SELECTION FOR EARLINESS AS A BASIS FOR EARLY HIGH PERFORMING SUNFLOWER HYBRIDS

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Abstract

The aim of the research was to find the genotypes (sunflower hybrids) capable of breaking the correlation between the yield potential and the length of vegetation period. The date of flowering and the date of physiological maturity have been the criteria for earliness selection. Four genotypes (2 cms lines and 2Rf lines) have been selected and utilized as testers and crossed with 248 partners each, in order to obtain 982 hybrid combinations. Of the theoretical number of 982 combinations, only 446 hybrids were tested in comparative trials.
The criteria for selection of combinations were: to be significantly different from the trial average for each of four testers, in moisture (% H_2O), oil content (%) or oil yield (q/ha).
30 hybrid combinations were selected from the total number of 446, representing 6.7%.
The ranking for earliness of the four studied groups of hybrids was: Lc 1019A (maturity group A), Lc 991A (maturity group B), Lc 1101C (maturity group B) and Lc 1103C (maturity group C).

Key words: *Helianthus annuus L.*, earliness, hybrids, moisture, oil content, oil yield.

Introduction

Sunflower became one of the most profitable crops in Romania today, because of the low inputs required to establish the crop, and the ready market for of the crop (oil mills).
After 1989, the sunflower growing area increased progressively from an average of 500.000 ha to more than 714.000 ha in 1995. In spite of this, the average yield in Romania in the last 6 years was about 15 q/ha (13.4 q/ha in 1995).

In the less favourable areas, somewhat unsuitable half-late or late hybrids were cultivated, being only ones available until now in Romania.
In response to this, Fundulea started a programme to identify early sunflower hybrids adapted to these cooler areas with the ability to reach physiological maturity by 15^{th} of September (sowing time at about 15^{th} of April).
There is known to be a positive correlation between the yield potential and the length of vegetative period, and especially between flowering and physiological maturity (STOENESCU et al.). The reasons which determined us to increase the selection of early genotypes were the increase in recent years of average temperature in the northern half of the country, a less favourable areas for sunflower, and in the low level of agricultural inputs of technology utilized during the transition period to market economy in Romania. Under such conditions the yield, by an early genotype could represent 85% of a late one. An early genotype cultivated in the southern zone of the country could be harvested 15 days earlier than a late one. In such situation the sunflower genotype can escape disease attack (*Phomopsis helianthi, Sclerotinia sclerotiorum*) and avoid the stress created by drought and heat in the month of August.

Materials and methods

The aim of the research was to find genotypes capable of breaking the correlation between the yield potential and the length of vegetative period. The date of flowering and the date of physiological maturity have been the criteria for earliness selection. Four genotypes (two cms lines and two Rf lines) have been selected and utilised as testers and crossed with 248 partners each, in order to obtain 982 hybrid combinations.
From the theoretic number of 982 combinations resulted only 446 hybrids with sufficient seed which were tested in comparative trials. The cms testers were Lc 1019A (77 combinations), Lc 991 A (97 combinations). The Rf testers were Lc 1101C (77 combinations) and Lc 1103C (195 combinations). The 446 hybrids were tested in 1995 at the Research Institute for Cereals and Industrial Crops, Fundulea. The criteria for the selection of combinations were: to be significantly different from the trial average for each of four testers, in moisture (%H_2O), oil content (%) or oil yield (q/ha).

Results, discussion and conclusion

The results for seed yield, oil content, oil yield, volumetric weight and moisture of 446 sunflower combinations are presented in Table 1. The 97 combinations having Lc 991A as cms tester, registered an average yield of 32.7 q/ha, oil content 53.0%, oil yield 15.4 q/ha and moisture 8,2%. Choosing the combinations significantly below the average for moisture, and above the average for oil yield, (Table 2), 6 genotypes were selected (6.2% of all).

In this case (Lc 991A) the average value for oil content was the highest one of all (53%).

The group of cms tester Lc 1019A produced only one combination of this type (1.3% of all). The average oil content of this group was 50.7%, lower than the group of Lc 991A. The moisture at harvest was also lower (0.1% than the other one).

The line Lc 1019A was extensively utilized in the last years in the breeding programme, having a very short period from flowering to physiological maturity despite the fact that the flowering date is the same as for half early material (+ 2 days HA89).

The group of Rf tester Lc 1101C (77 entries) produced 6 combinations (7.8%) significantly earlier (0.7% H_2O lower than the average of 8.2% H_2O) and having significantly higher oil yield (1.2 q/ha more than the average 14.4 q/ha). The average seed yield in this group was 32.3 q/ha and the oil content 50.2%.

The largest group in number was the one having as restorer line Lc 1103C (195 entries). This restorer line is a half early genotype (flowering -2 days HA 89).

The colour of leaves of this restorer is green-yellow, a clear character strongly inherited into hybrid combinations. The origin of this line is a synthetic population, having in its pedigree the wild species *Helianthus tuberosus*.

