



Dr. Frohberg inspects new Ellar wheat.

ELLAR...

A New Conventional Height Hard Red Spring Wheat

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Ellar is a new variety of hard red spring wheat released January 24, 1974, by the North Dakota Agricultural Experiment Station. The United States Department of Agriculture has participated in evaluating and testing Ellar. This variety is heavier in test weight and less susceptible to ergot than the hard red spring wheat variety, Waldron. Ellar is higher yielding when compared to Chris, equal to Waldron but not equal to Era, World Seeds 1809 and Olaf. This new awnless variety displays good field resistance to the prevalent races of stem and leaf rust.

Ellar (pronounced L-R) wheat is named in honor of L. R. Waldron, who was hard red spring wheat breeder for 38 years at the North Dakota Agricultural Experiment Station.

Agronomic Performance

Early generation evaluation indicated the potential agronomic desirability of the experimental line now named Ellar. Since 1970 Ellar has been tested as ND 491 for four years in field plot trials,

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in the Uniform Regional Hard Red Spring Wheat Nursery and for three years in the Crop Quality Council commercial quality tests.

Yield data from the individual North Dakota Agricultural Branch Experiment Stations show that Ellar and Waldron have yielded similarly at all locations except the Dickinson and Carrington (dryland) Stations (Table 1). At the western North Dakota locations, Ellar has yielded somewhat better than World Seeds 1809 but less than Era at all stations.

Comparative agronomic and disease data from the North Dakota Stations (Table 2) indicate that Ellar, compared to Waldron, is heavier in test

Table 1. Yield in Bushels Per Acre of Six Hard Red Spring Wheat Varieties Grown at North Dakota Stations, 1970-73.

| Variety | Dickinson | Williston | Minot | Carrington | | Langdon | Fargo |
|------------------|------------------|-----------|-------|------------|-----------|---------|-------|
| | | | | Dryland | Irrigated | | |
| | (3) ¹ | (3) | (2) | (3) | (3) | (3) | (4) |
| Ellar | 30.1 | 26.7 | 44.8 | 44.1 | 61.6 | 49.2 | 54.3 |
| Chris | 32.6 | 25.3 | 44.9 | 39.4 | 54.2 | 51.7 | 47.6 |
| Waldron | 32.2 | 27.4 | 43.0 | 41.6 | 61.0 | 49.9 | 55.6 |
| Era | 41.8 | 29.7 | 54.7 | 47.8 | 65.2 | 67.0 | 60.8 |
| World Seeds 1809 | 26.6 | 25.3 | 42.0 | 47.6 | 66.6 | 62.2 | 56.1 |
| Olaf | 34.5 | — | 46.2 | 48.2 | 65.6 | — | 58.1 |

¹ Number of tests.

weight, less susceptible to ergot, and similar for maturity, plant height and lodging resistance. Ellar has ranked equal to Waldron for leaf rust resistance, and superior to Chris, Era and World Seeds 1809. Incidence of leaf spotting diseases for Ellar, Waldron and World Seeds 1809 has averaged higher than Chris and Era.

Agronomic data from the regional nursery tests in the United States and Canada (Table 3) indicate that Ellar should be adapted to the upper midwest spring wheat production area. Information from the regional nursery was similar to and supported the data from North Dakota stations.

Resistance to Stem Rust

Ellar has shown resistance or moderate resistance to numerous stem rust races in North America (Table 4). Seedling plants have been moderately resistant to strains of race 15B prevalent in North Dakota and to cultures of races 32, 113 and 151 from Texas and Mexico. Ellar's stem rust reactions are similar to those of Olaf and Waldron; however, Waldron has a higher level of resistance to more races than either of the other two cultivars. Adult plants of Ellar have showed a high level of resistance to a composite of races

17, 29, 32, 87 and 151. In the field, adult plants were resistant or moderately resistant to races 32 and 151 in the Puerto Rico rust nurseries. Also, it was resistant to stem rust strains occurring naturally and cultures used in artificial inoculations in the 1971 International Spring Wheat Rust Nursery grown in North America and Mexico. Furthermore, when grown in the 1970-73 Uniform Regional Yield Trials, Ellar has shown adequate levels of resistance. With the exception of 1970, in which its rust reaction was predominantly resistant mixed with a few moderately susceptible infections, Ellar has maintained a good level of resistance to race 15B artificially inoculated in the 1970-73 Fargo rust nursery.

