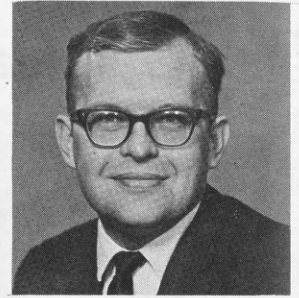


Waldron —

A New High - Yielding HRS Wheat



Smith



Frohberg



Sibbitt



Ebeltoft

... derived from a sequence of four separate North Dakota crosses . . . each examined, selected, and tested in detail before the next crossing step was taken . . . high yielding . . . superior straw strength . . . good field resistance to prevailing races of leaf and stem rust . . . shows resistance to new stem rust races 32B and 151 . . . high in protein . . . satisfactory milling and baking properties.

**Glenn S. Smith, R. C. Frohberg, L. D. Sibbitt and
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North Dakota farmers will grow about 60,000 acres of a new hard red spring wheat variety, "Waldron," this year. It was released January 1, 1969, by the North Dakota Agricultural Experiment Station, and developed cooperatively with the United States Department of Agriculture. The new variety is high-yielding in North Dakota and in the other hard red spring wheat states, and is also superior to other varieties in strength of straw. It has acceptable milling and baking qualities, and good disease resistance characteristics.

Waldron was named in honor of Dr. L. R. Waldron, long-time wheat breeder at the North Dakota Agricultural Experiment Station, Fargo, from 1916 to 1954. Dr. Waldron was responsible for the leading wheat varieties, Ceres, Vesta,

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Rival and Mida. Mida is in the Waldron pedigree.

Waldron was tested two years in the Uniform Regional Hard Red Spring Wheat Nursey, three years in field plot trials, two years in the Crop Quality Council commercial quality tests, and one year each in the Uniform Rust Nursery and the International Rust Nursery. Agronomic, disease and quality data from all the above trials have been considered in reaching the decision to release this new variety.

Agronomic and Disease Data

Table 1 gives the 1966, 1967 and 1968 comparative average yields of Waldron grown with Chris, Manitou, Polk and Justin, in the North Dakota Agricultural Experiment Station field plot trials in all parts of the state. Waldron HRS wheat has yielded best at Fargo, Williston, Mandan, Edgeley and Carrington. The average for Waldron in all ten sets of trials in the years grown was six per cent higher than for Chris. Waldron did not average significantly better in yield than Manitou

in these trials, but it does have stronger straw.

Table 2 gives comparative agronomic and disease data for Waldron and the same four commercial varieties in the 1967 and 1968 Uniform Regional Hard Red Spring Wheat Nursery. This experiment was grown at a total of 22 stations in 1967 and 21 stations in 1968 (1968 data available from only 13 stations at this date), representing eight states and Canada. In this total of 35 trials, Waldron yielded eight per cent better than Chris and four per cent better than Manitou, so it seems reasonable to expect that it will prove to be a widely adapted variety.

Waldron is slightly earlier than the other four commercial wheats, somewhat surprising in combination with its yield superiority. It has a very strong straw, as indicated by its low lodging score, and preliminary trials indicated it will accept more fertilizer (and water) without lodging, than the other "normal" height wheats.

Waldron displays good field resistance to prevailing races of leaf and stem rust, and greenhouse tests have demonstrated superior resistance to the new stem rust races, 32B and 151. It has a tendency to be lighter in test weight per bushel than the other varieties listed here.

Botanically, Waldron may be described as follows:

- Growth habit: typical spring
- Stem: mid-tall, white, very strong
- Spike: mid-lax, awnletted, white, fusiform, erect
- Glume: glabrous, white, short, mid-tenacious, shoulders wide and rounded to square
- Lemma beak: acute, 1-8 mm.
- Kernel: red, vitreous, ovate, mid-short
germ mid-size
crease mid-wide
brush mid-long

The upper internode develops a bright purple color as the variety matures, a distinctive feature in the field.

