



## ***DEVELOPING WHEAT VARIETIES FOR NORTH DAKOTA IN THE 1970's***

**A. G. HAZEN**

North Dakota wheat producers traditionally have been eager to obtain and produce new varieties of wheat.

In some instances, new varieties are very essential to maintaining our wheat production in North Dakota. An example is the near disastrous 15B stem rust of the early 1950's. And there have also been many instances when wheat varieties have been named and released primarily to improve yield, or to strengthen disease resistance, or to improve market quality. Instances of improvement have not been phenomenal but they have been constant, so that the overall improvement during the past several years has been noteworthy.

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*Hazen is Dean, College of Agriculture, and Director, North Dakota Agricultural Experiment Station.*

From a legal point of view, seed wheat may be offered for sale in North Dakota almost irrespective of its origin and by almost anyone who cares to solicit sales. If the seed offered for sale is Certified or Registered by the North Dakota State Seed Department, such certification is **only** to assure the prospective buyer that the seed is distinguishable as a specific variety, that it meets certain levels of germination, that it has purity with respect to noxious weed seeds, and other characteristics of this kind. Certification is **not** for the purpose of insuring any such characteristics as yield, disease resistance, plant growth habits, or value of the wheat in the commercial market.

Seed of wheat varieties may be developed, produced, certified, and offered for sale by any

individual or by any private company or by any public agency such as the North Dakota Agricultural Experiment Station or the United States Department of Agriculture. Very often the public agencies will jointly develop, name and release a new variety. Sometimes they do it alone even though there may have been considerable collaboration and testing in the early generation materials which serve as the parentage of the new variety.

#### **New Varieties Are Significant**

With North Dakota wheat production approximating 7,000,000 acres annually, there is no question that a new wheat variety which might be planted on as little as 10 per cent of the total acreage would represent a very significant market for seed of the new variety. Ten per cent of 7,000,000 is 700,000. Assuming a seeding rate of one bushel per acre on 10 per cent of our acreage immediately indicates the need for 700,000 bushels of seed. If seed of a new variety were available for this 10 per cent of the acreage, each one dollar per bushel of actual net profit from sale of the seed would represent \$700,000 of net profit to the owners of the seed.

By the same token, any single variety occupying 10 per cent or more of our acreage can have a significant effect upon the market quality, or market value of our entire commercial wheat crop.

Your Agricultural Experiment Station and Cooperative Extension Service have a vital part to play in the business of wheat production in North Dakota. In fact, this is one of the major responsibilities of these two groups. And wheat production is an involved and intricate business. Weather, variety of seed, fertility, weeds, finance, government programs, and commercial markets, just to mention a few, are important factors involved in wheat production. With so many factors which can influence the individual producer, it is understandable that when things are not going well he is looking for someone to blame. Sometimes, some of us at North Dakota State University are considered handy for that purpose.

#### **No Laws Apply**

No law tells the professional personnel of your Experiment Station and Cooperative Extension Service when to name and release a wheat variety. There is also no law, other than libel laws, that either guides or restrains your Station and Extension personnel from giving information about any wheat variety that may be offered for sale to our producers in North Dakota.

How, then, does the Experiment Station decide when to name and release a new variety? What

information do we offer about varieties which we do not develop, name and release?

Answers to these questions are not easy. Perhaps it is best to develop answers to these questions with some background comments and some specific examples. However, all of the comments which follow can be tersely summarized by the simple statement that the decisions and statements made are human judgments based upon the best information available to professional personnel at the time they are made. They are no better or no worse than the professional competence of those who make them, and often represent a mix of many differing viewpoints generously garnished with scientific data, pressures from business interests, political considerations, and our unwavering desire to do the very best job for our producers that we know how to do. We **do** try to be careful as well as helpful.

Outlined here are some facts and some indications of our position and policy as an Agricultural Experiment Station with respect to the hard red spring and durum classes of wheat.

In the first place, North Dakota has a unique geographical and climatic location making it possible to produce and market hard red spring and durum wheats which answer a specific need in the market—both domestic and export.

