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DEGREE OF HETEROSIS FOR YIELD, OIL PERCENTAGE AND AMOUNT OF OIL PER PLOT IN SAFFLOWER, *CARTHAMUS TINCTORIUS* L.¹

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ABSTRACT

Two experiments, one in 1970 and one in 1971, were conducted to study hybrid vigor in safflower (*Carthamus tinctorius* L.). Eleven cultivars were used as parents. Characters studied were yield, oil percentage and amount of oil per plot. Heterosis was observed in 1/2 to 5/6 of the hybrids for the characters studied. Hybrids made between Iranian and American cultivars showed a higher degree of heterosis than hybrids made between American cultivars.

INTRODUCTION

Heterosis was first reported in safflower by Cleassen (1) at which time no satisfactory method for producing hybrid seed on a large scale was known. Discovery by Rubis (2) of the gene *th*, which causes a form of structural male sterility, opened a way for hybrid seed production but with this method 100% hybrid seeds could not be produced. Rubis (3) studied safflower hybrids and found that the hybrids yielded 30% more than the check cultivar Gila. Five of the hybrids yielded 18% more than the average of the cultivars Gila, Frio and Dart, and the oil percentage of the hybrids was higher than that of the parent cultivars.

Urie and Zimmer (4) detected heterosis for the height in the hybrid plants and showed that the hybrid lines yielded 24% more than the cultivar Ute. Urie and Zimmer

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(5) also reported that when the hybrid seed lots contained 16-45% selfed seeds, the effect of heterosis was much lower.

The purpose of the present study was to gain additional information about the effects of heterosis in safflower.

MATERIALS AND METHODS

Two experiments were conducted, one in 1970 and the other in 1971. In 1970, three American cultivars (UC-1, Frio and Nebraska 852), two Iranian local cultivars (2811 and 3147) and 8 hybrids (2811xUC-1, UC-1x2811, Frio xUC-1, UC-1x Frio, 3147xUC-1, UC-1x3147, Nebraska 852xUC-1 and UC-1x Nebraska 852) were grown. In 1971, six American cultivars (UC-1, Dart, Rio, Gila, Leed and Ute), one Israeli cultivar (I-13) and the 12 hybrids (including reciprocals) resulting from crossing UC-1 with the other six cultivars were grown.

A completely randomized block design with three replications was used for both studies. Each plot of the experiment consisted of a 20-plant row spaced 60-cm apart in 1970 and 50-cm apart in 1971. In 1970, ammonium nitrate, superphosphate and potassium sulfate were applied to the plots at the rate of 100,200 and 100 kg/ha, respectively, before planting. In 1971 urea, superphosphate and potassium sulfate were applied at the rate of 50,100 and 100 kg/ha, respectively. Material was planted on April 13 in 1970 and on March 16 in 1971. Plots were weeded twice and irrigated nine times during the growth period of each experiment. Plots were sprayed with suitable insecticides three times each year to control aphids. Harvesting was done on September 6 in both years.

Characters studied each year were plot yield, oil percentage and amount of oil per plot. The results obtained for each character were statistically analyzed and the hybrids compared with both the mid parent and high parent.

RESULTS AND DISCUSSION

Significant differences were observed between certain hybrids and their parents for all three characters in both experiments. The mean performance of the hybrids is com-

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pared to their mid and best parents performance for the 1970 (Table 1) and the 1971 (Table 2) experiments.

Table 1. Mean performance of the hybrids, their mid and best parent in the 1970 experiment.

Hybrids and parents	Yield, g/plot	Oil, %	Oil yield, g/plot
UC-1 x 2811			
Hybrid	750	32.4	224
Mid parent	367	33.0	118
Best parent	483	35.3	148
UC-1 x 3147			
Hybrid	696	30.2	210
Mid parent	350	30.1	100
Best parent	449	35.3	111
UC-1 x Frio			
Hybrid	404	35.3	145
Mid parent	276	34.8	98
Best parent	302	36.3	107
UC-1 x Nebraska 852			
Hybrid	419	35.1	145
Mid parent	293	32.2	92
Best parent	335	35.3	96
5% LSD	224	4.3	79

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Table 2. Mean performance of the hybrids, their mid and best parent in the 1971 experiment.

Hybrids and parents	Yield, g/plot	Oil, %	Oil yield, g/plot
UC-1 x I-13			
Hybrid	447	34.1	152
Mid parent	180	30.6	55
Best parent	205	30.7	61
UC-1 x Dart			
Hybrid	300	36.2	109
Mid parent	170	31.4	54
Best parent	184	32.2	59
UC-1 x Frio			
Hybrid	402	34.1	139
Mid parent	185	33.7	64
Best parent	205	36.7	79
UC-1 x Gila			
Hybrid	341	34.5	118
Mid parent	158	32.1	62
Best parent	160	33.5	76
UC-1 x Leed			
Hybrid	480	35.5	170
Mid parent	200	35.5	96
Best parent	244	36.2	99
UC-1 x Ute			
Hybrid	384	33.4	118
Mid parent	226	33.4	78
Best parent	295	36.1	107
5% LSD	143	2.7	50

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Hybrids UC-1x2811 and UC-1x3147 had grain yields significantly higher than their best parent (Table 1); in the other two cases the yield of the hybrid was higher but the difference was not significant. For oil percentage the differences were not significant, however, for the amount of oil per plot in two cases the differences were significant.

In 1971 four of the six hybrids yielded significantly better than either their mid and best parents. The other two hybrids were superior to the parents but the differences were not significant. The oil percentage in all hybrids was higher than in the mid or best parents but the difference was significant only in two cases.

Hybrids between American cultivars showed less differences from their parents than hybrids of the crosses between American and Iranian cultivars. This might suggest differences between the two origins for factors affecting the characters studied. Providing agronomic characteristics are desirable, crosses between diverse germoplasm would warrant further study and exploration for potential high yielding hybrids.

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