Rps1	S	3.5
Swift	9-7	—	2.0	37	S	R	2.0
Kato	9-12	—	1.5	37	Rps1	—	2.5
Hodgson 78	9-14	9-20	2.0	37	Rps1	S	2.5
Hardin	9-15	9-21	2.0	38	Rps1	S	5.0
Sibley	9-16	9-21	2.0	36	Rps1	S	4.0
Weber 84	9-16	9-21	2.0	36	Rps1	R	2.5
Vickery	9-19	—	2.0	39	Rps1-c	S	5.0
Corsoy 79	9-20	9-22	1.8	39	Rps1-c	S	4.5
Bell	9-20	—	1.8	34	S	—	3.0
Sturdy	9-20	—	1.8	35	Rps1	—	2.5
BSR 101	9-22	9-21	1.8	36	Rps1	R	2.5
Hack	9-24	—	1.5	35	Rps1	S	3.0
Kenwood	9-24	—	2.0	38	S	—	3.5
Elgin 87	9-25	9-24	1.5	33	Rps1-k	R	3.5
Burlison	9-27	—	1.5	34	Rps1b + Rps3	—	2.5

¹1 = excellent, 5 = very poor; ²R = resistant, S = susceptible.

Table 35. Plant and seed characteristics of publicly developed soybean varieties, 1989.

Variety	Flower ¹	Pubescence ²	Hilum ³	Seeds	Quality	Protein	Oil
	Color	Color	Color				
				na./lb	score ⁴	% ^{5,6}	% ^{5,6}
Northern Zone (Crookston and Moorhead)							
Maple Ridge	P	T	Y	3880	3.0	38.6	19.1
Maple Amber	P	T	Br	3603	3.5	38.6	20.0
Maple Isle	P	T	Br	3414	4.0	38.1	19.8
McCall	P	G	Y	3661	3.0	37.8	19.0
Chico	W	G	Bf	3847	2.8	38.4	19.3

Table 35 (Continued). Plant and seed characteristics of publicly developed soybean varieties, 1989.

Variety	Flower ¹ Color	Pubescence ² Color	Hilum ³ Color	Seeds <i>no./lb</i>	Quality <i>score</i> ⁴	Protein % ^{5,6}	Oil % ^{5,6}
<u>Northern Zone (continued)</u>							
Maple Glen	P	T	Y	2686	3.0	37.8 ⁷	19.0 ⁷
Maple Arrow	P	T	Br	2671	2.3	39.2	18.6
Ozzie	P	G	Y	3109	2.3	39.6	18.7
Evans	W	G	Y	3027	2.3	38.3	19.3
Bicentennial	P	T	Br	2536	3.0	39.4	18.9
Proto	P	G	Bf	2967	2.0	38.6 ⁸	15.2 ⁸
Minnatto	W	G	Y	4989	1.8	36.3 ⁸	17.3 ⁸
Simpson	P	G	Bf	3088	2.8	37.6	19.3
Glenwood	P	G	lb	2752	2.5	39.1	19.4
Maple Donovan	P	G	Bf	3131	2.3	38.5	19.4
Dawson	P	G	Y	3110	2.3	38.0	19.0
Dassel	P	G	Y	3519	2.8	38.3 ⁷	18.5 ⁷
<u>Central Zone (Morris and Rosemount)</u>							
McCall	P	G	Y	3131	1.3	36.7	20.6
Chico	W	G	Bf	3603	1.5	37.8	19.8
Ozzie	P	G	Y	2734	1.5	38.7	19.9
Evans	W	G	Y	2734	1.3	38.1	20.1
Glenwood	P	G	lb	2564	1.3	38.6	19.4
Proto	P	G	Bf	2624	1.5	39.0 ⁸	15.3 ⁸
Dawson	P	G	Y	2768	1.3	37.3	20.1
Simpson	P	G	Bf	2967	1.5	37.6	19.3
Swift	W	T	Bl	2670	1.5	36.6	21.0
Maple Donovan	P	G	Bf	2885	1.3	37.9	20.0
Dassel	P	G	Y	2564	1.5	37.8	20.2
Haroson	P	G	Bf	2855	1.7	36.4 ⁷	19.7 ⁷
Kato	P	T	Bl	2073	1.5	39.2 ⁸	16.2 ⁸
Hodgson 78	P	G	Bf	2718	1.3	37.4	20.6
Sibley	W	G	Y	2328	1.3	38.7	19.3
Weber 84	W	T	Bl	3109	1.8	37.8	20.1
Hardin	P	G	Y	2873	2.0	37.7	20.4
Sturdy	P	G	lb	2340	1.5	35.5 ⁸	18.5 ⁸
Corsoy 79	P	G	Y	2855	1.8	38.1	19.4
<u>Southern Zone (Lamberton and Waseca)</u>							
McCall	P	G	Y	3691	1.8	37.3	20.5
Ozzie	P	G	Y	3220	2.0	39.0	20.6
Evans	W	G	Y	3492	1.3	38.3	21.4
Dawson	P	G	Y	3290	1.5	37.2	21.5
Proto	P	G	Bf	3243	1.5	39.3 ⁸	17.9 ⁸
Dassel	P	G	Y	3153	1.8	38.3	21.1
Glenwood	P	G	lb	3290	1.5	38.3	20.7
Simpson	P	G	Bf	3721	1.5	37.6	21.3
Swift	W	T	Bl	3175	1.8	36.6	21.9
Kato	P	T	Bl	2415	1.5	38.4 ⁸	19.9 ⁸
Hodgson 78	P	G	Bf	3131	1.3	37.4	21.3
Hardin	P	G	Y	3363	1.3	37.5	20.9
Sibley	W	G	Y	2838	1.5	38.3	21.2
Weber 84	W	T	Bl	3815	1.5	37.2	21.3
Vickery	P	G	Y	3131	1.3	37.8	20.5
Corsoy 79	P	G	Y	3243	1.3	37.5	20.6
Bell	P	T	Bl	2467	1.3	37.1 ⁸	20.2 ⁸
Sturdy	P	G	lb	2768	1.8	34.9 ⁸	22.2 ⁸
BSR 101	P	G	lb	2686	2.0	36.9	21.3
Hack	W	G	Bf	2624	1.5	37.1	21.3
Kenwood	P	T	Bl	3131	1.5	34.0 ⁸	22.9 ⁸
Elgin 87	P	T	Bl	2802	1.3	36.6	21.8
Burlison	W	T	Bl	2594	1.5	38.1 ⁸	19.1 ⁸

¹P = purple, W = white; ²T = tawny, G = gray; ³Y = yellow, G = gray, Br = brown, Bl = black, Bf = buff, lb = imperfect black; ⁴1 = excellent, 5 = very poor; ⁵13% moisture; ⁶1987-89; ⁷1988-89; ⁸1989.

Table 36. Yields and characteristics of public and private soybean varieties, northern zone, 1989 (Crookston, Moorhead, Shelly)

Brand or Originator	Variety	Matures	Yield			Lodging	Phytophthora	Chlorosis	Protein		Oil	
			1987-89 ²	1988-89 ²	1989				1988-89	1989	1988-89	1989
		<i>date</i>	<i>bu/A</i>	<i>bu/A</i>	<i>score</i> ³	<i>gene</i> ⁴	<i>score</i> ³	<i>%</i> ⁵	<i>%</i> ⁵	<i>%</i> ⁵	<i>%</i> ⁵	
Hyland	Barron	9-12	—	14	14	1.0	S	2.0	37.8	36.8	19.0	17.4
Agric. Canada	Maple Ridge	9-12	19	14	13	1.0	S	2.0	36.7	35.7	19.7	18.3
Sigco	KG20	9-13	22	16	15	1.0	S	2.0	37.1	35.4	19.3	18.5
Agric. Canada	Maple Isle	9-13	19	13	12	1.0	Rps1	5.0	37.9	36.0	18.8	18.1
Minn. A.E.S.	McCall	9-15	21	15	16	1.0	S	2.5	37.3	35.2	19.4	18.8
Agric. Canada	Maple Belle	9-15	—	—	13	1.0	Rps1	1.0	—	36.7	—	17.5
Jacques	011 ¹	9-22	26	18	17	1.0	S	3.5	36.9	35.3	19.4	18.4
Dahlgren	KG-40	9-22	—	16	16	1.0	S	3.5	38.1	36.3	18.5	17.5
Dahlgren	KG-41	9-22	—	—	14	1.0	S	4.5	—	37.3	—	16.7
University of Guelph	OAC Scorpio	9-24	—	—	17	1.0	S	4.0	—	34.6	—	18.9
GCS	Arco	9-24	—	—	13	1.0	S	2.0	—	35.3	—	18.6
Agric. Canada	Maple Arrow	9-25	17	12	10	1.0	Rps1	2.5	38.3	37.8	17.7	16.2
Hyland	Apache	9-26	—	18	21	1.0	S	2.5	39.1	37.1	17.7	16.7
University of Guelph	OAC Libra	9-26	—	—	18	1.0	S	4.5	—	34.3	—	19.4
Stine	0510	9-26	25	18	17	1.0	S	1.0	36.4	34.0	19.9	19.6
IS	604	9-26	24	16	15	1.0	S	2.5	36.4	34.0	19.9	19.5
University of Guelph	Bicentennial	9-26	22	15	14	1.0	Rps6	5.0	39.5	38.0	17.4	16.1
Minn. A.E.S.	Ozzie	9-26	23	15	14	1.0	Rps1	3.5	38.9	36.9	17.5	16.9
Jacques	8803	9-26	—	—	13	1.0	S	1.5	—	36.4	—	17.4
NK	X88004	9-26	—	—	12	1.0	S	3.5	—	37.4	—	16.5
Agric. Canada	Maple Glen	9-27	—	17	16	1.0	S	5.0	37.7	35.7	18.9	18.1
Dahlgren	KG-60	9-27	24	16	13	1.0	Rps1-c	4.0	37.9	36.3	18.6	17.4
AgriPro	AP0500	9-28	—	—	18	1.0	S	2.5	—	33.3	—	20.2
University of Guelph	OAC Pisces	9-30	—	—	18	1.0	S	2.5	—	35.2	—	18.6
Golden Harvest	H-1110	9-30	—	—	16	1.0	S	3.0	—	36.4	—	17.3
Minn. A.E.S.	Evans	9-30	24	16	13	1.0	Rps1	2.0	37.3	35.6	19.1	18.0
Pioneer	9061	10-1	27	18	16	1.0	Rps1	5.0	36.8	34.7	19.5	18.9
GCS	Terrebonne	10-1	—	—	15	1.0	S	3.0	—	36.7	—	17.2
Minn. A.E.S.	Dawson	10-2	26	20	19	1.0	Rps1	1.5	37.4	35.1	19.0	18.4
Agric. Canada	Maple Donovan	10-2	25	20	18	1.0	Rps1 + Rps4	2.0	38.3	35.9	18.3	17.8
IS	529	10-2	—	—	17	1.0	S	2.0	—	33.9	—	19.6
Dahlgren	KG-62	10-3	—	—	15	1.0	S	3.0	—	36.0	—	17.6
IS	546	10-5	26	20	17	1.0	Rps1	2.0	38.1	36.6	18.4	17.2
Dairyland	DSR-070	10-7	—	20	16	1.0	S	2.5	38.7	36.7	17.9	16.9
Hyland	Marathon	10-7	—	—	16	1.0	S	2.5	—	35.6	—	18.0
University of Guelph	OAC Eclipse	10-8	—	—	18	1.0	S	3.5	—	36.4	—	17.4
University of Guelph	OAC Aries	10-8	—	—	18	1.0	S	2.5	—	34.9	—	18.6
AgriPro	AP1650	10-9	26	19	14	1.0	Rps1	2.0	36.9	35.2	19.3	18.3
Hy-Vigor	Row-99	10-10	—	—	18	1.0	S	3.5	—	35.8	—	17.8
LSD 5%			2	3	5							

