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YIELD COMPONENTS OF SUNFLOWER HYBRIDS OF DIFFERENT HEIGHT

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SUMMARY

This research was carried in order to determine the yield components of four sunflower hybrids (*Helianthus annuus* L.) which differed in plant height. The hybrids were grown in three variants of plant population. The research lasted for two years, 1991 and 1992, and it was conducted at the Thrace Agricultural Research Institute in Edrine, Turkey.

Experiments were established in a split- plot arrangement in RCBD, in four replicates. The hybrids used in the experiments were two semidwarf hybrids, Sunbred- 265 and DO- 855, a standard height hybrid Trakya- 259 and a tall hybrid Tordillo. The three plants populations were a high population (71430 plants/ha; 70 x 20 cm), a standard population (47620 plants/ha; 70 x 30 cm), and a low population (35710 plants/ha; 70 x 40 cm).

Both plant height, and population were found to have a significant ($P<0.05$) effect on seed yield components.

According to the two-year results, the semidwarf hybrids had 8.4 and 18.8% higher seed yields in the high population than in the standard and the low population, respectively. For the standard and the tall hybrid, however, the standard plant population of 47620 plants/ha (70 x 30 cm) was determined as most suitable for high seed yield and oil yield per hectare.

Key words: Sunflower (*Helianthus annuus* L.), semidwarf, standard height, plant population.

INTRODUCTION

Some advantages of reduced height of sunflower hybrids are high resistance to lodging, easy cultivation and harvest. Scientific data on the performance and agronomic characteristics of short hybrids grown in different plant populations per hectare are limited. Stand density may affect seed yield of sunflower which depends on three components: number of heads per hectare, number of seeds per head, and 1000 seed weight. Optimum plant population varies from one production area to another. Some experiments have shown that increased plant population tends to increase seed yield and oil content (Robinson et al, 1989; Vannozzi and Baldini, 1988). However, it has also been reported that plant population bears no effect on seed yield (Prunty, 1983).

Plant population also affects other plant characteristics. As plant population is increased from low to high, flowering stage is delayed, plant height and lodging are increased, while seed size, head and stalk diameter are decreased (Vranceanu et al, 1982; Brigham and Young, 1985; Fick et al, 1985; Miller and Hommond, 1989). The performance of tall, semidwarf and dwarf hybrids differ with plant population. Short hybrids

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respond better to high plant population than standard or tall hybrids (Stanojević, 1989; Vannozzi and Baldini, 1990).

The objectives of this research was to determine the yield components of four hybrids of different height, grown in three plant populations.

MATERIALS AND METHODS

This research was carried out at the Thrace Agricultural Research Institute, Edirne, Turkey, in 1991 and 1992. The experiment was set up in split plot arrangement in RCBD, in four replicates. Hybrids with different heights were used as main plots. These were semidwarf hybrids Sunbred- 265 and DO- 855, Trakya- 259 of standard height, and tall hybrid Tordillo. Three plant populations were used as sub- plots: high, standard, and low population (71430, 47620, and 35710 plants/ha, respectively). The intra- row spacings were 20, 30 and 40 cm, in rows spaced 70 cm apart. The experiments were sown in the second half of April in both years. The seeds were overplanted per hill and thinned to one plant per hill three weeks after sowing. The experiments were not irrigated but received rain during growing season. Fertilizers (80 kg N and 80 kg P_2O_5 per hectare) were applied on the basis of soil test. Weed control was accomplished by using both chemicals and cultural practices. A herbicide EPTC (S- ethyl dipropyl carbamothioate) was used at a rate of 4500 cc per hectare.

Mean values of physiological maturity stage, plant height, head diameter, seed yield/ha, number of seeds/head, 1000 seed weight and oil content were determined in each plot and analyzed using ANOVA. Correlation coefficients were calculated between all characteristics (little and Hills, 1978; Russell, 1986).

RESULTS AND DISCUSSION

The mean values of seed yield and yield components for the four hybrids grown in the three plant populations are presented in Table 1. A correlation coefficient matrix between different agronomic traits is given in Table 2.

In this research, sunflower hybrid stature and plant population size had à significant effects ($P<0.01$) on seed yield and yield components. Comparable results were reported by Vannozzi et al, 1985 and Schneiter et al, 1988.

As seen in Table 1, the semidwarf hybrids reached physiological maturity approximately 2-4 days earlier than the standard hybrid and 7-9 days earlier than the tall hybrid. Besides, there were significant correlations between vegetation period on one side and plant height, head diameter, seed yield, and 1000 seed weight on the other ($r=0.647^{**}$, $r=0.391^{**}$, $r=0.305^{**}$ and $r=0.327^{**}$, respectively). Similar results have been reported by other researchers (Loubser et al, 1987; Zaffaroni and Schneiter, 1991).

Plant height in the high plant population was found to be 5 and 8 cm larger than in the standard and the low population, respectively. Comparable results were reported by Alessi et al, (1976), Loubser et al, (1987).

