EFFECTS OF ROW SPACING ON SUNFLOWER (Helianthus annuus L.) YIELDS AND OTHER CHARACTERISTICS

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ABSTRACT

A study was conducted to determine the effect of row spacing (50, 65, 80 or 95 cm) on yield and some characters of nine hybrids and one composite (V.8931) sunflower (Helianthus annuus L.) cultivars, under the ecological conditions of northern side of Turkey, in Samsun, 1989.

Culivars were inspected in ralations to some phenological and morphological characters, yield and yield components and some seed quality specification. In addition, inspected varieties were subjected the an economical value analysis.

For seed and oil yield, all of the hybrids were superior to composite V.8931. Hybrid P.6480 has been found having the highest value for seed and oil yield. But, seed quality characteristics of V.8931 were better than hybrids, except IS.8101.

Seed yield, at dense population, were decreased but seed and oil yields were increased.

Eight of hybrids were over to V.8931 with respect to economical values. This analysis showed that any high-yielding variety couldn't have high economical values.

Key words: *Economical value analysis.*

INTRODUCTION

Sunflower is one of the leading oil seed crops in the world. Because of high edible quality of its oil, high yield and adaptation ability, the importance of sunflower have been increasing. Sunflower is also the major oil crop in Turkey, and for conpensation of Turkey's national oil deficit, sunflower is absolutely most hopeful crop.

High-yielding cultivars of sunflower have been grown in Turkey since 1984 and they increased the yield and, of course, production of sunflower kernel in Turkey. For reaching the potential yield of a variety of sunflower plant dansity, as an agronomic techniques, must be evaluated for any varieties at a specific area. Even though growing conditions are optimum, if non-proper plant densities may cause the losses from the maximum yields.

İncekara (1) reported that sunflower varieties divided into three groups for their maturity period; early (90-120 days), medium (120-130 days), and late (over 130 days). At dense populations, this period may be shortened because of the rapid drying of the heads (2)

Gubbels and Dedio (3) observed that the plants were shorter at dense populations. At low populations, N content of the seeds were found to be high (4). In the previous works, the effect of plant density to oil content of seeds were differed. Mathers and Steward (5) and Robinson at all. (2) found that high plant densities increased the oil content, while Rao and Reddy (6) found to be decreased.

Robinson at all (2) found that seed yield of sunflower was 990-2710 kg/ha in Minnesota. This yield was found as of 2530-3790 in Russia (7), 3580-3770 in Romania (4) and, 5180 kg in Czechoslovakia (8). Robinson (9) reported that sunfower seed yield was determined by three factor i.e. , plant density, number of seeds /head, and 1000-seed weight. Similarly , Robinson at all. (2) reported that population was a major factor affecting seed yield. Occasionally at non-optimum conditions, because of a compensation among these tree factors, plant densities shown no effect on yield from two or three-fold increases in population (9). In the case of optimum conditins increasing plant density increases seed yield (2, 10).

MATERIALS AND METHODS

The field experiments were conducted at Bafra Plain having slightly alcaline clay soils, at the North Coastal area in Samsun, Turkey. Soil tests indicated that phosphorus level was low, and potassium level was high. Nitrogen as ammonium nitrate and phosphorus as triple superphosphate were applied uniformly at a rates of 200 kg N and 150 kg P_2O_5 per ha, respectively.

Seeds were showed on may 12, 1989 by four different row spacing (50, 65, 80 or 95 cm). Design was a " randomized complete block with split plot " layout replicated three times. Varieties were applied to main plots and row spacings to subplots. Plant distance was 30 cm on the row.

Field was irrigated at the prior to flowering. Yields and yield components were measured on fifteen perfectly spaced plants of each plot. These plants were covered by, perforated polyetilene bags againts the bird damage.

All data were subjected to standart analysis of variance and Duncan's multiple range test was used to compare the means. Varieties were also subjected to "Economical Value Analysis" (11). These analysis was evaluated based on the coefficiencts obtained from regression equations of seed oil content (Y= -1.5 + 0.05x), plant height (Y= 1.8 - 0.05x) plant height uniformity (Standart Deviation Y= 1.7 - 0.05x), and growing period (Y= 2.16 - 0.01x). For lodging ratio, this equations were obtained from the data of Dobrescu et all. as Y= 0.987 - 0.04x (12). "General value coefficients" were obtanied according to the varieties by multiplying this coefficients and than economical values of varieties calculated by multiplying the general value coefficients to varieties own seed yield. Hybrids were compared to standart V.8931.

