Int.J.Curr.Microbiol.App.Sci (2018) Special Issue-6: 2639-2645

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7692 **Special Issue-6 pp. 2639-2645**
Journal homepage: http://www.ijcmas.com

Original Research Article

Influence of Planting Time on Seed Yield and Oil Content of Safflower under Rainfed Condition of Vidarbha Region

G.V. Thakare, S.C. Vilhekar*, S.B. Sakhare, P.C. Uke and P.U. Ghatol

Oilseeds Research Unit, Dr. Panjabrao Deshmukh krishi Vidyapeeth, Akola (M.S), India
**Corresponding author*

A B S T R A C T

This study was carried out to determine the effect of optimum planting time for achieving highest seed and oil yield under rainfed condition of Vidarbha region. The experiment was conducted at Oilseeds Research unit, Dr. P. D. K. V., Akola, during *rabi* season 2016-17 using a split plot design with four replications along with three planting date viz., D_1-26.09.2016 (Recommended date of sowing), D_2-14.10.2016, D_3- 28.10.2016 and four cultivar viz., National check Annigeri-1 and high oil content varieties viz., NARI-6, NARI-57 and PKV Pink. The study revealed that, planting time affected the branches per plant, effective capsules per plant, 100 seed weight, seed yield, oil yield and oil content. The sowing of safflower during first fortnight of October i.e. 14th Oct. 2016 under rainfed condition gave the highest seed yield of 1118 kg ha^{-1} which was at par with sowing of crop on 26th Sept. 2016 (950 kg ha^{-1}). The oil yield of safflower also found significantly superior with second date of sowing (333 Kg ha^{-1}) and followed by recommended date of sowing (277 Kg ha^{-1}). The yield of safflower decreases as the crop sown at an interval of fifteen days after second date of sowing. Similar results were also obtained in gross monetary returns (Rs 32981 ha^{-1}), net monetary returns (Rs 13431 ha^{-1}) and B: C ratio (1.69). Significantly higher seed yield was observed in variety Annigeri-1 (1120 kg ha^{-1}) followed by PKV Pink (1045 kg ha^{-1}) and lowest seed yield was recorded with NARI-6 (788 kg ha^{-1}). Similar trend was also observed in respect of B:C ratio. Interaction effect on seed and oil yield was found significant. The highest seed yield were found with Annigeri-1 (1308 kg ha^{-1}) followed by PKV-Pink (1155 kg ha^{-1}) when sown at 14th October 2016. The interaction effect on oil yield also found significant. The highest oil yield 361 kg ha^{-1} was produced by Annigeri-1 when sown at 14th October 2016.

Keywords

Safflower, Planting time, Variety

Introduction

Safflower (*Carthamus tinctorius* L.) is an important *rabi* oilseed crop of Maharashtra, apart from its superior adaptability to scanty moisture conditions, it produces oil rich in poly unsaturated fatty acids (linoleic acid 78%) which plays an important role in reducing the blood cholesterol level. The tap root of crop posses deep and produce efficient root system and utilizes the soil moisture efficiently. The crop, being spiny, does not require protection from the stray cattle and birds. The oil content of whole seed ranges from 28 to 33%. The oil is also used for various industrial purposes. A number of products are developed from safflower such as carthamin pigments. This is used as a food additive for making herbal type of tea and extracting protein and amino

acids. There seems to be tremendous demand for edible oils which are turning into effective demand with increasing purchasing power. There is an urgent need to step up oilseed production on sustainable basis to meet the needs of increasing population and expanding demands. However, with chances on area expansion being limited, increase in oilseeds production have to come primarily from land saving technologies, highlighting a combination of high yielding plant types, standard agronomic practices and balance plant nutrition attained through integrated supply system (Hegde,1999).

India has the legitimate pride of being the largest producer of safflower in the world, grown on an area of 1.78 lakh ha with production of 1.14 lakh tonnes. In India, Maharashtra contributes an area of 1.07 lakh ha with production of 0.61 lakh tonnes and productivity of 566 kg ha^{-1} tonnes, respectively. (Anonymous, 2016).

The most important production factors in safflower are both soil and ambient temperature and soil moisture. Hence, sowing date assumes greater significance. Any delay in sowing resulted drastic reduction in seed yield and oil content. Sowing or planting of the crop at right time have a quite important. Early sowing with improved variety is one of most cost effective ways of increasing crop yields. Similar results were reported earlier by Daltalab *et al.,* (2013) and Sahu and Thakur (2013).

Cultivar selection is also a key management component in any cropping system even more critical in sowing date for crop production. All the varieties may not be suitable for timely as well as the late sowing. The field and quality properties of safflower are largely determined by ecological factors and cultivation techniques. Similar results were reported earlier by Soleymani *et al.,* (2011) and Daltalab *et al.,* (2013).

