

Experiment Station Announces Release of

NEW DURUM WHEATS RESISTANT TO 15B

By R. M. Heermann¹ and T. E. Stoa²

The release of four new durum varieties—Langdon (Ld. 372),³ Towner (Ld. 370), Ramsey (Ld. 369) and Yuma (Ld. 364)—is jointly announced by the North Dakota Agricultural Experiment Station and the United States Department of Agriculture. These new varieties, which have resistance to Race 15B of stem rust, were developed through a cooperative project between the United States Department of Agriculture and the North Dakota Agricultural Experiment Station.

The need for new varieties of durum wheat, with resistance to stem rust Race 15B, became urgent with the sudden appearance and increase of this race in 1950 in the durum area. The destructive epidemics of stem rust in 1953 and 1954 pointed out this need even more emphatically. Immediately following the 1950 season, efforts were concentrated toward the development of 15B resistant varieties as rapidly as possible. Varieties and selections with the best sources of resistance known at the time were crossed with varieties such as Carleton and Stewart in the September to December greenhouse crop of that year. The progenies from these crosses were then propagated at the rate of three generations per year through the use of greenhouse and field plantings.

The first test for rust reaction was obtained in the second generation, which was grown in the field in 1951. This planting was made at a late seeding date and enough rust developed to show which plants were susceptible. A few seeds from each of the more resistant plants were seeded in the greenhouse in early October 1951. From each plant harvested from this crop in January 1952 two kernels were immediately seeded in the greenhouse.

Approximately 2500 fourth generation plants were grown. The plants from this crop were harvested individually in late April and the seed from each was planted in a separate row in the field in 1952. A second field test for rust reaction was thus obtained. Evaluation for rust resistance and plant type was made on a row basis. Only rows which appeared to be uniformly resistant to stem rust and uniform for desirable plant type were harvested. From

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³The number in parentheses is its experimental number. The U. S. Department of Agriculture Cereal Investigation numbers of these varieties are C.I. 13165, C.I. 13247, C.I. 13246 and C.I. 13245, respectively.

then until the present time the selections showing the most promise were both increased for seed and tested more extensively for yield, disease resistance, general plant type and macaroni quality.

