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DETERMINATION OF SOME AGRONOMIC CHARACTERISTICS AND HYBRID VIGOR OF NEW IMPROVED SYNTHETIC VARIETIES IN SUNFLOWER (*Helianthus annuus* L.)

Abdurrahim T. Goksoy, Aydin Turkec* and Zeki M. Turan

Department of Field Crops, Faculty of Agriculture, University of Uludag, 16059 Bursa, Turkey

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SUMMARY

This study was conducted in order to improve new synthetic varieties having high yielding ability and to observe hybrid vigor in certain agronomic traits of these synthetics. Three Syn 1s, each composed of four inbred lines, (Syn 1A, Syn 1B, Syn 1C) and one Syn 1 derived from twelve lines (Syn 1D) were formed artificially by inter-crossing. Four experimental Syn 1s, their parental mixtures (Syn O's) and two check varieties (open pollinated Vniimk-8931 and commercial hybrid Sunbred-281) were evaluated in replicated field trials under Bursa conditions without irrigation in 1995, 1996 and 1997. The rates of heterosis observed in plant height, head diameter, seed number/head, 1000-seed weight, seed weight/plant (head) and seed yield/ha were found as 11.2, 14.7, 35.8, 15.7, 59.4 and 65.7%, respectively.

Key words: **sunflower, *Helianthus annuus* L., synthetic varities, hybrid vigor, seed yield and agronomical characters**

INTRODUCTION

In some cross-pollinated crops it has been possible to use hybrid vigor by breeding of synthetic varieties. Synthetic varieties are produced by intercrossing a number of genotypes selected for their general combining abilities (Alard, 1960; Mayo, 1989; Fern, 1987). The genotypes that are inter-crossed to produce a synthetic variety can be inbred lines, clones and mass-selected populations.

In several cross-pollinated species, their floral structures do not permit easy emasculation and pollen transmission. In such species it is not possible to produce hybrid (F_1) seed at low cost. These problems can be solved by breeding synthetic varieties (Mayo, 1989; Demir, 1975; Pick, 1978; Burton, 1983). As stated by Allard

* Corresponding author

(1960) synthetic varieties have several advantages as follows: 1- Seed production costs are lower than hybrids. 2- They have higher adaptation ability. 3- Synthetic varieties may have an important place where commercial acreage is too small for hybrid seed production. However, one practical disadvantage of synthetics would be lower uniformity than in a single-cross hybrid.

Hayes and Garber first suggested that the breeding of synthetic varieties could be used in plant breeding of their study maize in 1919 (Mayo, 1989). In some countries synthetic cultivars of maize and other crops were more widely used than hybrids. Especially in Europe, synthetic varieties have received wide use improvement of forage species in particular (Fehr, 1987).

The factors considered in the development of a synthetic cultivar include: (a) forming a population, (b) evaluation of parental lines, (c) evaluation of the combining abilities of parental lines, (d) test of experimental synthetics and (e) preparation of planting seed that have commercial use (Fehr, 1987).

Putt (1962; 1966) in his sunflower studies concluded that synthetic cultivars were a desirable alternative to single-cross hybrids when cross-pollination percentage was low and variable. He also studied the number of parental lines contributing to a synthetic cultivar and stated that some valuable synthetics could be developed from a small number of lines, as few as three to five. Similar results were obtained by Kloczowski (1972).

Breeding methods and some selected studies in sunflower breeding were reviewed in detail by Fick (1978). He also proposed that the synthetic cultivars in sunflower could be useful in countries or programs where hybrid seed production was limited for technical and economic reasons.

Synthetic sunflower cultivars have been produced and tested in the Soviet Union (Fick, 1978). During the past fifteen years, hybrid sunflower cultivars in Turkey took the place of traditional open-pollinated cultivars such as Vniimk and Peredovik. However, due to high inflation rates and lack of state subvention, demand for hybrid seed has ceased and farmers returned to traditional cultivars. A second alternative to the farmers will probably be synthetics.

In this study, four different experimental synthetics were formed by using several inbred lines and they were compared in replicated experiments including two controls in 1995, 1996 and 1997.