¹Blend (information furnished by originator); ²Morris dropped, Shelly in 1989 test; ³1 = excellent, 5 = very poor; ⁴Specific genes noted; S = susceptible; ⁵13% moisture.

Table 37. Yields and characteristics of public and private soybean varieties, central zone, 1989 (Becker, Morris, Rosemount)

Brand or Originator	Variety	Matures	Yield			Lodging	Phytophthora	Chlorosis	Protein		Oil	
			1987-89	1988-89	1989				1988-89	1989	1988-89	1989
		<i>date</i>	<i>bu/A</i>	<i>bu/A</i>	<i>score</i> ²	<i>gene</i> ⁴	<i>score</i> ²	<i>%</i> ⁵	<i>%</i> ⁵	<i>%</i> ⁵	<i>%</i> ⁵	
Minn. A.E.S.	Ozzie	9-12	41	37	39	2.0	Rps1	3.5	37.5	36.5	19.2	17.7
Sigco	49	9-14	—	—	48	2.0	S	2.5	—	33.5	—	20.3
Minn. A.E.S.	Dawson	9-15	44	42	44	2.6	Rps1	1.5	36.0	35.2	20.2	18.8
Pioneer	9091	9-15	45	42	44	1.9	S	2.0	37.2	36.0	19.4	18.1
Minn. A.E.S.	Evans	9-15	41	37	42	2.6	Rps1	2.0	37.2	35.9	19.4	18.3
University of Guelph	OAC Musca	9-15	—	—	39	2.4	S	4.0	—	33.9	—	20.0
NK	S06-57	9-15	40	39	39	2.6	Rps1-c	2.0	37.4	36.4	19.0	17.6
Jacques	J-080	9-16	—	43	45	2.4	S	4.5	35.8	34.4	20.6	19.6
GCS	Rosen	9-16	—	—	44	2.1	S	2.0	—	35.7	—	18.4
CFS	E89-011	9-16	—	—	39	2.0	S	4.0	—	35.2	—	18.8

Table 37 (continued). Yields and characteristics of public and private soybean varieties, central zone, 1989 (Becker, Morris, Rosemount)

Brand or Originator	Variety	Matures <i>date</i>	Yield			Lodging <i>score</i> ²	Phytophthora <i>gene</i> ⁴	Chlorosis <i>score</i> ²	Protein		Oil	
			1987-89	1988-89	1989				1988-89	1989	1988-89	1989
			<i>bu/A</i>	<i>bu/A</i>	<i>bu/A</i>			<i>score</i> ²	<i>%</i> ⁵	<i>%</i> ⁵	<i>%</i> ⁵	<i>%</i> ⁵
Pioneer	9111	9-17	—	46	49	2.0	S	2.5	37.5	36.2	19.1	17.8
NK	S07-80	9-17	—	—	48	2.2	S	2.5	—	34.9	—	19.3
Minn. A.E.S.	Simpson	9-17	43	40	42	2.3	Rps1	5.0	36.8	35.5	19.7	18.5
Minn. A.E.S.	Glenwood	9-17	43	38	40	2.0	Rps1	2.5	38.0	36.4	18.8	17.8
Ziller	BT 1790	9-18	51	49	54	2.0	Rps1-c	3.5	36.0	35.0	20.4	19.1
Sigco	71	9-18	—	—	46	2.1	Rps1	3.5	—	36.6	—	17.5
Asgrow	AO949	9-18	46	44	46	2.3	Rps1-c	2.0	37.6	36.2	19.2	17.9
Sigco	80	9-18	44	42	45	2.3	Rps1	2.0	37.8	36.5	19.0	17.8
Dairyland	DSR-122	9-19	—	—	46	2.4	S	2.0	—	36.2	—	17.9
Star	EXP 8908	9-19	—	—	44	2.2	S	4.5	—	35.4	—	18.5
Minn. A.E.S.	Dassel	9-19	42	39	43	2.0	Rsp6	2.0	37.2	36.7	19.2	17.4
Kaltenberg	KB098	9-20	—	44	48	2.2	S	2.5	37.0	36.0	19.5	18.0
Pioneer	9121	9-20	—	—	47	1.7	S	—	—	34.6	—	19.2
SSI	Cheyenne	9-20	—	—	46	2.3	Rps1	1.5	—	36.5	—	17.6
Ziller	BT1330	9-20	—	43	46	2.3	Rps1	2.0	37.6	36.3	19.2	17.9
NK	X8909	9-20	—	—	45	2.0	Rps1-c	3.0	—	36.0	—	18.0
GCS	Boyd	9-20	—	—	44	2.2	S	2.0	—	35.6	—	18.6
DeKalb	CX096	9-20	42	40	42	2.6	Rps1	2.0	37.6	36.3	19.1	17.9
Star	Exp 0222	9-20	—	—	42	2.0	S	2.0	—	36.2	—	17.8
DeKalb	CX117	9-21	49	46	51	2.6	S	3.5	36.2	35.1	20.2	18.8
GCS	Courtland	9-21	—	—	48	1.9	Rps1	3.0	—	36.2	—	18.1
SOI	Exp 811	9-21	—	—	48	2.1	S	2.5	—	35.6	—	18.3
NK	B 117	9-21	46	46	47	2.2	S	3.0	36.8	35.6	19.8	18.5
MO	0980	9-21	46	44	47	2.1	S	3.0	36.8	35.9	19.6	18.1
University of Guelph	OAC Dorado	9-21	—	—	47	2.2	S	3.5	—	34.3	—	19.7
Thompson	T-3100	9-21	47	44	46	2.0	S	5.0	36.9	35.5	19.8	18.7
Dairyland	DSR-135	9-21	44	44	45	2.4	S	2.5	36.9	36.0	19.6	18.2
Minn. A.E.S.	Hodgson 78	9-22	48	46	49	2.6	Rps1	2.0	36.0	35.1	20.4	19.0
IS	715	9-22	48	46	49	2.4	Rps1	5.0	37.6	36.3	17.8	17.8
Dairyland	DSR-128	9-22	46	44	48	2.0	Rsp1-c	2.5	36.0	34.9	20.3	19.1
Star	8815	9-22	—	—	47	2.1	Rps1-c	5.0	—	36.4	—	17.8
Thompson	EX541-B	9-22	—	—	45	2.1	S	3.5	—	35.7	—	18.3
SOI	EX 195	9-23	—	46	50	2.1	S	4.0	37.2	36.4	19.2	17.7
MO	1910	9-23	48	44	47	2.4	Rps1-c	5.0	36.8	36.4	19.4	17.6
CFS	E88-123	9-23	—	—	46	2.1	S	3.0	—	35.6	—	18.4
Ziller	Exp. 58	9-23	—	—	45	2.0	S	2.0	—	35.1	—	19.0
Agripro	AP1650	9-23	46	44	45	2.0	Rps1	2.0	35.6	34.6	20.6	19.4
Minn. A.E.S.	Kato	9-23	45	42	43	2.2	Rps1	2.5	40.4	38.5	17.5	15.8
Agripro	AP1776	9-24	48	46	53	1.9	Rps1	1.5	35.8	33.9	20.6	20.0
Kaltenberg	KB117	9-24	—	48	53	2.1	S	2.5	37.2	36.0	19.2	18.0
Atlas	115 ¹	9-24	—	—	51	2.1	M ³	4.0	—	35.6	—	18.3
MO	1820	9-24	48	48	50	2.1	S	4.5	36.5	35.9	19.7	18.1
Minn. A.E.S.	Sibley	9-24	45	44	48	2.6	Rps1	4.5	36.6	35.8	19.8	18.3
Star	Exp. 8916	9-25	—	—	50	2.2	S	3.0	—	36.4	—	17.6
C/LOL	Exp. 14	9-25	—	—	47	2.2	Rps1	3.5	—	35.9	—	18.1
Thompson	T-18	9-25	47	44	46	2.6	S	3.5	37.1	36.3	19.4	17.8
Hy-Vigor	Row-99	9-25	47	44	45	2.1	S	3.5	36.3	35.0	20.0	18.8
Funk	G-3185	9-26	—	—	48	2.2	S	1.5	—	35.9	—	18.1
SOI	EX 196	9-26	—	43	48	2.4	Rps1-c	2.5	36.4	35.2	20.2	18.7
Dairyland	DSR-157	9-26	—	44	48	2.3	Rps1-c	4.0	37.4	37.1	18.9	17.0
Stine	1865 ¹	9-26	47	45	46	2.0	S	5.0	36.7	35.6	19.6	18.3
Funk	G-3197	9-27	48	46	52	2.2	S	3.0	36.4	35.0	20.0	18.9
Stine	1070	9-27	—	48	50	2.1	S	3.5	37.1	36.3	19.4	17.7
Agripro	AP1989	9-27	—	48	48	2.6	Rps1-c	1.5	34.3	33.5	21.6	20.3
DeKalb	CX187	9-27	47	44	48	2.0	S	3.0	36.0	35.3	20.2	18.7
Golden Harvest	H-1170B ¹	9-27	45	42	47	2.4	S	3.5	35.6	34.8	20.5	19.1
Stine	EX1130	9-28	—	—	44	2.2	S	4.0	—	34.9	—	18.9
SOI	EXP 8918	9-29	—	—	50	2.3	S	4.5	—	36.4	—	17.7
Hy-Vigor	K-1980 ¹	9-29	—	—	46	2.4	Rps1-c	4.0	—	36.1	—	17.9
Dahlgren	KG-81	9-29	44	43	45	2.4	- Rps1-c	4.0	35.2	34.3	20.9	19.5
DeKalb	CX264	9-30	—	46	48	2.8	S	2.0	36.6	36.1	19.8	18.0
CFS	158	10-1	46	43	46	2.3	S	3.0	36.2	35.6	20.0	18.3
LSD 5%			3	4	7							

¹Blend (information furnished by originator); ²1 = excellent, 5 = very poor; ³Mixture of Rps1 and susceptible; ⁴Specific genes noted, S = susceptible; ⁵13% moisture.