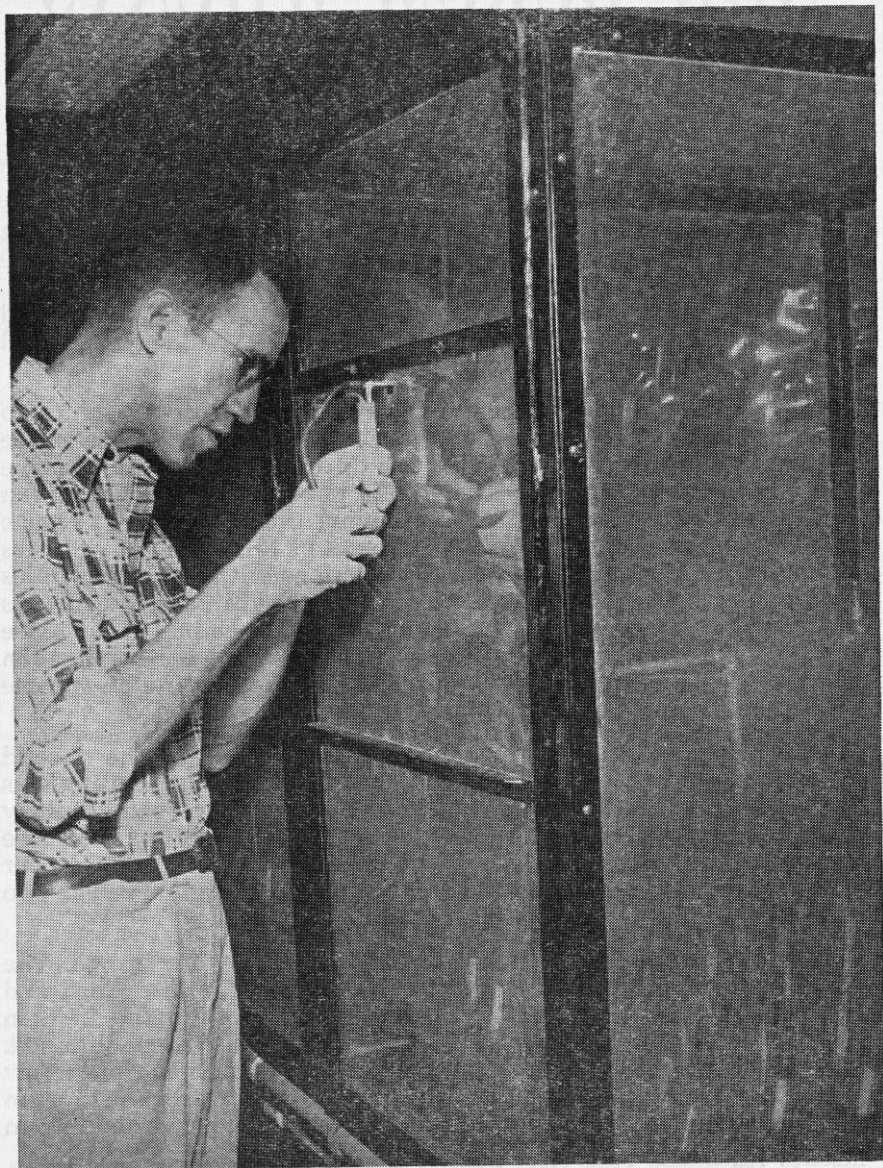


FIGURE 1.—Inoculating new durum wheat selections with stem rust in the greenhouse—part of the procedure in developing new varieties of rust-resistant wheat.

This period of testing and evaluation has been shortened to meet the urgent demand for 15B resistant durums. Therefore the evaluation of these varieties is not as complete as it has been on new varieties released in the past. The story of the breeding and a brief description of each of the varieties follows:

Langdon (Ld. 372)

Langdon obtained its resistance to Race 15B from Khapli, a variety of emmer introduced into this country from India. The development of Langdon involved four successive crosses in a modified backcross procedure. The first cross between a Mindum x Carleton durum selection (Ld. 194) and Khapli emmer was made in 1944 by Dr. Glenn S. Smith.⁴

In 1946 Dr. Smith selected a resistant F_3 progeny from this cross in a greenhouse seedling rust test with Race 15B. The second cross was made in 1949 between this resistant selection and Ld. 308. Ld. 308 is a selection from (Heiti x Stewart) x (Mindum x Carleton). The third cross was made in 1950 between Stewart and a resistant F_2 plant from the second cross. Following this an F_1 plant from this combination was crossed with Carleton in the spring of 1951. In a standard backcross procedure the same variety would be used in each of the successive crosses but in this case four different durum varieties were used. However, Mindum makes up a very high proportion of the parentage in all four durum varieties used as backcross parents. Therefore Langdon possesses many of the desirable characteristics found in Mindum.

Langdon is moderately resistant to Race 15B of stem rust. It has not shown the high degree of resistance to this race present in its Khapli emmer parent. However, it has shown good resistance to many races other than 15B in greenhouse tests, and in field tests outside of this area where other races were present.

Langdon has appeared to be about two days earlier than Mindum. It is shorter in straw height and has greater resistance to lodging than Mindum but it is not equal to Sentry in these characteristics. Langdon is somewhat more susceptible to leaf rust than Mindum or any of the other new varieties. It has shown good yielding ability over a wide range of locations. Its test weight and semolina quality are satisfactory. This variety tends to shed its awns when it ripens normally.

This variety is named in recognition of Langdon, North Dakota, which is the county seat of Cavalier county, one of the larger durum producing counties in the "durum triangle" of North Dakota. The experiment station where a large part of the durum breeding and testing is done is located near that city. It is also the site of the annual North Dakota Durum Show.

⁴Formerly in charge of durum wheat breeding, and now as Principal Plant Breeder for the North Dakota Experiment Station engaged largely in breeding the hard red spring (bread) wheats.

Yuma (Ld. 364)

Yuma obtained its resistance to Race 15B from Khapli emmer, the same source of resistance as in Langdon. Yuma is a selection from the second cross made in the development of the variety Langdon. There is only one backcross to a durum, Ld. 308, in the breeding of Yuma. It is nearly as resistant to 15B as its Khapli emmer parent.

Yuma is about two days earlier than Mindum. Its straw is about the same as Mindum for strength but it is six to eight inches shorter. It is superior to Mindum for yield when stem rust is severe enough to hurt Mindum. It has the lowest test weight of the four new varieties and is considered acceptable for macaroni quality. It has high resistance to shattering, which is a result of the large fraction of Khapli emmer in its parentage.