The average head diameter for the four hybrids was found to be 1.9 and 2.9 cm smaller in the high plant population than in the standard and the low population, respectively. There was a significant negative correlation between plant population and head diameter

Table 1. Mean comparisons between yield and yield components of the four sunflower hubrids in three plant populations based on combined data of 1991 and 1992.

No.	Hybrid	Intra plant space (cm)	Number of plants (per ha)	Vegetation period (day)	Plant height (cm)	Head diam. (cm)
1	Sunbred-265	20	71430	106.3 gh	126.5 de	12.4 ef
2	Sunbred-265	30	47620	107.3 fg	118.1 ef	14.4 cd
3	Sunbred-265	40	35710	107.9 ef	115.1 f	15.5 c
4	DO-855	20	71430	104.1 i	131.1 cd	11.8 f
5	DO-855	30	47620	105.4 h	125.5 cde	13.6 de
6	DO-855	40	35710	106.1 h	123.8 def	15.6 bc
7	Tordillo	20	71430	113.3 b	161.8 a	13.1 e
8	Tordillo	30	47620	114.5 a	159.5 a	15.1 c
9	Tordillo	40	35710	115.0 a	159.8 a	16.8 ab
10	Trakya-259	20	71430	108.5 de	145.0 b	13.4 de
11	Trakya-259	30	47620	109.3 cd	141.0 b	15.3 c
12	Trakya-259	40	35710	109.8 c	133.4 c	17.5 a
LSD (0.05) for main plot				1.9*	5.3**	1.1**
LSD (0.05) for sub plot				0.6	4.5**	0.6**
LSD (0.05) for all combi.				1.1	8.9	1.2
C.V. (%)				0.7	4.6	5.6
*, ** Significant at the 0.05 and 0.01 levels, respectively.						

(r=-0.719**). Besides, head diameter correlated significantly with seed number per head and 1000 seed weight (r=0.581** and r=0.224*, respectively). Similar finding were reported by Majid and Schneiter (1987).

The tall hybrid gave 13 to 17% higher seed yield/ha than the semidwarves and the standard hybrid. Also, there was a significant correlation between plant height and seed yield (r=0.653**). This result is corroborated by the findings of Brigham and Young (1985).

Table 1 indicates that the semidwarf hybrids gave 8.4 and 18.8% higher seed yield in the plant population thane in standard and the low population, respectively. On the other hand, the standard and the tall hybrid gave 5.6 and 13.8% higher yield in the standard plant population than in the high and the low population, respectively. Also, there was a significant correlation between seed yield and number of seeds per head (r=0.257**). Similar results have been reported by Fick et al, (1985), Vannozzi and Baldini (1988).

Seed number per head in the low plant population was 55 and 14% higher than those in the high and standard population, respectively. In addition, there was a significant negative correlation between plant population and seed number per head (r=0.625**). However, there was a significant correlation between seed number per head and 1000 seed weight (r=0.341**). Comparable results were reported by Miller et al, (1984).

Table 1. (Continued).

No.	Hybrid	Intra plant space (cm)	Number of plants (ha)	Number of seeds (per head)	1000 seed weight (g)	Oil in seed (%)	Seed yield (kg/ha)
1	Sunbred-265	20	71430	747.5 e	45.7 d	45.2 abc	2350 bc
2	Sunbred-265	30	47620	982.9 cd	50.8 bc	43.4 defg	2191 cd
3	Sunbred-265	40	35710	1104.3 bc	53.5 ab	42.9 defg	1977 d
4	DO-855	20	71430	823.0 ef	41.5 e	44.3 cdef	2381 abc
5	DO-855	30	47620	1043.5 c	45.5 d	44.6 bcd	2197 cd
6	DO-855	40	35710	1214.9 b	50.2 c	43.7 cdef	2168 cd
7	Tordillo	20	71430	726.8 f	48.8 c	44.5 cde	2482 ab
8	Tordillo	30	47620	1036.9 c	53.5 ab	42.8 efg	2620 a
9	Tordillo	40	35710	1219.8 b	56.3 a	41.9 fg	2531 ab
10	Trakya-259	20	71430	874.0 de	34.7 g	46.4 a	2205 cd
11	Trakya-259	30	47620	1246.4 a	38.1 f	46.3 ab	2289 bc
12	Trakya-259	40	35710	1365.1 a	40.6 ef	45.0 abcd	2011 d
LSD (0.05) for main plot				125.8**	4.5**	1.8**	210**
LSD (0.05) for sub plot				63.6**	1.5**	0.9**	121**
LSD (0.05) for all combi.				127.3	2.9	1.8	243
C.V. (%)				8.7	4.4	2.7	7.5
*, ** Significant at the 0.05 and 0.01 levels, respectively.							

Table 2. Correlation coefficients between yield and yield components based on the data of 1991 and 1992 (n:96).