#### **North Dakota Not Alone**

But, be assured that North Dakota is not the **only** place where these special wheats can be and are grown. Also be assured this special need is not by any means free from the supply-demand factor of the market. A premium quality product does not **always** command a premium price. But a premium quality product will always move in the market in preference to a lower quality product if the prices are the same.

Whether we like it or not, we simply **cannot** fully dictate either the market or the price for our wheat. We **can** work cooperatively among producers and cooperatively with industry, both domestic and foreign, in the orderly marketing of our product, and we **can** strive for a product which will be desired in the market. This means we should make every effort to both maintain and improve those characteristics of our wheats which are desired in the marketplace.

The Experiment Station believes the **long-term markets** for our North Dakota wheats are for domestic and export consumption and **not** for government purchase or storage.

The Experiment Station recognizes and welcomes wheat variety development by other public agencies and by private individuals and private organizations. However, we cannot and should not

be expected to know as much about varieties named and released by others as we know about the varieties which we develop, name and release. Neither can we allow impassioned requests for all kinds of tests to be made on large numbers of samples and on a one or two season basis to unduly disrupt or replace the great need to carry on our normal research and testing program.

Many years of experience working with thousands of tests indicate very clearly we cannot make tests on one sample of either a potentially new variety or a named and released variety, and make conclusive or reliable forecasts relative to its expected performance.

These same experiences also show why the development, naming and release of a new wheat variety should be the result of several years of professional effort from several areas of competence. The chances that a new variety may be "discovered" by accident are extremely remote indeed.

With these background comments about our position and policy as an Agricultural Experiment Station, let us very briefly outline the ever-increasing complexity of wheat variety development.

#### **Four Basic Areas of Research**

Basically, four areas of research are involved: agronomical, pathological, entomological, and cereal chemical. Sometimes these areas can be joined together as a team effort, and sometimes they operate independently.

In the agronomic area, the main factors investigated include systematic genetic search for parent lines which will provide useful offspring when crossed by the plant breeders. The plant breeder wants a plant that will grow under North Dakota conditions and provide a high yield on a strong straw and that can be reasonably harvested and stored. This involves soil fertility and management, and plant disease resistance. Plant breeders are constantly learning more about how to choose parents in the breeding program to salvage desirable characteristics and eliminate undesirable characteristics. But, breeders also have a very long way to go with respect to unlocking more of the secrets of nature.

Plant pathologists have a vital contribution to make in the development of new wheat varieties. Just remember this fact: there is no variety now available which can be considered immune to plant diseases. Rather, plants will exhibit levels of tolerance or resistance. Plant diseases are like people. They come in all sizes, shapes, and forms. You do not really know what kind of person you are dealing with until you have some experience with him

or see how he responds under pressure or stress. There is no simple test for the performance of a plant when exposed to diseases. Rather, such evaluation is a very complicated process requiring considerable time.

#### **Many Other Diseases**

While much is known about stem rusts and leaf rusts and other foliar diseases, about kernel blights, and ergot, and the like, we have not even scratched the surface with knowledge of many diseases not readily seen with the naked eye—the diseases and fungi which operate under the surface of the soil and attack the root systems of our domestic plants.

Then, there are the insects. Entomologists concern themselves with sawflies, grasshoppers, aphids, greenbugs, cereal leaf beetles, and a host of others which can devastate both the growing plant and the stored grain crop. Future control of these pests can be much better only if we more fully understand the life cycle, feeding habits, and physiology and metabolism of each of these insects as they exist under North Dakota conditions.

Most of us have little difficulty in recognizing a healthy crop of wheat as it grows. Each producer has no difficulty measuring the results of his management, his expense of production, and the value of his harvested crop. Bushels in the bin is a very convincing measure of the success of a wheat variety or a wheat crop.

While bushel yield is important as it translates into dollar profit or loss, we cannot escape the ultimate fact that unless there is some demand and use for a product, a large yield can be less profitable than a smaller yield if the larger yield does not fit a market need and the smaller yield does fit a market need.

