

Wheat Germplasm Releases by the Agricultural Experiment Station in 1987

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Male sterile facilitated recurrent selection (MSFRS) breeding in wheat began in 1972, when two mutant male sterile plants were found at Mesa, Arizona, in a planting of "Siete Cerros" common spring wheat. MSFRS wheat germplasm composite crosses A and B were released in 1976(1) to provide a source of genetic male sterility and a diverse gene pool. As a culmination of the subsequent wheat breeding work, three germplasms have been released or prepared for release in 1987. AZ-MSFRS-86 quality-enhanced, semidwarf, hard red spring wheat and AZ-MSFRS-86 quality-enhanced, semidwarf durum wheat were released in February. A request for release of one-irrigation, common wheat germplasm-87 has been made.

MSFRS BREEDING

The MSFRS breeding system, in general, consists of selecting each year, large numbers of male-fertile and genetically male-sterile plants for adaptability, stiff and short straw, spike size and length, seed size and number, tillering expression, freedom from disease, and other observed genotypically and physiologically desirable characters. Prior to release of the above germplasms, yield and seed quality have been very important selection criteria.

Crosses are made between selected plants using male steriles as female parents to facilitate hybridization. When possible, crosses are made between opposites in plant character combinations to maintain as much population heterozygosity as possible. The F₁ generation is increased for bulk harvest in Bozeman, Montana each summer. The F₂ generation is grown in Arizona each winter. It is planted at a very low seeding rate for Arizona adaptation, selection and crossing.

HARD RED SPRING WHEAT GERMPLASM

AZ-MSFRS-86 quality-enhanced, semidwarf, hard red spring wheat germplasm was released as a source of high yielding cultivars with bread-making qualities. It is the result of improving the AZ-MSFRS composite crosses A and B common wheat population through 10 additional cycles of 20 generations of MSFRS breeding. Early cycles involved gene introduction, selection and recombination for yield, hard red seeds, short stiff straw and included introduction of winter genes for greater tillering capacity. Since 1982, emphasis has been on retaining the yield of hard red spring semidwarf plant types, while introducing higher protein, stronger gluten and flour qualities suitable for commercial bread-making.

Quality data, courtesy of ConAgra Flour Milling Company, supplemented by data from Hayden Flour Mills and the USDA Wheat Quality Laboratory at Fargo, ND, were used to identify lines with suitable protein and gluten strength and to determine milling and baking performance.

Quality improvement has been in all areas. Increases in protein was measurable and dramatic. Selection data show a mean protein increase from 11.4% in 1982 to 14.1% in 1985, with a significant increase in the number of

selections with strong gluten and quality potential. The F₂ germplasm available for distribution will carry a greater frequency of genotypes combining high yield and superior quality each year.

DURUM WHEAT GERmplasm

AZ-MSFRS-86 quality-enhanced, semidwarf, durum wheat germplasm was released as a source of high yielding cultivars with superior pasta-making qualities. A population segregating for genetic male sterility was obtained from Western Plant Breeders in 1981. A broad diversified array of CIMMYT, Northern US, Canadian and Italian durums and descendants of their hybridization (products of conventional pedigree and population breeding 1975 to 1981) were utilized in hand pollination of male sterile plants in the 1982 crossing year. University of Arizona MSFRS durum breeding was initiated with 700 controlled crosses on selected male sterile plants.

Cooperation of ConAgra Flour Milling Company and the USDA Wheat Quality Laboratory in Fargo, ND, has been essential in identifying lines with superior semolina color, protein and gluten strength. Success in obtaining quality potential for pasta making has been rapid. Each year, high yielding genotypes with superior quality characteristics are topcrossed back into the current population as rapidly as selections for quality can be classified for yield. Progress is continuous. The F₂ germplasm available for distribution will each year carry a greater frequency of genotypes carrying high yield with superior quality.

ONE IRRIGATION COMMON WHEAT

One-irrigation, common spring wheat is suggested as a germplasm source for recurrent selection programs for specific environments where water is limited because of price or availability. It is also recommended as a germplasm source from which cultivars may be selected for use when water is limited to a single irrigation at or before planting.

In 1977, MSFRS wheat germplasm composite cross A-76(1) was grown with a one-irrigation culture and screened for earliness, head development and plump seeds. Outcross seed set on male sterile plants was also harvested. This germplasm served as the base for ten successive cycles of recurrent selection for adaptation to low-input, one-irrigation culture.

To broaden and enhance the genetic background, material from other programs was frequently added to the population. Cultivars with earliness, drought tolerance, dry land adaptability, and extensive dry land rooting systems from Australia, Pakistan, Mexico (CIMMYT) and the Middle East (ICARDA) were topcrossed into the population. Each year as superior plants were identified for earliness, seed size and plumpness, and determinate heading, head selections were made, grown in Montana and reselected for "best plant". The F₄'s were then increased in Arizona for yield evaluations, topcross pollination and gene recombination.

Seed of all three germplasm populations is available to qualified breeders and may be obtained from M.D. Sheedy, Maricopa Agricultural Center, Rt 2, Box 751-F, Maricopa, Arizona 85239. The 1987 seed will be available in October. Subsequent or updated germplasm will be available from the Plant Sciences Department of the College of Agriculture, University of Arizona, Tucson, Arizona 85721 or D.H. Smith, Small Grain Collection Bldg. 046, Agricultural Research Center-West, Beltsville, Maryland 20705. Appropriate recognition of source should be given when this germplasm contributes to research or development of new cultivars.

REFERENCES

1. Thompson, R.K. and K.C. Shantz. 1978. Registration of MSFRS wheat germplasm composite crosses A and B-76. *Crop Sci.* 18:698.
2. Thompson, R.K. 1979. Wheat improvement in Arizona. In *Forage and Grain, A College of Agriculture Report. Series P-47. The University of Arizona P. 19-23.*
3. Thompson, R.K. 1983. Registration of AZ-MSFRS-82RR rust resistant common wheat germplasm. *Crop Sci.* 23:605.