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DURUM.... a North Dakota Specialty

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DURUM WHEAT PRODUCTION IN NORTH DAKOTA

North Dakota has produced about 87 percent of the U. S. production of durum in each of the past five years (Table 1). North Dakota is the primary durum producer because: it has the combination of cool temperature during maturity and moderate rainfall throughout the season which produces a high quality product, durum generally outyields hard red spring wheat in the traditional "durum area", varieties have been bred for specific adaptation to North Dakota conditions, the farmers and marketing outlets are familiar with the production and marketing requirements, the pasta manufacturing industry has shown a keen interest and cooperative attitude in growers' problems, the North Dakota State Wheat Commission is actively involved in developing increased market outlets, an active U. S. Durum Growers Association has promoted the interests of the producers and the industry, and the durum area is small enough to permit close grower cooperation in solving problems related to durum.

Table 1. Durum acreage and production, 1965-1974*

	Acres planted (1000)		Production, bushels (1000)		
Year	U. S.	N. Dakota	U. S.	N. Dakota	N. Dakota %
1965	2,361	2,038	69,866	61,411	87.9
1966	2,491	2,120	63,248	55,120	87.1
1967	2,826	2,353	66,443	54,888	82.6
1968	3,679	3,059	99,501	83,420	83.8
1969	3,330	2,781	106,087	91,773	86.5
1970	2,018	1,752	50,522	43,800	86.7
1971	2,687	2,330	91,805	82,063	88.8
1972	2,592	2,333	73,037	65,493	89.7
1973	2,952	2,590	84,860	75,980	89.5
974	4,074	3,500	79,245	68,800	86.8

Data from the Statistical Reporting Service, USDA.

Acreage of durum fluctuates annually due to price ınd planting conditions. The specialty use of the ›roduct and the limited acreage results in a less tic supply-demand situation than for other classes wheat. Consumption of macaroni products in the United States has increased during the past 10 years based on durum mill grind figures (Table 2). Increased domestic consumption is part of the reason for the increased demand. Considerable emphasis on obtaining export markets and breeding varieties possessing the desirable quality traits also have had a significant effect on increasing demand and production (Table 3).

Table 2. U. S. macaroni consumption, 1966-1973*

	Mill grind durum	Domestic consumption	Per capita consumption
Year	cwtx1000	cwtx1000	lb
1966	13 640	13,760	7.02
1967	13,293	13,455	6.78
1968	13,924	14,100	6.95
1969	15,004	15,217	7.43
1970	15,732	15,994	7.72
1971	16,423	16,700	8.00
1972	16,998	17,401	8.33
1973	16,335	18,000**	8.62**

* Data from Macaroni Journal, National Macaroni Manufacturers Association.
** Estimates.

Table 3. U. S. durum production, consumption, and carryover, 1965-1974 (Million bushels)*

Year		Consumption		
Beginning July	Production	Domestic	Export	Carryover
1965	70	50	34	68
1966	63	41	47	54
1967	66	40	31	29
1968	100	37	46	24
1969	108	35	34	41
1970	53	36	39	80
1971	92	37	44	58
1972	73	40	65	69
1973	85	51	40	37
1974	78	43	40**	30**

* Data from the Statistical Reporting Service, USDA.
** Estimate.

The durum acreage in North Dakota is primarily in the northern and north central areas, but has spread to other areas when acreage increased due to a favorable price relationship with competitive crops. The past five years has produced a westward shift in the intensity of durum acreage, but the traditional durum triangle consisting primarily of Towner, Ramsey, Cavalier and Rolette counties remains the most important area in total production (Figure 1).

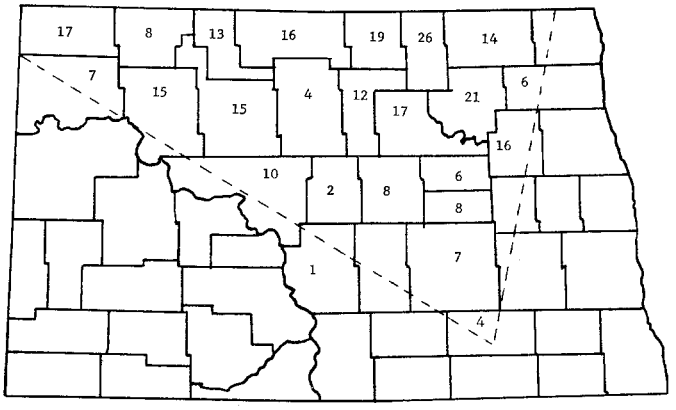

Figure 1. PERCENT OF FARM LAND PLANTED TO DURUM WHEAT BY COUNTY 1972-73*

*Based on total farm land per county in 1969. Data from the Statistical Reporting Service, USDA.