MATERIALS AND METHODS

In the study, twelve inbred sunflower lines originated from two distinct sources were used to create experimental synthetic cultivars. The inbred lines which were selfed for seven generations were selected from several lines according to their phenotypical superiority and simultaneous flowering times. Twelve inbred lines were grouped into three groups and three experimental synthetics were formed, each composed of four lines. Additionally, all of the twelve inbred lines were also used to create another synthetic cultivar. Table 1 shows the synthetics and their inbred parental lines with origins.

Table 1: Experimental synthetics and inbred parental lines with their origins from which they were developed

Synthetic	Inbred line and its origin	Synthetic	Inbred line and its origin
Syn 1(A)	Inb. line 1 (Vniimk-8931)	Syn 1 (C)	Inb. line 3 (Vniimk-8931)
	Inb. line 4 (Vniimk-8931)		Inb. line 5 (Record)
	Inb. line 7 (Record)		Inb. line 9 (Armavirsky)
	Inb. line 12 (Armavirsky)		Inb. line 11 (Armavirsky)
Syn 1(B)	Inb. line 2 (Vniimk-8931)	Syn 1 (D)	All the twelve lines given above
	Inb. line 6 (Record)		
	Inb. line 8 (Record)		
	Inb. line 10 (Armavirsky)		

Parental lines, were first intercrossed artificially by hand in 1994 and repeated in the following two years to get Syn 1 seeds for the experiments. Additionally, four Syn 0s were also obtained by mixing the seeds of parental lines in equal amounts. Syn 0s were included in the experiments to calculate hybrid vigor in Syn 1s,

Two commercial cultivars, an open-pollinated cultivar Vniimk-8931 and a hybrid cultivar Sunbred-281, were included in the field experiments as controls.

Field experiments including ten entries (four Syn 1s; four Syn 0s and two controls) were conducted in a randomized block design with four replications in 1995, 1996 and 1997. These experiments were carried out at the Experimental and Research Farm of Faculty of Agriculture located in Bursa. Plot size was 19.6 m^2 at harvest and the distances within rows and between plants were 0.70 m and 0.30 m, respectively. All growing practices essential for sunflower were applied to the experiments under natural conditions without irrigation.

In this study, six agronomic characters (final plant heigh head diameter, seed number per head, 1000-seed weight, seed yield per head and seed yield per hectare) were measured each year. All the data were analyzed for individual years separately using MSTAT program and finally they were combined over three years. Mean values of cultivars and years were grouped statistically using LSD method at a significance level of 5% (Turan, 1995).

RESULTS AND DISCUSSION

Result of analysis of variance

The results of analysis of variance for the six characters observed in the synthetics and controls were given in Table 2. The differences between cultivars (C) were found to be statistically significant in both individual years and combined

Table 2: The result of analysis of variance in six agronomical characters for individval years and combined data over three years

Source of variation	Degrees of freedom		Plant height				Head diameter				Seed number per head			
	(1)	(2)	1995	1996	1997	1995-1997	1995	1996	1997	1995-1997	1995	1996	1997	1995-1997
Blocks	3	9	**	ns	*	**	*	**	ns	**	ns	ns	*	ns
Years (Y)	-	2	-	-	-	**	-	-	-	**	-	-	-	**
Cultivars (C)	9	9	**	**	**	**	**	**	ns	**	*	**	**	**
Y x C	-	18	-	-	-	**	-	-	-	**	-	-	-	ns
Error	27	81	63.2	17.1	63.3	48.5	2.0	1.5	1.8	1.8	17457	6218	13340	12339

Source of variation	Degrees of freedom		1000 seed weight				Seed yield per head				Seed yield per ha			
	(1)	(2)	1995	1996	1997	1995-1997	1995	1996	1997	1995-1997	1995	1996	1997	1995-1997
Blocks	3	9	ns	ns	ns	ns	ns	ns	*	*	ns	ns	*	*
Years (Y)	-	2	-	-	-	**	-	-	-	**	-	-	-	**
Cultivars (C)	9	9	**	**	ns	**	**	**	**	**	**	**	**	**
Y x C	-	18	-	-	-	**	-	-	-	*	-	-	-	ns
Error	27	81	39.6	3.7	43.6	28.9	13.2	11.8	50.1	25.0	397	324	1010	577

(1): Degrees of freedom for individual years
(2): Degrees of freedom for combined data over three years
*,**: Statistically significant in the levels of 5% and 1% probability, respectively
ns: non-significant

three-years data for all the traits. It can be concluded from these results that there were marked variations permitting to detect the best cultivars.