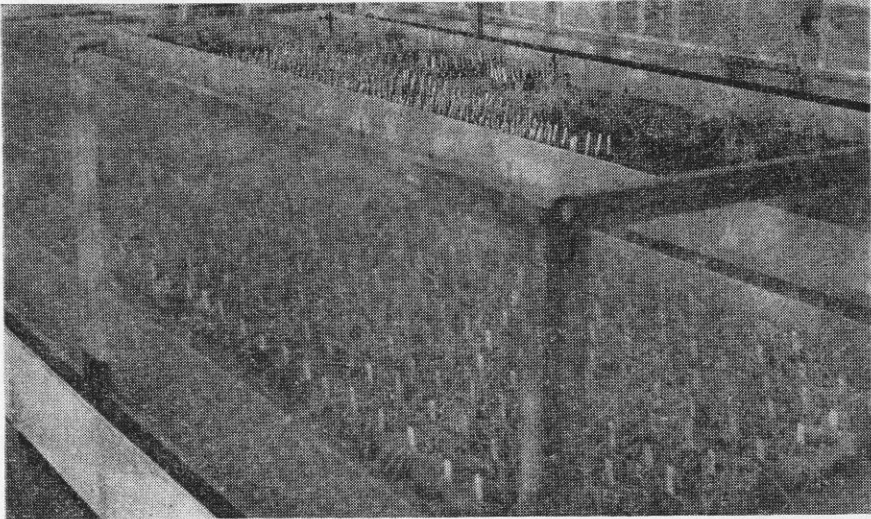


FIGURE 2.—Young durum plants, infected with stem rust, growing in the greenhouse. The reaction to stem rust observed on these plants determines which ones will be discarded and which will be harvested and grown again for increase, perhaps eventually to become new durum wheat varieties.

This variety is named in recognition of Yuma county, Arizona, where the seed increase of these four new varieties was grown during the winter of 1954-55. This winter increase made possible the seeding of nearly 8,100 bushels of new rust resistant durum in 1955 instead of only 238 bushels.

Ramsey (Ld. 369)

Ramsey is a selection from the cross, Carleton x P.I. 94701. The P.I. 94701 is a durum introduction from Palestine which was found to be resistant to Race 15B in the 1950 stem rust epidemic. This resistance is expressed in very small pustule size rather than in

complete absence of rust. The reaction changes toward greater susceptibility with higher temperatures. The P.I. 94701 resistance has been found to be ineffective against some of the rust races which were in the durum area before 1950. Therefore selections from this cross had to be checked for resistance to these old races as well as 15B. The results of the tests indicate that in Ramsey some factors for resistances from both Carleton and P.I. 94701 have been obtained.

Ramsey appears to mature about the same time as Mindum. It is one to two inches shorter in straw height than Mindum and slightly more resistant to lodging. It has shown good yielding ability at a wide range of locations. Its test weight and semolina quality are very satisfactory.

This variety is named in recognition of Ramsey county, North Dakota, another one of the larger durum producing counties in the "durum triangle."

Towner (Ld. 370)

Towner also is a selection from the cross, Carleton x P.I. 94701. The stem rust reaction of this variety appears to be the same as that of Ramsey. Since both varieties have the same sources of resistance and were selected and tested at the same time under the same conditions, they may be expected to behave similarly with any new races which might appear in the future.

Towner is similar to Mindum in date of maturity and height and strength of straw. It is superior to Mindum for yield, when stem rust is severe enough to hurt Mindum. It has high test weight and a smooth kernel type. It has a tendency to form chlorotic specks on its leaves in some seasons—a fault inherited from its Palestine



FIGURE 3.—Harvesting the new durum variety seed increases at the Langdon Branch Station.

parent. The yield tests indicate this variety performs best in the northern part of the durum area. It has been found to be satisfactory for macaroni making qualities.

This variety is named in recognition of Towner county, North Dakota, also one of the larger durum producing counties in the "durum triangle."

Increase and Release

The serious threat to the durum wheat crops from the destructive 15B epidemics made the concurrent breeding, testing, and the increasing of seed of promising new lines urgent. Time was saved by increasing promising lines in the very early stages along with the testing. Many of these lines, however, have since been discarded when later tests showed that they had some serious limitations. The quantity of seed of the remaining lines, already on hand and going into distribution, appears to have justified the early increases.