RESULTS AND DISCUSSIONS

Maturation, Plant Heigth and Plant Population

Increasing the row spacing delayed the maturation from 126.3 to 133.1 days (Table 1). This was a significant difference. At the dense populations, head mousture content is reduced earlier and this causes to early harvest maturity (2).

The varieties did not differ for maturity but varied from 126.5 to 134.1 days (H1 and Triumph). İncekara (1) mentioned that the varieties were found in medium or late maturing group.

Significant (at 01 % level) differences were found among varieties in terms of the plant height. P.6480 was the tallest (136.6 cm) and P.6440 was the shortest (118.0 cm) varieties. In general, at narrow row spacings plant heights were shorter with the exception of 50 cm. Plants were the shortest at 65 row spacing and the highest at 95 cm or 50 cm. Similar results were found by Gubbels and Dedio (3). Unexpected plant height of 50 cm seems to be due to competition of plants for light at the dense populations.

Seed Quality and Plant Population

Row spacing affected the seed quality via kernel ratio, oil and protein contents significantly. These variables had higher values at large row spacings (Table1). Similar to the results, Mathers and Stewart (5) observed the higher nitrogen content in the seeds, at low densities. But the results, releating the oil contents have been observed in adverse in the previus reports (1,7) with the exception of the results in this study and Rao and Redy (6)

In a broad sense, composite V.8931 has a good seed quality. It has the highest kernel ratio (75.80 %), and for oil and protein contents were seconds (Table 1). Hybrid

IS.8101 had the highest oil and protein contents as of 42.66 and 17.99 %, respectively. Differences among varieties were significant at 1 % level.

Yields, Seed Yield Components and Plant Population

Average seed yield increased from 3987 to 5958 kg/ha when row spacing enlarged from 50 to 95 cm (Table 1). Each of row spacing has been considered.different one from each others. Previous works also emphasized this clear effect of row spacing on yield (2, 9).

In contrary to seed yield, values of seed yield components i.e, head diameter, number of seeds/head and 1000-seed weight, were decreased as increasing row spacing. These results demonstrated the idea of population was a major factor affecting seed yield (2). Under the optimum growing conditions, the decreases in the values of eed yield components were not high as much as poor conditions, where the yields were constant at greatly differed plant populations (9).

Oil yields, similarly to seed yields, were high at dense populations even if oil contents of seed were low, and this relation shows that seed yield had effect on oil yield more than oil contents.

