Intensive Seed Increase Program Hastened Release of New Durums

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The serious threat to the North Dakota wheat crop from stem rust after 1950, when Race 15B became established in the wheat producing areas, resulted in greatly expanded breeding and testing programs. To find sources for resistance to this new race, and to incorporate this resistance into suitable varieties, became a major objective of plant breeders in all large wheat producing states. It became especially so in the northern spring wheat states where the exposure to, and injury from, rust could be most serious. Durum wheats, very susceptible and maturing late, were especially vulnerable to injury from this rust.

Results now coming from this expanded program are encouraging. New varieties of durum that promise considerable resistance to 15B have been developed. A considerable supply of the new seed has been built up and will go into wide distribution in 1956. This expanded and "stepped up" program was made possible through the coordination and cooperation of many workers in many fields, plus the enlarged greenhouse and testing facilities made available by recent legislatures.

Added greenhouse facilities permitted the propagation and testing of early generations of hybrid material in the winter. This made it possible, in the early generations in the hybridization program, to grow two to three generations (crops) during one year. The opportunity to grow and increase the seed of new lines in the southwest—Arizona or California—where seed can be planted in the fall and harvested the following spring in time for reseeding again in North Dakota, further shortened the time when seed of new varieties might become available and in general distribution. **Actually what usually requires from 10 to 12 years, if only one plant generation or crop can be grown each year, has in this instance, been crowded into five years.** Elsewhere in this publication is a statement of the breeding and a brief description of the lines to be released for sowing in 1956.

Preliminary Increase of F_4 Lines

Because of the great urgency, individual plants which showed good rust resistance were selected as F_4's in the winter of 1952 and checked again for rust resistance in the field that year. A preliminary increase of seed of the better lines for wider testing began during the winter of 1952-53. As results from these more

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extensive tests and observations became available, the best of these lines were continued under increase. After the summer of 1953 five of the lines were under increase and the amounts of seed available, over that needed for a limited testing program, approximated 10 to 15 pounds each.

In the fall of 1953 five to 10 pounds of each of these lines were sent to Brawley, California, for a further winter increase at the Southwestern Irrigation Field Station. The results of this increase were such that approximately five acres of each could be sown at the Langdon Station in 1954. Despite late sowing, and a very unfavorable late harvest season in the Langdon area, a fair crop was harvested. The heavy loss from rust to other varieties in 1954 and the performance of these experimental lines under these severe conditions, made it seem doubly desirable that these lines, promising much needed rust protection, and acceptable in yield and semolina quality, should be released as soon as adequate supplies of seed could be made available.

Commission Provides Funds

To enable a further and larger winter increase, an appeal was made to the State Emergency Commission for funds to finance the cost of such an increase. This commission generously agreed to advance the funds necessary. Following this, arrangements were entered into with a group of farmers in Yuma County, Arizona, to grow this seed during the winter of 1954-55, under contract with the North Dakota Experiment Station. One of the five lines, which in the tests had appeared less satisfactory than the others in agronomic characteristics, and also in semolina quality, was omitted from further increase. The four lines remaining, while varying in plant characteristics, had continued to appear satisfactory and in order to make available as much resistant seed as soon as possible it seemed desirable that all four be included in the increase and made available. Later, as more information becomes available and the seed supply more adequate, there would then be opportunity, if that appeared desirable, for giving preference to one or two lines over the others.

Two Sources of Resistance

The four lines represent two distinct sources of rust resistance—two from a Khapli emmer cross and two from a cross with a durum introduced from Palestine, a durum of inferior semolina quality, lacking in resistance to the once more common races of stem rust, but found to be resistant to Race 15B. Since these new lines were the increase of F_4 plants some segregation has occurred since the selections were made. There is, therefore, some ununiformity of plant type in each of these new lines, a matter of secondary concern considering the urgent need for rust protection.

Together the seed available from the four durums totaled about 250 bushels. From this 238 bushels were sent to Arizona to be sown

on 242 acres on 10 irrigated farms in the Yuma area between November 10 and 20, 1954. (In addition to the above durum acreage, 20 acres of ND 1, a new hard red spring wheat, also was sown). Sown in November, the crop emerges promptly and continues to make good growth into early December. Later in December and through January the short days and relatively low temperatures do not allow for much growth. As days lengthen and temperatures through February and March increase, plant development increases, the wheat crop usually reaching the heading stage in late March.

Cool Weather Slows Growth

The 1954-55 winter and spring temperatures in southern Arizona were such that the crop headed and ripened about one week later than usual. Except for this, results generally were satisfactory. The earliest variety and field to be harvested was swathed May 5, 1955. The latest field, and one of the latest varieties, was not ready until May 16th. The length of time between swathing and combining varied from four to seven days, depending on how ripe when swathed and the depth of the swath.