Waldron was tested as ND 363-1, C.I. 13958, a 1964 selection from a 1959 cross of Justin x ND 81. The antecedent of Waldron, ND 363, was tested in the 1964, 1965 and 1966 Uniform Regional Hard Red Spring Wheat Nursery, with the yield results given in Table 3.

The superior yielding capacity of ND 363 was established by its performance in these regional trials, but in 1964 it was discovered to be segregating for stem rust, some components being highly

susceptible. ND 363-1 (now named "Waldron") was identified as a line highly resistant to stem rust, so it was increased and in 1967 replaced ND 363 in the Regional Nursery. ND 363-1 has appeared identical to ND 363 in all respects except stem rust reaction.

The high yielding capacity of Waldron probably was derived from its paternal parent, ND 81, a breeding line which was entered in the Uniform Regional trials in 1957, 1958 and 1959. In the first two years, ND 81 outyielded all other entries in the trial. ND 81 also had very strong straw and wide adaptability, but was deficient in quality so was never named or released. ND 81 was selected from a cross of Lee x (Kenya 338AA x Lee-Mida). Thus Waldron is a derivative of a sequence of four separate North Dakota crosses, each of which was examined, selected and tested in detail before the next crossing step was taken. The first cross of this sequence, Lee x Mida, was under detailed study by Dr. Waldron when he retired in 1954. The three sequential crosses leading up to Justin, the maternal parent of Waldron, also were made in North Dakota, although more remote ancestors such as Lee and Thatcher from Minnesota, and Redman from Manitoba, originated from cooperating programs. The Kenya wheats, on which resistance to 15B stem rust is based, came from Africa. The crossing, selection, testing and increase of Waldron represents 16 generations of work in ten years.

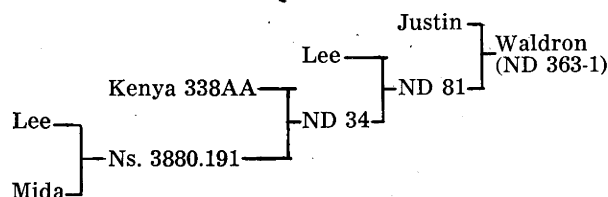


Fig. 1. Diagrammatic pedigree of Waldron.

The pedigree of Waldron is shown diagrammatically in Figure 1.

Milling and Baking Data

In addition to good agronomic properties, new wheat varieties must be satisfactory for commercial utilization. It is imperative that new hard red spring wheats be relatively high in test weight and wheat protein content. They must mill satisfactorily on equipment generally used by commercial mills and the flour must produce good bread under the usual conditions employed by bakeries.

Waldron is classified as having medium strength and satisfactory quality characteristics. On the average, this wheat is better than Manitou, about equal to Chris and a little below Justin or Polk.

Table 1. Waldron (N.D. 363-1) compared with standard wheats for yield (bushels per acre) in North Dakota Experiment Station trials, 1966-1968.

Variety	Fargo '67-'68	Langdon '66-'68	Minot '66-'68	Williston '66-'68	Dickinson '67-'68	Hettinger '67-'68	Mandan '66-'68	Edgeley '67	Carrington-dry '67-'68	Carrington, irr. '66-'67	N. D. Ave. b/a	% Chris (23) ²
Waldron	51.4	48.0	39.1	23.9	26.2	30.0	32.3	28.9	31.4	52.2	36.6	106
Chris	41.4	53.4	40.9	21.4	21.9	25.6	29.3	24.5	27.5	49.6	34.4	100
Manitou	42.6	52.2	41.3	22.3	28.4	30.9	30.1	27.1	30.3	49.9	36.0	105
Polk	48.7	48.2	38.7	23.4	28.4	27.0	31.6	¹	30.9	48.2	36.0	103
Justin	40.3	49.9	37.0	21.2	26.6	24.7	26.5	25.6	24.6	42.3	32.4	94

¹Polk not tested at Edgeley.
²Total of 23 station trials.