Table 38. Yields and characteristics of public and private soybean varieties, southern zone, 1989 (Fairmont, Lambertson, Waseca)

Brand or Originator	Variety	Matures <i>date</i>	Yield			Lodging <i>score</i> ²	Phytophthora <i>gene</i> ⁵	Chlorosis <i>score</i> ²	Protein		Oil	
			1987-89	1988-89	1989 ²				1988-89	1989	1988-89	1989
			----- <i>bu/A</i> -----				-----% ⁶ -----		-----% ⁶ -----			
Terra	Exp. 085 + ¹	9-9	—	34	42	1.7	Rps1	3.0	36.8	35.8	19.8	18.2
Ziller	BT 1790	9-11	—	36	43	1.8	Rps1-c	3.5	35.7	34.3	20.6	19.6
LS	Summit	9-11	—	—	40	2.3	S	4.0	—	34.1	—	19.8
Minn. A.E.S.	Hodgson 78	9-14	41	37	46	2.1	Rps1	2.0	35.6	34.2	20.8	19.7
Minn. A.E.S.	Kato	9-14	—	—	41	1.7	Rps1	2.5	—	37.0	—	17.1
Agripro	AP1776	9-15	43	38	48	1.3	Rps1	1.5	34.6	32.9	21.6	20.7
ISGO	2450	9-15	—	—	46	1.9	Rps1-c	2.0	—	34.0	—	19.7
Minn. A.E.S.	Sibley	9-16	42	38	43	2.6	Rps1	4.5	36.0	34.7	20.4	19.1
Latham	120	9-16	—	33	42	1.7	S	5.0	36.6	35.3	19.8	18.6
Dairyland	DSR-165	9-17	—	—	48	1.6	S	3.5	—	34.9	—	19.0
Iowa A.E.S.	Hardin	9-17	43	39	46	2.2	Rps1	4.0	36.2	34.4	20.3	19.4
Ziller	Exp. 57	9-17	—	—	46	1.8	S	3.5	—	33.9	—	19.9
Dahlman	1990	9-17	—	—	43	1.8	S	2.5	—	34.8	—	19.2
Iowa A.E.S.	Weber 84	9-17	40	36	39	2.1	Rps1	3.0	35.6	33.9	20.9	19.9
GFS	101	9-18	—	—	49	1.8	S	4.0	—	35.1	—	18.7
Thompson	T-3175	9-18	—	—	48	1.9	S	3.0	—	34.1	—	19.8
Terra	Exp. 180 + ¹	9-18	—	40	48	1.7	S	4.0	36.1	34.8	20.3	19.0
SSI	Commanche	9-18	—	—	47	1.6	S	3.0	—	35.0	—	18.9
Terra	Runner III + ¹	9-18	41	38	46	1.7	S	3.5	35.7	34.0	20.7	19.8
Pioneer	9161	9-18	—	44	46	1.7	S	3.5	36.0	34.8	20.4	19.1
ISGO	2290	9-18	—	—	44	1.4	S	3.5	—	35.8	—	18.2
GCS	Echo	9-18	—	—	43	1.7	Rps1	3.5	—	34.6	—	19.4
Ehrich	E-167	9-18	—	—	46	1.8	S	2.5	—	35.0	—	18.8
Pioneer	9181	9-18	42	38	45	1.9	Rps1-c	3.0	36.8	35.3	19.7	18.5
Jacques	J-181 ¹	9-19	—	40	51	1.8	S	3.0	35.3	33.6	21.1	20.2
Ziller	Exp. 652	9-19	—	—	48	1.6	S	3.0	—	34.9	—	19.0
Sigco	94	9-19	—	—	48	2.0	S	4.0	—	35.6	—	18.3
Kruger	K1012 +	9-19	—	—	47	1.6	S	2.5	—	34.7	—	19.2
KE	156	9-19	—	38	47	1.2	S	2.5	35.3	34.0	21.0	19.8
Ziller	BT 2650	9-19	42	37	46	1.7	S	3.5	35.4	34.1	21.0	19.7
GFS	206	9-19	42	38	45	1.6	S	3.0	35.6	34.4	20.7	19.3
ProfiSeed	2198	9-19	40	36	45	1.7	S	3.0	35.8	34.1	20.7	19.8
NC +	1L81	9-19	40	36	44	1.6	S	2.0	35.7	34.0	20.7	19.7
ISGO	1888	9-19	—	—	40	1.8	S	2.0	—	34.9	—	19.0
Star	8819	9-20	—	40	51	1.9	S	3.5	36.6	35.2	19.9	18.7
Tilney Farms	TF 1683	9-20	45	40	50	1.9	S	5.0	36.4	35.4	20.1	18.5
Wilson Blend	1880 ¹	9-20	44	40	49	1.6	M ⁴	3.5	35.6	34.5	20.8	19.4
Jacques	8719	9-20	—	—	49	2.0	S	4.0	—	33.8	—	20.0
Thompson	T-3187 ¹	9-20	—	—	49	2.0	S	3.5	—	34.6	—	19.2
Latham	200B ¹	9-20	41	36	48	1.8	S	3.0	35.8	34.4	20.6	19.3
Stine	EX 1130 ¹	9-20	—	—	48	1.7	S	4.0	—	34.8	—	19.0
DeKalb	CX187	9-20	40	36	48	1.4	S	3.0	35.4	34.0	20.8	19.8
CFS	E88-124	9-20	—	—	47	1.9	S	3.5	—	35.3	—	18.5
Hy-Vigor	Row King	9-20	—	—	47	2.1	Rps1	5.0	—	34.9	—	19.0
Sansgaard	Exp. 1924	9-20	—	—	47	1.4	S	3.5	—	34.7	—	19.1
C/LOL	L1700 ^{1,7}	9-20	—	—	47	1.8	Rps6 + Rps1	3.0	—	34.2	—	19.6
SOI	166	9-20	—	—	46	1.6	S	3.5	—	34.3	—	19.6
Kaltenberg	KB 116	9-20	42	37	46	1.7	S	2.0	35.2	33.8	21.1	19.9
SSI	Cherokee	9-20	—	—	46	1.8	S	3.0	—	34.1	—	19.7
Mustang	1180BL ¹	9-20	48 ⁷	—	45	2.0	M ³	3.5	—	34.3	—	19.4
Diamond	D150	9-20	42	37	45	1.7	S	2.5	35.6	33.8	20.8	19.9
Thompson	T-3180	9-21	—	42	51	1.8	S	5.0	36.5	35.1	20.0	18.8
Mustang	1150	9-21	52 ⁷	—	51	1.8	S	2.5	—	34.1	—	19.8
AgriPro	AP 1989	9-21	44	41	51	2.1	Rps1-c	1.5	34.4	33.0	21.7	30.7
Prairie Brand	PB 181B ¹	9-21	—	—	50	1.9	S	3.0	—	34.9	—	19.0
Asgrow	A 1929	9-21	—	—	50	2.0	Rps1-k	2.0	—	33.7	—	20.1
Tilney Farms	TF 1994	9-21	—	—	49	2.0	S	5.0	—	35.4	—	18.5
Thompson	T-11	9-21	43	38	48	1.7	S	3.5	35.2	33.9	21.1	19.9
S Brand	S170	9-21	—	—	48	1.4	S	2.5	—	34.4	—	19.3
Prairie Brand	PB 171B ¹	9-21	—	—	48	1.9	S	3.5	—	33.9	—	19.9
GCS	Prosper	9-21	—	—	48	1.7	Rps1	3.5	—	35.9	—	18.0
Iowa A.E.S.	BSR 101	9-21	39	36	46	1.7	Rps1	2.5	35.4	34.1	20.9	19.7
Funk	G-3197	9-21	39	34	47	1.4	S	3.0	35.4	33.7	21.0	20.1
Roszbach	Lakeside 106 ¹	9-21	—	38	46	2.0	Rps1	4.5	35.8	34.0	20.6	19.7
Diamond	89-2102	9-21	—	—	45	1.7	S	2.5	—	34.6	—	19.1

Table 38 (continued). Yields and characteristics of public and private soybean varieties, southern zone, 1989 (Fairmont, Lamberton, Waseca)

