T1978AGRO16

INVESTIGATION ON THE MINIMUM NUMBER OF PLANTS NECESSARY TO MAINTAIN THE HIGH-OIL CONTENTS VARIETY-POPULATION

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All modern high-oil open-pollinated sunflower varieties represent heterozygous populations. In free cross-pollination within the variety itself arise such hybrid combinations, that, if speaking of their economically valuable characters, appear to be plus- and minus-variants in comparison with the average indices of the variety (Pustovoit, 1975).

Breeding by the method of individual family selection makes it necessary to multiply a larger number of varieties during time of 2-3 generation with a comparatively small number of plants. Re-reproduction of collection of samples (standards) requires a preservation of the genetic material by a reciprocal pollination of small group of plants under isolation. The plant is highly cross-pollinated, and both yield and fertility are generally reduced by inbreeding (Putt, 1941). Self-pollination and increasing the degree of inbreeding leads to a depression, that is more strongly manifested in the first generation, reaching a yield reduced with up to 60.3 percent (Unrau and White, 1947).

Investigations on the minimum number of plants necessary to preserve the genetic characteristics of a variety have not been carried out. A test has been carried out with two varieties -- Peredovik and Balkan, aiming at establishing the number of plants necessary to maintain a high-oil open-pollinated variety in a period of several generations. Peredovik is a Russian variety, registered in 1960 (Zadorozhnii, 1972). Balkan is a Bulgarian variety, registered in 1975. These varieties have been maintained for three years (1974, 1975 and 1976) by a pollination in groups of 10, 25, 50, 75 and 100 plants under an isolation. Each group is carried out in three replications. Only a negative selection has been done. In 1977 all variants have been tested in two comparative varietal tests, in four replications after the method of the Latin square, in an area of 20 m^2. The check variant in the experiment is sown with elite seeds from the primary sample of the 1973 harvest, from which the experiment has been carried out. Records have been made on seed yield, the percentage of the kernel, oil content of the kernel and of the whole seeds. Ten plants of each replication have been measured to determine the stem height, the height at which the head is set and its diameter, the number of leaves and the vegetation period.

Results and Discussion

Data in Table 1 show the changes that have taken place in the variants of variety Peredovik three years later. The average seed yield is lowest when the variety is maintained with 10 plants and highest with 75 plants. Mathematically proved is only the reduced productivity of the variants 10 I and 10 II. High productivity in variants of 75 plants has not been proved. Speaking of that complex index, the number of plants in the ranges of 25-100 plants is of no im-

portance. Restriction in the number of plants up to 10, leads to a distinctly expressed depression. The same process affects even stronger the oil content of the seeds. Low oil content in variants of 10 plants is only due to changed relation between the husk and the kernel. The low seed yield and the reduced oil content, that becomes 1.59% lower than the check variant, causes a still more significant fall in the index of oil production per ha. High oil content typical for variety Peredovik is preserved both in the kernel and the whole seeds of the other four groups.

Investigation on productive and qualitative indices in variety Balkan does not prove any presence of significant differences between the variances and the check. The average seed yield is in the range of 27.35 c/ha - 28.30 c/ha. The variants of the second group, 25 II and 25 III are of lower productivity, while no reduction is observed in the first group. Oil content of variety Balkan's seeds is with 3.59% higher than that of Peredovik. This higher oil content is due both to the oil content of the kernel, that is with 3.06% higher and the percentage of the kernel -- 1.85% higher.

In all variants tested, in spite of the limited number of plants, the variety keeps its high oil content and reproduces unchanged. Only in variant 25 III together with the lowering productivity the oil content of the kernel comes to 61.64% -- that is with 2.31% lower than that of the check. The relative oil production in the same variant decreases to 91.06%.

Table 3 gives data concerning some characters of variety Peredovik that are not related directly with yield. When having only 10 plants to maintain the variety, productivity reduction is combined with decreasing the plant's height. The average value for the first three variants is with 14.5 cm lower than the check. The variation of this character is more strongly felt within the limits of the groups. In the group of 10 plants the difference between the extreme values is 7.7 cm; in the group of 25 plants it comes to 13.4 cm; it is highest in the group of 50 plants -- 16.9 cm, and goes down to 13.6 -- for 75 plants and 6.3 cm -- for 100 plants. Reduction of these variations to unaverage value leads if compared with the first group to limitation of the intervals in the ranges of 5.5 - 10.6 cm. Height of the stem in all variants except 50 III does not reach that of the check variant. That is most probably due to the triple negative selection where the latest and the highest plants have been removed. The height at which the head is set depends on the stem height and in variety Peredovik it varies from 137.8 cm up to 171.0 cm. This index is closely related with the variety suitableness for mechanized harvesting. Although the average values are close to the check ones, in the separate variants a stronger deviation is existing. The size of the head expressed by its diameter is significantly variating too, from 16.2 cm with 25 I to 19.4 cm with 75 I. But those changes do not bring to any differences in the yield of seed and oil. The smaller number of leaves in the group of 10 plants is due chiefly to the height of the stem. Smallest changes are recorded in the vegetation period.

Data concerning variety Balkan are very close to that of Peredovik and so they are not presented in the paper.

