

## EVALUATION AND COMPARISON OF 14 VARIETIES OF SUNFLOWER (*HELIANTHUS ANNUUS* L.) UNDER SEMI-ARID CONDITIONS

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Sunflower, an oil-seed crop, has been grown on limited areas in the Northern parts of Iran. Because of high quality of the oil and its usage in many food products, demand for sunflower oil has been recently increasing throughout the world. Today, sunflower oil is one of the rare agricultural commodities and its price is soaring. In order to meet the great demand for sunflower oil, cultivation of sunflower has been introduced to different parts of the country. Khuzestan Plain, located in the Southeast of Iran, has a great potential for sunflower production due to its vast favorable natural resources.

In the last few years, extensive experiments have been conducted by Agronomy Department of the College of Agriculture at Ramin Production and Research Center, 40 kilometers north of Ahvaz. One of the objectives of the experiments has been to find suitable varieties for the area, since climatical conditions at Khuzestan are much different from those in the Northern parts of the country (figure 1). For this reason

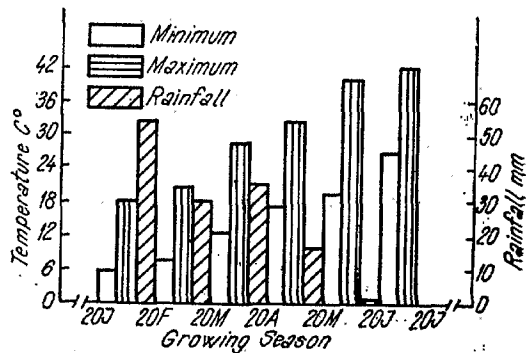


Fig. 1 — Mean values of minimum, maximum temperature and rainfall over the last 4 years at Ramin.

three experiments were conducted during 1971, 1972, and 1973, the results of which are summarised in this report.

#### MATERIALS AND METHODS

*1971 Experiment*: Eleven imported sunflower varieties were planted and evaluated with regard to four agronomic traits, i.e., grain yield, oil yield, oil percent, and protein percent. The experiment started in February 21.

Varieties used in this experiment were:

(1) Record, (2) Orizont, (3) VNIIMK 6540, (4) HS-52, (5) HS-53 (from Romania), (6) Chernjanka 66, (7) VNIIMK 8931 (from USSR), (8) Majak, (9) Peredovik, (10) NS-P 317, and (11) NS-P 16 (from Yugoslavia).

A randomized complete blok design with five replications was used. Every plot consisted of four rows and measurements were made on the two middle rows. Each row was 12 meters long. Distances between rows and between plants on a row were 0.60 meter and 0.30 meter, respectively. Urea (300 kg/ha) and Triple Superphosphate (150 kg/ha) were applied to the experimental plots before planting. The plots were irrigated as needed. The number of irrigations was twelve. The experiment was protected from bird damage, an important factor limiting sunflower production in some of Khuzestan Plain. Prior to harvesting, 0.50 meter was discarded from both ends of the measurements rows. Date of harvesting was July 21.

*1972 Experiment*: In this experiment the same varieties were used. During early stages of growth, plants were damaged by heavy rains. Therefore, no data were collected.

*1973 Experiment*: In 1973 three varieties, i.e., Louch, Armavirsky 3497 (from USSR), and Esanka (from France) were added to the experiment. Time of planting was March 4. Four additional agronomic traits (100-kernel weight, empty seed percent, plant height, and capitule diameter) were measured. Design of the experiment and methods of planting and harvesting were the same as 1971. Date of harvesting was June 25.

Soxhlet method was used for fat extraction and protein content was measured by Kjeldahl method.

#### RESULTS AND DISCUSSION

Results of the analysis of variance for the 1973 experiment with regard to the eight agronomic traits are presented in table 1. Values of CV and LSD (0.05) are also shown in the table.

Highly significant differences were found between varieties for seed yield, oil yield, 1000-kernel weight, percent unfilled seed, plant height, and capitule diameter. The values calculated for percent oil content and percent protein were not significant.

