

The Effect of Sowing Date on Yield, Yield Components and Oil Content of Three Spring Safflower Cultivars under Full Irrigation in Tabriz (*Carthamus tinctorius* L.)

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ABSTRACT: To study the effects of sowing date on seed yield and oil yield, its components and oil content of three spring safflower varieties a factorial experiment based on randomized complete block design with three replications was conducted during spring 2010 at Agricultural Research Station, Agriculture Faculty Islamic Azad University, Tabriz branch, Iran. Treatments in this study consisted of four levels for sowing date (26April, 2 May, 8 May, and 14May) and three safflower varieties (Mex33, Isfahan, Goldasht). Analysis of variance showed that late planting (26April) reduced seed yield and oil yield, seed number per head, head number per plant, 1000-seed weight and oil content of seed. The highest seed yield was observed in the first planting date (2267 kg/ha) and the lowest seed yield at the forth sowing date (1124 kg/ha). The highest head number per plant was obtained at first planting date (13.44) and the lowest was at the forth sowing date (6.77). The highest seed number per head was obtained at first planting date (57.78) and the lowest at the forth sowing date (36). The highest 1000-seed weight at first planting date (37.78gr) and lowest 1000-seed weight at the forth sowing date (26.33gr). The highest oil yield was obtained from first planting date (782.60 kg/ha) and lowest from fourth sowing date (292 kg/ha). Also, effect of sowing date on oil percentages gets no significant.

Keywords: Oil yield, Safflower, Seed yield, Sowing date

INTRODUCTION

There is an increased demand for oil production in Iran. In order to reduce deficiency in oil production and the level of oil and oilseed imported, oilseed crop production areas and oil yield should be increased or Alternative oil crops should be introduced (Nikabadi and Soleimani, 2008). Spring oilseed crops including safflower have potential to meet much of Iran oil demand. Regarding growth conditions, safflower is not selective and is more tolerant to drought and low temperatures (e.g., -12 °C) than other oil crops. In particular, in arid conditions, it can be planted in fallow areas (Karaca et al.,

1989). The resistance of safflower to harsh climatic conditions makes it possible to be rotated with wheat, Barley, lentils, chickpea and tobacco in arid areas. Therefore, it is fair to assume that safflower has a great Potential for arid areas of the Iran region as an alternative plant to traditional winter crops. The field and quality properties of safflower are largely determined by ecological factors and cultivation Techniques. It was reported that the sowing date and cultivars of safflower vary depending on ecological conditions (Alessi et al., 1981; Hadjichristodoulou, 1989; Rao et al., 1990; Tomar, 1995; Patel et al., 1997; Samarthia and Muldoon, 1997).

Tuncurk and Vahdentin (2004) reported that the highest yield for safflower was obtained from 10 April sowings of the cultivar Diner-118. Therefore, in order to obtain safflower with high yield and quality, it is essential to determine the suitable growth conditions and cultivation techniques.

The aim of this study was to determine the optimum sowing date and selection the best cultivar of three safflower under the full irrigation in Tabriz conditions of Iran.

MATERIALS AND METHODS

Field trials were conducted in the 2010 Spring growing seasons at Agricultural Research Station, Agriculture Faculty Islamic Azad University, Tabriz branch, Iran with 46 geographical coordinates degree and 17 east degree also, 38 geographical latitude degree in 5 minute north with 1360 height of sea surface. The experimental design was randomized complete Block with 2 factors in 3 replicate blocks. First factor was four sowing dates (26 April, 2 May, 8 May and 14 May) and second factor was three spring safflower varieties (Mex33, Isfahan, Goldasht) and intrarow spacing was (30cm) whereas interrow spacing was chosen as 20 cm as reported by Patel et al (1997). Also, replications space were 2 meter each other and every replications consist of 12 plots with 4 in 2 m size. Plots had 6 rows and row length was 4 m. At first seeds disinfect with fungicide carboxine tiram with amount 2 per 10000. irrigation did after sowing and the next irrigation accomplished with attention to weather condition in every 7 days. Observations were carried out on 4 central rows, and 1 m from both ends of the rows was left as it represented the border effect. Nitrogen (60 kg ha⁻¹) and phosphorous (50 kg ha⁻¹) were applied. Half of the nitrogen and all of the phosphorous were applied prior to sowing, and the rest of the nitrogen was applied in June month. Plant Protection practices were carried out when needed. A 4.8 m² area was harvested on 15 Sep by a plot combine machine when the plants were completely dried out. Seed samples with the shells of each plot were milled and then the oil percentage was determined in 5 g by Soxhlet apparatus. Oil yield was calculated by multiplying oil percentage and the seed yield of each plot. 1000 seed weight obtained of 1000 seed weight in four replication. Also, number of head in shrub, number of seed in head taken from average four samples in per plot. The results of examine were analyzed according to the factorial design using the MSTAT-C program. Means were the least significant difference (LSD) test at percent 0.05.

