VARIABILITY OF SOME LEAF AREA PARAMETERS IN SUNFLOWER INBRED LINES

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Abstract

Five sunflower inbred lines in the S_4 generation, which differed in the total number of leaves per plant, were sown in the S_5 generation and tested for some leaf area parameters. Five plants were randomly selected from each sub-line in the F_5 generation and sown in the F_6 generation. Six plants from each sub-line in the F_6 generation were again randomly selected for further study.

The results obtained were processed by the method of hierarchical analysis of variance.

The investigation included 155 inbred lines. The lines in different generations of selfing varied significantly in the number of leaves per plant. A significant variability was established for the number of green leaves per plant in the lines from the three generations of selfing.

Key words: Sunflower, variability, inbred line, total number of leaves per plant, hierarchical analysis of variance.

Introduction

Numerous authors (WATSON ET AL., 1952; ĆUPINA, 1983; etc.) have emphasized the importance of the number of leaves and the number of green leaves, especially in later stages of plant development (from flowering to physiological maturity), for sunflower yield

forming. The number of green leaves at the stage of flowering should be as large as possible because it increases the leaf area index.

When defining a sunflower ideotype, ŠKORIĆ (1975) pointed out the following desirable characteristics of the medium leaves on the sunflower plant: between 25 and 30 medium leaves per plant, optimum arrangement, medium size, and short petiole. The position of leaves should be semi-erect, to facilitate the penetration of light, especially in thick stands. The top leaves should be active to the stage of physiological maturity.

Genetic variability is the basic precondition for breeding. However, variability has been greatly reduced in many crops by continual breeding for high yield and phenotypic uniformity (BOROJEVIĆ, 1981). Knowledge of genetic diversity within and between lines, sub-lines, and genotypes facilitates the selection by reducing the number of parental pairs in initial phases of breeding programs.

The objective of this investigation was to screen sunflower inbred lines for variability in the total number of leaves per plant and the dynamics of leaf number from flowering to physiological maturity.

Material and Method

The source material for the production of lines was the protein variety Kolos, developed at the Institute of Agricultural and Technological Research in Zaječar. The tested material was grown in the experiment field of the Institute in the course of 1989 and 1990.

Five sunflower inbred lines in the S_4 generation, which differed in the total number of leaves per plant, were sown in the S_5 generation and tested for the variability of some leaf area parameters.

Five plants were randomly selected from each sub-line in the F_5 generation and sown the next year in the F_6 generation. Six plants from each sub-line in the F_6 generation were then randomly selected for further study.

The number of green leaves was counted at the stage of flowering and the dynamics of their number after flowering followed at 10-day intervals. For easier handling of the data, the dates of counting after flowering were indicated as follows:

I) F - flowering,
II) F+10 - 10 days after flowering,
III) F+20 - 20 days after flowering,
IV) F+30 - 30 days after flowering.

The data obtained were processed by the method of hierarchical analysis of variance (K. BOROJEVIĆ, 1963, 1986) and the method of sub-samples (HADŽIVUKOVIĆ, 1973). Model II was used for the hierarchical analysis of variance.

Results

The sums of squares and degrees of freedom calculated and the variances obtained for the total number of leaves per plants are shown in Table 1. The variance of the lines tested, obtained by the F test, indicates that the variance of the sub-lines and sub-sub-lines was greater than that of the error. As the material tested differed significantly at LSD 1%, it was evident that the variability of the characteristic tested was not accidental but governed by genetic factors.

The results of the F test for the number of green leaves at the stage of flowering indicated a large diversity and significant differences, especially between the lines in the S_4 generation (Table 3).

These results also show that the lines differed significantly in the number of green leaves per plant. The F test applied at F+10, F+20, and F+30 (Tables 4 and 5) displayed significant differences in the number of green leaves 20 and 30 days after the stage of flowering.

Discussion

The results of the F test showed that the variance in the lines was fairly high, higher than the level of LSD 1%. Significant variance occurred also when the F tests was applied to the sub-lines and sub-sub-lines. This was an indication that the material tested was significantly more variable in the number of leaves per plant than the genotypes which comprised the source material. Writing about the importance of the genotype, ILIINA (1975) declared the genotype, i.e., the genetic basis, as the most important factor in leaf formation.

Tab. 1 - Analysis of variance for the total number of leaves per plant

Source of variation	DF	SS	MS	F	5%	1%
Between lines	4	7661	1915.16	32.08	2.9	4.4
Between S_2 lines	20	1194	59.71	2.99	1.6	2.0
Between S_3 lines	100	1996	19.96	3.88	1.0	1.0
Between plants	625	3216	5.15			
TOTAL	749	14067				

Tab. 2 - Analysis of variance for the number of green leaves at the stage of flowering

Source of variation	DF	SS	MS	F	5%	1%
Between lines	4	1206	301.48	8.19	2.9	4.4
Between S_2 lines	20	736	36.81	2.38	1.6	2.0
Between S_3 lines	100	1545	15.45	2.95	1.0	1.0
Between plants	625	3279	5.25			
TOTAL	749	6766				

Tab. 3 - Results of the F test for the number of green leaves in F+10, F+20, and F+30

Source of variation	F+10	F+20	F+30	5%	1%
Between lines	3.90	6.03	9.10	2.9	4.4
Between S_2 lines	3.49	3.83	3.45	1.6	2.0
Between S_3 lines	2.89	3.18	4.07	1.0	1.0

For sunflower, it is crucial to have a maximum number of green leaves at the stage of flowering. Our results showed that the lines, sub-lines, and sub-sub-lines tested were significantly variable regarding that particular characteristic (Tables 2 and 3).

The differences established were not accidental but genetically conditioned. The level of significance at LSD 1% was established at practically all stages of plant growth and for all sources of variation. The only exception was the stage F+10 where the level of significance was found at LSD 5%.

Conclusion

The following conclusions were drawn on the basis of the test of variability for the number of leaves in sunflower inbred lines.

The different generations of the material tested differed significantly in the number of leaves per plant.

The lines in the different generations of selfing exhibited significant differences in the number of green leaves in the period from flowering to physiological maturity.

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