The effect of the years (Y) on all the characters was also statistically significant. On the other hand, the interaction between year and cultivars (Y x C) contributed significantly to the phenotypical variation in all characters except seed yield/ha. The significant effects of years and Y x C interactions are not suprising for these traits because they are inherited quantitatively.

Plant height

Plant height or stem length is an important character in sunflower. As the plant height increases, the higher harvesting losses appear. Thus shorter plant height is an important breeding objective in sunflower (Knowles, 1978).

Table 3: Average plant heights of experimental synthetics, control varieties and the years (cm)

Cultivar	Year				Heterosis%	% of Sunbred 281
	1995	1996	1997	1995-1997		
Syn I(A)	154.5 cd	124.0 de	167.1 be	149.7 c	8.0**	95.4
Syn 0(A)	141.6 e	120.9 e	152.8 de	138.6 d		
Syn 1(B)	159.4 be	130.4 c	167.1 be	154.4 be	13.4 **	98.4
Syn 0(B)	146.4 de	118.7 e	141.9 e	136.2 de		
Syn 1(C)	169.6 b	136.6 b	157.0 cd	150.2 c	13.0**	95.7
Syn 0(C)	150.6 cde	120.2 e	127.4 f	132.9 e		
Syn 1(D)	158.8 be	127.7 cd	163.5 bed	150.9 c	10.5**	96.2
Syn 0(D)	149.1 cde	121.4 e	142.1 e	136.6 de		
Vniimk-8931	189.6 a	161.3 a	183.3 a	178.1 a		113.5
Sunbred-281	156.9 cd	140.0 b	173.8 ab	156.9 b		100.0
Mean	157.7 a	130.1 b	157.6 a	148.5	11.2	

Vniimk-8931, first control, gave the tallest plants (178.1 cm), as expected in the experiments (Table 3). But second control, Sunbred-281, was much shorter (156.9 cm) than Vniimk-8931 and more suitable for machine harvesting. Plant heights of Syn 1s ranged from 149.7 to 154.4 cm and no significant differences existed among them. On the other hand, their mean values in plant height were very similar to the height of Sunbred-281. Parental mixtures (Syn 0s) gave plant heights showing non-significance and ranging from 132.9 to 138.6 cm. All the Syn 1s produced taller plants than those of Syn 0s which contribute to them. Thus, hybrid vigor percentages showed that the plant heights of Syn 1s exceded their parental means significantly by 8.0 to 13.4%. Mean heterosis calculated over all Syn 1s was about 11%. Heterosis in plant height was observed by several experimenters. Knowles (1978) and Putt (1966) reported that crosses of plants having different heights produced plants as tall as or taller than the tall parent in the F_1.

The effect of the years on the plant height was highly significant and the shortest plants were measured in 1996 (Table 2). Differences between the cultivars found in the individual years were due to significant Y x C interaction in plant height.

Head diameter

Head diameter in sunflower has the most significant effect on seed yield. Its size is influenced greatly by environmental factors especially by plant population, soil moisture and soil fertility. But, there is usually an optimum diameter for maximum seed production in field conditions. More probably the most important head characteristics affecting yield is the number of sound seeds or seed weight per head (Knowles, 1978; Weis, 1983).