This is what wheat quality is all about.

#### **Mistaken Judgments**

And this is where we really have a major problem of decision-making to deal with as wheat varieties are evaluated. All too often the impression seems to prevail that a sample of grain can be given a simple quality test. Unless one is willing to take the time to understand the quality factor, he can quickly come to such conclusions and reactions as we have been frequently reminded of. These mistaken judgments may be typified by the two most prevalent reactions heard many times. They go something like this—sometimes more politely stated than the choice of words below, and sometimes even more bluntly:

"1. Those academic egg-head professors at NDSU aren't interested in promoting any wheat

variety that they have not developed, named and released; and,

"2. This quality thing is a myth. Wheat is wheat, and a lot of that quality talk is just running scared from big industry. Let's call their bluff and make them take a lower quality if it means more yield to us."

These kinds of comments are powerfully persuasive, and when a person is having a tough time making the dollars stretch he is anxious to at least try any reasonable proposition to improve his situation.

So, let us consider further this elusive thing we call wheat quality. As has already been suggested, wheat quality is **not** a simple or single characteristic of wheat. It is **not** something which can be determined easily, and it is variable not only between varieties but also between geographic locations and different seasons of weather. Once produced and harvested, wheat quality can be affected further by storage and transportation conditions.

To arrive at a valuable and enduring judgment of wheat quality, one must keep in mind two principal parties. One of these is the wheat producer and the other is the first purchaser of the wheat who will begin its processing—the miller.

#### **Plant Breeding is Important**

Many years of experience have demonstrated that plant breeding techniques can greatly influence wheat quality. Breeding a new variety cannot in itself guarantee that every crop produced from that variety will be either equal or entirely consistent in quality. But, these same years of experience have provided ample evidence that plant breeding provides **the best single** potential for quality control and consistent quality. Giving careful attention to quality, together with the disease and other environmental factors that can be controlled, has produced the plant breeding techniques that have been so successful in developing and maintaining what we regard today as desired wheat quality standards.

A judgment of hard red spring wheat quality is the result of analyzing at least 20 different factors which can be measured in the laboratory. Some of these factors are considered more important to quality than others, but it is the combination of all of them that constitutes the basis for judgment. Many of the same factors and techniques used in quality determinations for new lines of wheats being tested as potential new varieties are also utilized by industry to determine the quality of commercial wheat used for milling and baking.

Measurement starts with the kernels of wheat before any processing has taken place. Test weight

and protein content are familiar tests. Additionally, the 1,000 kernel weight, kernel size, and enzymes are examples of determinations made with the kernel.

In changing the raw kernel into a milled wheat flour, additional factors including pounds of flour yield from each 100 pounds of grain, conditioning properties, ease of milling, ash content, protein content of the milled flour and the speck count in the flour are determined. Some wheat kernels have more protein in the bran than others, and all of the protein is not transferred to the milled flour.

#### **Quality of Bread Dough**

After milling the wheat to flour, it is possible to develop further quality measurements as the flour is converted to bread dough. Plasticity of the dough is recorded on Farinograph machines. The mixing time, which is so critical in automatic machine bakeries, is measured. And the elastic properties of the dough are determined.

Finally, as the dough is allowed to ferment and then is baked into a loaf of bread, loaf volume, crust color, crumb color, panning characteristics, and absorption are among the useful factors which are measured.

Quality of durum wheat is determined similarly to hard red spring wheat, except instead of baking the dough into bread, the semolina is extruded into spaghetti or macaroni where similar characteristics may also be determined.

Domestic and foreign millers do not buy wheat from our area on the basis of a specific variety. Rather, this geographical area has developed a reputation over time as being dependable for consistently high quality from the several varieties produced each year. Therefore, quality reports of the total North Dakota crop reflect the total or average quality of all the varieties combined during a particular season. These quality determinations can be accepted with a high degree of confidence only so long as all the wheat, or at least a high percentage of it, is produced from varieties having acceptable and comparable quality characteristics.

