"RESPONSE TO RECURRENT SELECTION FOR OIL CONTENT IN THREE SUNFLOWER POPULATIONS"

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SUMMARY

Population improvement in cross-pollinated crops is the base for the development of inbred lines in the production of hybrids. Several selection procedures, commonly used in corn breeding, can be used on Sunflower with some modifications due to the reproductive structure.

Three Sunflower populations with different genetic origins were used: P-1, P-3, and P-4. The populations P-3 and P-4 were improved by Mass Selection Method, and the population P-1 by Recurrent Selection Method for Specific Combining Ability (SCA).

The populations P-3 and P-4 increased the oil content by mass selection. The non significant difference between C2 and C3 in P-3 and between C3 and C4 in P-4 indicates that the rate of increase in oil content may decrease with the subsequent cycles of mass selection. However, these populations could serve as a base population in selection for oil yield using a type of recurrent selection using progeny evaluation.

In the population P-1, the oil content also was shifted upwards, but the rate was slight, possibly by the low oil content of the base population.

INTRODUCTION

Population improvement in cross-pollinated crops is the base for the development of inbred lines in the production of hybrids.

Several selection procedures, commonly used in corn breeding, are applicable to Sunflower with certain modifications due to their reproductive structure and flowering process.

Improved populations with genetic variability and high gene frequency for oil content and yield, are the common source for obtaining inbred lines.

The purpose of this study was to evaluate the effectiveness of two breeding methods for increasing oil content and yield in three synthetic populations.

MATERIAL AND METHODS

Three Sunflower populations with different genetic origins: P-1, P-3, and P-4, synthesized in EEA Pergamino-INTA, were used (Table 1).

Table 1. Origin and characteristics of the three Sunflower populations

	Population		
	Pergamino 1 P-1	Pergamino 3 P-3	Pergamino 4 P-4
Origin	Bulking Russian lines and wild specie. Immune to Puccinia helianthii	Bulking local adapted varieties and wild species	Bulking of Rumanian cultivars: Record, OS 52 and Horizon
Cycle	Intermediate	Intermediate-late	Intermediate-early
Seed Color	Black	Stripped	Black
Percent oil	30-35 %	35-40 %	40-45 %
Cytoplasm	Normal	Normal	Normal
Fertility Restore System	Present	Present in low frequency	Absent

Mass selection for oil content and yield was carried out on the base population (C0) and each subsequent cycles of P-3 and P-4. The populations were planted in isolated field; one thousand plants were selected for agronomic aspect. Oil content and individual yield were determined. The best plants (20 %) by oil content and individual yield were selected to comprise the first cycle (C1) bulking equal number of seeds of each selected plant. The same procedure was applied for the other three cycles for P-3 and four cycles for P-4.

Recurrent selection method for Specific Combining Ability (SCA) was applied on the base population P-1 and on each subsequent cycles (C1, C2 and C3). Selected plants by agronomic aspect were crossed by tester "cms HA 89", an inbred line of recognized combining ability. These plants were evaluated for their hybrid performance for oil content and individual seed yield and selected to comprise the subsequent cycle.

The original and mass selection cycles were evaluated in two seasons (89/90 and 90/91) for the populations P-3 and P-4 while the original Population P-1 and their three cycles were evaluated only in one season (90/91) in randomized block designs with four replications at Pergamino.

RESULTS

The P-3 mean population for oil content increased from 34.20 for C0 to 37.62 for C3 and 37.90 for C2 (Table 2), approximately two percentage point after each cycle of mass selection.

Seed yield and oil yield were also measured in the three populations and their cycles, but not significant differences among cycles were noted (data not shown).

Table 2. Means and coefficient of variance for oil content in Co, C1, C2 and C3 derived from P-3 by mass selection at Pergamino.

	Percent of Oil		
	89/90	90/91	Mean
Cycle 2	41.57 a *	33.90 a	37.90 a
Cycle 3	41.65 a	33.67 a	37.62 a
Cycle 1	37.96 b	33.97 a	35.70 b
Cycle 0	38.17 b	30.37 b	34.20 c
Average	40.31	32.87	36.36
C.V. %	2.32	4.11	3.25
LSD 5 %	1.44	2.16	

* Means followed by the same letter are not significantly different at the 5 % level of probability (LSD)

There was nearly an increase of two percentage points after each cycle of mass selection, although the difference between C2 and C3 was not significant.

The means for oil content for P-4 cycles are shown in Table 3. The content increased from 42.23 % for C0 to 48.27 for C3 and 47.28 C4, (Table 3), approximately five percentage points after four cycles of mass selection; but the difference was non significant between C3 and C4.

Table 3. Means and coefficient of variance for oil content in Co, C1, C2 and C3 derived from P-4 by mass selection at Pergamino.

	Percent of Oil		
	89/90	90/91	Mean
Cycle 3	50.34 ab *	46.20 a	48.27
Cycle 4	51.16 a	43.40 ab	47.28
Cycle 2	47.69 bc	40.40 bc	44.04
Cycle 1	46.06 c	41.10 bc	43.23
Cycle 0	45.79 c	38.67 c	42.23
Average	48.21	41.95	
C.V. %	3.98	2.65	
LSD 5%	2.95	3.08	

* Means followed by the same letter are not significantly different at the 5 % level of probability (LSD)

The P-1 population cycles followed the same general tendency in oil content (Table 4). The increase was slight possibility due to the low oil content (35-40 %) in the source population.

Table 4. Means and coefficient of variance for oil content in Co, C1, C2 and C3 derived from P-1 by recurrent selection at Pergamino.

	Percent of Oil 90/91
Cycle 3	39.65 a *
Cycle 0	37.06 ab
Cycle 2	37.38 ab
Cycle 1	34.81 b
Average	37.22
C.V. %	8.52

* Means followed by the same letter are not significantly different at the 5 % level of probability (LSD)

CONCLUSIONS

The populations P-3 and P-4 increased the oil content by mass selection. The non significant difference between C2 and C3 in P-3 and between C3 and C4 in P-4 indicates that the rate of increasing in oil content may decrease with the subsequent cycles of mass selection for these populations and may limit effectiveness of this method. However, these populations could

serve as a base population in selection for oil yield using a type of recurrent selection using progeny evaluation.

Also in the population P-1 selected for SCA, the oil content was shifted upwards, but the rate was slight, possibly by the low oil content of the base population. This population bacause of its low susceptibility to disease could serve as the base for deriving inbred lines to cross with high oil content lines.

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