RESULTS AND DISCUSSION

Seed Yield

According to the result of mean comparison the highest seed yield obtained of first planting date with

(2267 Kg/ha) and the lowest seed yield was in fourth planting date with (1124 Kg/ha). Second and third planting date were at next level after the first planting date respectively with (1856, 1530 Kg/ha) (table 2). The results showed that first planting date to second date, second to third and third to fourth had increased respectively (22.4, 21.30 and 36.12 percent) (table 2). The highest seed yield was in Mex 33 cultivar with 1856 Kg/ha and lowest was in Goldasht cultivar with 1432 Kg/ha. Isfahan cultivar with 1794 Kg/ha had seed yield between two before cultivars (table 3). Mex 33 cultivar to Isfahan cultivar and Isfahan to Goldasht had raised seed yield respectively (4/21, 24/38 percent) (table 3). The increasing seed yield in Mex33 and Isfahan to Goldasht can be related on their genetic. Seed yield with all characteristics expect seed number per head and head number had a significant positive correlation. Therefore increasing of these characters showed rising in seed yield (table 4). Omid and Sharifmogadas (2010) reported that seed number per head and head number had the biggest role in raising yield. But at this study the effect of this character was significant. Uzel and et al (2003) and Singh (1993) observed decreasing in seed yield under effect of late date.

1000-Seed Weight

The result of mean comparison showed the highest 1000-seed weight obtained at first planting date with 37.78 gr and the lowest was at fourth planting date with 26.33 gr. The second and third planting dates were between the first and fourth planting date with 34.33 and 29.56 gr (table 2). In fact the seed weight at the first planting date to second and the second to third also, the third to fourth had raised respectively (10.04, 16.13 and 12.26 percent) (table 2). The highest 1000-seed weight was Goldasht cultivar with 39.83 gr and the lowest was in Isfahan cultivar with 27.25 gr and The Mex cultivar with 28.92 gr was in contrasting level between two other cultivars. Therefore increasing in 1000-seed weight in Goldasht to Mex33 and Isfahan were respectively (39.20 and 44.57 percent) (table 3). In late planting date caused to get significant decrease in 1000-seed weight. This state relate to effect of environment stress at lasting of growth season. Also, Tuncurk and Vahdentin (2004) reported side effect of environmental condition on safflower in late planting date. Reported by Robertson and Holl (2004) on safflower showed decreasing in 1000-seed weight under the late date. Head number, seed yield had significant positive correlation and it had the highest coefficient correlation with head number about 0.44 that showed maintained (table 4). But Ashri stated no significant and negative between 1000-seed number and head number.

Seed number per head

Mean comparison of seed number per head showed that the highest obtained of first time with 57.78 No and the lowest was at fourth sowing date with 36 No. The

second sowing date with 48.24 No and third with 42.11 No were after the first time. The first sowing date to second, second to third and third to fourth showed raise respectively (19.82, 14.50 and 16.97 percent). Over all seed number per head at first sowing date relates to fourth date had increasing about 70 percent (table2). The highest seed number per head was in Mex cultivar with 53.11 No and the lowest obtained of Goldasht cultivar with 36.83 No. Also, Isfahan cultivar with 48.08 No was in contrasting level between two other cultivars. This character in Mex33 cultivar relates to Goldasht had increasing about 44.36 percent (table3). Increasing in earlier sowing date got cause of on time pollination, prolong of growth and seed filling period. Omid and Sharifmogadas (2010) studied on universal collection of safflower founded average of seed number per head is about 28 to 31.9. Seed number per head had positive correlation with seed yield (table 4). Also, ashri (1975) and Uzel (2003) founded that negative correlation was between head number and seed number per head and rate of this correlation was more in Iranian cultivars.

Head number per plant

Head number per plant is the importation of compound yield (Tuncurk and Vahdentin. 2004). The results of mean comparison showed that the highest was at first time with 13.44 No and the lowest was at fourth sowing date with 6.77 No. head number per plant at second sowing date with 10.33 No was after first sowing date. Also, third sowing date with 8.44 No was between the second and fourth sowing date. Rising of head number at first sowing date to third and third to fourth were respectively about (22.39 and 24.66 percent) (table2). The

highest head number per plant was in Mex 33 cultivar with 12.33 No and the lowest obtained of Isfahan and Goldasht cultivars respectively with (6.917 and 9 No) (table3).