Table 4: Average head diameters of experimental synthetics, control varieties and the years (cm)

Cultivar	Year				% Heterosis	% of Sunbred 281
	1995	1996	1997	1995-1997		
Syn 1(A)	20.3 a	16.0 ab	13.8	16.7 a	13.6**	104.4
Syn 0(A)	17.3 cd	13.2 cd	13.7	14.7 de		
Syn 1(B)	19.6 ab	16.6 a	13.6	16.6 ab	16.1**	103.8
Syn 0(B)	16.5 cde	13.0 cd	13.4	14.3 e		
Syn 1(C)	17.7 bcd	14.07 bc	13.8	15.4 cd	16.7**	96.3
Syn 0(C)	14.3 f	12.4 d	12.9	13.2 f		
Syn 1(D)	17.8 bc	15.5 ab	13.6	15.6 bcd	12.2**	97.5
Syn 0(D)	14.5 ef	13.5 cd	13.9	13.9 ef		
Vniimak-8931	15.7 def	12.8 d	14.2	14.2 ef		88.8
Sunbred-281	17.1 cd	16.3 ab	14.7	16.0 abc		100.0
Mean	17.1 a	14.4 b	13.7 c	15.1	14.7	

Hybrid cultivar Sunbred-281 (16.0 cm) yielded significantly bigger heads than Vniimk-8931 (14.2 cm) (Table 4). Head sizes of Syn 1s, as seen in Table 4, were larger than in their Syn 0s and they varied from 15.4 to 16.7 cm. On the other hand, head diameters of Syn 1s did not show any significant difference from that of Sunbred-281. Although no correlation analysis were applied to the data of head diameters, it is clearly seen that there is a positive correlation between Syn 1s and Syn 0s. Thus, it can be concluded that the parental lines having large heads tends to give better synthetics, as reported by Fick (1978) and Russel (1953).

The rates of heterosis of Syn 1s for head diameter changed from 12.2 to 16.7% with an average of 14.7%. Several workers reported that there was an important heterosis in head size (Schuster, 1964; Klozowki, 1975).

Seed number per head

Seed number per head in Syn 1s varied from 718 to 869 over the three years (Table 5). The differences among them were not significant, except for Syn l(B) in which the least seed number per head was observed. The seed numbers per head produced by the parental mixture (Syn 0s) changed from 529 to 652 and their mean values were statistically lower than those of Syn 1s. Thus, a great variation in heterosis ranging from 31.2 to 43.0%, with an average of 35.8%, was observed in the seed number per head. On the other had, it may easily be seen that there was a positive correlation between Syn 1s and Syn 0s (Table 5).

Table 5: Average seed numbers per head of experimental synthetics, control varieties and the years

Cultivar	Year				Heterosis%	% of Sunbred 281
	1995	1996	1997	1995-1997		
Syn 1(A)	886 cd	924 a	702 bc	838 b	43.0**	86.7
Syn 0(A)	718 de	624 cde	417 de	586 de		
Syn 1(B)	856 cde	729 bc	570 cd	718 c	35.7**	74.3
Syn 0(B)	675 e	518 e	393 e	529 e		
Syn 1(C)	1080 ab	770 b	756 ab	869 b	33.3**	89.9
Syn 0(C)	803 de	603 de	549 cde	652 cd		
Syn 1(D)	996 bc	813 ab	666 bc	825 b	31.2**	85.3
Syn 0(D)	812 cde	598 de	476 de	629 cd		
Vniimk-8931	908 bcd	706 bcd	904 a	839 b		86.8
Sunbred-281	1192 a	905 a	803 ab	967 a		100.0
Mean	893 a	719 b	624 c	745	35.8	

In the experiment, the highest seed number per head (967 seeds per head) was measured in the variety Sunbred-281. So, the seed numbers of Syn 1s pear head were less than those of the control variety and their seed numbers per head amounted to only 74.3-89.9% of Sunbred-281. The years also affected significantly seed number/head and the highest seed number was measured in 1995.

1000-seed weight

Another important yield component in commercially grown sunflower cultivars is 1000-seed weight, and it is changes from 40 to 100 g. Fick (1978) pointed out that the seed weight was inherited by intermediate level of heritability.