Comparisons made among varieties are summarized in Table 2. The highest and the lowest grain yield belong to HS-53 and Esanka, respectively. Grain yield difference between HS-53 and HS-52 was not significant. HS-53 outyielded all other varieties in grain yield. Next to HS-53

Table 1

## Analysis of Variance of 8 Agronomic Traits for 14 Sunflower Varieties in 1973

Source of variation	Df	F							
		Seed yield	Oil yield	1000 kernel-weight	Unfilled seed	Plant height	Capitule diameter	Oil content %	Protein %
Blocks	4								
Varieties	13	6.184**	6.068**	16.515**	29.812**	9.433**	2.212*	0.431	0.621
Exp. error	52								
Coef. of var. %		15	16	4	19	14	8	7	10
LSD (0.05)		0.547 <sup>a</sup>	269.4 <sup>b</sup>	2.763 <sup>c</sup>	0.848 <sup>d</sup>	35.2 <sup>e</sup>	1.68 <sup>e</sup>	—	—

\*Significant at 0.05 level, \*\*Significant at 0.01 level.  
a: ton/ha., b: kg/ha., c: gram., d: percent, e: centimeter.

and HS-52 was VNIIMK 8931, though differences between grain yield of this variety and Armavirsky 3497, VNIIMK 6540, and Louch were not significant. The grain yield performance of Record, one of the recommended varieties, was poor relative to other varieties. The mean performance of grain yield over all varieties was 2.842 tons/ha.

Highly significant differences were obtained for oil yield. This can be attributed to the differential ability of grain yield performance of the varieties. Since, differences in percent oil content were not statistically significant among varieties (table 2) therefore, the order of varieties for this trait is essentially similar to that of grain yield. The mean for oil yield over all varieties was 1307 kg/ha.

Esanka also had the lowest 1000-kernel weight while Chernjanka 66 ranked the highest. Next to Chernjanka 66 are Louch and VNIIMK 8931, respectively. Record, Peredovik, HS-53, and HS-52 had low 1000-kernel weight. The mean value of 1000-kernel weight over all varieties is 52.64 grams.

Data in table 2 indicate that Esanka had the highest percent unfilled seed and the differences between this variety and the others are significant. Next to Esanka is Chernjanka 66. Majak and HS-53 had the lowest percent unfilled seed. The poor grain yield performance of Esanka and Chernjanka 66 could be attributed to their high percent of unfilled seeds. The relatively high percentage of unfilled seeds in Esanka and Chernjanka 66 is largely due to the fact that these two varieties are short (Table 2, column 6) and early. These two varieties were surrounded by tall and semi-tall varieties in the field and they had no access to pollinating insects. There was not enough pollen in the field when the two varieties were receptive, because the other varieties were either late or semi-late. This crucial point should be considered in the future experiments in order to obtain a reliable estimate of agronomic performance for each variety.

Means of Agronomic Traits for 14 Sunflower Varieties in 1973

Variety	Grain yield (ton/ha)	Oil yield (kg/ha)	1000-kernel weight (gr)	Unfilled seed (%)	Plant height (cm)	Capitule diameter (cm)	Oil content (%)	Protein (%)
Esanka	1.804 a*	839 a	44.8 a	8.5 a	100.0 a	14.4 ab	46.7 a	16.5 a
Record	2.274 ab	1009 ab	47.4 ab	3.1 cd	218.0 cd	14.5 ab	45.0 a	18.6 a
Orizont	2.592 bc	1202 bc	55.0 ef	2.8 de	209.6 bcd	14.9 abcd	46.3 a	16.7 a
Chernjanka 66	2.658 bc	1206 bc	57.0 ef	4.0 b	103.4 a	13.7 a	46.0 a	16.7 a
Majak	2.682 bc	1248 bcd	55.8 ef	1.9 ef	193.8 bcd	15.3 abcd	46.5 a	17.0 a
Peredovik	2.762 bc	1199 bc	48.6 bc	2.9 de	193.0 bc	15.4 abcd	43.8 a	17.1 a
NS—P 317	2.824 c	1297 cd	51.2 cd	3.4 bc	197.0 bcd	16.5 d	45.9 a	16.8 a
NS—P 61	2.826 c	1291 cd	53.0 de	3.2 bcd	209.4 bcd	15.9 bcd	46.0 a	16.1 a
Louch	2.952 cd	1369 cde	56.4 ef	3.9 bc	153.2 bc	14.7 abc	46.7 a	16.5 a
VNIIMK 6540	2.988 cd	1369 cde	56.0 ef	2.1 ef	201.0 bcd	15.3 abcd	45.5 a	17.3 a
Armavirsky 3497	3.036 cd	1389 cde	55.6 ef	3.6 bc	192.2 bc	14.3 ab	47.7 a	16.5 a
VNIIMK 8931	3.114 d	1484 de	56.2 ef	3.1 cd	228.6 d	15.8 bcd	47.7 a	16.1 a
HS—52	3.504 ed	1783 f	50.4 cd	2.7 def	178.6 d	16.5 d	47.1 a	17.0 a
HS—53	3.872 d	1611 ef	49.6 bc	1.9 ef	187.8 bc	16.3 dc	46.2 a	16.7 a
Mean	2.842	1307	52.6	3.4	186.1	15.2	46.0	16.8

Varieties with a common letter within a column are not significantly different at 5% level.