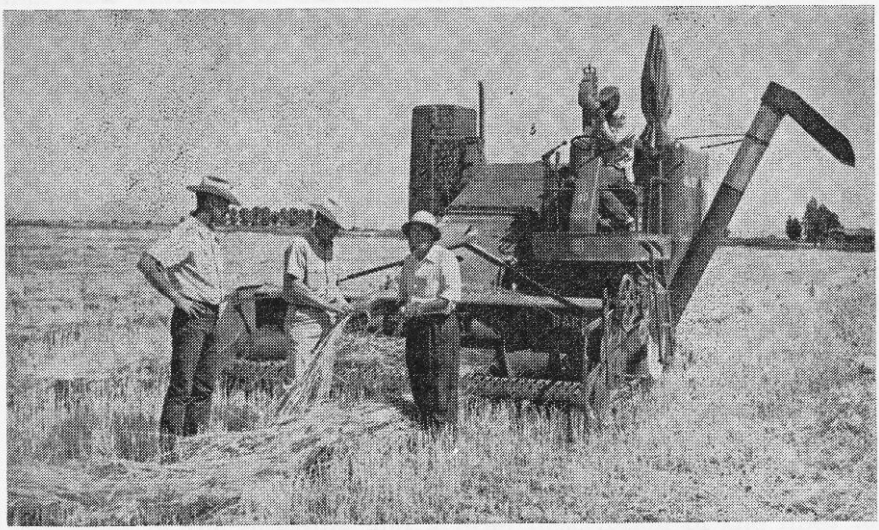


FIGURE 1.—*Combining a field of Ramsey (Ld 369), Yuma, Arizona. Spring* 1955.

The 242 acres of durum produced about 8100 bushels of new seed. Transport of the seed was by commercial truck, and as such the grain was bagged and loaded directly from the field as combined, returned promptly to North Dakota, cleaned for seed, treated and made ready for sowing again. Truck transportation from Yuma usually required from four to six days. The time between swathing a field in Arizona and when the crop was threshed, cleaned, treated and sowed again in North Dakota usually ranged between 12 and 15 days.

Many Cooperating in Increase Program

Here we wish to express the appreciation of the North Dakota Experiment Station for the excellent cooperation of the many who helped in making this program work. This includes the Southwestern Irrigation Field Station at Brawley, California, where the early increases were made; the cereal technologists assisting in evaluating the many lines for semolina quality; the State Emergency Commission which provided the funds, thus assuring that the larger increases in Arizona could be financed[4]; commercial seedsmen who set aside their cleaning plants and gave prompt attention to cleaning and treating the seed as it arrived from Arizona; members of the Extension staff in North Dakota who supervised the distribution of this seed, and last but not least the 239 farmers who by earlier arrangements agreed to pay for this seed and reserve from 20 to 40 acres of their choicest fields for it. Because of this excellent cooperation, and that of many others, there are now available about 120,000 bushels of new rust resistant durum seed where one year ago there were only 250 bushels, and if you go back to the winter of 1952, only four single plants, each of these from one kernel.

In this urgent and "speeded up" program, time has not permitted the extensive tests usual in connection with a good breeding and testing program. Similarly, time has not permitted the reselection and purification desired. It is, however, our hope and belief that no serious deficiencies will show up as these lines come into larger production.

Allocation of Seed

All new durum increases in 1955 were under contract to this Experiment Station. In the increase program the amount of seed originally allotted to each county was in proportion to its usual durum acreage. It is planned that increases now on hand largely remain in the counties where they were grown and there be allocated to other growers. The county agent, assisted by directors of the local Crop Improvement Association or some other advisory committee, will receive and approve applications for the new seed.

For the sake of the best handling and increase of new seed, local committees are urged to keep the allotment preferably at about 20 bushels to each applicant and not less than 10 bushels if possible. In some instances the local committee may find it advisable to allot larger amounts to some applicants who are recognized seed growers and who have special facilities for doing the job. Where this is desirable, the larger increases put under contract will assure a larger supply of good seed which then can be shared in substantial quantities the following year and at a price fair to all.

Seed on hand at the experimental branch stations and seed farms will be allotted to marginal durum counties not sharing in any seed in 1955. In so far as possible counties now having seed of

[4]A loan of $65,000. This has since been repaid, using the income from the seed when sold.

only one of the varieties, will be given an opportunity to share in another variety, thus assuring the growers a wider choice in the durum they grow after 1956. The stocks of seed now on hand include about 52,000 bushels of Ld 372, now named Langdon; 32,000 bushels of Ld 369, named Ramsey; 12,000 bushels of Ld 370, named Towner; and 23,000 bushels of Ld 364, named Yuma.