Brand or Originator	Variety	Matures <i>date</i>	Yield			Lodging <i>score</i> ²	Phytophthora <i>gene</i> ⁵	Chlorosis <i>score</i> ²	Protein		Oil	
			1987-89	1988-89	1989 ²				1988-89	1989	1988-89	1989
			<i>bu/A</i>					<i>%</i> ⁶		<i>%</i> ⁶		
Dairyland	DSR-170	9-21	—	—	44	1.8	S	3.0	—	34.9	—	19.0
ISGO	BSR 2530	9-21	—	—	44	1.8	S	4.5	—	36.4	—	17.7
Ehrich	E-198	9-21	—	—	43	1.9	S	4.0	—	35.4	—	18.5
Golden Harvest	H-1170B ¹	9-22	44	41	52	2.2	S	3.5	35.2	33.9	20.0	19.9
Prairie Brand	PB 192B ¹	9-22	—	—	51	2.1	S	4.0	—	35.3	—	18.5
Pioneer	9202	9-22	44	40	51	2.0	S	4.0	35.2	33.3	21.1	20.4
Kruger	K2100+	9-22	—	—	50	1.9	S	2.0	—	34.7	—	19.2
MO	2500 ¹	9-22	45	42	49	2.1	S	4.5	34.2	33.1	21.8	20.6
Dairyland	DSR-206	9-22	—	—	49	1.8	S	2.0	—	35.2	—	18.8
NK	S19-90	9-22	—	—	48	1.3	Rps1-c	4.0	—	33.8	—	20.0
Star	8820	9-22	—	44	48	2.0	S	³ 5	34.6	33.0	21.6	20.8
Latham	570	9-22	—	36	48	1.9	S	5.0	37.2	35.1	19.4	18.7
S Brand	B 170	9-22	—	—	48	1.8	S	4.5	—	33.9	—	19.7
SOI	198	9-22	—	—	48	2.0	S	4.0	—	33.0	—	20.7
Asgrow	A2187	9-22	44	41	47	2.0	Rps1	2.5	36.2	34.2	20.3	19.6
NK	S17-18	9-22	—	—	46	2.7	Rps1	2.5	—	34.0	—	19.7
Illinois A.E.S.	Corsoy 79	9-22	44	40	45	2.1	Rps1-c	4.0	36.0	34.4	20.4	19.4
ProfiSeed	1140	9-22	—	—	45	2.1	Rps1	5.0	—	36.2	—	17.8
NC +	1K98	9-22	42	38	45	2.2	Rps1	2.5	35.6	34.9	20.6	18.9
Diamond	D200	9-22	—	39	44	1.8	S	3.5	36.2	35.1	20.3	18.9
AgriPro	AP 2021	9-22	41	38	43	1.9	Rps1	2.5	34.9	33.7	21.3	20.0
Atlas	225 ¹	9-23	—	—	54	2.0	S	3.0	—	33.9	—	19.8
Star	Exp. 8921	9-23	—	—	52	2.1	S	3.5	—	34.4	—	19.4
Asgrow	A2234	9-23	45	42	51	1.8	Rps1-k	3.0	36.9	35.8	19.9	18.4
Thompson	T-30P ¹	9-23	47	42	50	2.0	S	3.0	36.4	34.6	20.2	19.2
SOI	285	9-23	—	42	50	2.0	S	3.5	36.8	34.9	20.0	19.1
Star	Exp. 8921	9-23	—	—	50	2.4	S	3.5	—	33.5	—	20.2
Kruger	KB 220+ + ¹	9-23	—	—	49	2.0	S	2.5	—	34.7	—	18.9
NK	S15-50	9-23	42	38	49	2.0	Rps1-c	4.5	35.5	34.0	21.0	19.9
Diamond	89-1101	9-23	—	—	49	1.9	S	2.5	—	35.8	—	18.2
Dairyland	DSR-196	9-23	—	—	49	2.0	S	2.5	—	35.3	—	18.5
Thompson	Ex 3200	9-23	44	41	49	2.2	S	4.5	35.4	34.1	20.8	19.7
Ehrich	E-240	9-23	—	—	49	2.1	S	3.0	—	35.4	—	18.5
Stine	1065 ¹	9-23	—	—	49	2.1	S	4.0	—	34.4	—	19.5
Golden Harvest	H-1235B ¹	9-23	—	42	49	2.1	S	2.0	36.6	34.7	20.0	19.1
Latham	401 ¹	9-23	44	41	48	1.8	S	2.0	36.4	34.9	20.1	18.9
S Brand	S42C	9-23	—	—	48	2.0	S	4.0	—	33.0	—	20.7
KE	Exp. 510011 ¹	9-23	—	—	48	2.0	S	2.5	—	35.4	—	18.5
AgriPro	2292	9-23	—	—	48	1.6	Rps1-c	3.0	—	35.4	—	18.4
Willette Seed Farm	Prescott 108 ¹	9-23	43	40	48	2.3	M ⁴	4.0	35.8	34.4	20.6	19.5
Ehrich	E-184	9-23	—	—	48	1.9	S	2.0	—	35.5	—	18.4
CFS	213	9-23	—	42	47	2.0	S	3.0	36.6	35.1	20.0	18.8
GCS	Action	9-23	—	—	46	1.6	Rps1	4.0	—	34.5	—	19.4
Minn. A.E.S.	Sturdy	9-23	—	—	46	1.9	Rps1	2.0	—	34.9	—	18.9
Sexauer	SX 1020	9-23	—	—	46	2.3	Rps1	5.0	—	35.8	—	18.1
Jacques	J-231	9-23	—	41	46	2.1	Rps1	2.0	36.6	34.9	20.0	19.0
CFS	158	9-23	40	36	44	1.9	S	3.0	36.4	35.4	20.2	18.6
Riverside	1405	9-23	—	36	43	2.1	Rps1	2.5	36.2	34.9	20.2	18.9
Thompson	Ex 3190	9-24	—	—	57	2.1	S	3.0	—	35.5	—	18.4
S Brand	S40C	9-24	—	47	54	1.8	S	3.5	35.6	35.0	20.7	18.9
SOI	296	9-24	—	—	53	2.1	S	4.0	—	35.2	—	18.7
SSI	Pawnee	9-24	—	—	52	2.0	S	2.0	—	34.9	—	18.9
Stine	2915 ¹	9-24	—	—	51	2.1	S	3.5	—	34.0	—	19.9
Stine	2035 ¹	9-24	—	—	51	2.0	S	4.0	—	35.5	—	18.4
MO	1095 ¹	9-24	—	—	50	2.0	S	3.0	—	34.9	—	19.0
Jacques	8824	9-24	—	—	50	1.7	S	2.0	—	34.7	—	19.2
MO	Ex 2110	9-24	—	—	50	2.0	S	4.0	—	34.4	—	19.5
Terra	TR 231B + ¹	9-24	—	40	50	2.1	M ³	4.5	36.4	35.3	20.0	18.6
Prairie Brand	PB 223B ¹	9-24	—	—	49	2.1	S	2.5	—	35.2	—	18.7
NK	S20-26	9-24	—	—	49	2.0	Rps1-c	3.0	—	35.1	—	18.7
DeKalb	CX 264	9-24	44	40	49	2.0	S	2.0	37.3	35.2	19.4	18.7
DeKalb	CX 174	9-24	43	40	48	2.2	S	2.5	36.6	35.2	20.0	18.7
Sexauer	SX 2080	9-24	—	—	48	2.0	Rps1	4.5	—	36.0	—	17.9
Sexauer	SX 1090	9-24	—	39	47	2.2	Rps1	4.5	38.0	36.8	18.8	17.3
SRF	Exp 61830	9-24	—	40	47	2.1	Rps3	5.0	37.3	35.8	19.5	18.2

Table 38 (continued). Yields and characteristics of public and private soybean varieties, southern zone, 1989 (Fairmont, Lamberton, Waseca)

Brand or Originator	Variety	Matures <i>date</i>	Yield			Lodging <i>score</i> ²	Phytophthora <i>gene</i> ⁵	Chlorosis <i>score</i> ²	Protein		Oil	
			1987-89	1988-89	1989 ²				1988-89	1989	1988-89	1989
			<i>bu/A</i>					<i>%</i> ⁶		<i>%</i> ⁶		
Hy-Vigor	K-A2180 ¹	9-24	—	—	46	2.1	S	3.5	—	34.4	—	19.1
Funk	G-3255	9-24	—	—	46	1.9	Rps1	2.0	—	35.6	—	18.3
KE	212	9-24	—	39	45	2.2	Rps1	4.5	36.3	35.3	20.2	18.6
DeKalb	CX 259	9-25	—	—	54	2.1	S	3.5	—	34.1	—	19.8
Iowa A.E.S.	Kenwood	9-25	—	—	52	2.3	S	3.5	—	34.2	—	19.5
ProfiSeed	1152	9-25	46	42	52	2.1	S	2.5	37.0	35.0	19.8	19.0
Mustang	1280 BL ¹	9-25	50 ⁷	—	51	2.1	M ³	2.5	—	35.1	—	18.8
Sansgaard	Exp. 2062	9-25	—	—	50	1.9	S	3.0	—	35.7	—	18.2
KE	Exp. 121023	9-25	—	—	49	1.8	S	4.5	—	33.6	—	20.1
Kaltenberg	KB 231	9-25	43	41	49	2.0	S	2.0	36.9	35.2	19.7	18.7
Iowa A.E.S.	Elgin 87	9-25	43	42	48	2.2	Rps1-k	3.0	34.8	33.3	21.1	19.6
Latham	650	9-25	43	38	48	2.0	S	2.5	36.8	35.2	20.0	18.6
GCS	Hartland	9-25	—	—	46	1.7	Rps1	4.0	—	37.3	—	16.7
Dahlgren	DS-3220 ¹	9-26	—	—	54	2.1	S	4.0	—	32.8	—	20.9
ProfiSeed	1294	9-26	—	—	49	2.4	Rps1	3.0	—	35.5	—	18.4
Illinois A.E.S.	Hack	9-26	44	41	48	2.0	Rps1	3.5	36.2	34.6	20.4	19.3
Asgrow	A2543	9-26	—	—	48	1.6	Rps1-k	3.5	—	37.8	—	16.3
Latham	561 ¹	9-26	—	—	47	2.0	S	3.0	—	35.2	—	18.7
KE	KE 199	9-26	—	40	46	2.1	S	2.0	36.1	35.2	20.4	18.7
Kruger	KE 228	9-27	—	—	60	2.0	S	4.0	—	36.7	—	17.3
Indiana A.E.S.	Century 84	9-27	39	39	44	2.0	Rps1-k	3.0	39.2	38.3	17.7	15.9
MO	2960	9-28	—	—	49	2.0	S	4.5	—	36.4	—	17.6
KE	KE 258	9-28	—	40	47	1.7	S	2.5	38.2	36.9	18.6	17.2
LSD 5%			3	4	4							

¹Blend (information supplied by originator); ²1 = excellent, 5 = poor; ³Mixture of Rps1 and susceptible; ⁴Mixture of Rps1 and Rps1-c; ⁵Specific genes noted, S = susceptible; ⁶13% moisture; ⁷1988 planting omission, 1987 and 1989 data only.

SUNFLOWER

The oilseed varieties of sunflower are used for oil and protein-feed extraction. The nonoilseed varieties are used for nutmeats, salted whole seed, or birdfeed.

Row spacings in these trials were 30 inches, and plant populations/acre averaged 23,000 for oilseed and 17,000 for nonoilseed varieties.

Yield and oil percentage data of all varieties are based on seed of 10 percent moisture. Data for other hybrids tested in previous years may be found in earlier editions of this publication.

