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# Agronomic Performance of Some Promising Sunflower Hybrids grown under Agro-climatic Conditions of Malakand Division

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**Abstract**
Studies were carried out on various local sunflower hybrids at Agriculture Research Institute Mingora, Swat to find out the most suitable and high yielding hybrids for its successful cultivation throughout Malakand division. Based on yield and yield components data, it was concluded that hybrids C341/R344 and C300/R368 are high yielding hybrids in this area. It is therefore suggested that these hybrids may be recommended for commercial cultivation in Malakand division.

## Introduction

Sunflower (*Helianthus annuus L.*) is one of the major annual oilseed crop species grown for edible oil. The oil extracted from sunflower seeds is highly regarded by consumers due to its taste, cooking qualities, and fatty acid profile. There is always a need to develop better hybrids with increased seed and oil yields. Sunflower hybrids offer higher seed yields and oil percentages in the presence of heat, drought, pathogens, and insects. In Pakistan Sunflower was grown on an area of 255679 hectares with a total production of 358532 tons and an average yield of 1402 kg/ha. (G.O.P. 2004). In NWFP during the same period it was grown on an area of 89 ha with a total production of 171 tons and an average yield of 1921 kg/ha. (G.O.P. 2004). Hakan et al (2003) conducted a field experiment to evaluate the agronomic performances and genotypic differences of some sunflower hybrids. In this study 20 sunflower genotypes were used. The 2-year results showed that the genotypes differed significantly in all the characteristics investigated, except for kernel percentage. Similarly, the year had a significant influence on the agronomic parameters of the genotypes, with the exception of 1000-seed weight. The study suggested that higher seed yields may be achieved through the use of hybrid genotypes under the region's conditions. Based on these 2 years' data, it was concluded that P-64A52, Trakya-80, AS-508 and HI with their higher seed and oil yield could be successfully grown under this region's conditions. Amir and Khalifa (1991) reported that variation in seed yield among sunflower hybrids most likely resulted from genotype differences. Seed oil content of sunflower hybrids depends on genotype but is also affected by environmental conditions and cultural practices. Ahmad et al (2005) studied heterosis and inbreeding depression in 7.7 half diallel crosses of sunflower and reported significant genetic differences among the parents, their F1 hybrids and F2 populations for all the characters under study. Yield and leaf area showed highly significant heterosis in F1 hybrids ranging from 102 to 309% and 46.3 to 163.9%, respectively, while inbreeding depression in the F2 population ranged from 17-71% and 9.7-43%, respectively. Leaves per plant showed low level of heterosis in F1 hybrids (-0.9 to 39.7%), whereas the effect of inbreeding depression in F2 population was comparatively high (1.1 to 22.2%) for this character. The parent RHA-822 proved itself to be a good general combiner by making higher contribution towards heterosis both in F1 hybrids and in F2 populations. Alaza and Fernandez-Martinez (1997) produced thirty-six sunflower hybrids by factorial cross of six male-sterile and six restorer lines. Estimates of narrow sense heritabilities, calculated with information from analyses combined across environments, were 0.65 for yield, 0.80 for seeds per head, 0.84 for seed weight, 0.81 for head diameter, 0.60 for sterile head center, 0.72 for oil content, 0.61 for harvest index, 0.72 for biomass, 0.94 for days to bloom, and 0.42 for drought susceptibility index. Rainfed yield was positively correlated with yield components. The shortage of edible oil in Pakistan is well recognized and it has attracted the attention of the government and private sector. Pakistan is spending a sum of 7-8 million per annum on the import of edible oil. Therefore it is the need of the day to evolve and promote high yielding hybrids to achieve self-sufficiency in edible oils.

The present study is aimed to study the agronomic performance of locally developed sunflower hybrids and select the most desirable and high yielding ones for irrigated lands of Malakand Division.