Table 2. Waldron (N. D. 363-1) compared with standard wheats for agronomic and disease characters in the Uniform Regional Nursery, 1967 and 1968.¹

Variety	C.I. No.	Date headed ²	Lodging score ³	Leaf rust %	Stem rust %	Bushel weight Ave. % Chris	Yield per acre Ave. % Chris
Waldron	13958	(27) ⁴	(11)	(15)	(12)	(35)	(35)
Chris	13751	31	1.9	0.2	0.6	58.4	99
Manitou	13775	33	4.1	0.2	0.4	59.2	100
Polk	13773	32	3.2	8.3	0.1	58.5	99
Justin	13462	34	3.6	0.2	0.2	60.7	103
		34	2.6	27.3	0.5	58.5	99

¹1968 data comparable but incomplete.
²Date headed equals days after June 1.
³Lodging score 1 equals erect, 9 equals completely lodged.
⁴Number of trials averaged in parentheses.

Table 3. Average yields of ND 363 in comparison with other standard commercial varieties in the Uniform Regional Hard Red Spring Wheat Nursery, 1964-1966.

Variety	Average Yield (bu./A.)				
	1964 (18) ¹	1965 (20)	1966 (18)	Ave. (56)	% Chris
ND 363	31.4	39.0	34.1	34.8	103
Chris	30.7	38.5	32.0	33.7	100
Manitou	31.6	37.7	32.6	34.0	101
Polk	31.0	37.7	30.8	33.2	95
Justin	26.9	32.3	27.5	28.9	86

¹Number of stations in parenthesis.

Table 4 shows average quality data for Waldron, Chris, Manitou, Polk and Justin grown under comparable conditions at the experiment stations throughout the state. The data represent 19 separate tests over a 3-year period.

The test weight of Waldron is similar to Chris, better than either Justin or Manitou but averages about 2.0 lbs. below Polk. 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 higher. Plump wheat usually yields more flour and this is important to the commercial miller. Percentage of vitreous kernels is also important as a major grading factor. In this respect, Waldron is high, although all varieties shown are satisfactory.

Table 4. Average milling and baking properties for Waldron, Chris, Manitou, Polk and Justin in North Dakota experiment station trials, 1966-1968.

Quality Characteristics	Variety				
	Waldron	Chris	Manitou	Polk	Justin
Test weight, lbs/bu.	59.4	59.5	59.9	61.5	59.0
Vitreous kernels, %	91.0	89.0	89.0	90.0	90.0
Wheat protein, %	15.9	15.6	15.7	15.4	16.4
Flour protein, %	15.0	14.8	14.9	14.6	15.5
Flour yield, %	65.9	66.2	65.3	67.2	66.4
Flour ash, %	0.43	0.42	0.42	0.42	0.42
Absorption, %	66.3	66.4	65.3	65.9	67.4
Dough characteristics ¹	4.0	4.0	3.3	4.0	4.0
Loaf volume, cc.	887	924	874	912	940
Symmetry ²	4.4	4.4	4.3	4.4	4.5
Crust color ¹	4.0	4.0	4.0	4.0	4.0
Crumb grain and texture ³	8.1	8.1	8.0	8.1	8.0
Crumb color ³	8.0	8.3	7.7	8.5	8.2
Farinogram classification	6.0	6.0	6.0	6.7	7.3

Quantitative data expressed on 14.0% moisture basis.
¹Highest score 4.0.
²Highest score 5.0.
³Highest score 10.0.

Spring wheat varieties high in wheat and flour protein content are very desirable, not only from a nutritional standpoint but these factors are usually associated with good baking qualities. Although Waldron is below Justin in this characteristic, it is higher than the other three varieties. The flour yield obtained from experimental milling tests is a little low but within the range of acceptability. The flour ash (mineral) content of this new wheat is acceptable.