Table 6: Average 1000 seed weights of experimental synthetics, controls and the years (g)

Cultivar	Year				Heterosis%	% of Sunbred 281
	1995	1996	1997	1995-1997		
Syn 1(A)	62.9 a	43.2 de	60.1	55.4 ab	19.9**	106.3
Syn 0(A)	46.9 cd	35.4 g	56.2	46.2 ef		
Syn 1(B)	63.4 a	46.5 bc	61.7	55.6 ab	2.0	106.7
Syn 0(B)	58.6 ab	44.3 cd	56.7	54.5 ab		
Syn 1(C)	54.5 abc	44.6 cd	62.7	53.9 abc	25.0**	103.5
Syn 0(C)	37.9 d	39.4 f	52.1	43.1 f		
Syn 1(D)	58.8 ab	48.0 ab	62.9	56.5 a	16.0**	108.4
Syn 0(D)	47.0 cd	41.3 ef	58.0	48.7 de		
Vniimk-8931	46.0 cd	49.3 a	53.9	49.7 cde		95.4
Sunbred-281	51.5 bc	47.4 ab	57.6	52.1 bcd		100.0
Mean	52.7 b	43.9 c	58.0 a	51.6	15.7	

The Syn 1s in the experiments gave 1000 seed weights ranging from 53.9 to 100 g (Table 6). All the Syn 1s, except Syn 1(B), exceeded their respective Syn 0s, as seen in Table 6. The rates of heterosis of Syn 1(A), Syn 1(C) and Syn 1(D) in seed weight were 19.9, 25.0 and 16.0%, respectively. Althought inbreeding depression is considerably less for seed weight, a significant heterosis has generally been observed in sunflower (Fick, 1978; Kloczowski, 1975).

The Syn 1s were additionally compared with the commercial hybrid Sunbred 281. All of the experimental synthetics gave seed weight higher about 3.5 to 8.4%, with an average of 6.2%, than Sunbred 281. Especially Syn 1(D), composed of twelve inbred lines, which gave the highest 1000-seed weight in the experiments according to the three-year average.

The 1000-seed weights of the years were also found to be significantly different. The experiment conducted in 1997 gave highest seed weight. The cultivars did not differ in 1000 seed weight in 1997. Thus a significant Y x C interaction was observed.

Seed yield per plant

Sunflower seed yield is the product of three components: (a) number of heads per unit area, (b) number of seeds per head and (c) individual seed weight. Since most cultivars produce single head per plant, component (a) is determined by plant spacing. The other components produce seed weight per plant or per head when they are multiplied with each other. For this reason the seed weight per plant is an important yield component determining seed yield directly.

Table 7: Average seed yields per plant of experimental synthetics, controls and the years (g)

Cultivar	Year				Heterosis %	% of Sunbred 281
	1995	1996	1997	1995-1997		
Syn 1(A)	54.7 bc	39.9 a	42.5 ab	45.7 b	72.4**	91.6
Syn 0(A)	33.7 fg	22.1 d	23.7 d	26.5 d		
Syn 1(B)	50.0 c	33.9 c	36.7 bc	40.2 c	38.1**	80.6
Syn 0(B)	42.6 d	23.0 d	21.8 d	29.1 d		
Syn 1(C)	58.5 ab	34.4 bc	47.6 a	46.8 ab	72.0**	93.8
Syn 0(C)	30.4 g	23.8 d	27.4 cd	27.2 d		
Syn 1(D)	57.5 ab	39.0 ab	41.8 ab	46.1 ab	55.2**	92.4
Syn 0(D)	37.1 ef	24.7 d	27.4 cd	29.7 d		
Vniimk-8931	41.5 de	34.8 bc	36.8 bc	37.7 c		75.6
Sunbred-281	60.5 a	42.7 a	46.5 ab	49.9 a		100.0
Mean	46.7 a	31.8 c	35.2 b	37.9	59.4	

The seed weights per plant of the Syn 1s differed significantly and changed from 40.2 to 46.8 g (Table 7). Syn 1(B) gave the lowest seed yield per plant among Syn 1s. But all the Syn 1s surpassed their own Syn 0's. Thus, as a result, there occurred a significantly higher heterosis and the rates of heterosis ranged from 38.1 to

72.4%, with an average of 59.4%. Some investigators also reported an important heterosis in their studies in seed yield per plant (Putt, 1966; Kloczowski, 1972).