## Materials and Methods

The evaluation trial of different locally developed sunflower hybrids was conducted at ARI, Mingora, Swat. The field was thoroughly prepared and fertilizer was applied @ 90:50 N: P kg/ha at the time of seed bed preparation. The experiment was laid out in randomized complete block design with three replication and 20 treatments with plot size of 4 x 1.8 Sq. m., comprising 3 rows 4 meter long with 60 cm spacing. Plant to plant distance was kept 25 to 30 cm, with a sowing depth of 2-4 cm. Thinning was practiced; when the plants were 10-12 centimeters tall and earthling up was done as the plants reached 80 centimeters height, in order to prevent lodging. Three irrigations were applied during the whole cropping season. The crop was harvested at maturity. The harvested bundles from each plot were labeled and kept separated. Each bundle was then threshed and yield data in kg/ha

were recorded. The seed yields and other relevant data on different hybrids were collected as according to standard procedure.

**Results and Discussion**

***1. Days to Physiological Maturity and Plant Height (cm)***

Data on days to maturity and plant height is presented in table-1. Days to maturity revealed significant variation at (P≤ 0.05). It is evident from the data that hybrid C341 x R346 had an early in maturity with 122 days, while hybrid C852 x HAR4 had late maturity with 137 days, as compared to check hybrid C383 x R311 with 129 days. Plant height also revealed significant differences at (P≤ 0.05). It was evident from the average data that maximum plant height of 183 cm was recorded for hybrid C303 x R340, while minimum plant height of 81 cm was recorded for hybrid C341 x R346 as compared to check hybrid C383 x R311 with plant height of 115 cm. This variation in days to maturity and plant height may be attributed to specific genetic characteristic of these hybrids.

***Table-1. Days to Maturity and Plant Height (cm) of Sunflower Hybrids Evaluation Trial***

| *S. No.* | **F1 cross combination** | **Days to Physio-logical maturity** | **Plant height (cm)** |
|---|---|---|---|
| 1 | C300 x R368 | 130 A-D | 129 H |
| 2 | C341 x R346 | **122 D** | **81 K** |
| 3 | C341 x NDBLYS | 130 A-D | 130 H |
| 4 | C383 x R266 | 133 ABC | 132 GH |
| 5 | C303 x R344 | 132 ABC | 179 AB |
| 6 | C320 x RG1G1 | 127 BCD | 133 FGH |
| 7 | C382 x R368 | 135 AB | 112 IJ |
| 8 | C341 x R344 | 132 ABC | 178 AB |
| 9 | C822 x R266 | 127 BCD | 102 J |
| 10 | C822 x R346 | 131 ABC | 111 IJ |
| 11 | C382 x RG1G1 | 128 BCD | 145 EF |
| 12 | C303 x R266 | 126 CD | 161 CD |
| 13 | C337 x R365 | 135 AB | 154 DE |
| 14 | C852 x HAR4 | 135 AB | 130 H |
| 15 | C337 x BM1 | 133 ABC | 154 DE |
| 16 | C303 x R340 | 131 ABC | **183 A** |
| 17 | C852 x HAR4 | **137 A** | 150 DE |
| 18 | C337 x HAR2 | 133 ABC | 167 BC |
| 19 | C852 x R365(4) | 135 AB | 143 EFG |
| 20 | C383 x R311 (check) | 129 A-D | 115 I |
| LSD value at (P≤ 0.05) | | 8.8 | 12.8 |

***2. Head Diameter (cm) and Seed Count***

Data on head diameter and seed count/head is presented in table-2. Data on head diameter revealed non-significant differences at (P≤ 0.05), however, maximum head diameter of 23 cm was recorded for hybrid C303 x R266, while minimum head diameter of 14 cm was recorded for hybrid C341 x R346, as compared to check hybrid C383 x R311 with head diameter of 18 cm. Data on seed count/head revealed significant differences at (P≤ 0.05). It is evident from the average data recorded that maximum seed count/head of 1781 was recorded for hybrid C341 x R344, while minimum seed count/head of 754 was recorded for hybrid C 341 x R346, as compared to check hybrid C383 x R311 with seed count of 853. Variation among head diameter and seed count/head may be attributed largely to genetic characteristics, however fertility and nature of soil as well as environmental conditions could also be the cause of this variation.

