

WHEAT VARIETIES—WHICH TO GROW¹

by

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The use of varieties resistant to stem rust and other important plant diseases insures a more dependable yield. Where the varieties chosen are also capable of better than average yield they add further to a higher total production.

North Dakota has enjoyed recently several successive years of high production (Table 1). Summer rainfall over most of the State, and growing-season temperatures, have been generally favorable during this period. However, improved varieties also have contributed to these record or near record yields. The use of rust resistant wheats in the spring wheat area has done much to restrict the development and spread of stem rust, thus warding off serious crop losses in some years. Together, these several factors have all added up to more satisfactory yields and high production.

State Yields and Production

For the 5-year period, 1926 to 1930, the average yield per acre of wheat in North Dakota was 11.3 bushels. It dropped to 7.4 and 8.9 bushels, during the next two 5-year periods, respectively, when either drought or severe rust injury seriously damaged the crop. Since 1941 the average yield has ranged from 13.7 to 19.6 bushels, averaging for the period 16.1 bushels per acre. For the last 5 years the annual wheat acreage in North Dakota has approximated 10 million acres. This large acreage, and larger than average yields, have combined to give North Dakota an annual production ranging from 136 to 156 million bushels. On about the same acreage during the 5-year period, 1926-1930, the average annual production was 115 million bushels.

Table 1—Acreage cropped to wheat, average yield and total annual production for North Dakota, 1926 to 1948.²

Year	Acreage (harvested)	Acre yield bushels	Total production bushels
1926-30	10,117,000	11.3	114,806,000
1931-35	7,657,000	7.4	59,675,000
1936-40	6,753,000	8.9	63,087,000
1941	8,155,000	17.3	140,722,000
1942	7,321,000	19.6	143,616,000
1943	8,326,000	18.2	151,387,000
1944	9,856,000	15.9	156,321,000
1945	9,955,000	15.7	154,568,000
1946	10,192,000	13.7	139,824,000
1947	10,263,000	14.3	146,383,000
1948	9,518,000	14.3	136,580,000
1941-48	9,198,250	16.1	146,175,125

¹Data from Bureau of Agr. Economics, U. S. Dept. of Agr. The 1948 estimates are subject to revision in 1949.

²The writers are indebted to the following men for supervising the trials at their respective stations: Edgeley, J. P. Tiernan; Langdon, Victor Sturlaugson and Reuben Heermann; Minot, G. N. Geiszler; Dickinson, Leroy Moomaw and T. J. Conlon; Williston, Arlon Hazen and Elvin Anderson; also to R. H. Harris and L. D. Sibbitt, Department of Cereal Technology for appraisal of the varieties for their respective milling, baking or macaroni qualities.

Present Status of Resistance to Stem Rust and Leaf Rust

While much progress has been made in the development, introduction and use of varieties that resist rust, thus lessening the hazards of production, not all danger from disease has been removed. No variety now available is immune to rust. We continue to have adequate resistance against the races of stem rust now most prevalent in this area. However, there is always the possibility that new races could increase, become well established and attack our present varieties.

In the case of leaf rust that situation is now here. Most of our present varieties when first released were resistant both to stem rust and to leaf rust. Since 1944 their leaf rust resistance has been much less pronounced. All commercial varieties have been showing an increasing amount of infection, at times nearly as much as "susceptible" varieties.

It is quite apparent that we are now dealing with a race (or races) of leaf rust which was not prevalent a few years ago. Wheat breeders and plant pathologists recognized this change and for several years have been searching for, and experimenting with, parental lines having the desired resistance for use in a breeding program in order to meet this threat. Considerable progress is being made in this direction and it is expected that in the reasonably near future varieties of hard red spring wheat with more adequate leaf rust protection will be available.

