



The effect of density, variety, and planting date on yield and yield components of safflower

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Abstract

More than 90 percent of Iranian domestic need for oil is imported. *Carthamus tinctorius L.*, one of the native plants in Iran, is tolerant to drought and salinity. Its seeds contain 35% high-quality oil and 15% protein. To study the effect of density, variety, and planting date on yield and yield components of safflower, an experiment was carried out using split-plot design with four replications at Islamic Azad University, Bojnord Branch, Iran in fall 2005. Date of planting was the main factor (a₁=September 23, a₂=October 2, a₃= October 12, a₄= October 22) and varieties (b₁=LRV51/51, b₂= Zargosan and b₃=295) and densities (c₁=4, c₂=9, c₃=12, c₄=15 centimeters) were the sub-factor. The results showed that there was an interaction effect among planting date, variety and density. The highest seed yield (2679 kg) was produced with September 23 planting time, LRV 51.51 and 4 centimeter density. The first planting date yielded the highest average oil seed compared to the other planting dates, 715 kg/ha. Among the varieties LRV51.51 produced the highest amount of oil. There was a correlation between plant seed yield and oil yield (r=0.89) and the number of seeds per pod (r=0.8).

Key words: Safflower - seed yield - oil yield – correlation - important traits

Introduction

Safflower (*Carthamus tinctorius L.*) is one of our oldest domesticated crops. It is a major oil seed crop. Iran, with an annual 240 mm of rainfall, is classified as a dry region in the world. Safflower, one of the native to Iran and is tolerant to drought and salinity. It is a valuable oil seeds in Iran, which imports most of its edible oil. Its seeds contain 35% high-quality oil and 15% protein. The petals, colored orange, are used mainly as the condiment in food preparation.

In studying best planting time of safflower in southern Iran, S. Motelipour (2001) expressed that the highest seed yields (1276 kg/ha) and oil (330 kg/ha) were obtained when it was planted in Oct.22. The sooner the planting time, the more rapidly it emerged and plant height increased. Jelali (2001) showed that double row planting had higher seeds per head and consequently increased seed yield.

According to the path analysis, seed yield was determined by head diameter, heads/plant and seeds/head since these characters had highly positive significant direct effects on seed yield (Arshan.B 2007). Ozel,A et al.(2004) showed that the most suitable sowing date and intrarow spacing for safflower on Harran Plain were November and 5 cm, respectively. In the study of yield components, leaf pigment contents, patterns of seed filling, dry matter, LAI and LAID of some safflower (*Carthamus tinctorius L.*) genotypes in Iran, Mokhtassi.B (2007) expressed that Zarghan-279 (with the greatest LAID) had 25% longer LAID than LRV.51/51 (with the lowest LAID). Also, higher dry matter accumulation, HI, seed weight/capitulum, 1000-seed weight and capitulum diameter were found to be closely related to high-yield genotypes.

Materials and Methods

In autumn 2005, an experiment was carried out using split-plot design with four replications at Islamic Azad University, Bojnord Branch,Iran. Date of planting was the main factor (a₁=September 23, a₂=October 2, a₃= October 12, a₄= October 22) and varieties (b₁=LRV.51/51, b₂=Zargosan and b₃=295) and density (c₁=4, c₂=9, c₃=12, c₄=15 centimeters)



were the sub-factors. Experiment plot consisted of rows of 4-m long and 0.5 m apart. Data on yield per plant and yield component were obtained by calculating the mean of five randomly selected plants in each plot. Some important collected data were plant height, number of secondary branches, oil yield per plant, number of heads, the number of seed per heads, and 100 seed weight.

Results

Seed yield

The results showed that there was a significant difference between planting time and density. The highest seed yield belonged to the first planting time (Sep.22) with 2704 kg/ha and 4-cm density with 2679 kg/ha. Four-cm density led to a more uniform growth in the rows, which made for a better distribution of light within the canopy. The results are in accord with Azary (2001) that showed with the decreasing the space between plants the seed yield increased. LRV.51/51 had the highest yield because of its numerous pods. The interaction between planting time and variety was significant. The highest seed yield was obtained from LRV.51/51 Oct. 12 planting time.

Oil seed percentage

The percentage of oil is also an important quality to be investigated. The results indicated that the interaction between planting time and variety, the one between planting time, variety and density were significant. Therefore, the percentage of oil seed is affected by genotype.

Oil yield

The results indicated that the interaction between planting time and variety, planting time and density. The one between planting time, variety and density was significant.

The interaction between variety and density, Zarghan and 4-cm density, the highest oil yield was obtained with 749 kg/ha (table1).

The highest oil yield belonged to the first planting time (sep.22) with 715 kg/ha and 4-cm density with 736kg/ha. The highest oil yield was obtained from LRV.51/51 with 721 kg/ha.

Correlation

The correlation of yield and the yield components with each other are shown in table2.

There was a high correlation among yield and number of secondary branches($r=0.59$), oil yield per plant ($r=0.89$), number of heads ($r=0.80$), and the number of seeds per head ($r=0.51$).

Based on the results, there was a positive correlation between number of heads per plant and the number of secondary branches($r=0.85$).

The correlation between yield per plant, and the number of heads per plant was also reported by Ashri (1971).

Table 1: Interaction between variety and density

	Ranked order	
Mean 1=	749.9 A	C ₁ B ₂
Mean 10=	735.5 AB	C ₁ B ₃
Mean 4=	734.0 AB	C ₂ B ₁
Mean 8=	718.9 ABC	C ₂ B ₂
Mean 2=	718.2 ABC	C ₂ B ₃
Mean 7=	717.7 ABC	C ₃ B ₁
Mean 5=	705.6 ABC	C ₃ B ₂
Mean 6=	696.9 ABC	C ₃ B ₃
Mean 11=	685.7 BC	C ₁ B ₂
Mean 9=	681.2 BC	C ₄ B ₁
Mean 3=	677.2 BC	C ₄ B ₂
Mean 12=	669.8 C	C ₄ B ₃



Table 2. Correlation among traits

	Seed yield	Oil yield	Number of heads	Number of seed per heads	Number of secondary branches	1000 seed weight	days to maturity
Seed yield	-						
Oil yield	0.89**	-					
Number of heads	0.80**	0.031	-				
Number of seed per heads	0.51**	0.07	0.65**	-			
Number of secondary branches	0.59**	0.21	0.85**	0.141	-		
1000 seed weight	0.07	0.17	0.126	0.07	0.13	-	
days to maturity	-0.02	0.16	0.71**	0.15	0.67	0.02	-

Discussion

Based on the results, LRV51/51 had the highest yield, among the studied varieties. It is recommended that these varieties are used in the in the region and regions with similar climate. LRV51/51 was ranked first in having traits which correlate highly with yield, which were oil yield per plant, and the number of heads per plant. The highest seed yield (2679 kg/ha) was produced with September 23 planting time, and 4 centimeter density.

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