Component		1	2	3	4	5	6	7
1.	P.pop.	1.000						
2.	V.per.	-0.172	1.000					
3.	P.hei.	0.148	0.647**	1.000				
4.	H.dia.	-0.719**	0.391**	0.184	1:000			
5.	Yield	0.201	0.305**	0.653**	0.036	1.000		
6.	N.Seed	-0.625**	0.082	0.122	0.581**	0.257**	1.000	
7.	S.wei.	-0.299**	0.327**	-0.044	0.224*	-0.024	0.341**	
8.	Oil	0.234*	-0.137	0.143	-0.013	0.178	0.162	-0.485**
*, ** Significant at the 0.05 and 0.01 levels,, respectively.								

1. Plant population (Plant/ha)
2. Vegetation period (day)
3. Plant height (cm)
4. Head diameter (cm)
5. Seed yield (kg/ha)
6. Number of seeds/head
7. 1000 seed weight (g)
8. Oil in seed (%).

In the low plant population, 1000 seed weight was 18 and 7% higher than in the high and the standard population, respectively. Also, there was a significant negative correlation between 1000 seed weight and oil content in seed (r=0.485**). Similar results were reported by Robinson (1980) and Stanojevi} (1989).

The oil content of the four hybrids increased approximately by 3,8 as the plant population was increased from low to high. Besides, there was a significant correlation between plant population and oil content (r=0.234*). Similar finding were reported by Harmati et al, (1990); and Schneiter et al, (1992).

CONCLUSIONS

Regarding the semidwarf hybrids, the high plant population of 71430 plants/ha (70x20 cm) was found to be most suitable for high seed yield and oil yield per hectare. For the standard and the tall hybrid, however, the standard plant population of 47620 plants/ha (70x30 cm) was optimal for high seed yield and oil yield per hectare.

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INVESTIGACION SOBRE COMPONENTS DE VARIEDADES HIBRIDAS DE GIRASOL DE DIFERENTE ALTURA

RESUMEN

Esta investigación se llevó a cabo para determinar el rendimiento y sus componentes en cuatro variedades híbridas de girasol (*Helianthus annuus* L.) con diferente altura utilizando tres densidades distintas de población, en el Instituto de Investigacióon Agraria de Thrace, Edirne, Turquía durante dos años en 1991 y 1992.

Los experimentos se llevaron a cabo utilizando parcelas divididas (split plot) con un diseño de bloques al azar con cuatro repeticiones. Los híbridos de distinta altura utilizados en los experimentos fueron dos híbridos semienanos Sunbred-265 y DO-855, uno de altura estandar Trakya-259 y un híbrido alto Tordillo. La densidad de plantas utilizada en los experimentos fue una alta densidad de 71430 plantas/ha (marco 70 x 20) una densidad normal con 47620 plantas/ha (marco 70 x 30 cm) y una densidad baja, 35710 plantas/ha y marco 70 x 40 cm. En este trabajo las diferentes alturas de las variedades híbridas y densidad de poblaciones tuvieron un efecto significativo ($P < 0.05$) en los componentes dol rendimiento.

De acuerdo con los resultados de dos años los dos híbridos semíenanos tuvieron rendimientos de semilla mas altos en la densidad de población normal y baja (8.4 y 18.8% respectivamente). Sin embargo las variedades híbridos de altura estandard y altos on condiciones de alta densidad 71430 plantas/ha (70 x 20 cm y densidad estandard 47620 plantes/ha), mostraron rendimiento en semilla y aceite por hectárea mas altos.

COMPOSANTES DU RENDEMENT CHEZ DES HYBRIDES DE TOURNESOL SE DIFFÉRENCLANT PAR LEUR TAILLE

RÉSUMÉ

Cette étude a été menée afin d'étudier le rendement et les composantes du rendement de quatre hybrides de tournesol (*Helianthus annuus* L.) se différenciant par leur taille. Les hybrides étaient cultivés selon trois structures de peuplement. Les investigations ont durónot dons one et 1992. et ont étéconduites à l'Institut de Recherche Agronomique de Edirne en Turquie.

Le plan expérimental consistait en un split splot à quatre répétitions. Les hybrides étudiés les suivants; deux hybrides demi-nains, Sunbred-265 et DO-855, un hybride de taille standard, Trakya-259 , et un hybrid de haute taille, Tordillo. Les trois structures de peuplement s'etablissaient ainsi - peuplement haute densité (47 620 plantes/ha; 70x30 cm) et de faible densité (35710 plantes/ha; 70x60 cm). La hauteur des plants et la densité de peuplement se sont révélées avoir toutes deux un effect significatif (p,0.05) sur les composantes du rendement en grain.

D'après les résultats de ces deux années d'expérimentation, les hybrides demi-nains ont un rendement respectivement supérieur de 8.4 et 18.8% pour le peuplement à forte densité par rapport aux peuplements de moyenne et faible densité. Cependant, concernant l'hybride standard et l'hybride"haut" la densité de population de 47 620 plantes/ha (70x30 cm) s'est révélée la plus souhaitable pour l'otention de rendements élevés en grain et en huile.