Table 1. Characteristics of Sunflower Varieties and Row Spacing

	Maturity Period (d)	Plant Height (cm)	Head Diamet. (cm)	Number of Seed per head	Seed Weight (g)	Kernel Ratio (%)	Oil Content (%)	Protein Content (%)	Seed Yield (kg/ha)	Oil Yield (kg/ha)
Varieties										
P.6480	129.6	138.0 a	21.32 a	2038 a	60.81 b	71.29 d	40.78 a	15.53 c	6071 a	2460 a
As.506	131.3	136.6 a	20.23 ab	1846 ab	56.50 b-d	68.72 e	39.94 a	16.26 bc	4221 bc	1681 bc
H.1	126.5	130.3 ab	19.30 b	1912 ab	51.04 d	71.79 cd	41.60 a	16.23 bc	4660 b	1938 ab
IS.7479	129.3	130.5 ab	19.29 b	1910 ab	52.86 cd	71.45 cd	38.62 ab	15.70 c	4827 b	1847 bc
Triumph	134.1	129.5 ab	19.16 b	1483 ab	57.20 bc	73.71 a-c	35.31 b	15.86 c	4600 b	1625 bc
IS.7775	131.4	137.1 a	19.15 b	1904 ab	52.98 cd	71.29 d	41.53 a	16.15 bc	4899 b	2018 ab
P.6440	128.7	109.7 c	19.12 b	1689 ab	61.61 b	74.40 ab	40.37 a	16.48 bc	4958 b	1989 ab
IS.8101	129.2	119.6 bc	19.12 b	1522 bc	67.75 a	74.62 ab	42.66 a	17.99 a	5070 b	2161 ab
P.6431	127.1	118.0 bc	19.02 b	1804 ab	58.68 bc	73.02 b-d	39.51 a	15.87 c	5176 ab	2038 ab
V.8931	131.0	134.6 a	16.48 c	1199 c	61.70 b	75.80 a	40.87 a	17.18 ab	3353 c	1365 c
Diff.	NS	S	S	S	S	S	S	S	S	S
Row Spacing										
50	126.3 c	130.4 a	18.12 d	1634 b	54.19 d	72.09 b	37.57 c	15.26 c	5958 a	2246 a
65	129.3 b	125.3 b	18.91 c	1677 b	57.33 c	72.37 ab	39.89 b	16.09 b	4808 b	1919 b
80	130.5 ab	127.5 ab	19.58 b	1794 a	59.29 b	72.88 a	41.13 ab	16.59 b	4385 c	1809 bc
95	133.1 a	130.3 a	20.26 a	1835 a	61.61 a	73.09 a	41.88 a	17.35 a	3987 d	1674 c
Diff.	S	S	S	S	S	S	S	S	S	S

NS=Not significant; S=Significant at P<0.01 level.

Hybrid varieties have been seen having high yield of seed and oil over composite V.8931. P.6480 was the highest and V.8931 was last for both yields. V.8931 had have also the minimum values for head diameter and number of seeds/head while second for 1000-seed weight. These results stated that yields of hybrids are due to higher head diameters or numbers of seeds/head.

The findings relating to seed yields were relatively higher than that of previous studies (2, 4, 5) but close to that of Kovacık and Skaloud (8). Optimum growing conditions, calculating the yields based on ideal plant number/ha, and preventing bird damage resulted in high seed yield.

Economical Value Analyses of Varieties

Economical value analyses of varieties were summerized in Table 2. As seen in this table, economical values of varieties were ranged from 87.4 (Triumph) to 297.1 (IS.8101). For relative economical value, based on standart variety V.8931, five varieties had economical values over two times of V.8931, vhile Triumph was lover than it.

Table 2. Economical Value Analysis of Varieties

Variety	Seed yield (kg/ha)	Oil contents (%)	Plant height uniform	Plant height (cm)	Lodging (%)	Maturity period (d)	General value cofficient	Econom. value	Relative econom value
V.8931	3353	0.54	0.98	1.13	0.94	0.67	0.370	124.1	100.0
As.506	4221	0.50	1.25	1.12	0.95	0.66	0.439	185.3	149.3
P.6431	5176	0.48	1.24	1.21	0.94	0.72	0.487	252.1	203.1
P.6480	6071	0.54	1.11	1.11	0.94	0.69	0.431	261.7	210.8
P.6440	4958	0.52	1.26	1.25	0.96	0.69	0.543	269.2	216.9
H.1	4660	0.58	1.28	1.15	0.95	0.71	0.576	268.4	216.3
IS.7775	4899	0.58	1.08	1.12	0.94	0.67	0.442	216.5	174.5
IS.7479	4827	0.43	1.13	1.15	0.93	0.68	0.354	170.9	137.7
IS.8101	5070	0.63	1.18	1.20	0.95	0.69	0.586	297.1	239.4
Triumph	4600	0.27	1.02	1.15	0.94	0.64	0.190	87.4	70.4

Characteristics inspected in economical value analysis, with the exception of oil contents and seed yields, is necessity for intensive farming. So that, high yielded hybrids P.6480 and P.6431 (6071 and 5176 kg/ha, respectively) could't be leader according to results of economical value analyses; while IS.8101, P.6440 and H.1, which have better characteristics for intensive farming, had higher economical values.

As the result, it is concluded that P.6480 and P.6431 were more appropriate for non-mechanized farming, and IS.8101, P.6440 and H.1 for intensive farming with machanizing. Triumph, V.8931 and IS.7479 were good for neither intensive nor extensive farming.

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