There have been no serious disease or pest problems contributing to durum acreage distribution since the stem rust epidemics of the 1950's and early 1960's. The potential yields of newer varieties of durum, hard red spring wheat and barley (the major competitors) have increased simultaneously due to major emphasis in breeding programs (Table 4).

DURUM WHEAT MANAGEMENT

Successful production of durum requires inputs similar to hard red spring wheat. The most important considerations are: choice of variety, fertility level based on soil tests and cropping history, early planting, seeding rate, weed control, harvest timing and threshing methods.

Table 4. Average yields (bu/a) of durum wheat, hard red spring wheat, and barley in North Dakota, 1965-1974*

Year	Durum	Hard Red Spring	Barley
1965	31.0	24.0	40.0
1966	26.5	22.0	31.0
1967	24.0	22.0	32.0
1968	28.0	26.0	40.5
1969	32.5	28.0	42.0
1970	25.0	23.0	34.0
1971	32.5	31.5	45.0
1972	28.5	29.0	40.0
1973	27.5	27.5	37.0
1974	20.0	20.5	26.5
Avg.	27.6	25.4	36.8

* Based on harvested acres; data from the Statistical Reporting Service, USDA; barley 48 lb/bu and wheats 60 lb/bu.

Several varieties are available including recent releases from North Dakota State University and Canadian Agriculture. Variety characteristics are listed in Circular A-170. Variety distribution in North Dakota for the past eight years is shown in Table 6. The most recent releases, Botno, Crosby and Rugby, were in the seed increase stage in 1974 and probably will occupy larger acreages in 1975. Botno is a potential replacement for Rolette since it has demonstrated superior yield and quality while possessing similar earliness. Crosby and Rugby are supplements to Ward; Crosby possesses a higher yield in certain areas and Rugby possesses improved spaghetti color.

Fertility requirements for durum are similar to those for hard red spring wheat. Soil tests should be conducted to determine fertilizer needs. Ward, Rugby, Rolette and Botno have lodging resistance similar to

Table 5. Durum wheat varieties available for planting in North Dakota.

Variety	Origin	Year Released	Beards	Height	Straw strength	Maturity	Reaction to Stem rust[1]	Reaction to Leaf rust[1]	Normal crop[2] Test wt.	Normal crop[2] Kernel size	Normal crop[2] Overall quality
Crosby	N.D.	1973	yes	med.	strong	m.early	R	R	avg.	med.	exc.
Botno	N.D.	1973	yes	med.	v.strong	early	R	MS	avg.	med.	exc.
Rugby	N.D.	1973	yes	med.	v.strong	m.early	R	R	avg.	med.	exc.
Ward	N.D.	1972	yes	med.	v.strong	m.early	R	R	avg.	med.	exc.
Rolette	N.D.	1971	yes	med.	v.strong	early	R	MS	high	large	good
Leeds	N.D.	1966	yes	med.	strong	m.early	R	R	high	med.	exc.
Wells	N.D.	1960	yes	med.	m.strong	m.early	R	R	avg.	small	good
Lakota	N.D.	1960	yes	med.	m.strong	m.early	R	R	avg.	small	good
Macoun	Canada	1973	yes	med.	strong	m.early	R	MS	avg.	large	exc.
Wakooma	Canada	1972	yes	med.	weak	medium	MR.	MS	low	large	exc.
Wascana	Canada	1971	yes	med.	weak	medium	MR	MS	low	large	exc.
Hercules	Canada	1969	yes	med.	strong	early	R	MS	avg.	large	good

1/ R=resistant; MR=moderately resistant; MS=moderately susceptible.

2/ Avg.=average; med.=medium; exc.=excellent

Table 6. Durum variety distribution in North Dakota, 1968-1974*

Variety	Release date	1968**	1969	1970	1971	1972	1973	1974
Wells	1960	50.0	38.4	29.1	29.8	24.6	27.8	17.5
Leeds	1966	50.0	60.0	69.3	67.8	67.6	50.0	28.2
Hercules	1969	-------	-------	-------	1.4	5.9	4.6	1.4
Rolette	1971	-------	-------	-------	-------	0.5	14.6	38.4
Ward	1972	-------	-------	-------	-------	-------	0.8	12.7
Other***		-------	1.6	1.6	1.0	1.4	2.2	1.8

* Data from the Statistical Reporting Service, USDA.