Companies have entered hybrids in these trials voluntarily. Their addresses are: AgriPro/NAPB, P.O. Box 250, Brookings, SD 57006;

Agway Inc., Box 169, Grandin, ND 58038; Cargill Seed Division, Box 5645, Minneapolis, MN 55440;

Cenex/Land O'Lakes, P.O. 1291, Minot, ND 58702;

Contiseed, P.O. Box 1296, Huron, SD 57350;

Dahlgren and Company, Inc., 1220 Sunflower St., Crookston, MN 56716;

Hagen Seed, Inc., R.R. 2, Fertile, MN 56540;

Interstate Seed and Grain Company, Box 470, Fargo, ND 58107;

Jacques Seed Co., 720 St. Croix St., Prescott, WI 54021;

Keltgen Seed Company, Box A, Olivia, MN 56277;

Northrup King Co., 7500 Olson Memorial Hwy., P.O. Box 959, Minneapolis, MN 55440;

Pioneer HiBred International Inc., 1202 23rd St. S., Fargo, ND 58103; Seedtec International Inc., Box 5692, Fargo, ND 58105; Sigco Research, Inc., Box 289, Breckenridge, MN 56520;

Sokota Hybrid Producers, Brookings, SD 57006; Stauffer Seeds, Inc., 1323 23 St. S., Fargo, ND 58103.

Table 39. Yield of sunflower varieties

Variety and company	Morris		Rosemount		2 Location Average	
	1987	1988	1987	1988	1987	1988
<i>lbs/A</i>						
Oilseed types						
AgriPro 4200, AgriPro/NAPB	—	1467	—	1603	—	1535
Hysun 340, Contiseed	—	1146	—	1654	—	1400
Hysun 350, Contiseed	—	1282	—	1410	—	1346
Hysun 354, Contiseed	1510	1356	1327	1543	1419	1450
DO-855, Dahlgren	1947	1443	1882	1742	1915	1593
Cenex 6101, Cenex/Land O'Lakes	—	1220	—	1563	—	1392
Cenex 7101, Cenex/Land O'Lakes	—	1349	—	1356	—	1353
Cenex 8101, Cenex/Land O'Lakes	—	1259	—	1839	—	1549
Exp 8713, Jacques	—	1454	—	1703	—	1579
Capri, Jacques	2422	1371	1863	1639	2143	1505
Sunbred 277, Northrup King	1427	1184	1151	1470	1289	1327
Sunbred 281, Northrup King	1087	1114	1492	1599	1290	1357
Sunbred 256, Northrup King	2236	1374	1835	1459	2036	1417
S1296, Stauffer	2269	1045	1875	1610	2072	1328
Nonoil seed varieties						
Royal Hybrid 321, Agway	2126	1780	2348	1925	2237	1853
Royal Hybrid 2141, Agway	2644	1594	1575	1797	2110	1696
D131, Dahlgren	2624	1596	1908	1588	2266	1592
Sunbird II, Contiseed	—	1985	—	2341	—	2163
Sun-Giant 9054, Hagen Seed, Inc.	—	1989	—	2183	—	2086
LSD 5%	642	676	389	542	515	609

Table 40. Characteristics of oilseed sunflower varieties

Variety and company	Oil ¹		Seeds		Planting to		Lodging 1988	Height 1988
	1988	1987-88	1988	1987-88	50% bloom 1988	maturity 1988		
	-----percent-----		-----no./lb-----		-----days ³ -----		score ²	inches ⁵
AgriPro 4200, AgriPro/NAPB	45	—	15,150	—	68	90	2.2	39
Hysun 340, Contiseed	40	—	16,640	—	67	96	4.2	38
Hysun 350, Contiseed	42	—	17,780	—	68	92	1.7	43
Hysun 354, Contiseed	46	45	13,624	7,536	70	94	2.7	38
DO 855, Dahlgren	44	44	14,480	8,250	67	86	1.7	41
Cenex 6101, Cenex/Land O'Lakes	41	—	14,270	—	66	86	2.2	40
Cenex 7101, Cenex/Land O'Lakes	38	—	17,500	—	67	86	4.5	41
Cenex 8101, Cenex/Land O'Lakes	42	42	12,936	8,100	68	88	1.3	40
Exp 8713, Jacques	39	—	16,200	—	64	91	6.8	39
Capri, Jacques	39	42	15,400	7,868	64	89	3.7	37
Sunbred 277, Northrup King	44	43	13,136	9,196	71	92	5.5	43
Sunbred 281, Northrup King	49	48	15,696	10,304	71	94	5.2	39
Sunbred 256, Northrup King	42	43	14,544	8,264	64	87	6.0	38
S-1296, Stauffer Seeds	37	41	14,360	8,562	64	87	5.0	38

¹10 percent moisture basis; ²1 = erect, 9 = horizontal; ³Bloom, maturity and height were significantly shortened by dry conditions in 1988. Averages from previous years = 74 (bloom), 123 (maturity) and 69 (height).

Table 41. Characteristics of nonoilseed sunflower varieties

Variety and company	Large Seed ¹	Test Weight 1988	Seeds 1988	Planting to		Lodging 1988	Height 1988
				50% bloom 1988	mature 1988		
	%	lbs/bu	no./lb ²	-----days ³ -----		score ⁴	inches ³
Royal Hybrid 321, Agway	—	26	7856	65	86	1.7	46
Royal Hybrid 2141, Agway	42	27	7304	66	88	1.3	46
D 131, Dahlgren	34	26	9056	65	86	3.5	44
Sunbird II, Contiseed	—	35	8176	70	100	1.0	50
Sun-Giant 9054, Hagen Seed	—	22	7456	64	86	8.3	48

¹Held on 20/64 round-hole sieve, 6 year/location average; ²Seeds/pound was significantly increased in 1988. The average from previous years = 3966; ³Bloom, maturity and height were significantly shortened by dry conditions in 1988. Averages from previous years = 72 (bloom), 123 (maturity) and 69 (height); ⁴1 = erect, 9 = horizontal.



Experiment station work requires both field and greenhouse environments. These fields, on the University of Minnesota St. Paul campus, are newly planted as evidenced by the fresh tractor tire tracks.

Lupin



Pulse Crops

ADZUKI

Adzuki is planted and harvested using production practices common to other dry edible field beans. Domestic consumption is small, but potential export markets are not being fully exploited. A sweet paste made from adzuki is a filler in quality confectionary products in Japan.

Adzuki seemed especially adapted in certain parts of central Minnesota where soils have good internal drainage and are lower than 7.5 pH. Highest yields have been achieved on the irrigated sands of central Minnesota.

Test plots and farm fields have been periodically destroyed by a seed borne bacterial stem rot disease which is difficult to control. Unpredictable appearances of this disease have delayed expansion of adzuki production. Some test plots at Staples were affected by this disease in 1989.

Quality, certified seed production in low humidity environments would likely solve this problem. Such seed is not now being produced, resulting in low acreage of adzuki in Minnesota.

VARIETIES

Dainagon—Medium-late maturity. Medium height. Large, red seed. Snow Brand Seeds, Japan.

Hayate—Early maturity, medium height. Small, red seed. Snow Brand Seeds, Japan.

Hokaido—Medium-late maturity. Medium height. Medium, red seed. Hashimoto Foods, Kobe Japan.

Kotobuki—Early-medium maturity. Medium height. Medium, red seed. Snow Brand Seeds, Japan.

Minoka—Medium-late maturity. Medium Height. Large, red seed. Selected

by Minnesota Agricultural Experiment Station from a Taiwan introduction. Released 1980.

Sakae—Medium-late maturity. Medium height. Small, red seed. Snow Brand Seeds, Japan.

Takara—Early-medium maturity. Medium height. Small, red seed. Snow Brand Seeds, Japan.

Table 42. Seed yield and characteristics of Adzuki varieties

Variety	1988-89		2 Location average ¹	Seed weight ²	Planting to maturity	
	Becker	Staples			Becker 1989	Height ³
	----- lbs/A -----			no./lb	----- days -----	inches
Dainagon	1035 ⁴	2179	1607	3852 ⁵	106	24
Erimo	2139 ⁴	2015	2077	4305 ⁵	105	—
Hayate	1991	2391	2118	4988	100	21
Hokaido	1881 ⁴	2180	2031	3556 ⁵	111	26
Kotobuki	1839	1968	1940	3787	116	25
Minoka	2051	2054	2029	3284	103	24
Sakae	1953	2323	1999	4831	108	28
Takara	1860	2332	2201	4960	102	26
LSD 5%	660	688	456			

¹Becker and Staples 1988 - 1989; ²average of Becker and Staples 1988 and Becker 1989; ³long-term average; ⁴Becker 1989 only; ⁵not tested in Becker 1988.

FIELD BEAN

Fieldbean is combine-harvested as mature, dry seed. It is used for human food and reaches the grocer's shelf in either canned or dry form.

There are more than 15 market classes of dry, edible bean, with only nine grown commercially in Minnesota. Varietal tests are confined to varieties within the navy, small white, pinto, dark red kidney, light red kidney, pink, black turtle soup, great northern, and small red classes. Other classes are grown successfully, but Minnesota trials have not yet identified important differences within classes.

Data for other hybrids evaluated in pre-

vious years may be found in the 1988 and earlier editions of this publication.

NAVY VARIETIES

Agri-1—High yield. Early maturity. Bush. Medium seed. Developed by Gentec Seeds, Ltd.

Bunsi—Medium yield. Late. Erect vine. Medium size, navy seed. Released by Colombian Agriculture Institute. Rereleased by Agricultural Experiment Station in 1982. Variety protection pending.

C-20—High yield. Late. Erect vine. Medium size, navy seed. Developed by Campbell Soup Co. Released by Michigan Agricultural Experiment Station in 1982.

Variety protection pending.

Crestwood—High yield. Late. Medium size bush. Large, navy seed. Developed by Gentec Seeds Ltd., Box 98, Woodslee, Ontario. Variety protection pending.

Ex Rico 23—Medium yield. Late. Erect vine. Large seed. Released by University of Guelph, Ontario, Canada. Licensed 1980.

Fleetwood—High yield. Late. Medium size bush. Medium size, navy seed. Released by Agriculture Canada, Harrow. Licensed in 1977.

Harofleet—High yield. Late. Medium size bush. Small, navy seed. Developed by Agriculture Canada, Harrow and University of Guelph. Licensed in 1983.