The line has a good tolerance to *Phomopsis helianthi* (VRÂNCEANU et al., 1994). Another character of this line is the slow loss of water at maturity, related to the "stay green" character. The average moisture of this group was 10.6%. In this group 17 genotypes (8.7%) were selected for earliness. The average for oil yield was 14.5 q/ha, and for oil content 48%. The percentage of selected genotypes was 8.7% (17 of 195).

The 30 hybrid combinations selected from the total number of 446 (6.7%) are the result of an very intensive selection against the positive correlation between the yield and the length of vegetative period. The possibility to discover early high performance sunflower hybrids depends on:

- the total number of combinations created as a wide basis from selection.
- the "per se" value of parental lines utilized as female and male.

The ranking for earliness of the four groups of hybrids was: Lc 1019A (maturity group A), Lc 991A (maturity group B), Lc 1101C (maturity group B), Lc 1103C (maturity group C).

Table 1

Seed yield, oil content, oil yield, volumetric weight and moisture ($\%H_2O$) of 446 sunflower hybrids

Fundulea, 1995

cms tester Lc 991A (97 entries)

	Seed yield q/ha	Oil content %	Oil yield q/ha	Volumetric weight kg/hl	H_2O %
Mean	32.7	53.0	15.4	39	8.2
LSD 5%	2.7	2.2	1.6	2.2	0.8
C.V.	8.4	4.1	10.3	5.6	1.0

cms tester Lc 1019A (77 entries)

Mean	33.6	50.7	15.2	37.0	8.1
LSD 5%	3.3	1.8	1.7	2.5	0.8
C.V.	9.7	3.6	11.9	6.6	1.0

Rf tester Lc 1101C (77 entries)

Mean	32.3	50.2	14.4	40	8.2
LSD 5%	2.1	1.7	1.2	1.9	0.7
C.V.	6.5	3.4	8.1	4.7	0.9

Rf tester Lc 1103C (195 entries)

Mean	30.2	48.0	14.5	37.0	10.6
LSD 5%	3.2	1.9	1.8	1.9	0.2
C.V.	10.6	3.9	12.8	5.1	1.9

Table 2

Seed yield, oil content, oil yield, volumetric weight and moisture (% H2O) of sunflower selected hybrids for earliness
Fundulea, 1995

	Hybrid	Seed yield (q/ha)	Oil content %	Oil yield (q/ha)	Volume-tric weight kg/hl	H_2O %
1	Lc-991A x RF-94-560	36.7	55.4	18.1	38	7.5
2	Lc-991A x RF-94-600	35.0	55.7	17.4	40	6.5
3	Lc-991A x RF-94-601	35.9	56.0	17.9	41	6.5
4	Lc-991A x RF-94-606	35.0	54.8	17.1	40	6.9
5	Lc-991A x RF-94-628	36.5	53.0	17.2	43	6.6
6	Lc-991A x RF-94-660	36.3	53.9	17.6	40	7.5
7	Lc-1019A x RF-94-658	36.7	53.1	17.3	39	6.6
8	CT-94-689 x Lc-1101C	32.2	48.4	13.9	40	6.5
9	CT-94-707 x Lc-1101C	35.6	51.6	16.4	43	7.3
10	CT-94-714 x Lc-1101C	30.1	52.0	13.9	40	6.8
11	CT-94-720 x Lc-1101C	34.0	54.5	16.5	43	7.1
12	CT-94-725 x Lc-1101C	31.6	53.2	15.0	37	6.8
13	CT-94-742 x Lc-1101C	30.2	50.2	13.5	36	7.3
14	CT-92-73 x Lc-1103C	28.4	45.6	13.0	35	10.3
15	CT-92-89 x Lc-1103C	31.6	49.1	15.5	39	10.3
16	CT-92-111 x Lc-1103C	28.1	49.5	13.9	36	10.3
17	CT-92-114 x Lc-1103C	30.6	47.3	14.5	38	10.3
18	CT-92-133 x Lc-1103C	27.8	48.8	13.6	39	10.3
19	CT-92-140 x Lc-1103C	27.4	48.5	13.3	36	10.3
20	CT-92-165 x Lc-1103C	32.5	46.5	15.1	36	10.2
21	CT-92-172 x Lc-1103C	33.4	49.7	16.6	40	10.2
22	CT-92-183 x Lc-1103C	35.2	45.9	16.2	38	10.3
23	CT-92-219 x Lc-1103C	29.1	48.6	14.1	37	10.3
24	CT-92-221 x Lc-1103C	34.6	49.1	17.0	39	10.3
25	CT-92-222 x Lc-1103C	31.0	49.4	15.3	41	10.2
26	CT-92-240 x Lc-1103C	33.2	49.6	16.5	36	10.2
27	CT-92-244 x Lc-1103C	28.3	49.4	14.0	37	10.3
28	CT-92-258 x Lc-1103C	31.1	48.6	15.1	39	10.3
29	CT-92-279 x Lc-1103C	32.7	49.1	16.1	35	10.3
30	CT-92-280 x Lc-1103C	33.0	50.2	16.6	39	10.3

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