*Table-2. Head Diameter and Seed Count of Sunflower Hybrids Evaluation Trial*

| *S. No.* | F1 cross combination | Head Diameter (cm) | Seed Count/head |
|---|---|---|---|
| 1 | C300 x R368 | 21 | 1549 B |
| 2 | C341 x R346 | **14** | **754** I |
| 3 | C341 x NDBLYS | 23 | 1240 CD |
| 4 | C383 x R266 | 20 | 1259 C |
| 5 | C303 x R344 | 22 | 1496 B |
| 6 | C320 x RG1G1 | 18 | 1038 FG |
| 7 | C382 x R368 | 20 | 1056 EFG |
| 8 | C341 x R344 | 21 | **1781 A** |
| 9 | C822 x R266 | 20 | 977 GH |
| 10 | C822 x R346 | 17 | 1101 DEFG |
| 11 | C382 x RG1G1 | 18 | 1194 CDE |
| 12 | C303 x R266 | **23** | 1427 B |
| 13 | C337 x R365 | 22 | 1541 B |
| 14 | C852 x HAR4 | 20 | 1217 CD |
| 15 | C337 x BM1 | 22 | 1182 C-F |
| 16 | C303 x R340 | 18 | 1275 C |
| 17 | C852 x HAR4 | 20 | 1236 CD |
| 18 | C337 x HAR2 | 19 | 1517 B |
| 19 | C852 x R365(4) | 21 | 1180 C-F |
| 20 | C383 x R311 (check) | 18 | 853 HI |
| LSD value at (P≤ 0.05) | | N.S. | 145 |

***3. Stem Girth (cm) and Yield (kg/ha)***

Data on stem girth (cm) and yield (kg/ha) are presented in table-3. It is clear from the data that stem girth remained non significant, however, hybrid C341 x R344 had maximum stem girth of 2.7 cm, while hybrids C341 x R346 and C822 x R266 each had minimum stem girth of 1.7 cm, as compared to check hybrid C383 x R311 with stem girth of 2.4 cm. Data on yield (kg/ha) revealed significant differences at (P≤ 0.05). The average data showed that maximum yield of 4028 kg/ha was recorded for hybrid C341 x R344, followed by hybrid C300 x R368 with seed yield of 3430 kg/ha, while minimum seed yield of 930 kg/ha and 1111 kg/ha were recorded for hybrids C303 x R340 and C337 x HAR2, respectively, as compared to check hybrid C383 x R311 with seed yield of 2875 kg/ha. Genetic character of each hybrid has a dominant role for this variation, however, this could also be attributed to change in soil fertility and soil structure. The results are in agreement with Amir and Khalifa (1991) who reported that variation in seed yield among sunflower hybrids most likely resulted from genotype differences.

*Table-3. Stem Girth (cm) and Yield (kg/ha) of Sunflower Hybrids Evaluation Trial*

| *S. No.* | F1 cross combination | Stem Girth (cm) | Yield (kg/ha) |
|---|---|---|---|
| 1 | C300 x R368 | 1.8 | **3430 AB** |
| 2 | C341 x R346 | **1.7** | 1708 EFG |
| 3 | C341 x NDBLYS | 2.5 | 3055 BC |
| 4 | C383 x R266 | 2.5 | 2638 B-E |
| 5 | C303 x R344 | 2.6 | 2319 C-F |
| 6 | C320 x RG1G1 | 2.3 | 3013 BCD |
| 7 | C382 x R368 | 2.3 | 2638 B-E |
| 8 | C341 x R344 | **2.7** | **4028 A** |
| 9 | C822 x R266 | **1.7** | 2263 C-F |
| 10 | C822 x R346 | 1.8 | 2542 B-F |
| 11 | C382 x RG1G1 | 2.3 | 2083 DEF |
| 12 | C303 x R266 | 2.6 | 2361 C-F |
| 13 | C337 x R365 | **2.7** | 1666 FG |
| 14 | C852 x HAR4 | 2.2 | 2500 B-F |
| 15 | C337 x BM1 | 2.2 | 2875 BCD |
| 16 | C303 x R340 | 2.9 | **930 G** |
| 17 | C852 x HAR4 | 2.4 | 1666 FG |
| 18 | C337 x HAR2 | 2.4 | **1111 G** |
| 19 | C852 x R365(4) | 2.3 | 3097 ABC |
| 20 | C383 x R311 (check) | 2.4 | 2875 BCD |
| LSD value at (P≤ 0.05) | | N.S. | 958 |

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