Hyden—High yield. Late. Vine. Medium seed. Resistant to all strains of BCMV and has field resistance to Fusarium root rot. Has a barely noticeable tan spot near the hilum opposite the micropyle. Released by Washington Agricultural Experiment Station and USDA in 1985.

Midland—Medium yield. Medium maturity. Bush. Small, navy seed. Developed by W. T. Thompson and Sons, Blenheim, Ontario. Distributed by Asgrow Seed Co., Twin Falls, ID. Variety protection pending.

OAC Seaforth—Medium yield. Early. Erect bush. Small, navy seed. Developed by Agriculture Canada, Harrow and University of Guelph. Licensed in 1983.

Pearl—High yield. Medium maturity. Bush. Medium seed. Developed by Gentec Seeds, Ltd.

Seafarer—Medium yield. Early. Erect bush. Medium size, navy seed. Released by Michigan Agricultural Experiment Station in 1967.

Snowbunting—Medium yield. Early. Medium size bush. Medium size, navy seed. Released by Clarence Muehlfeld, Bridgeport, MI in 1974. Distributed by Agri Sales Inc., Olivia, MN.

Snowflake—Medium yield. Early. Erect bush. Medium size, navy seed. Released by

Clarence Muehlfeld, Bridgeport, MI in 1974. Distributed by Agri Sales, Inc., Olivia, MN.

Sunrise—High yield. Late. Medium size bush. Medium seed. Developed by Gentec Seeds Ltd., Box 98, Woodslee, Ontario. Variety protection pending.

Upland—Medium yield. Medium maturity. Medium size bush. Medium size, navy seed. Released by Clarence Muehlfeld, Bridgeport, MI in 1974. Distributed by Agri sales inc., Olivia, MN.

Wesland—Medium yield. Late. Bush. Medium seed. Developed by W. T. Thompson and Sons, Blenheim, Ontario. Distributed by Asgrow Seed Co., Twin Falls, ID. Variety protection pending.

PINTO VARIETIES

Fiesta—High yield. Early. Large, prostrate vine. Large, pinto seed. Released by Idaho Seed Bean Co., Twin Falls, ID in 1981. Seed sale regulated by U.S. Variety Protection Act.

Gala—High yield. Medium maturity. Large, prostrate vine. Large, pinto seed. Released by Idaho Seed Bean Co., Twin Falls, ID in 1981.

Nodak—High yield. Early. Large, prostrate vine. Medium size, pinto seed. Released by USDA and North Dakota, Wash-

ington, and Idaho Agricultural Experiment Stations in 1984.

Pindak—High yield. Medium maturity. Large, prostrate vine. Small, pinto seed. Released by USDA and North Dakota Agricultural Experiment Station in 1981.

UI 126—High yield. Late. Large, prostrate vine. Large seed. Released by Idaho Agricultural Experiment Station in 1983.

UI 129—High yield. Late. Large, prostrate vine. Medium seed. Released by Idaho Agricultural Experiment Station in 1983.

Wyo 167—High yield. Late. Large, prostrate vine. Large seed. Released 1983 by Wyoming Agricultural Experiment Station.

KIDNEY VARIETIES

Isabella light red kidney—Low yield. Early. Large, erect bush. Very large, light red seed. Released by Michigan Agricultural Experiment Station in 1983.

Linden light red—Medium yield. Very late. Large, erect bush. Very large, light red seed. Released by California Agricultural Experiment Station in 1981.

Montcalm dark red—Medium yield. Late. Large, erect bush. Very large, dark red seed. Released by Michigan Agricultural Experiment Station in 1974.

Red Kloud light red—Low yield. Early.

Table 43. Seed yield of fieldbean varieties

Class and variety	Becker ¹	Crookston	Lamberton	Morris	Staples ¹	Crookston	Morris	Lamberton	Becker ¹	Average 4
	1988					1982-5,87	1982-5,87	1982-5,87	1982-4,87	locations ⁶
-----lbs/A-----										
Pinto										
Earliray	2111	665	578	27	1811	—	—	—	—	—
Fiesta	2261	826	815	240	2664	2259 ⁵	1824 ⁵	1434 ⁵	2484 ⁵	1968
Gala	2013	809	1069	120	2524	2267 ⁵	2007 ⁵	1351 ⁵	2595 ⁵	2019
Nodak	3294	847	940	117	2847	2295	2158	1286	2760	2091
ISB84440	2294	300	444	571	1747	—	—	—	—	—
ISB84114	2548	938	1201	39	2942	—	—	—	—	—
Pindak	3146	1200	1316	76	2576	1832	1870	1456	2430	1869
Pinray	2968	1015	1038	181	2521	—	—	—	—	—
UI 126	2751	955	1413	717	2617	1738 ³	2251 ³	2141 ³	2765 ²	2146
UI 129	3095	—	—	482	2539	2037 ³	2211 ³	2200 ³	2732 ²	2233
Wyo 167	2296	—	—	—	—	2172 ⁵	2145 ⁴	1510 ⁴	2596	2146
Othello	3137	1468	1170	338	2956	2315 ²	2235 ²	1227 ²	3056 ²	2208
Navy										
Agri-1	2832	465	564	458	2392	2579 ²	1953 ²	1168 ²	2529 ²	2057
Albion	3030	924	994	518	2372	—	—	—	—	—
Bunsi	2627	587	832	327	2142	2153	1939	1172	2274	1864
C-20	2994	731	876	458	2412	1839	2269	1430	2415	1966
Crestwood	2801	887	1063	284	2563	2210 ⁴	2128 ⁴	1461 ⁴	2384	2072
Ex Rico 23	2418	606	1248	121	2689	1369 ⁵	2092 ⁵	1370 ⁵	2225 ⁴	1740
Fleetside	2871	709	1126	355	3311	—	—	—	—	—
Fleetwood	3268	864	1115	33	3133	1880	1928	1431	2561	1918
Harofleet	3104	630	1003	183	3010	1983	1846	1383	2619	1923
Hyden	—	—	—	—	—	2259 ⁴	2054	1459 ⁴	2974 ²	2033
Midland	1828	937	1173	181	2605	2122 ⁴	1755 ⁴	1427 ⁴	1709	1750
OAC Seaforth	3163	770	1192	163	2398	1374	1668	1270	1982	1552
Pearl	1685	1072	1159	192	2659	2812 ²	2145 ²	948 ²	2802 ²	2177
Seafarer	—	—	—	—	—	1261	1729	1240	1819	1496
Snowbunting	2590	898	1334	510	2512	1840	2020	1271	1978	1767
Snowflake	2536	815	1131	201	2474	1563 ⁴	1737 ⁴	1178 ⁴	2044 ⁴	1631
Stinger	2455	767	1390	532	2761	—	—	—	—	—
Suncrest	2751	727	1550	467	2366	—	—	—	—	—
Sunrise	—	—	—	—	—	2493 ⁴	2058 ⁴	1448 ³	2638	2258
UI 6137	2719	807	1045	402	2813	—	—	—	—	—
Upland	2845	850	1319	507	2504	1630	2009	1386	2237	1793
Wesland	2395	960	1321	613	2529	2211 ⁴	1888 ⁴	1456 ⁴	2059 ⁴	1904

Large, erect bush. Very large, light red seed. Released by Cornell University Agricultural Experiment Station in 1973.

GREAT NORTHERN AND SMALL WHITE VARIETIES

Aurora small white—High yield. Late. Erect vine. Very small, white seed. Released by New York Agricultural Experiment Station in 1973.

Emerson great northern—High yield. Medium maturity. Large, prostrate vine. Very large, white seed. Released 1971 by Nebraska Agricultural Experiment Station.

UI 158 small white—High yield. Late. Erect, short vine. Large seed for small white class. May sometimes be classed as navy. Released by Idaho Agricultural Experiment Station in 1985.

UI 425 great northern—High yield. Late. Short vine. Medium size, great northern seed. Released by Idaho Agricultural Experiment Station in 1985.

PINK AND SMALL RED VARIETIES

Harold pink—High yield. Late. Large, prostrate vine. Larger seed than Viva. Released by Washington, Idaho, and Oregon Agricultural Experiment Stations and USDA in 1984.

UI 37 small red—Low yield. Very early. Short, usually erect vine. Large, dark red seed. Released by Idaho Agricultural Experiment Station in 1964. Recommended only as a very early maturing fieldbean; other small red varieties yield more in a normal growing season.

Victor pink—High yield. Medium maturity. Large, prostrate vine. Larger seed than Viva. Released by Washington, Idaho, and Oregon Agricultural Experiment Stations and USDA in 1983.

Viva pink—High yield. Late. Large, prostrate vine. Pink seed resistant to splitting. Released by Washington Agricultural Experiment Station and USDA in 1974.

BLACK TURTLE SOUP VARIETIES

Black Magic black turtle soup—High yield. Late. Erect vine. Small black seed. Released by Michigan Agricultural Experiment Station in 1981.

Domino black turtle soup—High yield. Late. Erect vine. Small black seed. Released by Michigan Agricultural Experiment Station in 1981.

Ebony black turtle soup—High yield. Medium late. Erect vine. Small black seed. Wilbur-Ellis Co., Spokane, WA. Seed sale regulated by U.S. Variety Protection Act.

Midnight black turtle soup—Medium yield. Late. Erect vine of excellent type for combine-harvest. Small black seed. Released by Cornell University Agricultural Experiment Station in 1980. Seed sale regulated by U.S. Variety Protection Act.

T39 black turtle soup—High yield. Medium late. Erect vine. Small black seed. Released by California Agricultural Experiment Station.