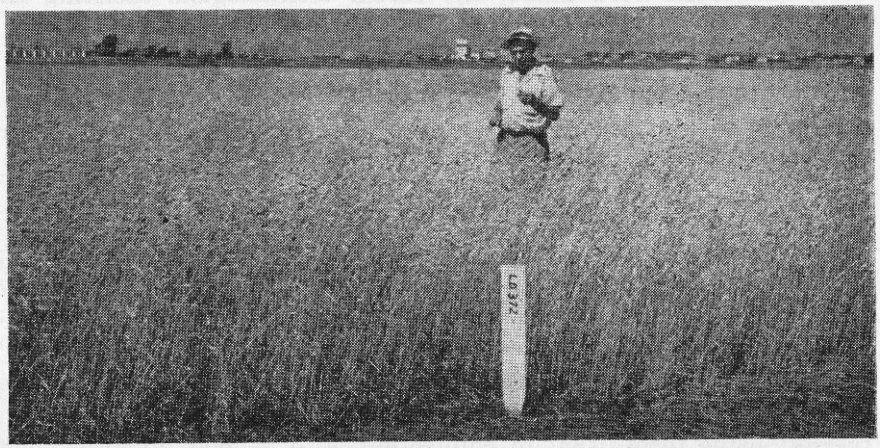


FIGURE 2.—*An increase field of Langdon (Ld 372) grown in 1955 at the Langdon, N. D., Branch Experiment Station. (Photo by W. P. Sebens.)*

While the four durums have considerable resistance to stem rust, Race 15B, they are not immune. Observations to date indicate that Langdon, Ramsey and Towner will, under severe rust conditions, show a fair amount of infection. This infection, however, as observed in the case of Ramsey and Towner, has resulted in relatively small pustules which come on rather late in the plant's development. Therefore it is believed that the interaction of the plant and the rust organism is influenced by temperatures, the higher temperature resulting in more infection. How these new varieties will compare with other durums in resistance or susceptibility to other diseases, such as the root rots or head blights, is likewise not fully known. There is not yet evidence that they will be appreciably different from the other durums in this respect. Langdon has shown a little more leaf rust than the other varieties.

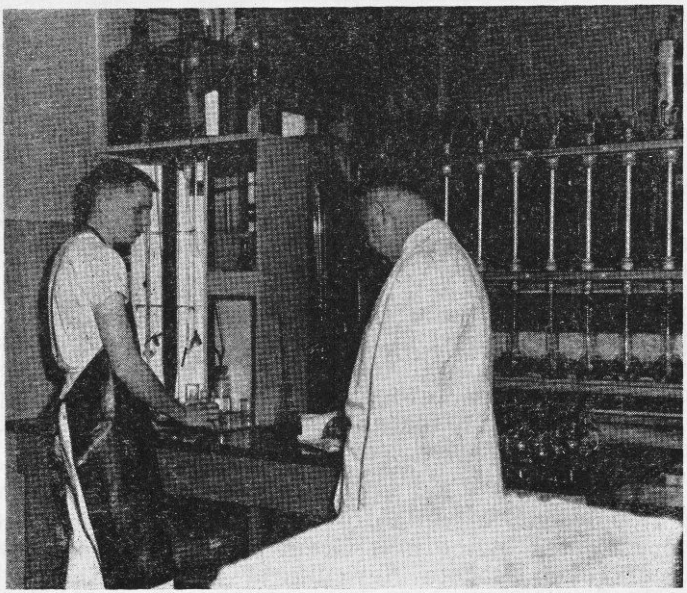
Recommendations for 1956

The supply of seed of the new durums should sow about 100,000 acres in 1956. This obviously is only a small portion of the durum acreage to be sown. It will be necessary, therefore, in 1956 to rely heavily on seed from other varieties. What, then, are the choices one can make?

There is now a larger supply of good seed and a larger variety choice than for some time. Sentry, while not resistant to Race 15B, has a degree of tolerance to this race which makes it a safer variety

than Stewart or Mindum. Also it is earlier to head and ripen, thus affording better opportunity to "escape" injury than is the case with later ripening varieties. Vernum would be the next choice. It also has some tolerance to 15B. Vernum is earlier than Mindum but later than Sentry and has a weaker straw. Mindum would be the third choice.

While no one can foretell what the rust situation may be in 1956, the outlook appears brighter and much more encouraging for the durum grower than it was a year ago. Assuming timely sowing and development of our wheat crop in 1956, with normal spore showers from the south, no new race or races of rust, and no unusually favorable environment for the rust organism, then the large acreage of resistant Selkirk and much of the remaining wheat acreage sown to rust tolerant varieties should have a considerable retarding influence on the rust build-up. This could shorten the time when the crop would be exposed to heavy infection and thereby increase chances for the less resistant varieties to come through.



NITROGEN CONTENT *of different samples of hard red spring wheat, durum wheat and barley is being determined here by Phillip Harju, a North Dakota Agricultural College student, shown here in the laboratory of the Department of Cereal Technology. Since nitrogen is an important component of protein, and protein content of a bread cereal is directly related to its nutrient value and also its baking quality, such nitrogen determinations are very important. For durum wheats a medium protein range is preferred, while in barley a high protein content is desirable for livestock feeding but a medium or relatively low content is best for malting.*