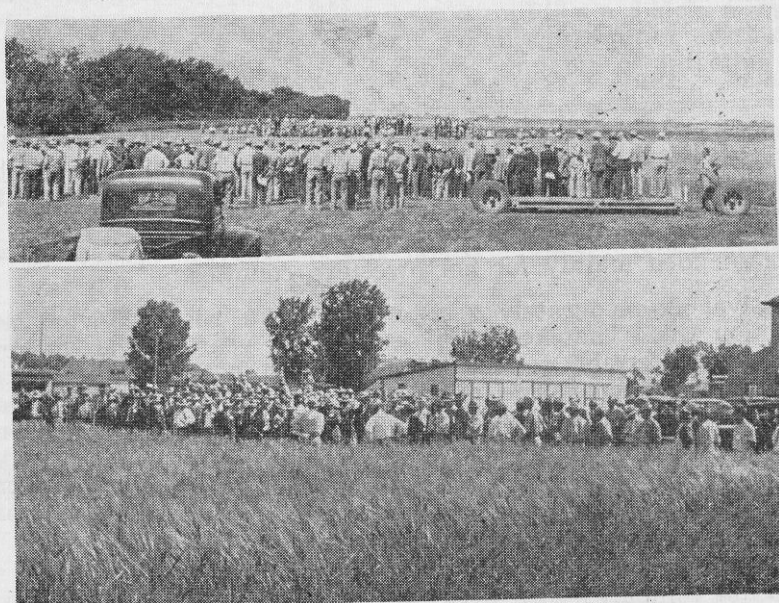
While the rusts are the most serious of the diseases attacking our wheat crop, no one of our varieties has much resistance to root-rots or head-blight. With the exception of Rescue all varieties of hard red spring wheat now grown are readily attacked by sawfly, one of the serious hazards to the wheat crop in the north-western counties.

Which Variety to Grow

No one of the varieties we now have is superior in all respects. Each has some advantages, and some disadvantages. Disease is a greater factor in some years than in others and in these years varieties having most resistance will usually stand out. In the absence of rust, or other serious diseases, varieties lacking in resistance may do as well as or better than resistant varieties. Time of maturity can be an important factor in some years, especially in years when excessively high temperatures or drought may occur at a critical period in the development of the crop.

Every grower therefore, must balance the advantages against the disadvantages and choose the variety which he believes will best meet the problems and crop hazards which are most common to his area. This report presents in Table 2 a summary of comparisons for the leading hard red spring varieties since 1946, when the last report was made. (Bimonthly Bulletin Vol. 8, No. 3). The reader may thus note how varieties have compared in recent years, under seasonal conditions which he may recall.

An unusually severe spring frost was an important factor influencing yield differences in these tests in 1946. Mida, Regent, and Renown appeared to have been injured most. Thatcher, Newthatch, Rival and the durums were the least injured. There was considerable leaf rust in 1947, especially in some areas and on late sowings. In 1948 high temperatures, with drought in late May and early June, hastened the development of the crop. Early varieties, which were most advanced, recovered less fully during the favorable conditions which followed in June. The early varieties, again most advanced during the early July high temperatures, were unable to gain the full advantage from the favorable ripening temperatures which occurred after about July 10.



Farmer groups inspecting experimental plots Agricultural Experiment Station, Fargo, 1948.

That one may note the differences obtained over a wider range of seasonal conditions another summary table is presented for varieties grown for the longer period. (See Table 3). Mindum, a variety of durum, is included in each of these tables to show how durums and hard red spring varieties have compared. A brief description and discussion of the leading varieties follows herewith.

Thatcher is resistant to stem rust and loose smut but susceptible to leaf rust. Thatcher is grown chiefly in the northwestern part of the State and in Canada, in areas where injury from leaf rust usually is not serious. In these areas it has been yielding well in comparison with other varieties. Because Thatcher holds its kernels tightly and stands up well it is favored in some commun-

Table 2—How the more commonly grown varieties of hard red spring wheat have compared in yield with each other and with Mindum durum during the last three years, 1946 to 1948. (Bushels per acre)