Milling and Baking Quality

In addition to very good agronomic properties, new wheat varieties should be satisfactory for commercial utilization. New hard red spring wheats should be relatively high in test weight and wheat protein content. They should also mill satisfactorily on equipment used in commercial milling. The milled flour should be low in ash content and produce good quality bread under a range of conditions.

Table 2. Summary of Agronomic Performance of Five Hard Red Spring Wheat Varieties Grown at North Dakota Stations, 1970-73.

| Variety | Date Head | Height Inch | Ldg. Score ¹ | % Rust Leaf Stem | Leaf Score ² | Ergot % ³ | Test Weight Lbs/Bu | Yield Bu/A |
|------------------|-------------------|-------------|-------------------------|------------------|-------------------------|----------------------|--------------------|------------|
| | (24) ⁴ | (22) | (12) | (11) | (7) | (5) | (25) | (21) |
| Ellar | 6-30 | 34 | 1.3 | tMR | 0 | 4.1 | 60.2 | 44.8 |
| Chris | 7-4 | 36 | 4.5 | 20MS | 0 | 3.0 | 60.4 | 42.2 |
| Waldron | 6-30 | 34 | 1.3 | tMR | 0 | 3.9 | 59.6 | 45.0 |
| Era | 7-6 | 29 | 1.7 | 10MS | 0 | 3.0 | 61.1 | 52.7 |
| World Seeds 1809 | 6-26 | 26 | 1.7 | 10MS | 0 | 4.2 | 60.5 | 47.3 |

¹ Lodging score, 1 is erect; 9 is completely lodged.

² Leaf spotting diseases visual rating 1, no infection; 6, severe infection.

³ Percentage ergot by weight in grain samples cleaned for milling, 1971.

⁴ Number of tests.

Table 3. Summary of Agronomic Performance of Five Hard Red Spring Wheat Varieties Grown in the Uniform Regional Nursery, 1971-72.

| Variety | Days To Head | Height Inch | Ldg. Score ¹ | Leaf Rust | Stem Rust | Leaf Score ² | Shattering % ³ | Test Weight Lbs/Bu | Yield Bu/A |
|---------|-------------------|-------------|-------------------------|-----------|-----------|-------------------------|---------------------------|--------------------|------------|
| | (30) ⁴ | (31) | (21) | (18) | (14) | (6) | (4) | (38) | (36) |
| Ellar | 61 | 35 | 2.2 | R | R | 3.5 | 14 | 60.0 | 44.1 |
| Chris | 64 | 38 | 4.5 | R-MS | R | 3.0 | 11 | 60.0 | 41.0 |
| Waldron | 62 | 35 | 2.2 | R | R | 4.0 | 13 | 59.3 | 44.1 |
| Era | 66 | 30 | 2.1 | R | R | 2.9 | 2 | 60.6 | 53.0 |
| Olaf | 63 | 31 | 1.7 | R | R | 3.3 | 5 | 60.1 | 48.8 |

¹ Lodging score, 1 is erect; 9 is completely lodged.

² Leaf spotting diseases visual rating 1, no infection; 6, severe infection.

³ Visual estimate on plot border rows about 10 days after harvest.

⁴ Number of tests.

Quality tests involving milling, baking and rheological (physical dough) properties conducted on Ellar for the past four years classify this variety as satisfactory. In general, the overall quality characteristics of Ellar are rated as better than World Seeds 1809 and considerably better than Era. Ellar, however, ranked slightly lower than Waldron or Chris.

Tables 5 and 6 show comparable average data for Ellar, Chris, Waldron, Era and World Seeds 1809. These tables represent 26 samples grown and tested over a four-year period at Fargo and other branch stations throughout North Dakota.

