

SUNFLOWER BREEDING IN CHILE

By

Vital Valdivia B.
Oilseed Crop Breeder
Agricultural Research Institute
Santiago, Chile--South America

Prior to the second World War, most of the edible oil consumed in Chile was imported. Due to war conditions there was an urgent need to increase domestic supplies of edible oils and commercial production of sunflower started in 1939 with 1.200 hectares. Stimulated by an increased demand, the area increased to about 57.000 hectares in 1953. Following 1953 there has been a decline to an average of 30.000 hectares in the last five years.

The sunflower production area is located between 30° and 38° S. latitude, where most of the crop must be produced under irrigation.

Late maturing varieties are grown, reaching about 2 meters in height and maturing in 135-150 days. In the last four years, high-oil, early maturity varieties introduced from the USSR have been grown. Long term average yield has been 12 quintales per hectare. Top yields are 30 quintales per hectare.

The other oilseed crop grown in Chile is rape, which is produced in the cooler climate of the southern region of the country.

The introduction and production of other oilseed crops is being considered. At the moment, the two crops that are receiving the most attention are soybean and safflower.

Sunflower is in direct competition with crops such as corn, potatoes, small grains, beans, etc., but with improved sunflower varieties this crop may be expanded to some extent because Chile is not producing the amount of edible oil that it consumes. It is consuming less than the amount estimated to be the minimum for good nutrition, and there is a need for expansion of oilseed production.

Even though the sunflower crop does not have most of the serious diseases and pests found in other countries, Sclerotinia disease is one of the most troublesome problems in sunflower production.

Chilean sunflower breeding started in 1942 with the objective of introducing varieties of high seed yield and high oil content.

The first variety grown in the country was Gray Striped. It was a late maturing tall variety reaching about 3 meters in height. Later it was replaced by Klein, an earlier maturing Argentine variety, and Saratov, a short season variety. In 1964, Russian varieties with higher oil content were available for growers. Two of them, Armavirski 3497 and Peredovik, were licensed. These varieties are in general very early for the conditions of central Chile and as a result of this, perhaps, are rather low in seed yield, but the oil yield is reasonably good because of their higher oil content (Table 1).

Table 1. Seed yield, oil percentage (dry-weight basis) and oil yield of sunflower varieties compared at 2 locations, 1963-1965

Varieties	Seed yield		Oil		Oil yield		Percentage of Saratov in average	
	kg/ha		percentage		kg/ha		Seed yield	Oil yield
	Stgo.Chillán		Stgo.Chillán		Stgo.Chillán			
			(*)		(*)			(*)
Armavirski 3497	2623	2665	45.7	48.7	1302	1300	94	138
Búlgara	2390	2580	42.3	42.9	1134	1196	89	124
Kurdistana	2365	2765	43.0	41.9	1085	1260	92	135
Peredovik	2343	2547	45.0	47.1	1076	1159	87	119
Stepniak	2641	2614	43.6	44.6	1294	1165	94	131
Vniimk 1646	2562	2361	44.6	45.0	1306	1059	88	126
Vniimk 3519	2469	2383	41.0	39.4	1137	950	87	111
Vniimk 6540	2642	2644	45.0	46.7	1253	1284	94	135
Saratov (check)	2864	2731	34.5	33.8	984	897	100	100
Klein A (check)	2956	3135	39.3	38.6	1258	1214	109	131

(*) Data of 2 years, 1964 and 1965

Breeding work with new introduced varieties has been directed toward selecting a plant type better adapted to our main sunflower area. In this regard, good progress has been made. Table 2 shows the seed and oil yields of Klein Q, an old-adapted variety, compared with the original introduced variety Klein A and with the same variety after some years of selection. Another example is given in Table 3 with varieties Armavirski 3497 and Peredovik.

Table 2. Results of selection in sunflower variety Klein A.

Varieties	Seed yield kg/ha	% of Klein Q	% oil seed (dry basis)	Oil yield kg/ha	% of Klein Q
<u>Average of 36 tests at 5 locations, 1958-1960:</u>					
Klein A ^(*) (original seed)	2501	84	39.0	976	100
Klein Q ^(**)	2980	100	32.8	979	100
<u>Average of 5 tests at 2 locations, 1965-1966:</u>					
Klein A (Selection)	2981	102	41.2	1152	111
Klein Q	2918	100	36.1	1035	100

(*) Klein A was imported from Argentine for its higher oil content

(**) Klein Q is an old adapted variety.

Table 3. Results of selection in sunflower varieties Armavirski 3497 and Peredovik. Performance at 2 locations, 1963-1966

Varieties	<u>1963 (Original seed)</u>				<u>1964-66 (Selections of desirable types)</u>			
	Seed yield kg/ha	% of Sar- atov	Oil yield kg/ha (*)	% of Sar- atov	Seed yield kg/ha	% of Sar- atov	Oil yield kg/ha (**)	% of Sar- atov
Armavirski 3497	2432	84	819	118	2695	98	1235	134
Peredovik ^(***)	2419	84	838	121	2529	92	1141	124
Saratov	2883	100	692	100	2763	100	919	100

(*) In 1963 oil determination was made by a laboratory Carver Press

(**) In 1964, 1965, 1966, oil was determined with petroleum ether

(***) Early maturity variety grown for many years in Chile.

Varietal improvement at present is directed, to a considerable extent, to the combining of the high oil content of the Russian varieties with the better adapted growth habit of varieties such as Klein. Several approaches are being made. Crosses have been made between the two types. In some of these, the oil content of the adapted portion of the segregating populations is being improved by recurrent selection for oil. Another procedure that is being attempted is backcrossing. Two ways of doing this are being explored. One is to backcross to the later variety, selecting for the highest oil segregates to be used in further backcrossing. The other way has been to backcross once and twice to the high oil Russian type selecting for oil content and full season maturity in the segregating populations.

Another investigation carried out with sunflower has been a program of hybrids for commercial seed production. Several hundred inbred line x variety and line x line combinations have been tested. Two commercial inbred line x variety hybrids, Oleofen 1 and Oleofen 2, have been released. Oleofen 2 has produced 20% more seed and 12% more oil per hectare than Klein, when tested in the northern part of the sunflower production area. However, the hybrids have occupied only about 10 per cent of the overall sunflower acreage because their lower oil content does not make them attractive to the oilseed processors. Sunflower is grown in Chile under contract to oilseed processors; therefore, it is very important to produce commercial hybrids with higher oil content. This has become more important with the introduction of the high-oil Russian varieties and the better prices that the farmer is receiving for growing these varieties.

The central problem in the production of hybrids now is the development of inbred lines with higher oil content. In fact, the program started to select for oil content in the last six years when equipment for determination of oil content in small samples became available. In the last three years, a few promising lines have been identified. A single cross made by hand pollination has produced up to 7,500 kg/ha in yield trials. The yield of the same single cross produced by natural crossing in the last growing season was rather disappointing because of the low percentage of hybrid plants; however, the performance of the hand pollinated single cross shows the yield potential of sunflower hybrids. Other approaches that are being used to utilize heterosis are synthetic varieties; preliminary results indicate that they offer good prospects for further advance.

* * *

DISCUSSION

Panchenko: From where did you get the Russian varieties and what year?

Valdivia: We procured the seed in 1962. We purchased elite seed from Russia for our plant breeding program.

- - -