Variety	Fargo 1946-48	Edgeley 1946-48	Langdon 1946-48	Minot 1946-48	Dickinson 1946-48	Williston 1946-48	Weighted average 18 station years
Thatcher	25.9	22.2	35.0	28.3	25.2	34.5	28.5
Pilot	26.2	21.9	34.4	24.1	27.0	32.9	27.7
Rival	26.1	23.6	41.7	24.9	27.8	32.5	29.4
Mida	25.0	23.5	39.2	27.7	26.1	31.6	28.8
Cadet	24.4	23.1	36.5	24.9	26.9	31.8	27.9
Ceres	25.6	.....	.....	.....	23.0	31.8	.....
Redman	24.1	21.3	.....	28.8	.....	.....	.....
Henry	29.4	24.5	.....	26.1	.....	.....	.....
S. D. 2280	25.7	21.9	.....	.....	.....	.....	.....
Mindum	32.9	23.5	41.7	34.9	31.9	.....	.....

ities for direct combining. It possesses excellent milling and baking qualities. Relatively short straw, early ripening, a small kernel which bleaches easily, and a tendency to low test weight are some of the other characteristics of this variety. Thatcher is recommended mainly for northwestern counties.

Rival is moderately resistant to stem rust, showing more infection than Thatcher in a severe rust year. Rival, however, is not as susceptible to leaf rust or to scab, has moderately strong straw, large kernels and is an excellent yielding variety (Table 3). Its most serious weakness is its susceptibility to shattering when ripe and to bleaching. Rival sprouts readily in a wet harvest season. Compared with Mida, Rival is resistant to loose smut. Rival is recommended mainly for the eastern and central parts of the State, on farms where swathing or binder harvest is the usual practice.

Pilot compares with Rival in resistance to stem and leaf rust, but is later in ripening and has a weaker straw. Pilot yields well over a wide range of conditions, does not shatter, and when not lodged seriously is suitable for straight combining. Mid-size, tapering kernel with conspicuous brush and relatively low test weight, are characteristics of this variety. Pilot is recommended for the central and western parts of the State.

Mida is highly resistant to stem rust, but like Rival and Pilot can not now be considered more than moderately resistant to leaf rust. Mida is resistant to covered smut, but susceptible to loose smut and scab, and was injured more by spring frost in 1946 than Rival or Thatcher. Mida has fairly strong straw, ripens mid-early, yields well, is bearded, the beards sometimes turning dark as the crop ripens. The grain has high test weight. The large kernels have good color, and are fairly resistant to weathering in the swath or shock. The kernels are held more tightly than in Rival but not sufficiently tight to allow it to be considered safe for direct

combining. Mida is recommended mainly for the eastern and central parts of the State, on farms where binder harvest, or swathing is the usual practice.

Loose Smut on Mida Wheat

The organism responsible for loose smut in varieties like Mida enters the wheat plant at the time it is in blossom, infecting and growing within the wheat kernel as it develops. The infected mature kernel is not distinguishable from a healthy one. The fungus remains dormant within the kernel until the kernel germinates, at which time the fungus resumes growth, developing within the growing plant, eventually destroying the head, which upon emerging from the boot breaks out as a black mass of spores. These spores, blown about by air currents or carried by insects are, under the right conditions, capable of infecting adjacent non-smutted plants then in blossom.

Table 3—How Mida has compared in yield with some other varieties for the years grown, 1939 to 1948. (Bushels per acre).

Variety	Fargo 1939-48	Edgeley 1939-48	Langdon Minot 1939-48 1945-48	Dickinson 1940-48	Williston 1940-48	Weighted	
						1948	average 51 station years
Thatcher	25.4	19.9	29.4	29.0	21.2	33.3	26.1
Rival	26.4	23.2	34.3	27.9	22.3	31.0	27.6
Pilot	26.7	22.3	31.3	26.9	22.0	32.3	27.0
Mida	27.1	23.2	34.9	30.6	22.5	31.3	28.2
Ceres	24.6	.....	.....	.....	19.8	31.8	.....
Vesta	.....	.....	.....	.....	21.1	32.5	.....
Mindum	30.0	21.5	35.8	.....	24.0	.....	.....