** Estimate.

*** Includes Crosby, Rugby, Botno and Wascana.

Waldron and thus tolerate high fertility levels. Low levels of nitrogen coupled with warm, moist conditions between heading and maturation may reduce kernel vitreousness and market subclass. Durum can be successfully grown in continuous cropping rotations. Durum is more tolerant to leaf disease organisms than hard red spring, hence would be more desirable if a wheat-wheat rotation is used when cropping history indicates leaf disease presence.

Early planting is desirable. Durum may be planted as soon as soil temperatures reach 35 degrees F. and danger of severe frost is past. The variety Leeds appears to be more sensitive to cold soil conditions than other varieties. If planting is unusually delayed, plant the earlier varieties Botno and Rolette to minimize the possibility of frost damage at maturity.

The seeding rate for durums varies among varieties due to differences in kernel size (Table 7). The desired plant spacing under normal soil moisture and planting date conditions is one plant per linear inch in a six-inch row spacing. Increase planting rate when late planting occurs.

Table 7. Durum kernel size and seeding rate recommendations for North Dakota.

Variety	Avg. kernel size, g/1000*	Recommended seeding rate, lb/a
Rolette	43.2	90-105
Botno	40.7	75-90
Crosby	40.2	75-90
Rugby	40.7	75-90
Ward	41.4	75-90
Leeds	39.5	75-90
Wells	33.3	60-75

* 14 tests of the Uniform Regional Durum Nursery grown in North Dakota, 1970-1974.

There are two critical factors in the harvest of durum, time of swathing and threshing care. Studies have indicated that the most desirable durum quality, particularly spaghetti color, is obtained when the plants are swathed at about 35 percent grain moisture. This is equivalent to the hard dough stage of kernel development or when the kernel has lost all green color. Loss of quality and increased risk of weather damage may occur if swathing is delayed. The availability of shorter, strong-strawed varieties has encouraged some straight combining assisted by artificial drying when necessary. Proper adjustment of cylinder speed and concave opening is important during threshing because durum kernels are usually about 15 to 25 percent larger and also harder than hard red spring wheat. The large size and brittleness (vitreousness) may contribute to kernel breakage unless careful, frequent adjustment is made. Excessive broken kernels will reduce the numerical grade of durum and resell in possible discounts on the commercial market.

DURUM RESEARCH

Considerable research effort has been directed toward increased production of a quality durum product in North Dakota. The durum breeding program has been involved primarily in the improvement of agronomic, quality and disease resistance factors. Varieties have been bred and released which have major improvements in stem rust resistance, yielding ability, earlier maturity, shorter straw, stronger straw, larger kernels and higher spaghetti color (Table 8). Spaghetti color is one of the most important durum quality characteristics. It is determined by adding water to semolina, kneading and extruding the paste under controlled conditions, and measuring the yellow color with a light reflectance analyzer. Spaghetti color can only be partially estimated by visual appearance of the kernel.

Research conducted on fertilization has shown that durum and hard red spring wheat respond similarly. Tests of durum varieties with low nitrogen levels have shown a reduction in vitreousness, but all varieties did not respond similarly. Seeding rate and date experiments have helped determine the desirable seeding rate and have shown that earlier planting is most desirable. New studies to evaluate the newer, earlier varieties' response to rate and date of seeding are underway. Weed control studies have determined the most effective herbicides and their rates and timing. All varieties did not have the same tolerance levels to high rates of herbicide application.

Table 8. Estimates of major improvements in durum wheat varieties by breeding during the period 1929 to 1973.

Variety	Release date	Height in	Lodging %	Heading days	Yield* % of Leeds	Stem** rust	Kernel wt. g/1000	Spaghetti color score
Mindum	1917	47	80	67	100	S	39	8.8
Wells	1960	37	40	63	107	MR	33	8.9
Leeds	1966	37	20	62	100	R	39	9.1
Rolette	1971	35	15	59	107	R	43	8.9
Ward	1972	36	10	61	115	R	41	9.3
Rugby	1973	36	10	62	115	R	41	9.4
Botno	1973	35	15	59	112	R	41	9.1
Crosby	1973	36	20	61	115	R	40	9.3

* Disease-free conditions.

** S, MR and R = Susceptible, Moderately Resistant and Resistant.

Harvest management studies are underway to determine the effect of different methods of harvest, such as swathing, straight combining, drying, and the like on yield and quality. Development of earlier, shorter, stiffer-strawed varieties may allow a change in harvest management. The effects of excessive weathering due to rainfall have been determined in relation to grain sprouting and quality. Engineering studies on drying times, temperature, and air volume movement have helped the grower obtain efficient drying with minimum quality loss and fuel cost. Further research will benefit all aspects of the North Dakota durum industry.

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