Table 43 (continued). Seed yield of fieldbean varieties

Class and variety	Becker ¹	Crookston	Lamberton	Morris	Staples ¹	Crookston	Morris	Lamberton	Becker ¹	Average 4
	1988					1982-5,87	1982-5,87	1982-5,87	1982-4,87	Locations ⁶
	-----lbs/A-----									
Small White										
K 0125	1751	747	968	411	2925	—	—	—	—	—
UI 158	3020	790	837	138	2823	—	—	—	—	—
Aurora	2035	867	728	483	2060	2046 ⁵	2027 ⁵	1396 ⁵	2246 ⁵	1912
Great Northern										
Emerson	2797	992	1192	623	2650	2340 ⁵	2063 ⁵	1581 ⁵	2614 ⁴	2150
Spinel	—	—	—	—	—	1895 ³	2356 ³	2037 ³	1862 ³	2038
UI 425	2583	1241	1457	700	2655	1986 ⁴	2362 ⁴	1891 ⁴	2647 ⁴	2222
Small Red										
UI 37	—	—	—	—	—	1658 ⁵	1376 ⁵	957 ⁵	1678 ⁴	1417
Pink										
Viva	—	—	—	—	—	1888 ⁵	2011 ⁵	1601 ⁵	2036 ⁴	1884
Harold	—	—	—	—	—	2273 ⁴	2005 ³	1784 ³	1786 ²	2023
Victor	—	—	—	—	—	2167 ⁴	1845 ³	1811 ³	2233 ²	2006
Light Red Kidney										
Isabella	2889	777	799	169	2543	—	—	—	—	—
ISB821003	2880	865	957	197	2384	—	—	—	—	—
ISB82772	2779	813	1097	246	2567	—	—	—	—	—
K-59	2652	788	—	—	2156	—	—	—	—	—
Kamiakin	2294	303	1495	22	1922	1937 ²	1134 ²	954 ²	2119 ²	1536
Kardinal	2050	339	595	146	1793	2066 ²	943 ²	941 ²	2369 ²	1580
Lark	2655	727	1452	—	2689	—	—	—	—	—
Linden	—	—	—	—	—	1857 ³	1616 ³	933 ⁴	2747	1885
Red Kloud	2620	735	507	—	2026	1241 ⁵	1344 ⁵	792 ⁵	2247	1362
Dark Red Kidney										
ISB82865	2628	630	684	345	2308	—	—	—	—	—
Mecosta	—	—	—	—	—	—	—	974 ²	2055 ²	1515
Montcalm	1667	556	1032	133	2747	1598	1451	979	2284	1541
Royal Red	2672	330	645	193	1796	1938 ²	872 ²	721 ²	2241 ²	1443
Black Turtle Soup										
Black Magic	—	—	—	—	—	1765 ⁵	2007 ⁵	1486 ⁵	2374 ⁴	1908
Domino	—	—	—	—	—	1906 ⁵	2083 ⁵	1425 ⁵	2423 ⁴	1959
Ebony	—	—	—	—	—	2067 ⁵	2077 ⁵	1447 ⁵	2407 ⁴	2000
Midnight	—	—	—	—	—	1663 ⁵	2005 ⁵	1403 ⁵	1931 ⁴	1751
T-39	—	—	—	—	—	1852 ⁵	2086 ⁵	1530 ⁵	2208 ⁴	1919
LSD 5%	909	404	451	493	430	234	187	171	219	90

¹Irrigated; ²One year data; ³Two year data; ⁴Three year data; ⁵Four year data; ⁶Does not include 1988 data.

Table 44. Reaction of fieldbean varieties to some important pathogens and air pollution¹

Class and variety	Rust ²	Blight ²		Mosaic ²		Anthracnose ³	Fusarium root rot ²	White mold ²	Air pollution ²
		common	halo	V1	V15				
Pinto									
Fiesta	T	S	T	T	T	—	S	S	—
Gala	S	S	T	T	T	B	S	S	S
Nodak	T	S	S	T	T	—	T	—	—
Pindak	T	S	T	T	T	S	T	S	S
Holberg	S	S	T	T	T	S	T	S	—
NW 410	S	S	T	T	T	—	T	S	S
NW 590	S	S	T	T	T	—	T	S	S
Olathe	T	S	T	T	T	BG	S	S	S
UI-111	S	S	T	T	S	S	S	S	S
UI-114	S	S	T	T	T	S	T	S	S
UI-126	S	S	T	T	T	—	T	S	S
UI-129	S	S	T	T	T	—	T	S	S
Wyo 166	S	S	T	T	S	—	S	S	S
Wyo 167	S	S	T	T	S	—	S	S	S
Navy									
Bunsi	T	S	T	T	T	G	S	T	T
C-20	T	S	T	T	T	BGD	T	T	T
Fleetwood	T	S	T	T	T	ABG	S	S	T
Harofleet	T	S	T	T	T	ABGD	S	S	T
OAC Seaforth	S	S	T	T	T	ABGD	S	S	S
Seafarer	S	S	T	T	T	ABG	S	S	S
Snow-Bunting	S	S	T	T	S	AB	S	S	S
Snow-Flake	S	S	T	S	S	A	S	S	S
Up-Land	T	S	T	T	S	A	S	S	S
Admiral	T	S	T	T	T	S	S	S	S
Bos'n	T	S	T	T	T	S	S	S	S
Crestwood	S	S	T	T	T	ABGD	S	T	T
Ex Rico 23	T	S	T	T	T	G	S	T	S
Hyden	—	—	—	T	T	—	T	—	—
Laker	T	S	T	T	T	AG	S	S	T
Midland	S	S	T	T	T	S	S	S	S
Neptune	T	S	T	T	T	S	T	T	T
Northland	T	S	T	T	T	S	S	S	S
NW 395	T	S	T	T	T	—	S	T	S
Pulsar	T	S	T	T	T	—	T	S	S
Sanilac	S	S	T	T	S	ABG	S	S	S
Swan Valley	T	S	T	T	T	BGD	T	T	T
Wesland	T	S	T	T	T	S	S	S	S
Small White									
Aurora	T	S	T	T	T	BG	T	T	T
UI-158	T	—	—	T	T	—	T	T	T
Great Northern									
Emerson ⁴	S	T	T	T	T	—	S	S	S
UI-425	T	—	T	T	T	—	—	S	T
Spinel	T	S	T	T	T	—	—	S	S
Small Red									
UI-37	S	S	S	T	T	—	S	S	S
Pink									
Harold	S	S	T	T	T	—	T	S	S
Victor	S	S	T	T	T	—	T	S	—
Viva	S	S	T	T	T	—	T	S	—
Dark Red Kidney									
Montcalm	T	S	T	T	T	A	S	S	T
Light Red Kidney									
Linden	T	S	S	T	T	—	S	S	T
Red Kloud	T	S	T	T	T	G	S	S	T
Isabella	T	S	T	T	T	S	S	S	T
Ruddy	—	S	S	T	T	S	S	S	T
Black Turtle Soup									
Black Magic	T	S	T	T	T	G	T	T	T
Domino	T	S	T	T	T	BGD	T	T	T
Ebony	T	S	T	T	T	—	T	S	T
Midnight ⁵	T	S	T	T	T	BGD	T	T	T
T 39	T	S	T	T	T	G	T	T	T

¹Many of these reactions are adapted from North Central Regional Publication 198 and other sources. ²T=tolerant or resistant, S=susceptible. ³Resistant to A=alpha, B=beta, G=gamma, and D=delta races of anthracnose. ⁴Resistant to bacterial wilt. ⁵Resistant to pythium root rot.

Table 45. Characteristics of fieldbean varieties

Average - 4 locations ⁴			Average - 4 locations ⁴			Average - 4 locations ⁴				
Seeds	Planting to		Seeds	Planting to		Seeds	Planting to			
	Maturity	Growth ⁶		Maturity	Growth ⁶		Maturity	Growth ⁶		
<i>no./lb --- days ---</i>			<i>no./lb --- days ---</i>			<i>no./lb --- days ---</i>				
Pinto			Midland	2770	99	B	Pink			
Earliray	1132 ¹	83 ¹	OAC Seaforth		2431	94	Viva	1713	103	V
Fiesta	1409	98					Harold	1393	105	V
Gala	1166	100				ESV	Victor	1351	102	V
Nodak	1321	96	Pearl	2343 ³	99 ³	B				
ISB84440	1552 ¹	102 ¹	Seafarer	2474 ³	93	B	Dark Red Kidney			
			Snowbunting	2320	94	SV	ISB82865	896 ¹	99 ¹	B
ISB84114	1144 ¹	121 ¹	Snowflake	2284	90	SV	Mecosta	1135 ²	110 ⁵	B
Pindak	1520	99	Stinger	2180 ¹	124 ¹	ESV	Montcalm	1015	105	B
Pinray	1204 ¹	92 ¹	Suncrest	2308 ¹	92 ¹	B	Royal Red	1379 ³	112 ³	B
UI 126	1297	107	Sunrise	2101	94	B				
UI 129	1318	108	UI 6137	2372 ¹	90 ¹	B	Light Red Kidney			
							Isabella	1069	93 ¹	B
Wyo 167	1193	107	Upland	2443	96	ESV	ISB821003	816 ¹	122 ¹	ESV
Othello	1358 ³	103 ³	Wesland	2401	100	ESV	ISB82772	756 ¹	95 ¹	B
							K-59	1174 ³	121 ¹	B
Navy			Small White				Kamiakin	1256 ³	112 ³	B
Agri-1	2343 ³	89 ³	K 0125	2708 ¹	124 ¹	B				
Albion	2100 ¹	85 ¹	UI 158	2577	105	B	Kardinal	1211 ³	110 ³	B
Bunsi	2396	101	Aurora	3044	103	V	Lark	900 ¹	101 ¹	B
C-20	2355	105					Linden	942	109	B
Crestwood	2161	100	Great Northern				Red Kloud	990	96	B
			Emerson	997	100	V				
Ex Rico 23	2176	102	Spinel	1220	104	B	Black Turtle Soup			
Fleetside	2272 ¹	114 ¹	UI 425	1159	103	V	Black Magic	2305	104	ESV
Fleetwood	2516	103					Domino	2328	102	ESV
Harofleet	2537	104	Small Red				Ebony	2281	102	ESV
Hyden	2511	87	UI 37	1437	91	ESV	Midnight	2402	102	ESV
							T-39	2225	100	ESV

¹Becker-1988; ²Crookston, Lamberton, Morris-1987; ³Becker-1988, Crookston, Lamberton, Morris-1987; ⁴Becker-1982-4, 88, Crookston, Lamberton, Morris-1982-5, 87; ⁵Crookston, Lamberton-1987; ⁶V = vine, SV = shortvine, ESV = erect short vine, B = bush.

FIELDPEA

Fieldpea (*Pisum sativum*) is usually combine-harvested as mature, dry seed. The seed is sold for use in soup and pigeon feed or fed on the farm to sheep, hogs, or cattle. When used for a forage or feed grain crop, fieldpea usually is 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.

VARIETIES

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

Helka—Early maturity. Medium vine length. Semi-leafless, bush-type growth habit. Green-seeded variety. Resistant to

Ascochyta, *Fusarium* and BYMV. Developed by Hankkija, Finland. Distributed by NorFarm Seeds, Roseau, MN.