In contrast to covered smut (bunt, or "stinking smut"), where the spores are carried on the outside of the seed, the loose smut organism is under the seed coat, and thus ordinary seed treatment is not effective. The "modified hot water treatment" can be used, but is difficult to apply under farm conditions or to large quantities of seed. Based on reports and actual field counts the amount of loose smut in Mida in 1948 varied from light to heavy infestations. Fields in some northeastern counties generally showed the most loose smut, while infection in the more western counties was relatively light.

No one can foretell what the smut situation in the 1949 crop may be, when using 1948 crop seed. However, farmers whose fields showed a heavy infection in 1948 should find it advisable to obtain seed from a section of the State where the infection was light. The chances for serious smut losses would be less with such seed.

Cadet, a beardless variety, compares favorably with other varieties in resistance to stem and leaf rust, has fair resistance to loose smut, but is only moderately resistant to covered smut.

Cadet grows taller and ripens later than other beardless varieties commonly grown, comparing more with Pilot in time of ripening. It has moderately strong straw and does not shatter readily. In yield tests Cadet has compared favorably with other varieties, especially in the northern and western part of the State. For 39 comparisons since 1941, at the several stations, Cadet averaged 28.4 bushels, Thatcher 27.8, Pilot 29.2 and Mida 30.3 bushels per acre. In weight per bushel it resembles Thatcher, Regent, and Pilot, all tending to be low. In milling and baking qualities it compares favorably with Thatcher and other wheats of good quality. Based on observations to date Cadet is recommended primarily for northern sections of the State, where temperatures during the ripening season are usually not as severe and injury to late varieties therefore less.

Vesta, a sister selection of Rival, is a bearded good yielding variety with satisfactory resistance to stem rust, but lacking in resistance to leaf rust, and in strength of straw. Unlike Rival, Vesta does not shatter, but holds its kernels tightly and at times is considered "hard to thresh." Vesta flour yields are higher than in other varieties commonly grown and the quality of the flour, altho not outstanding, is considered satisfactory. Because of its susceptibility to leaf rust and weak straw, Vesta is considered only for the western part of the State, where rust injury and lodging are usually less serious.

Regent is a beardless early-ripening, relatively short-strawed variety, with good resistance to stem rust and bunt. Regent when first released was considered as having good resistance to leaf rust, but since then has carried a heavy infection in some years. Regent, too, lacks in resistance to root-rot and scab and is not considered a high yielding variety (See Bimonthly Bul. Vol. 8, No. 3, 1946). It has low test weight, but otherwise good milling and baking properties characterize this variety. Regent is recommended mainly for the eastern part of the State and where a beardless early variety is especially desired.

Redman is a more recent introduction from Manitoba. It is an early beardless variety, comparable to Regent in many respects, and similar in its resistance to stem and leaf rust. For the few years tested Redman has indicated that it may be a higher and more dependable yielding variety than Regent, but it is not expected to outyield some of the other varieties now commonly grown. In 8 comparisons since 1946 the average yield for Regent was 23.9 bushels, for Redman 25.9 bushels per acre. For 13 comparisons (Table 4) Redman averaged 27.8 bushels, Thatcher 28.8, Mida 29.3 and Cadet 28.1 bushels per acre. Present stocks of Redman lack some in uniformity of type or purity. This new variety is suggested primarily as a replacement for Regent or where an early beardless variety is especially desired.

Rescue is an introduction from Saskatchewan, Canada, where it was bred and selected, with the purpose of obtaining a variety

Table 4—How Redman has compared in yield with other varieties during the years tested. (Bushels per acre).