Although the experimental synthetics gave higher heterosis, none of them could exceed the hybrid Sunbred 281 which produced the highest seed weight per plant. Only the mean values of Syn 1(C) and Syn 1(D) did markedly approach Sunbred 281 (49.9 g). Therefore, they did not statistically differ from Sunbred 281.

The years also differed in seed yield per plant, as well as other traits measured. The highest seed yield per plant was observed in the first year.

Because the seed yields per plant of cultivar did not have same order in individual years, Y x C interaction was detected.

Seed yield

Seed yield of experimental synthetics and control varieties were given in Table 8. As expected, the lowest seed yield was obtained in the open-pollinated variety, Vniimk-8931 (1776 kg ha^{-1}). The commercial hybrid, Sunbred 281, gave the highest yield (2225 kg ha^{-1}). Seed yields of the Syn 1s, as an average of three years varied from 187 to 2114 kg ha^{-1}.

Table 8: Average seed yields of experimental synthetics, controls and the years (kg ha^{-1})

Cultivars	Years				Heterosis %	% of Sunbred 281
	1995	1996	1997	1995-1997		
Syn 1(A)	2287 a	2036 ab	1909 ab	2077 a	78.9**	93.3
Syn 0(A)	1281 d	1135 d	1066 d	1161 c		
Syn 1(B)	2155 ab	1738 c	1647 bc	1847 b	46.1**	83.0
Syn 0(B)	1635 c	1181 d	977 d	1264 c		
Syn 1(C)	2442 a	1762 c	2138 a	2114 a	75.7**	95.0
Syn 0(C)	1162 d	1218 d	1230 cd	1203 c		
Syn 1(D)	2315 a	1959 abc	1876 ab	2050 a	62.0**	92.1
Syn 0(D)	1300 d	1265 d	1231 cd	1265 c		
Vniimk-8931	1890 bc	1738 bc	1654 bc	1776 b		79.8
Sunbred-281	2396 a	2190 a	2088 a	2225 a		100.0
Mean	1886 a	1627 b	1582 b	1698	65.7	

The differences among Syn 1's were significant and Syn 1(B) gave lower seed yield than Syn 1(A), Syn 1(C) and Syn 1(D). When Syn 1s are compared with Sunbred 281, it can be seen that Syn 1(C), Syn 1(A) and Syn 1(D) gave seed yield as high as Sunbred 281 and they altogether formed the highest yielding group. Syn 1(B) having lower seed yield per plant and seed number per head also gave lower seed yield than Sunbred 281 as well as than the remaining Syn 1s. At the other hand, all the Syn 1s except Syn 1(B), exceeded Vniimk 8931 greatly.

Another important thing that attracts attentions is that Syn 1(D) composed of twelve inbred lines did not differ from Syn 1(A) and Syn 1(C), each of which were composed of four inbred lines.

Seed yields of the parental mixtures (Syn 0s) ranged from 1161 to 1265 kg ha^{-1} and no significant differences among them were determined. Thus, the heterosis rates that occurred in Syn 1s changed from 46.1 to 78.9%, with an average of 65.7%. Because sunflower is an open-pollinated species, it is naturally expected to observe higher heterosis in seed yield (Fick, 1978; Putt, 1966). Thus the production of hybrid seed in sunflower took the place of open-pollinated cultivars. The discoveries of CMS and restorer systems have also contributed to breeding hybrid sunflower cultivars.

The years also differed in seed yield and the highest seed yield was obtained in 1995. The seed yield went down steadily in 1996 and 1997 (Table 7).

Although there was no any significant Y x C interaction detected in seed yield, Syn 1(C) showed a significant deviation from decreasing effect of the years on seed yield (Table 8).

CONCLUSIONS

Four experimental synthetics (Syn 1s) were compared with their parental mixtures (Syn 0s). As expected, heterosis rates for plant height, head diameter, seed number per head, 1000-seed weight, seed weight per plant (head) and seed yield per ha were found to be high and their values were as 11.2, 14.7, 35.8, 15.7, 59.4 and 65.7%, respectively.