Investigations on the tested variants of the varieties Peredovik and Balkan in a period of three generations show that limitation of the number of plants in the ranges of 25-100, does not exert any negative influence on pre-

serving the productive qualities and varietal characters. The comparison shows that Balkan, created 15 years later than Peredovik possesses a relatively higher heterogenity, its depression proving to be lower and was observed even in variants with larger number of plants. Investigation with variety Peredovik continue.

Literature Cited

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TABLE 1. Seed Yield and Oil Content in Variants of v. Peredovik

No. of plants Variants	Seed Yield	Relative Yield- %	Percentage of Kernel	Oil Content of Kernel	Relative Oil Yield
1 Group					
10 Plants I	26.84+	94.9	75.61	59.86	90.1
10 Plants II	26.65+	94.2	77.21	59.99	91.1
10 Plants III	27.52	97.3	77.70	60.16	95.0
Average	27.00	95.4	77.14	60.00	92.1
2 Group					
25 Plants I	28.13	99.4	79.30	61.89	101.9
25 Plants II	27.68	97.8	79.22	59.79	96.8
25 Plants III	29.36	103.8	78.82	61.45	105.0
Average	28.39	100.4	79.11	61.04	101.2
3 Group					
50 Plants I	27.93	98.7	78.77	60.66	98.5
50 Plants II	29.01	102.5	77.48	60.40	100.2
50 Plants III	29.07	102.8	78.67	60.50	102.2
4 Group					
75 Plants I	28.66	101.3	78.82	60.99	101.7
75 Plants II	28.95	102.3	77.23	60.27	99.5
75 Plants III	29.63	104.7	78.18	60.29	103.1
Average	29.08	102.8	78.08	60.52	101.4
5 Group					
100 Plants I	28.04	99.1	78.70	60.24	98.2
100 Plants II	29.24	103.4	78.48	60.57	102.6
100 Plants III	27.78	98.2	78.21	60.77	97.5
Average	28.35	100.2	78.46	60.53	99.6
Peredovik (Check)	28.29	100.0	78.63	60.89	100.0

+LGD 5% - 1.42 c/ha for seed yield

TABLE 2. Seed Yield and Oil Content in Variants of V. Balkan

No. of plants Variants		Seed Yield	Relative Yield-%	Percentage of Kernel	Oil Content of Kernel	Relative Oil Yield
1 Group						
10 Plants	I	28.14	100.5	81.79	63.75	101.86
10 Plants	II	27.30	97.5	81.03	64.05	98.35
10 Plants	III	28.51	101.9	78.63	64.09	99.74
Average		27.98	100.0	80.48	63.96	99.98
2 Group						
25 Plants	I	28.99	103.6	79.31	63.51	101.37
25 Plants	II	26.54	94.8	81.12	62.54	93.47
25 Plants	III	26.53	94.8	80.22	61.64	91.06
Average		27.35	97.7	80.22	62.56	95.30
3 Group						
50 Plants	I	28.35	101.3	80.24	63.38	100.09
50 Plants	II	27.53	98.4	78.95	62.38	94.12
50 Plants	III	28.51	101.9	79.41	63.15	99.25
Average		28.13	100.5	79.53	62.97	97.82
4 Group						
75 Plants	I	29.15	104.1	79.27	63.27	101.49
75 Plants	II	27.39	97.9	80.19	62.77	96.92
75 Plants	III	27.98	100.0	80.65	63.78	99.91
Average		28.17	100.6	80.04	63.27	99.44
5 Group						
100 Plants	I	28.60	102.2	80.81	64.39	103.66
100 Plants	II	28.30	101.1	80.59	63.44	100.44
100 Plants	III	28.00	100.3	79.32	64.36	99.23
Average		28.33	101.2	80.24	64.06	101.11
Balkan (Check)		27.99	100.0	80.48	63.95	100.00

LGD 5% - 1.52 c/ha for seed yield

TABLE 3. Basic Characters of Plants - Variety Peredovik

No. of Plants Variants		Height of Stem	Height of Head	Head Diameter	No. of Leaves	Vegetation Period
1 Group						
10 Plants	I	185.6	149.2	19.1	28.2	104
10 Plants	II	189.6	171.0	17.7	30.0	105
10 Plants	III	193.3	157.3	18.0	27.2	105
Average		189.5	159.2	18.3	28.5	105
2 Group						
25 Plants	I	201.9	171.0	16.2	29.9	108
25 Plants	II	199.4	157.7	18.2	28.3	105
25 Plants	III	188.5	137.8	18.9	29.7	105
Average		196.6	155.5	17.8	29.3	106
3 Group						
50 Plants	I	190.1	148.4	18.6	29.4	106
50 Plants	II	203.1	162.7	18.2	31.2	106
50 Plants	III	207.0	165.5	17.7	32.1	106
Average		200.1	158.9	18.2	30.9	106
4 Group						
75 Plants	I	188.5	149.0	19.4	28.8	107
75 Plants	II	194.4	158.1	17.6	28.2	106
75 Plants	III	202.1	161.3	19.3	29.6	108
Average		195.0	156.1	18.8	28.9	107
5 Group						
100 Plants	I	192.7	147.8	18.4	28.1	109
100 Plants	II	199.0	167.5	17.1	29.9	107
100 Plants	III	198.1	164.3	17.8	30.2	105
Average		196.6	159.9	17.8	29.4	107
Peredovik (Check)		204.0	162.1	18.6	30.2	106