



Dr. Fick with Experimental Sunflower.

PARENTAL LINES FOR PRODUCTION OF CONFECTIONERY SUNFLOWER HYBRIDS

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Four cytoplasmic male-sterile and two fertility-restorer parental lines suitable for the production of confectionery sunflower hybrids were developed and jointly released March 1, 1974, by the Agricultural Experiment Station, North Dakota State University; the Agricultural Experiment Station, Texas A & M University; and the Agricultural Research Service, U.S. Department of Agriculture.

The parental lines are the first to be made available for use in commercial production of large-seeded confectionery hybrids, using the cytoplasmic male-sterility and fertility-restorer system. They were released to hybrid sunflower seed producers to accelerate the development and testing required to provide superior hybrid seed to confectionery sunflower growers at an early date. Hybrids produced from these lines are resistant to rust. Based on preliminary tests, they also are higher yielding than the currently grown open pollinated varieties and have satisfactory seed size and/or hull-to-nutmeat ratios.

History and Description

Efficient production of hybrid sunflower seed was made possible with the discoveries of cytoplasmic male-sterility in 1968 and of fertility restoration in 1970. Parental lines for use in production of oilseed hybrids were subsequently

developed. A limited acreage of oilseed hybrids produced by use of the cytoplasmic male-sterile and fertility-restorer system was grown in 1973.

Development of parental lines for use in producing large seeded confectionery hybrids was initiated at North Dakota State University in 1971. Four sunflower inbred lines, HA 285, HA 286, HA 287 and HA 288, all of which were resistant to rust and had produced agronomically desirable hybrids in preliminary testing, were converted to cytoplasmic male-sterility for use as female parents of hybrids. The procedure followed was that of crossing the inbred lines to cytoplasmic male-sterile plants and repeated backcrossing of each line to its respective maintainer line.

HA 285 and HA 288 were selected from Menonite RR, a large seeded, rust resistant variety developed by Agriculture Canada, Morden, Manitoba. HA 286 traces to a large seeded variety from Israel. HA 287 was selected from a cross that involved Menonite, Menonite RR, Mingren, and Commander, and was made by the Agricultural Research Service, U.S. Department of Agriculture, College Station, Texas.

The fertility-restorer lines, RHA 280 and RHA 282, were selected from the rust-resistant variety

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Yield tests at Fargo, ND and Crookston, MN were conducted by C. M. Swallers, assistant professor, North Dakota State University, Fargo, and L. J. Smith, agronomist, Northwest Experiment Station, University of Minnesota, Crookston.

Table 1. Performance of Five Hybrid Varieties Compared with Sundak, Dahlgren 694, Mingren and Commander grown at Fargo and Casselton, North Dakota and Crookston, Minnesota in 1973.

Variety	Days to 50% Flower	Height Inches	Rust	Test Weight Lb/Bu.	Yield Lb/A	% Over 20/64	Nutmeat %
Hybrid 860	67	65	R	22.6	2,228	85.5	52.9
Hybrid 850	68	71	R	23.8	2,086	54.8	57.1
Hybrid 872	67	61	R	24.0	1,865	36.1	57.9
Hybrid 852	66	66	R	25.1	1,812	16.2	61.6
Hybrid 862	68	61	R	23.0	1,581	24.6	61.1
Sundak	68	67	R	24.1	1,784	44.8	57.5
Dahlgren 694	66	63	S	21.0	1,213	43.5	53.5
Commander	66	63	S	21.5	1,079	45.7	54.5
Mingren	66	63	S	20.8	1,025	43.0	53.8

Sundak, and from a cross made at College Station, Texas of Boneta Giant Manchurian x Mennonite RR. The fertility-restorer gene from the oilseed line RHA 266 was later incorporated into RHA 282 by backcrossing. Genes for fertility restoration in RHA 280 are in normal cytoplasm, whereas genes for fertility restoration in RHA 282 are in male-sterile cytoplasm.

All cytoplasmic male-sterile and fertility-restorer lines are resistant to rust and produce rust-resistant hybrids. The lines represent a wide range with respect to such agronomic characteristics as plant height, maturity, seed size, seed color and hull thickness. Consequently, it should be possible to produce hybrids from these lines that are adapted to particular growing regions and suitable for specific confectionery and/or birdfeed markets.

Cytoplasmic male-sterile lines HA 286 and HA 288 are midseason in maturity and should match with restorer lines RHA 280 and RHA 282 when planted simultaneously for purposes of producing hybrid seed. HA 285 and HA 287 flower earlier than RHA 280 and RHA 282 and may have to be planted later than the restorer lines for maximum hybrid seed production.

Hybrid Designation

Hybrids involving these parental lines have been designated numbers derived from the last two digits of the female and last digit of the male parents, for example, cmsHA 285 x RHA 280 is designated Hybrid 850. In numbering a three-way hybrid, the last digit of the second parent of the single-cross female is added, for example, (cmsHA 285 x HA 286) x RHA 280 is designated Hybrid 8560. This designation, followed by the name of the seed company or Agricultural Experiment Station that produced the hybrid seed, such as "Hybrid 850, produced by _____," should alleviate the identity problem when a particular hybrid is marketed under several different names and by several different companies.

Performance of Hybrids

Performance data on five of the eight possible single-cross hybrids that can be produced from these lines were obtained from three locations in 1973 (Table 1). The average yield of the five hybrids was 7 percent more than that of the highest yielding, currently grown, open pollinated variety Sundak, and 58 percent, 77 percent and 87 percent more than those of Dahlgren 694, Commander and Mingren, respectively. The highest yielding hybrid, Hybrid 860, showed a 25 percent, 84 percent, 106 percent and 117 percent advantage over Sundak, Dahlgren 694, Commander and Mingren, respectively. Light to moderate rust was present in the three tests and probably contributed somewhat to the superior yields and test weights of the resistant hybrids over those of the rust-susceptible varieties. Days to 50 percent flowering and height of the hybrid varieties were comparable to those of the open-pollinated varieties. Hybrids with RHA 280 produced a high percentage of large seeds, exceeding the seed size of the largest seeded, open pollinated variety. RHA 282 hybrids produced somewhat smaller seeds, but with a thinner hull and higher nutmeat percentage.

Increase and Distribution of Seed

Breeder seed increase of each of the parental lines was conducted in Florida during the winter of 1973-74. In compliance with the policy of mutual sharing of new variety seedstocks, seed of each cytoplasmic male-sterile line and its corresponding maintainer line, and each fertility-restorer line was made available to other states with an interest in confectionery sunflowers. Seed also was distributed to qualified hybrid sunflower seed producers. The seed will be used for increase of the individual lines and production of hybrid seed. Limited hybrid seed produced from these lines should be available for commercial production in 1975.

The North Dakota Agricultural Experiment Station will maintain purified seed stocks of each line so long as the lines are in demand.