Variety	Fargo 1946-48	Edgeley 1946-48	Langdon 1947-48	Minot 1946-48	Dickinson 1948	Williston 1948	Weighted average 13 station years
Thatcher	25.9	22.2	37.9	28.3	33.0	36.8	28.8
Pilot	26.2	21.9	37.7	24.1	39.8	36.8	28.4
Rival	26.1	23.6	46.1	24.9	35.8	33.5	29.6
Mida	25.0	23.5	42.9	27.7	35.9	30.9	29.3
Cadet	24.4	23.1	38.7	24.9	37.8	32.6	28.1
Redman	24.1	21.3	38.3	28.8	31.4	31.4	27.8

of hard red spring wheat resistant to sawfly injury. In this respect Rescue is superior to other varieties of hard red spring which we are now growing. Rescue is beardless, has some resistance to stem rust, but is very susceptible to leaf rust and lacks in resistance to covered smut. It grows slightly taller than Thatcher and ripens later than Thatcher or Mida, comparable with Pilot and Cadet in this respect. In weight per bushel Rescue averages about like Thatcher or slightly lower, and the grain is more resistant to bleaching.

In trials to date Rescue has not shown as satisfactory yields as some of the other varieties (See Table 5). In none of the 4 years grown at Williston did Rescue exceed or equal Thatcher, the variety grown most commonly in the northwestern part of the State. It yielded less than Thatcher in 3 out of 4 years grown at Minot. Its performance during the three years tested at Dickinson has been relatively more favorable as Rescue yielded as well or better than Thatcher in each of the 3 years grown. For the 11 station years tested Thatcher averaged 28.9 and Rescue 26.3 bushels per acre.

Table 5—How Rescue has compared in yield with some other varieties at the stations where tested. (Bushels per acre).

	Williston 1945-48	Minot 1945-48	Dickinson 1946-48	Weighted average 11 station years
Thatcher	31.7	29.0	25.2	28.9
Pilot	30.4	26.9	27.0	28.2
Rival	30.2	27.9	27.8	28.7
Mida	29.2	30.6	26.1	28.9
Cadet	29.6	27.9	26.9	28.2
Rescue	26.9	25.8	26.0	26.3

Another deficiency of Rescue is its milling and baking qualities. From comparable tests made to date cereal technologists report the flour yield and protein content as average but point out that the quality of the protein and baking strength of the flour, as measured by the loaf volume, classes it as fair but distinctly

below Thatcher. The Rescue flour is very low in water absorption, a factor regarded as unfavorable in a good bread flour. The quality also appears to be less uniform than in other hard red spring wheats. Because of these limitations, Rescue is recommended only as an emergency variety, (1) for use in fields where the likelihood of a severe sawfly infestation is great and the stands are likely to break over early; (2) on farms lacking in harvesting equipment and power that permit of timely harvest, or (3) in fields where operating a combine pickup may not be desirable.

Henry, developed and released by the Wisconsin Experiment Station, is a bearded, mid-late variety, satisfactory in resistance to stem rust, and moderately resistant to leaf rust and covered smut. In comparable trials Henry has shown very satisfactory yields, but has been unsatisfactory in milling and baking qualities. Lower protein content, lower water absorption and lower loaf volume are some of its characteristics. For these reasons Henry is not recommended for use in regions where high quality bread wheats are generally grown.

Varieties of Durum

Of the approximately 10 million acres cropped to wheat since 1944 from 2 to nearly 3 million acres have been in durum. This is from about 20 to more than 25% of the total wheat acreage. Before 1930 the acreage in durum was even higher, averaging nearly 4 million acres for the 5-year period, 1926 to 1930. Beginning about 1930 there was a serious drop in the export market, greatly curtailing the outlet for this type of wheat. For the next 5-year period, 1931 to 1935, the average acreage cropped to durum was under 2 million acres.

Table 6—Acreage cropped to durum wheat in North Dakota, average yield and total production, 1926 to 1948.^a

Year	Acreage (harvested)	Acre yield bushels	Total production bushels
1926-1930	3,893,000	12.2	48,270,000
1931-1935	1,889,000	8.3	16,007,000
1936-1940	2,157,000	9.8	22,189,000
1941	1,991,000	16.5	32,852,000
1942	1,712,000	20.0	34,240,000
1943	1,763,000	17.0	29,971,000
1944	1,816,000	14.8	26,877,000
1945	1,815,000	16.5	29,948,000
1946	2,232,000	14.5	32,364,000
1947	2,701,000	15.0	40,515,000
1948	2,863,000	14.0	40,082,000
1941-1948	2,111,625	16.0	33,356,125

^aData from Bureau of Agr. Economics, U. S. Dept. of Agr. 1948 estimates preliminary.

