

*(Helianthus annuus L.)*

**Effects of defoliation at anthesis on grain yield and its components in sunflower  
(*Helianthus annuus L.*) in different levels of plant density and sowing date**

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Johnson, 1972; Beer, 1983)

.(Schneiter *et al.*, 1987; Sackston *et al.*, 1959

Schneiter *et al.*, 1987 )

.(Petroff *et al.*, 2002 ; Jonson *et al.*, 1972

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.(Dawson *et al.*, 1965

.(Connor *et al.*, 1997)

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Ashley *et al.*, 1999; Ashley *et al.*, 2002; )

.(Connor *et al.*, 1992; Connor *et al.*, 1997

.(Muro, 2001)

.(Schneiter *et al.*, 1987 )

R7 R4

.(Sackston *et al.*, 1959) CO2

(Beer, 1983)

(Jonson, 2003)

(Vrebalov *et al.*, 1972)

Jose *et al.*, 2004)

.(Schneiter *et al.*, 1987

(Muro *et al.*, 2001)

(S<sub>2</sub>) (S<sub>1</sub>) (S<sub>3</sub>) (Schneiter *et al.*, 1987)

(D<sub>4</sub>) (D<sub>3</sub>) (D<sub>2</sub>) (D<sub>1</sub>) R7

(Def<sub>2</sub>) (Def<sub>3</sub>) (Schneiter *et al.*, 1981)

(Dawson *et Beer* , 1983)

(Muro *et al.*, 2001; Goud *et al.*, 1994; *al.*, 1965)

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Table 1. Analysis of variance for seed yield, yield components and oil content as affected by planting density, sowing date and defoliation

S. O. V.		df.	Seed yield (tha <sup>-1</sup> )	No. total seed m <sup>-2</sup>	No. of unfilled grain m <sup>-2</sup>	No. of filled seed m <sup>-2</sup>	Unfilled seed percentage	1000 grain weight (g)	Oil content (%)
Replication (R)		3	25567.57**	25567.573**	427364.21**	12032992.174**	1148.188*	1616.03**	7.717 <sup>ns</sup>
Sowing date (S)		2	137952**	768996.896**	1604318.396**	4520887.313**	1480.413**	5263.390**	389.319**
Error a	a	6	770.298	249337.109	21094.072	340324.729	49.586	102.212	6.295
Plant densities (D)		3	41516.33**	31977807.1**	1608385.78**	19327830.229**	22.509 <sup>ns</sup>	628.267**	.271 <sup>ns</sup>
S×D	×	6	731.843**	34809.063 <sup>ns</sup>	19549.840 <sup>ns</sup>	61475.063 <sup>ns</sup>	5.667 <sup>ns</sup>	149.274 <sup>ns</sup>	.232 <sup>ns</sup>
Error b	b	27	1501.945	51000.619	17873.421	35141.451	18.61	161.756	.581
Defoliation (Def)		2	36420.88**	1298070.08**	330360.188**	2909681.896**	567.566**	724.419**	.058 <sup>ns</sup>
S×Def	×	4	1040.949 <sup>n</sup>	65026.042 <sup>n</sup>	6225.833*	57298.5129*	7.768 <sup>n</sup>	3.218 <sup>ns</sup>	.072 <sup>ns</sup>
Def * Def	×	6	143.608 <sup>ns</sup>	6696.194 <sup>ns</sup>	2078.188 <sup>ns</sup>	5271.618 <sup>ns</sup>	17.828 <sup>ns</sup>	3.703 <sup>ns</sup>	.086 <sup>ns</sup>
S * D * Def	×	12	57.014 <sup>ns</sup>	4084.111 <sup>ns</sup>	2107.306 <sup>ns</sup>	3427.743 <sup>ns</sup>	.879 <sup>ns</sup>	3.738	.200 <sup>ns</sup>
Error c	c	72	818.857	44487.266	14411.706	53439.113	16.395	39.198	2.571

\* and \*\*: Significant at %5, %1 level of probability, respectively.

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.(Muro, 2001; Schneiter, 1987)

.(Schneiter *et al.*, 1987)

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Beer, 1983; Dawson *et al.*, 1965; )

Johnson, 1972; Jonson, 2003; Muro, 1994;

.(Muro, 2001; Schneiter *et al.*, 1987

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Table 2. Mean comparison for different traits in different levels of planting dates, planting density and defoliation

Treatment	Seed yield (tha <sup>-1</sup> )	No. total seed m <sup>-2</sup>	No. of unfilled seed m <sup>-2</sup>	No. of filled seed m <sup>-2</sup>	1000 grain weight (g)	Unfilled percentage	Oil content (%)
S1	273.3 a	4041 a	538 c	3503 a	75.14 a	13.65 c	45.70 a
S2	204.8 b	3930 a	776 b	3154 b	61.52 b	20.22 b	42.31 b
S3	167.7 c	3788 a	898 a	2891 b	54.55 c	24.69 a	40.04 c
D1	174.0 d	2785 d	504 d	2281 d	69.38 a	19.63 a	42.71 a
D2	205.2 c	3625 c	639 c	2986 c	63.90 ab	18.40 a	42.75 a
D3	228.2 b	4269 b	818 b	3451 b	62.17 b	19.79 a	42.56 a
D4	253.8 a	5000 a	989 a	4012 a	59.49 b	20.25 a	42.72 a
Def1	243.8 a	4079 a	648 c	3431 a	67.78 a	15.94 c	42.65 a
Def2	213.2 b	3930 b	752 b	3177 b	63.17 b	19.81 b	42.72 a
Def3	188.9 c	3751 c	812 a	2939 c	60.16 b	22.80 a	42.68 a

Means, in each columns and treatment, followed by similar letter(s) are not significantly different at 5% probability level- using Duncan's Multiple Range Test.