In percentage of vitreous kernels, which is a major grading factor, Ellar is about equal to Waldron and Chris, better than World Seeds 1809 and much better than Era. The test weight of Ellar is higher than Chris or Waldron, but is not as high as Era or World Seeds 1809. Test weight is important from both the standpoint of the grower and the miller. Plump heavy wheat usually is higher in grade and, hence, the price per bushel to the grower is usually higher. Plump wheat generally yields more flour and this is important to the commercial miller.

Hard red spring wheat varieties that are high in wheat and flour protein contents are very de-

sirable, not only from a nutritional standpoint but, more importantly, these factors are usually associated with good baking qualities. Although Ellar is lower than either Chris or Waldron in wheat and flour protein contents, it has higher protein content than Era and World Seeds 1809. The drop in protein from wheat to flour for all of the varieties shown in the table are at acceptable levels. The flour extraction obtained from experimental milling tests is lower for Ellar than any of the other varieties shown, but within the range of acceptability. The flour ash (mineral) content of this new variety also is acceptable.

Possibly the best criterion for wheat quality is the baking test when performed under specific controlled conditions in which all variables, except the flours being evaluated, are kept as constant as possible. Absorption, an important characteristic, is of great interest and concern to the commercial baker and refers to the quantity of water required to obtain a dough of proper consistency for baking. A flour that is high in absorption will produce more pounds of bread per sack of flour than one with low requirements. As shown in the table, the absorption of Ellar is the highest in this comparison. It is 0.6 of a percentage unit higher than Chris, 1.0 percentage unit higher than Waldron and 2.8 and 4.3 percent-

Table 4. Seedling Reactions of Five Bread Wheat Varieties to Races of the Stem Rust Fungus, Puccinia Graminis, f. sp. Tritici.

| Variety | Race and Varietal Reaction* | | | | | | | | | | | |
|---------|-----------------------------|----|-------|-------|----|----|----|-----|----|------|-----|-----|
| | 9 | 11 | 15B-2 | 15B-6 | 17 | 29 | 32 | 38 | 56 | 87 | 113 | 151 |
| Ellar | R | R | MR | MR | R | MR | MR | MR | MR | MR | MR | MR |
| Chris | R | R | R | S | R | R | MS | SMR | R | MR | MS | MS |
| Waldron | R | R | R | MR | R | R | MR | MR | R | R | MR | MR |
| Era | R | R | R | R | R | MS | MR | MR | R | R | MR | MR |
| Olaf | R | MR | MR | MR | R | MR | MR | MR | MR | MRMS | MR | MR |

*R - resistant, MR - moderately resistant, MS - moderately susceptible, S - susceptible.

Table 5. Summary of Average (4 Years) Quality Data for Ellar, Chris, Waldron, Era and World Seeds 1809 Comparably Grown at North Dakota Stations (1970-71-72-73 Crops).

| Variety | Vitreous Kernels | Test Weight | Wheat Protein ¹ | Flour Protein ¹ | Protein Difference From Wheat to Flour ¹ | Flour Yield | Flour Ash ¹ |
|------------------|---------------------|----------------|-------------------------------|-------------------------------|--|----------------|---------------------------|
| | % | lbs/bu | % | % | % | % | % |
| Ellar | 87 | 60.6 | 14.8 | 13.9 | -0.9 | 67.0 | 0.42 |
| Chris | 88 | 60.3 | 15.0 | 14.4 | -0.6 | 67.8 | 0.42 |
| Waldron | 88 | 59.9 | 15.2 | 14.4 | -0.8 | 67.9 | 0.44 |
| Era | 77 | 61.7 | 13.4 | 12.5 | -0.9 | 70.5 | 0.44 |
| World Seeds 1809 | 84 | 61.5 | 14.5 | 13.6 | -0.9 | 68.8 | 0.40 |

¹ Expressed on a 14.0% moisture basis.