#### **Research on Yield and Quality**

To the present time, the North Dakota Agricultural Experiment Station has maintained a program of hard red spring and durum wheat research and information directed toward the dual objectives of keeping as high yield **and** as high quality among wheat varieties as possible. Based upon numerous visits by foreign trade teams and frequent consultation with domestic processors, we believe we have a unique market, both domestic and export, which

is based upon this concept of quality. And unless currently utilized standards of the several factors are at least maintained, if not improved, North Dakota stands the distinct risk of losing this unique market. Alternative sources of lower quality wheat are available to the millers. These sources would have an economic production and transportation advantage over this area if North Dakota wheats were not of any higher quality than wheat from those areas.

#### **Hard to Regain Lost Markets**

A market once lost due to lowering of quality can be most difficult, if not impossible, to regain.

Returning to the two questions asked earlier:

1. How, then, do we decide when to name and release a new variety?
2. How do we decide what information to offer about varieties which we do not develop, name and release?

We decide to name and release a wheat variety when, in our judgment, the proposed new variety should equal or improve some of the major agronomic, pathologic and quality characteristics without highly jeopardizing the remaining characteristics. A favorable decision is normally reached no earlier than the eighth generation after the first breeding cross, and after at least three seasons of field testing and quality determinations from large plots and seed increase fields. This means a minimum of about six years from the first plant breeding cross to naming and releasing a variety for commercial production. Thousands are rejected regularly.

With respect to information about varieties which we do not develop, name and for commercial production, reasonable efforts will be made to provide available information. If the advanced experimental materials of these potential varieties are shared with the Experiment Station and are in our tests, we can formulate recommendations earlier than if we must wait until after a material is named and released before we test it.

#### **Some Varieties Not Recommended**

At this time we feel very strongly that some recently named and released varieties in our area are deficient enough in desired quality to recommend they should **not** be grown in significant commercial quantities in North Dakota.

Specifically, the 1969 release of a hard red spring wheat variety from Canada named Neepawa is not recommended by NDSU for commercial production in North Dakota. This judgment decision was reached after the 1970 crop was harvested. Here is an instance where the Station's early tests of samples of the experimental line, before it was

named and released as Neepawa, indicated it might be acceptable for quality. Seed of this potential variety was obtained and then increased on our Branch Stations and with cooperative North Dakota seed increase growers during the 1970 season. It appears now, after further testing of Neepawa grown under North Dakota conditions, some of the desired quality characteristics have not been maintained.

Two hard red spring wheats, Era and Fletcher, released in 1970 by the University of Minnesota are not recommended by NDSU for commercial production in North Dakota. These varieties are both semi-dwarf types of wheat.

The three semi-dwarf types of wheat varieties named and released by World Seeds, Inc.; namely, Red River 68, named and released in 1967; World Seeds 1812, named and released in 1969; and World Seeds 1809, named and released in 1970; are not recommended by NDSU for commercial production in North Dakota.

Bonanza, another semi-dwarf type of hard red spring wheat named and released by DeKalb Ag Research, Inc., in January, 1970, is not recommended by NDSU for commercial production in North Dakota, nor is Bounty 208 from Cargill.

Varieties named and released both by private interests and by sister public institutions are evaluated as objectively as we know how in our greenhouses, plots, fields, and processing laboratories.

#### **Professional Research and Extension**

The state has at NDSU a professional research and extension team which is highly competent, thoroughly objective, and fiercely loyal to the North Dakota crop and livestock producers. There is really no other reason for their existence, and they know and believe this. At the same time, they are human beings working in a somewhat unpredictable and ever-changing biological environment where Mother Nature still maintains a multitude of secrets. Therefore, their findings and recommendations are subject to unintentional error. Even so, the batting average has been historically excellent, perhaps even superior, when comparing the past recommendations and forecasts with historical facts.

We expect and encourage the producer to make his own decisions with respect to variety selection. Consider and use our recommendations for what they are intended to be: human judgments based upon experience, information available, and a dedicated desire to assist in maintaining and improving the economic and social well being of our North Dakota people.