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

Kimo—Early-mid maturity. Short vine

length. Green seed, medium-large seed. Semi-leafless. Developed by Hankkija, Finland. Distributed by NorFarm Seeds, Roseau, MN.

Miranda—Very high yield. Very early. Very short. Very large, cream-colored seed. Released by Cebeco-Handelsraade (Netherlands). Seed distributed by International Seeds, Halsey, OR. Seed sale regulated by

Table 46. Characteristics and seed yield of fieldpea varieties, Roseau, 1989

Variety	Seed yield	Planting to		Plant length	Seed weight	Seed protein
		bloom	maturity			
<i>lbs/A</i>		<i>----- days -----</i>		<i>in.</i>	<i>no./lb</i>	<i>%¹</i>
Bellevue	1771	56	—	64	2943	26.3
Helka	2223	53	86	64	2091	23.7
Impala	1744	54	88	53	2033	23.6
Kimo	2409	53	87	59	1975	22.8
Miranda	1060	52	87	58	1515	24.5
Procon	1585	53	85	51	1522	23.9
Renata	1204	52	84	54	2134	24.7
Solara	1472	53	86	49	1535	23.6
Tipu	1529	55	88	73	1983	24.4
Titan	1037	55	93	56	1774	23.5
Trapper	1106	55	93	68	4058	28.3
LSD 5%	430					

¹10 percent moisture basis.

U.S. Variety Protection Act.

Procon—Very high yield. Very early. Short vined but not dwarf. Large, cream-colored seed for protein concentrate in live-stock rations. Released by Minnesota Agricultural Experiment Station in 1986.

Renata—Medium maturity. Large cream-colored seed, semi-leafless. Highly resistant to Fusarium wilt. Resistant to Ascochyta Race C and Downey Mildew. Released by Cebeco-Handelsraade (Netherlands). Seed distributed by Interna-

tional Seeds, Halsey, OR.

Solara—Medium maturity. Short, very large bluish seed. Semi-leafless. Resistant to Fusarium wilt and Ascochyta Race C. Developed by Cebeco-Handelsraade (Netherlands). Distributed by International Seeds, Halsey, OR.

Tipu—High yield. Medium maturity. Long vined. Medium size, cream-colored seed. Semi-leafless plant type with normal stipules and leaflets reduced to tendrils. Released by Agriculture Canada, Morden. Li-

censed in 1985. Production of certified seed limited to Canada.

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

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

LENTIL

Lentil is a pulse crop, and the seed is used in soup. The crop is sown with a grain drill and harvested with a windrower and combine.

VARIETIES

Brewer—High yield. Early maturity. Medium height. Medium size seed. Released by Washington Agricultural Experiment Station and USDA in 1982.

Chilean 78—Medium yield. Early maturity. Medium height. Medium size seed. Chilean, introduced to the U.S. about 1920,

is the principal variety grown. Chilean 78 was distributed to growers in 1981.

Eston—High yield. Medium maturity. Short. Very small seed. Released by University of Saskatchewan. Licensed in 1981. Production of certified seed limited to Canada.

Jasper—Medium yield. Late maturity. Short. Very small, dark mottled seed. Wilbur-Ellis Company, Spokane, WA 99206. Variety protection pending.

Laird—Low yield. Late maturity. Tall. Large seed. Released by University of

Saskatchewan. Licensed in 1978. Production of certified seed limited to Canada.

Primera—Medium yield. Late maturity. Medium height. Large seed. Wilbur-Ellis Company, Spokane, WA 99206.

Red Chief—Medium yield. Early maturity. Medium height. Medium size seed. Cotyledon color in the seed is brick red in contrast to the yellow of other varieties. Released by Washington Agricultural Experiment Station and USDA in 1980.

Table 47. Characteristics and seed yield of lentil varieties

Variety	Grand Rapids	Crookston	Becker ¹	Seeds	Seed protein	Height	Lodging ¹	Planting to	
	1982-85	1981,85	1982-84		% ²			bloom	maturity
	-----lbs/A-----			no./lb		inches	score ³	----- days -----	
Brewer ⁴	943	2031	1357	8,890	27.4	18	4.9	60	111
Chilean 78 ⁵	750	—	1226	9,650	26.5	19	4.8	61	110
Eston	1029	1733	1650	15,120	25.1	17	3.4	63	113
Jasper ⁶	1043	1525	—	15,120	26.5	17	3.8	63	116
Laird ⁷	343	1344	820	7,440	24.2	21	3.5	67	115
Primera ⁶	554	1895	—	5,670	28.3	18	4.9	64	119
Red Chief ⁴	757	1673	1574	9,070	26.7	18	5.6	60	111
LSD 5%	132	512	164						

¹Irrigated; ²Oven-dry; ³1 = erect, 9 = flat; ⁴1982-85; ⁵1982-84; ⁶1985; ⁷1981-84.

LUPIN¹

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

The crop should be planted from early to mid-April and should be ready to harvest in August to September. Lupins are easily direct combined because of their upright growth habit. Yields up to 4400 lbs/a have

been produced in Minnesota.

Lupin utilization includes direct-feeding to poultry and livestock. It is also marketed for human consumption, processed into various products such as flour, pasta and hulls for dietary fiber. Lupins should not be produced until potential markets or uses are first identified.

Additional information is provided in the "Lupine Production and Utilization" folder (item no. AG-FO-3494) available from the Distribution Center, 1420 Eckles Avenue, 3 Coffey Hall, University of Minnesota, St. Paul, MN 55108. Seed sources include:

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

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

Goldsmith Seeds, Inc., P.O. Box 1349, Gilroy, CA 95021 (L2019N, L2085N); Seedway Seeds, Hall, NY 14963 (Eastland)

¹Spelled "lupin" per both international convention and normal pronunciation. "Lupine" now appears only in historical reference.

Table 48. Seed yield of lupin varieties

Variety	Rosemount			Staples		Becker			G.Rapids		Overall average
	1987	1988	1989	1988	1989	1987	1988	1989	1988	1989	
	-----lb/A-----										
Blanca 101	678	1018	1918	—	2200	1189	1282	1769	1676	1408	1460
Eastland	496	827	1982	1334	1888	1132	1034	1329	849	535	1141
Gela x 243	759	1047	2214	1295	2527	1104	1320	2104	1527	1251	1515
Horizont	691	986	1981	1755	1848	1146	1322	2001	1163	1203	1410
Kiev	640	809	1921	1265	2667	897	1235	1250	1115	528	1233
L 2019 N	—	—	—	—	2621	—	—	1580	—	763	1655
L 2085 N	—	—	2246	—	2590	—	—	2011	—	1274	2030
Primorski	757	846	2353	1112	2327	1401	1116	1343	1242	1176	1367
Strain 21	623	987	2079	1527	2552	904	1117	2192	1625	1153	1476
Ultra	555	781	1484	1284	2252	880	1206	1947	1309	1011	1271
46-10	581	930	1851	1466	2266	930	1188	1874	1518	1041	1365
47-5	776	857	1935	1581	2053	1205	1175	2283	982	1130	1398
LSD 5%	126	187	466	527	535	194	366	639	680	268	140

Table 49. Characteristics of lupin varieties, 1987-1989

Variety	Planting to		Lodging ³	Plant height ⁴	Seed weight ⁵	Seed protein ⁶
	90% bloom ¹	maturity ²				
	----- days-----		score ⁷	inches	no./lb	---- % ⁸ ----
Blanca 101	51	107	1.5	25	1478	34.6
Eastland	53	108	1.4	23	1448	33.1
Gela x 243	47	107	1.9	24	1432	35.7
Horizont	51	107	1.6	24	1445	36.9
Kiev	55	106	1.8	22	1502	35.6
L 2019 N	62	113	1.0	25	1382	31.6
L 2085 N	56	106	1.1	26	1718	32.5
Primorski	52	105	1.3	21	1511	37.5
Strain 21	53	108	2.1	24	1436	37.2
Ultra	55	105	1.5	23	1441	34.3
46-10	52	106	1.6	24	1375	36.0
47-5	54	109	1.6	24	1385	37.0

¹Grand Rapids and Rosemount 1988 - 1989, Becker and Staples 1989; ²Becker, Rosemount and Staples 1989; ³Staples 1988 - 1989, Becker, Grand Rapids and Rosemount 1989; ⁴Becker and Rosemount 1987 - 1989, Grand Rapids and Staples 1988 - 1989; ⁵Becker and Rosemount 1988 - 1989, Grand Rapids and Staples 1989; ⁶Becker and Rosemount 1987 - 1989, Grand Rapids and Staples 1989; ⁷1 = erect, 9 = horizontal; ⁸10% moisture basis.



Planting depth and seed quality contribute to differential emergence, accounting for these height differences within a row of lupin.

PLANTING RATE AND DATE

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

Crop	Bushel weight (pounds) ¹	Seeds/pound (number)	Rate/acre (pounds)	Rate (seeds)	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	105,000/acre	
Kidney.....		900	115	105,000/acre	
Navy.....		2,500	42	105,000/acre	
Navy 6- to 14-inch rows.....			60	155,000/acre	
Pink.....		1,700	60	105,000/acre	
Pinto.....		1,300	80	105,000/acre	
Small Red.....		1,400	75	105,000/acre	
Small White.....		3,000	35	105,000/acre	
Flax.....	56	88,000	42	85/square foot	April 15 to May 15
Forage Grasses (perennial)	If mixed with legume, sow at time indicated for the legume.				
Bromegrass alone.....	14	136,000	16	50/square foot	Early spring or summer
in mixtures.....			10	31/square foot	
Orchardgrass in mixtures.....	14	653,000	2	30/square foot	Early spring or summer
Reed canarygrass alone.....	46	526,000	7	85/square foot	Early spring or summer
in mixtures.....			5	60/square foot	
Tall fescue in mixtures.....	25	229,000	4	21/square foot	Early spring or summer
Timothy in mixtures.....	45	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	150,000-200,000	May 20 to June 10
Annual canarygrass.....	50	58,000	30	40/square foot	Early spring
Buckwheat.....	48	14,900	50	17/square foot	June 15 to July 20
Canola <i>B. napus</i>	50	140,000	8	25/square foot	May
Canola <i>B. campestris</i>	50	210,000	5	25/square foot	May
Fieldpea.....	60	2,300	180	9/square foot	Early spring
With 1½ to 2 bushels of oat.....			70	4/square foot	
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

¹U.S. legal if established. If not established, weight given is that most widely accepted in the United States.