Table 6. Summary of Average (4 Years) Quality Data for Ellar, Chris, Waldron, Era and World Seeds 1809 Comparably Grown at North Dakota Stations (1970-71-72-73 Crops).

| Variety | Absorption | Mixing Time | Loaf Volume | Crust Color ¹ | Symmetry ² | Grain and Texture ³ | Crumb Color ³ | Farinogram Classification |
|------------------|------------|----------------|----------------|-----------------------------|-----------------------|-----------------------------------|-----------------------------|------------------------------|
| | % | min. | cc. | | | | | |
| Ellar | 66.6 | 6.8 | 877 | 4.0 | 4.4 | 8.0 | 8.0 | 5.2 |
| Chris | 66.0 | 6.5 | 903 | 4.0 | 4.4 | 8.0 | 8.2 | 5.8 |
| Waldron | 65.6 | 6.6 | 901 | 4.0 | 4.4 | 8.0 | 7.8 | 5.2 |
| Era | 62.3 | 6.8 | 832 | 4.0 | 4.4 | 7.9 | 7.2 | 5.2 |
| World Seeds 1809 | 63.8 | 6.2 | 871 | 4.0 | 4.4 | 7.4 | 7.6 | 5.5 |

¹ Highest score 4.0.

² Highest score 5.0.

³ Highest score 10.0.

age units higher than World Seeds 1809 and Era, respectively.

Although the loaf volume of Ellar is lower than Chris or Waldron, it is higher than either Era or World Seeds 1809. Loaves having a large volume are desirable provided other factors, such as the general shape of the loaf (symmetry) and the color of the loaf crust, are satisfactory. Ellar is equal to all of the varieties in these two factors. The internal characteristics of the loaf are ascertained routinely and provide information concerning the grain and texture and color of the crumb. The grain and texture of a desirable loaf should contain relatively small elongated thin-walled cells of uniform size. In addition, the texture should have a "silky sheen" to the surface. The desirable color of the loaf crumb made from unbleached flour should be bright and only slightly creamy. The crumb grain and texture of Ellar is equal to Chris and Waldron, slightly better than Era, but considerably better than World Seeds 1809. The crumb color of Ellar is not as good as Chris; however, it is better than Waldron or World Seeds 1809 and much better than Era.

Although not all of the physical dough (rheological) data are presented in Table 6, complete tests were performed on all of the varieties shown. Physical dough properties are relatively difficult to define. Possibly the simplest explanation could be termed the "elastic properties" of a flour-water dough.

One of the most widely used instruments for physical dough testing is the Brabender Farinograph. The Farinograph is a recording dough instrument that measures plasticity and mobility of dough subjected to prolonged, relatively gentle mixing action at a constant temperature. Resistance offered by the dough to the mixing blades is transmitted through a dynamometer (a device

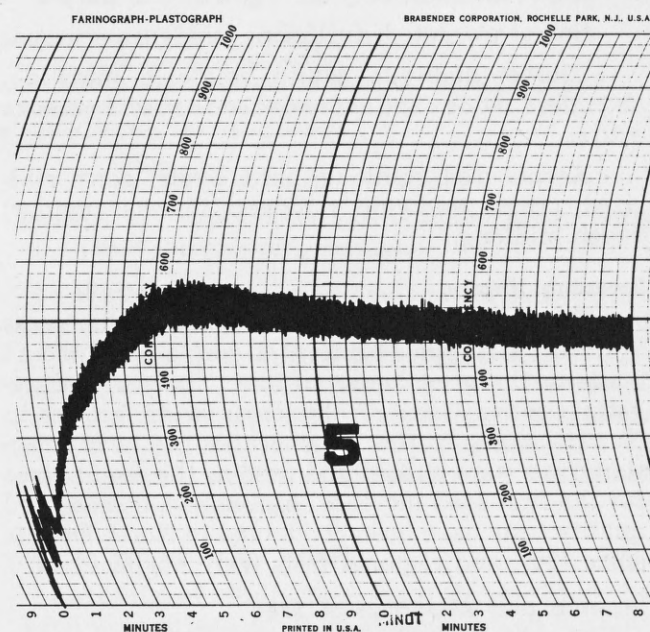


Figure 1. Farinogram showing average mixing strength of Ellar.

which measures mechanical energy) to a pen that traces a curve on a kymograph chart. This chart, which is commonly called a farinogram, provides information concerning the mixing time, the mixing tolerance and the absorption (or water-binding capacity) of the flour being tested.