Each of these four new varieties now offered for release has resulted from the increase of an F_4 plant. Therefore some variation in plant type can be expected due to subsequent segregations. This variation, however, is regarded as of secondary importance when the urgent need for rust resistance is considered. The tests to date are not complete, nor have they extended over a sufficiently long period to determine conclusively which of the four lines or varieties are superior, when all characteristics making up a good variety are considered. However, all have value in assuring considerable protection against 15B.

Of the lines increased, four are released because more rust resistant seed could thus be produced in a given period of time. An attempt to determine the best one of these four would have required more time, also more seed for testing. In the early stages the seed increase then would have been retarded. The four varieties also offer two sources of stem rust resistance, thus increasing the chances for protection against a new race or races which later might come into the area.

Elsewhere in this publication is a more detailed discussion covering the increase of these durums. Twelve counties in North Dakota comprise the larger portion of the durum growing area. Therefore, much of the seed available for increase in the spring of 1955 was placed in those counties, and a lesser portion of the increase was placed in the more marginal durum counties. Other states sharing in the available seed were Minnesota and South Dakota, also the Province of Manitoba through the Dominion Laboratory of Cereal Breeding, Winnipeg, Canada. Further distribution of the seed for 1956 plantings in North Dakota will be mainly in those counties where the 1955 increases were made.

Acknowledgments

Durum wheat breeding in North Dakota is conducted cooperatively by the North Dakota Agricultural Experiment Station and the Field Crops Research Branch, Agricultural Research Service, U. S. Department of Agriculture.

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Fewer Farms—But More Facilities

Preliminary report of the 1954 census of agriculture shows that North Dakota had 61,939 farms in 1954. Of these farms, 28,358 have telephones; 55,815 have electricity; 11,178 have television sets; 25,400 have piped running water; 25,195 have home freezers; 2,218 have electric pig brooders; 16,464 have electric feed grinders; and 11,886 have milking machines.

Cass county leads all counties in all facilities. It is followed by Richland, Grand Forks and Walsh counties which also rank high in all facilities.

The leading counties in the number of farms having specified facilities are as follows:

Northwest District: telephones—Ward 892; electricity—Ward 1,766; television sets—Ward 603; piped running water—Ward 775; home freezers—Ward 825; electric pig brooders—Ward 67; power feed grinders—Ward 631; milking machines—Ward 366.

North Central District: telephones—Bottineau 928; electricity—McHenry 1,472; television sets—Bottineau 490; piped running water—Bottineau 773; home freezers—Bottineau 819; electric pig brooders—McHenry 40; power feed grinders—McHenry 480; milking machines—McHenry 424.

Northeast District: telephones—Walsh 1,177; electricity—Walsh 1,859; television sets—Grand Forks 466; piped running water—Grand Forks 918; home freezers—Pembina 856; electric pig brooders—Grand Forks 90; power feed grinders—Grand Forks 535; milking machines—Cavalier 456.

West Central District: telephones—McLean 730; electricity—McLean 1,562; television sets—McLean 308; piped running water—McLean 631; home freezers—McLean 827; electric pig brooders—McLean 49; power feed grinders—Dunn 426; milking machines—McLean 272.

Central District: telephones—Wells 689; electricity—Stutsman 1,805; television sets—Stutsman 288; piped running water—Stutsman 632; home freezers—Stutsman 797; electric pig brooders—Stutsman 63; power feed grinders—Stutsman 499; milking machines—Stutsman 532.

East Central District: telephones—Cass 1,577; electricity—Cass 2,219; television sets—Cass 1,365; piped running water—Cass 1,474; home freezers—Cass 1,251; electric pig brooders—Cass 197; power feed grinders—Cass 736; milking machines—Cass 580.

Southwest District: telephones—Hettinger 582; electricity—Stark 1,011; television sets—Stark 87; piped running water—Stark 486; home freezers—Stark 589; electric pig brooders—Hettinger 73; power feed grinders—Stark 418; milking machines—Stark 264.

South Central District: telephones—Morton 881; electricity—Morton 1,338; television sets—Morton 427; piped running water—Morton 577; home freezers—Morton 602; electric pig brooders—Morton 45; power feed grinders—Emmons 506; milking machines—Morton 399.

Southeast District: telephones—Richland 1,349; electricity—Richland 2,191; television sets—Richland 939; piped running water—Richland 1,202; home freezers—Richland 917; electric pig brooders—Richland 142; power feed grinders—Richland 652; milking machines—Richland 453.