North Dakota leads all states in the production of durum, as it does in the production of hard red spring wheat. In recent years about 90 percent of the durum produced in the United States was grown in North Dakota. The average annual production since 1941 was 33 million bushels, with production highest during the last two years when about 40 million bushels were produced. The durum acreage is centered in a group of northern counties beginning with Cavalier on the east, Rolette on the west and extending south into the east-central part of the State. Other counties extending to the South Dakota border, and counties adjacent to these areas, also grow considerable durums, but with less success.

Many of the problems in the growing of hard red spring wheat are also common to the production of durum. Durum varieties as a class, however, have high resistance to leaf rust and some are resistant to many races of stem rust. Durums also have considerable resistance to sawfly. They require from a week to 10 days longer to ripen than most of the hard red spring varieties and are susceptible to root-rots and some of the head blights. A brief description of the more common varieties is given herewith.

Mindum is one of the varieties most commonly grown. It is a good yielding variety, when grown under favorable conditions, and usually produces grain of clear amber color that is essential in the production of good quality semolina. Mindum is susceptible to some of the prevailing races of stem rust, lacks some in strength of straw and is not very tolerant to drought and high temperatures.

Stewart is highly resistant to stem rust, has about the same strength of straw as Mindum and requires about 2 days longer to ripen. Stewart holds the kernel tightly. The color of the grain and the quality of the semolina is equal to Mindum. Stewart is especially suited to the more northern part of the durum growing area.

Table 7—How the leading varieties of durum have compared in yield during the years at the stations where tested. (Bushels per acre).

	Langdon 1940-48	Fargo 1940-48	Edgeley 1943-48	Weighted average	
				18 station years	24 station years
Mindum	39.2	29.9	23.6	34.5	31.8
Stewart	41.3	29.4	23.2	35.3	32.3
Carleton	38.3	26.1	.....	32.2	.....
Vernum	37.5	29.2	23.5	33.3	30.9
Red durum	34.3	29.6	.....	31.9	.....

Carleton also has high resistance to stem rust and produces grain of excellent semolina quality. Carleton differs from Stewart and Mindum in having a distinctly stronger straw. It is later in ripening than Mindum, is more susceptible to scab and more variable in yield than either Stewart or Mindum. Carleton is recommended mainly for conditions where the strongest straw is necessary.

Vernum is a selection from a Mindum x Vernal (emmer) cross and backcrossed to Mindum 4 times to recover the desirable semolina qualities of Mindum. The crosses and selections were made by Glenn S. Smith, formerly with the U. S. Department of Agriculture, in cooperation with the North Dakota Agricultural Experiment Station, the variety first released in 1947. Vernum is an amber durum having stem rust resistance equal to Stewart and Carleton, but 3 to 4 days earlier in ripening. Because of greater earliness Vernum does not have the yielding capacity of Stewart, when conditions for late varieties are not unfavorable. However, under late drouth or high ripening temperatures earliness can be an advantage. For these reasons Vernum is recommended only for the southern sections of the durum growing area. Vernum has the disadvantage of weak straw. It is satisfactory in macaroni qualities.

Kubanka is one of the older varieties and less uniform in plant type than Mindum. In some communities local strains have been developed and are being grown. Some of these strains have a little more rust resistance than others, or are slightly more tolerant to drought than Mindum. In most instances Mindum or Stewart should have preference over Kubanka.

Red Durum (D-5) has high resistance to stem rust, and at one time was grown extensively because, having high rust resistance it was able to yield relatively well when sowed late and under unfavorable conditions as to rust. It matures earlier than Mindum, has a weak straw and the grain has a dull reddish color. On the market Red durum is purchased mainly for use in mixed poultry feeds, where it has preference over amber durums. As an admixture in amber durum it seriously lessens the value of that durum for macaroni purposes.