A typical farinogram pattern for Ellar is shown in Figure 1. Although the farinogram classification of Chris is a little higher than the other varieties shown in this comparison, all would be ranked as having "medium strong" type gluten properties and all would be satisfactory.

Ellar has been tested in the Uniform Regional Nursery for four years. On the basis of these tests, Ellar was classified on the average as having "good promise."

At a recent meeting of the Crop Quality Council (February 5, 1974), the average results obtained from 10 samples of Ellar tested over a three-year period were considered by research personnel from 21 different state, federal and industrial wheat quality laboratories. It was concluded that the baking characteristics of Ellar, although not quite equal to Chris, were satisfactory. In general, it was the overall opinion of the group that Ellar meets the milling and baking requirements for upper midwest spring wheat.

Botanical Description

Ellar is a hard red spring wheat variety, *Triticum aestivum* L., with the following botanical description:

Growth habit: typical spring, daylength sensitive.

Stem: mid-tall, very strong, white to purple.

Spike: awnleted, fusiform, middense, erect.

Glume: glabrous, white, midlong, midwide; shoulders wide and rounded to square; beaks acute.

Kernel: red, midlong, hard, ovate; germ mid-sized; crease midwide, middeep; cheeks angular; brush midlong.

Breeding History

Ellar, CI 17289, is a selection from the cross Waldron/4/Kenya Farmer/3/Lee//Mida/Cadet made in the greenhouse in 1964. The early segregating generations of the cross were grown in North Dakota. In the F₅ generation, 14 head selection rows were bulked and used as the seed source for the first seed increase. Agronomic, disease and quality tests have been conducted in North Dakota since 1969, and regional tests were begun in 1970.

Increase and Allocation of Seed

The first increase of Ellar was produced from a block of rows in the 1968-69 winter nursery at

Ciudad Obregon, Sonora, Mexico. Ten bushels of seed in 1969 and 40 bushels in 1971 were produced at the Agronomy Seed Farm, Casselton, N.D. Part of this seed was used for seeding field plot trials and commercial quality tests. A winter increase (1971-72) near Yuma, Arizona, produced 240 bushels of seed. Further increase was delayed until 1973 so that additional information could be obtained on the response of Ellar to ergot infection. Foundation seed available from these increases will be allocated in North Dakota to County Crop Improvement Associations and the Seed Division of the North Dakota Agricultural Association for seed increase in 1974. Allocation will be made to other states in compliance with the policy of mutual sharing of new variety seed stocks.

The North Dakota Agricultural Experiment Station will maintain purified Breeders seed of Ellar hard red spring wheat for Foundation seed growers so long as the variety is commercially in demand.

Summary

Ellar, a new conventional height hard red spring wheat variety, has been released by the North Dakota Agricultural Experiment Station. It is heavier in test weight and less susceptible to ergot than the HRS wheat variety, Waldron. Ellar is similar to Waldron for other agronomic characters and resistance to stem and leaf rust.

Ellar is a little lower than Chris or Waldron in wheat and flour protein contents. The drop in protein from wheat to flour is at an acceptable level, as is flour yield and flour ash. Ellar appears to be exceptionally high in flour-water absorption. All of the other quality values reported are satisfactory. In general, it appears that the overall quality of Ellar is better than World Seeds 1809 and considerably better than Era. It is, however, rated as slightly lower than Waldron or Chris.

Acknowledgments

The development, selection and testing of this new variety was a cooperative effort of the Departments of Agronomy, Cereal Chemistry and Technology, and Plant Pathology, North Dakota State University, and the NDSU Branch Experiment Stations throughout the state. Scientists of the ARS-USDA also have participated in the evaluation and testing. The additional winter increase at CIANO (Experiment Station), Ciudad Obregon, Sonora, Mexico, expedited the development and increase of the variety through cooperation of the Crop Quality Council, Minneapolis, Minn., the Rockefeller Foundation, and the Mexican Ministry of Agriculture. The NDSU Seed Stocks Project organized and supervised the large increase phases in North Dakota and at Yuma, Arizona.