The best criterion for wheat quality still is the baking test carried out under specific controlled conditions in which all variables, except the flours being evaluated, are kept as constant as possible. Dough mixing time and water absorption are determined from the farinogram curve. Absorption refers to the quantity of water required to obtain a dough of proper consistency for baking. This measurement is of great interest to the baker as a flour that requires a relatively high amount of water will produce more pounds of bread per sack of flour than one with low requirements. The absorption of Waldron is about the same as Chris, better than Manitou or Polk but not as high as Justin. Dough characteristics emphasize the elasticity of the dough during the fermentation period; Waldron is very good in this regard.

The loaf volume of Waldron, although lower than all the varieties in this comparison with the exception of Manitou, is considered acceptable. Large loaves are desirable provided other factors such as the general shape of the loaf (symmetry) and the color of the loaf crust are satisfactory. The internal characteristics of the loaf are ascertained routinely and provide information about the grain and texture, and color of the crumb. The grain and texture of a desirable loaf should contain small elongated thin-walled cells of uniform size. The desirable color of the loaf crumb made from unbleached flour should be bright and only slightly creamy; Waldron is acceptable for grain and texture. Although the color of the crumb is below Justin, Chris or Polk, it is better than Manitou which is acceptable to commercial millers. The farinogram pattern depicts the mixing time, mixing tolerance and strength of a flour-water dough. In this test, Waldron is not as strong as Justin or Polk but is equal to Manitou and Chris. Figure 2 shows the typical medium strength farinogram given by Waldron.

Independent tests of Waldron from other sources have faulted this new variety to a minor degree for water absorption, flour color, and the crumb color of the loaf. However, the milling evaluation results and the other baking characteristics were satisfactory.

At a recent meeting of the Crop Quality Council (Dec. 11, 1968), 19 state, federal and industry laboratories concluded that the baking characteristics of Waldron were good and in most other respects it was somewhat similar to Chris. The group considered it to have met the milling and baking requirements for Upper Midwest spring wheats in two years of Crop Quality tests.

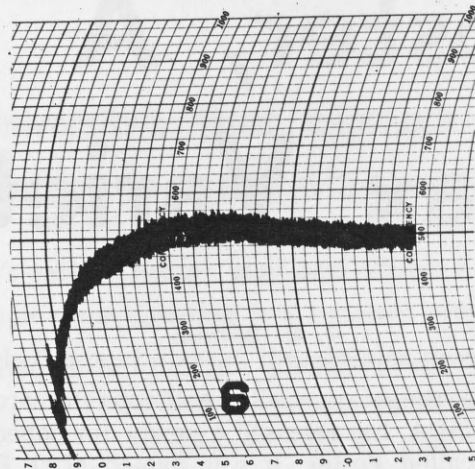


Fig. 2. Farinogram showing average mixing strength of Waldron.

Increase and Allocation of Seed

Some extra winter generations in the greenhouse and in Mexico and Arizona have expedited the development and increase of Waldron. When 1967 tests indicated the possible commercial promise of Waldron, fifty bushels were fall-planted in Arizona, yielding 2,600 bushels for 1968 increase. During the past season this stock was increased to more than 70,000 which is being allotted to North Dakota growers for 1969 planting. Other states also had access to limited supplies of the new variety, if they wished to increase it, in compliance with the policy of mutual sharing of new variety seed stocks.

The 70,000 bushels of Waldron is being cleaned and bagged, and will be allotted to the county crop improvement associations. Some seed also is being made available to the Seed Trade Association. The county associations will select the increase growers for their areas. All 1969 increases will be under contract.

The Agricultural Experiment Station will maintain purified and true-to-type stocks of Waldron for foundation seed growers as long as the variety is commercially in demand.

Summary

The new hard red spring wheat, Waldron, is distinctly superior to Chris in yielding capacity, straw strength, earliness and stem rust resistance. Test weight per bushel has been less than for Chris or Polk, but equal to that for Manitou or Justin.

Waldron has satisfactory milling and baking quality; it is classified as having medium strength. In protein content, Waldron is equal to or better than the leading commercial varieties. Overall, Waldron is better in quality than Manitou, about equal to Chris and below Justin or Polk.