The experimental synthetics were also compared with two commerical check varieties, Vniimk 8931 and Sunbred 281. The lowest seed yield per ha was obtained from Vniimk 8931 and the higest seed yield (2225 kg ha^{-1}) was obtained from the commercial hybrid Sunbred 281. Although combining abilities of the parental lines were not evaluated and not selected for their combining abilities, Syn 1(A), Syn 1(C) and Syn 1(D) gave seed yields as high as 93.3, 95.0 and 92.1% of Sunbred 281, respectively. The differences between synthetics and Sunbred 281 were not significant.

Syn 1(D), composed of twelve inbred lines, was not different in seed yield from synthetics derived from four lines. The results obtained here confirmed the conclusions reported by Putt (1966) and Kloczowski (1972).

According to the results, obtained in this study it may be proposed that it could be possible to develop synthetic varieties having seed yields as high as those of hybrids.

In this study, experimental synthetics were formed by artificial intercrossing. But in practice it is essential to use natural cross-pollination by insects for producing cheaper seed for sowing. Thus, the next step is to study natural cross pollination problems under Bursa conditions.

Putt (1962) pointed out that there was a great positive correlation between the yielding ability of hybrids and the percentage of seed for sowing. On the other hand, hybrid seed percentage is greatly dependent to the self-incompatibility levels of inbred lines. Thus, the second next problem to be solved is to study self-incompatibility levels of the inbred lines which will be used in forming synthetics.

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DETERMINACIÓN DE ALGUNAS CARACTERÍSTICAS AGRONÓMICAS Y DE VIGORES HÍBRIDOS DE LAS NUEVAS, MEJORADAS VARIEDADES SINTÉTICAS DE GIRASOL (*Helianthus annuus* L.)

RESUMEN

El objetivo de este estudio ha sido mejorar las nuevas variedades sintéticas de alto potencial para el rendimiento, e investigar su vigor híbrido para ciertas características agronómicas. Con el cruzamiento mutuo, se han obtenido artificialmente, tres variaciones sintéticas, compuestas por cuatro líneas consanguíneas cada una (Syn 1A, Syn 1B y Syn 1C) y una derivada de 12 líneas (Syn 1D). Estas cuatro líneas sintéticas experimentales, mezcla de sus componentes parentales (marcadas con Syn O) y dos variaciones de control (polinización abierta Vniimk-8931 y el híbrido comercial Sunbred-281) se han evaluado en el ensayo del campo con repeticiones en las condiciones de la localidad de Bursa sin irrigaciones durante los años 1995, 1996 y 1997. Se han obtenido los siguientes valores de heterosis: altura de la planta 11,2%; diámetro de la cabeza 14,7%; número de semillas por cabeza 35,8%; peso de 1000 semillas

15,7%; peso de semilla por planta (cabeza) 59,4% y rendimiento de semilla por hectárea 65,7%.

DÉTERMINATION DE CERTAINES CARACTÉRISTIQUES AGRONOMIQUES ET DE LA VIGUEUR HYBRIDE DE NOUVELLES VARIÉTÉS SYNTHÉTIQUES AMÉLIORÉES DE TOURNESOL (*Helianthus annuus* L.)

RÉSUMÉ

Le but de cette étude était d'améliorer les nouvelles variétés synthétiques ayant un grand potentiel de rendement et d'observer la vigueur hybride de certaines de leurs caractéristiques. Par croisements réciproques, on a obtenu trois variétés synthétiques, chacune étant composée de quatre lignes inbred (Syn 1A, Syn 1B, Syn 1C) et une variété synthétique dérivée de douze lignes (Syn 1D). Ces quatre lignes synthétiques, mélanges des composantes de leurs parents (désignées par le symbole Syn O) et deux variétés de contrôle (Vniimk-8931 fertilisée à l'extérieur et l'hybride commercial Sunbred-281) ont été évaluées dans des champs expérimentaux dans les conditions de la localité de Bursa sans irrigation en 1995, 1996 et 1997. Les valeurs hétérosis suivantes ont été obtenues: hauteur de la plante 11.2%; diamètre de la tête 14.7%; nombre de semences par tête 35.8%; masse de 1000 semences 15.7%; masse de semences par plante (tête) 59.4% et rendement de semences par hectare 65.7%.