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(Muro *et al.*, 2001)

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Table 3. Mean comparison for different traits as affected by interaction of planting dates and defoliation

Treatment		Seed yield (tha <sup>-1</sup> )	No. total seed m <sup>-2</sup>	No. of unfilled seed m <sup>-2</sup>	No. of filled seed m <sup>-2</sup>	1000 grain weight (g)	Unfilled percentage	Oil content (%)
Def1 ×S1	×	322.0 a	4259 a	469 h	3790 a	78.96 a	10.73 e	45.71 a
Def2 ×S1	×	305.0 ab	4072 b	533 g	3538 ab	74.86 a	13.23 e	45.78 a
Def3 ×S1	×	282.4 bc	3792 cd	612 f	3180 bc	71.58 ab	16.98 d	45.61 a
Def1 ×S2	×	234.6 d	4078 b	686 e	3392 b	66.05 bc	16.70 d	42.23 b
Def2 ×S2	×	224.8 de	3925 bc	802 d	3124 bc	60.39 cd	20.83 c	42.34 b
Def3 ×S2	×	215.4 e	3788 cd	841 c	2946 d	58.12 de	23.14 bc	42.38 b
Def1 ×S3	×	170.4 f	3901 c	789 d	3112 bc	58.60 de	20.40 c	40.02 c
Def2 ×S3	×	163.9 fg	3792 cd	922 b	2870 d	54.26 de	25.37 b	40.05 c
Def3 ×S3	×	156.6 g	3672 d	982 a	2690 e	50.79 c	28.29 a	40.04 c

Means, in each columns and treatment, followed by similar letter(s) are not significantly different at 5% probability level- using Duncan's Multiple Range Test.

Table 4. Mean comparison for different traits as affected by interaction of planting densities and defoliation

Treatment		Seed yield (tha <sup>-1</sup> )	No. total seed m <sup>-2</sup>	No. of unfilled seed m <sup>-2</sup>	No. of filled seed m <sup>-2</sup>	1000 grain weight (g)	Unfilled percentage	Oil content (%)
D1×Def1	×	197.6 ef	2916 h	402 h	2514 h	73.02 a	14.35 f	42.79 a
D1×Def2	×	174.0 f	2799 hi	522 g	2277 i	69.09 ab	20.09 bcde	42.73 a
D1×Def3	×	150.3 g	2640 i	588 f	2053 j	66.03 abc	24.43 a	42.59 a
D2×Def1	×	236.3 bc	3796 f	549 g	3247 e	68.75 ab	14.81 f	42.63 a
D2×Def2	×	202.5 cd	3644 f	644 e	3000 f	62.66 bcd	18.46 cde	42.83 a
D2×Def3	×	176.8 f	3434 g	723 d	2711 g	60.29 bcd	21.94 abc	42.78 a
D3×Def1	×	255.3 ab	4424 d	732 d	3692 c	65.88 abc	16.80 ef	42.49 a
D3×Def2	×	226.0 bc	4268 de	830 c	3438 d	62.12 bcd	19.99 bcde	42.59 a
D3×Def3	×	203.2 de	4117 e	893 b	3223 e	58.51 cd	22.59 ab	42.58 a
D4×Def1	×	286.1 a	5181 a	909 b	4272 a	36.84 a-d	17.82 def	42.70 a
D4×Def2	×	250.2 ab	5009 b	1014 a	3994 b	58.81 cd	20.70 bcd	42.72 a
D4×Def3	×	215.2 c	4812 c	1044 a	3768 c	55.83 d	22.25 ab	42.75 a

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Means, in each columns and treatment, followed by similar letter(s) are not significantly different at 5% probability level- using Duncan's Multiple Range Test.

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## Effects of defoliation at anthesis on grain yield and its components in sunflower (*Helianthus annus* L.) in different levels of plant density and sowing date

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### ABSTRACT

**Jamshidi, E., A. Ghalavand and J. Daneshian. 2007.** Effects of defoliation at anthesis on grain yield and its components in sunflower (*Helianthus annus* L.) in different levels of plant density and sowing date. Iranian Journal of Crop Science. 9(1): 32-44.

Changing crop canopy as to facilitating the interception of more radiation and maximizing photosynthesis rate is one of the approaches to increasing crop production. In order to study this hypothesis as well as to determine the effect of the size of source and sink and the role of stem reserved assimilates in grain filling in caps, a field experiment was carried out in split plot arrangement- using complete randomized block design with four replications, in Seed and Plant Improvement Institute Field Experiment Station, Karaj, Iran. In 2006 cropping season. Sowing dates (June 20, July 11 and July 31) was assigned to main plot and four plant density levels (6, 8, 10 and 10 plants m<sup>-2</sup>) and three leaf defoliation levels (without defoliation, defoliation of alternate leaves of upper half of plant and defoliation of leaves of lower half of plant) were randomized in sub-plot and sub-sub plots, respectively. Results showed that sowing date, plant density and defoliation had significant effect on seed yield, No. of seed m<sup>-2</sup>, No. of unfilled seed and No. of total seed m<sup>-2</sup>. The interaction of three factors, however was significant on No. of filled seed and unfilled seed m<sup>-2</sup> at 5% probability level. Increasing plant density, increased No. of seed m<sup>-2</sup>, hence the highest grain yield m<sup>-2</sup> was achieved for 12 plant m<sup>-2</sup> (2538 kg/ha). Results also revealed that grain yield is more dependent on current photosynthesis and leaves in upper part of plants are more important in determination of grain yield m<sup>-2</sup> and its components.

**Key words:** Sunflower, Sowing date, Planting density, Defoliation, Grain yield, Yield components, Oil percentage.

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