The range in capitule diameter among varieties tested was between 13.7 cm (Chernjanka 66) and 16.5 cm (NS-P 317 and HS-52). In 1973 experiment relationship between percent unfilled seed and 1000-kernel weight was contradictory. As the percent unfilled seed increases, more space and nutrients becomes available for the rest of the seeds and as a result a direct relationship is anticipated. Such a direct relationship was found in Chernjanka 66 but not in Esanka which had the highest percent unfilled seed and the lowest 100-kernel weight.

The agronomic performances of the 11 varieties common in both experiments were compared over the two years. In table 3 the means for each of the 4 measurements are calculated for both experiments.

Table 3

Mean of 4 Agronomic Traits for 11 Sunflower Varieties in 1971 and 1973

Variety	Grain yield tons/ha			Oil yield kg/ha			Oil content %			Protein %		
	1971	1973	Mean	1971	1973	Mean	1971	1973	Mean	1971	1973	Mean
Record	1.938	2.274	2.106	888	1009	948.5	45.8	45.0	45.4	20.3	18.5	19.4
Orizont	2.039	2.592	2.316	1024	1202	1113.0	50.2	46.3	48.3	20.6	16.7	18.7
Chernjanka 66	1.893	2.658	2.276	810	1206	1008.0	42.8	46.0	44.4	18.0	16.7	17.4
Majak	2.188	2.682	2.435	1147	1248	1197.5	52.4	46.5	49.5	16.6	17.0	16.8
Peredovik	1.803	2.762	2.283	883	1199	1041.0	42.0	43.8	46.4	17.5	17.1	17.3
NS—P 317	2.126	2.824	2.480	1017	1297	1157.0	47.6	45.9	46.8	18.2	16.8	17.5
NS—P 16	2.159	2.826	2.493	1062	1291	1176.5	49.2	46.0	47.6	19.1	16.1	17.6
VNIIMK 6540	2.067	2.988	2.528	967	1369	1168.0	46.8	45.5	46.2	19.3	17.3	18.3
VNIIMK 8931	2.414	3.114	2.764	1303	1484	1375.5	54.0	47.7	50.9	19.7	16.1	17.9
HS—52	3.068	3.504	3.286	1393	1783	1588.0	45.4	47.1	46.3	20.3	17.0	18.7
HS—53	2.982	3.872	3.427	1414	1611	1512.5	47.4	46.2	46.8	16.5	16.7	16.6

Data in table 3 show no evidence of year x grain yield interaction. There was an over all increase in grain yield in 1973 due to favourable climatic conditions prevailed during growing season. The means of grain yield over the two years for the three top varieties, i.e., HS-53, HS-52, and VNIIMK 8931, were 3.427 tons/ha., 3.286 tons/ha., and 2.764 tons/ha., respectively.

The mean of grain yield for Record was minimum. VNIIMK 8931 had the maximum percent oil content in both years with a mean value of 50.9%. Chernjanka 66 ranked the lowest with regard to percent oil content (44.4%). Next to Chernjanka was Record. The trends for oil yield existing in Ramin. Superiority of HS-52 and HS-53 was expected since content, respectively.

### CONCLUSIONS

From the results obtained, it can be concluded that HS-52, HS-53, and VNIIMK 8931 are superior varieties under environmental conditions existing in Ramin. Superiority of HS-52 and HS-53 was expected since

they are hybrid varieties. Record, a standard variety in the Northern parts of the country, does not seem to be a suitable variety in Khuzestan. This is confirmed by the results obtained from the experiments carried out by Agricultural Research Center of KWPA at Safi-Abad which is located at the Northern part of Khuzestan.

Since hybrid seeds of HS-52 and HS-53 must be imported every year with a high price, more emphasis should be put on cultivation of VNIIMK 8931.

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