Salera (1996) stated that late sowing date can get significant decreasing in head number cause of this phenomenon were vegetative growth period and hot temperature. Also, Rao (1990) and Ashri (1975) observed this decreasing because of sowing date in number head.

Oil percentage

Sowing date hadn't any significant effect on oil percentage (table1).

Oil Yield

Sowing date had significant effect in 1% level (table1). The highest oil yield obtained of first sowing date with 782.60Kg/ha and the lowest was in fourth sowing date with 292 Kg/ha (table2). There weren't any significant between the cultivars. Oil yield obtained of seed yield in oil percentage. Nevertheless, the oil percentage cultivars hadn't any significant difference each other but different significant of seed yield get cause of increasing in oil yield. Therefore the oil yield relates to seed yield and they have much correlation with each other (table4). Nikabadi and Soleimani (2008) reported no significant difference in oil percentage and oil yield at spring safflower cultivars in Isfahan region. They said that the average of oil percentage and oil yield were respectively 29.6 percent and 563.6 Kg/ha. Also Uzel and et al (2003) founded the highest of oil yield was 11 November with 431.5 Kg/ha and the lowest obtained of 16 March with 409.95 Kg/ ha that this decreasing was in oil yield because of late sowing date.

Table 1. Mean square analysis for measurement characteristics Ms

S.O.V	df	Seed number per head	Head number	1000seed weight	Oil%	oil yield	Seed yield
Replication	2	2281/361*	97/33*	124/083*	119/341*	1268686/84**	11837034/02*
Sowing date	3	776/324*	73/583*	230/741*	21/837 ^{ns}	381628/71**	2117909/954*
Cultivar	2	838/361*	63/583*	560/583*	29/004 ^{ns}	94178/128 ^{ns}	629225/778*
SD×C	6	36/657 ^{ns}	1/583 ^{ns}	2/546 ^{ns}	6/398 ^{ns}	6072/121 ^{ns}	72587/037 ^{ns}
Error	22	26/482	4/212	2/598	12/431	27393/393	133614/331
CV%	-	11/18	21/05	5/04	11/95	33/13	21/58

**, *, ns: significant at the 1%, 5% probability levels and non significant respectively

Table 2. effect of means comparison different sowing date on survived characteristics with Duncan test

Sowing date	Characteristic	Number head	Number seed per head	1000seed weight	Oil yield Kg	Seed yield Kg
First		13/44a	57/78a	37/78a	782/60a	2267a
Second		10/33b	48/24b	34/33b	486/50b	1856b
Third		8/44bc	42/11c	29/56c	435/30b	1530c
fourth		6/77c	36d	26/33d	292c	1124d

Table 3. means comparison characteristics in survived spring safflower cultivars

genotype	Characteristic	Number seed per head	Number head	1000seed weight	Seed yield Kg
Mex33		53/17a	12/33a	28/92b	1856a
Local		48/08b	6/917b	27/250c	1794b
Isfahan		36/83c	9b	39/83a	1432c
Goldasht		1/486	0/5925	0/465	105/5

Table 4. correlation characteristics

characteristics	Number seed per head	Number head	1000seed weight	Oil%	Yield seed	Oil Yield
Number seed per head	1					
Number head	-0/758 ^{ns}	1				
1000seed weight	0/228 ^{ns}	0/449*	1			
Oil%	0/486*	0/305 ^{ns}	0/06 ^{ns}	1		
Yield seed	0/888 ^{ns}	0/735 ^{ns}	0/394*	0/503*	1	
Oil Yield	0/741**	0/725**	0/583*	0/846**	0/953**	1

**, *, ns: significant at the 1%, 5% probability levels and non significant respectively

CONCLUSION

The results of this study showed the Mex33 cultivar had best seed yield among other cultivars. Late sowing date get cause of decreasing in seed yield and other compound yield. Also, late sowing date had no significant on oil percentage and this result need to more study. Therefore the seed yield is more important character that effect of sowing late. Difference of oil seed had high correlation with seed yield and other characters such as 1000-seed weight, oil percentage had a positive significant on yield.

ACKNOWLEDGEMENT

The authors thank my supervisor professor Hamdolah Kazemi- Arbat for support Of the present study.

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