Since it costs no more to plant early than late and grow improved variety than local, yields can be increased significantly by earlier planting without incurring any additional cost of production. Under Indian conditions time of sowing of crop varies with the choice of the crop, variety, availability of soil moisture and irrigation facility. However, there are specific reasons for achieving high crop yields.

Under dryland conditions, sowing of crop depends on the receipt of rainfall and availability of soil moisture. Early sowing utilizes the soil moisture more effectively. The crop put forth early vigour, growth and development resulting in higher production. Due to delayed sowing, the rate of decline in yield varies from 4 to 80 kg/day/ha. Delayed sowing leads to reduction in yield because of the prevalence of pest and disease, poor germination due to low temperature, poor plant stand and severe terminal drought.

Most oilseed crops have an indeterminate growth habit; adaptation is influenced by tolerance to high temperature and drought stress. The recommended sowing time of west Maharashtra and Marathwada is last week of September to mid October (Reddy and Patil, 1995). Sowing time and varieties plays an important role in crop husbandry and remains to be prominent factor in deciding seed as well as oil yield. One of the possible ways to boost the seed yield is to sow the high yielding varieties at appropriate time. Optimum sowing time is important non-monetary input and if managed properly helps to enhance seed yield.

Materials and Methods

The experiment was conducted at Oilseeds Research unit, Dr. P. D. K. V, Akola, during *rabi* season 2016-17. Experiment was framed by split plot design with four replications along with three planting date viz., D_1- 26.09.2016, D_2-14.10.2016, D_3-28.10.2016 and four cultivar viz., National check Annigeri-1 and high oil content varieties viz., NARI-6, NARI-57 and PKV-Pink. This study was carried out to determine the effect of optimum planting time for achieving highest seed and oil yield under rainfed condition of Vidarbha region.

The sowing of Safflower was done on three different sowing date with fifteen days interval from the recommended date of sowing and where ever required protective irrigation were given to save the crop, four varieties were tested under rainfed condition. All recommended cultural practises were adopted with the recommended dose of fertilizer. The complete dose of phosphorous (25 kg P_2O_5) along with half dose of nitrogen (20 kg/ha) as per recommendation was placed 10 cm deep in the line to the side of the crop row but prior to each sowing uniformly in each plot. The remaining half dose of (20 kg N/ha) was applied at 30-35 days after sowing. The fertilizers used were 40:25:00, urea (46% N) and single super phosphate (16% P_20_5). Five plants were randomly selected by moving diagonally in the centre of plot.

Growth, yield attributing observations and yield were recorded at harvest. The oil content of safflower seed was estimated using the Nuclear Magnetic Resonance (NMR) method (Model Oxford mQA 6005).

$$\text{Oil yield (kg ha}^{-1}\text{)} = \frac{\text{Oil content (\%) X Seed yield (kg ha}^{-1}\text{)}}{100}$$

Oil yield kg ha^{-1} was calculated from oil percentage and seed yield. The data collected was analyzed by using statistical procedure of analysis of variance as described by Panse and Sukhatme (1971).

Results and Discussion

Effect of planting time

The planting time shows the significant effect on seed yield and oil yield of safflower, crop sown on 14th Oct. 2016 under rainfed condition gave the highest seed yield of 1118 kg ha-1 which was at par with sowing of crop on 26th Sept. 2016 (950 kg ha-1). Deokar *et al.,* (1984) obtained the highest yield by sowing of safflower in the 41st MW at Dry Farming Research Station, Solapur. Patel *et al.,* (1997) also reported the seed (18.40 qt/ha) and straw (52.32 qt/ha) yield was highest with sowing of safflower at 41st MW. The results are in conformity with those findings of Rajput *et al.,* (2007). This might be due to convenient temperature for longer time favourable for germination as well as vegetative and reproductive growth of plants.

The oil yield of safflower also found significantly superior with second date of sowing (333 Kg ha-1) and followed by recommended date of sowing (277 Kg ha-1). Similar results were reported by Patel *et al.,* (1996) and Koduri et al (2003). They reported that maximum oil content (30.39 %) and oil yield (5.65 qt/ha) were recorded under sowing in 41st MW. 41st MW sowing might have improved root development and ultimately better nutritional environment within plants resulted in increase in oil yield.

The lowest seed and oil yield was recorded with Third date of Sowing (30 DAS after recommended date of sowing) viz, 830 and 247 Kg ha-1 respectively. The yield of

safflower decreases as the crop sown at an interval of fifteen days after second date of sowing. Similar results were also obtained in gross monetary returns (Rs 32981 ha-1), net monetary returns (Rs 13431 ha-1) and B: C ratio (1.69). A trial was conducted on safflower under irrigated conditions at Phaltan, Maharashtra and observed that crop sown on 12th October recorded significantly highest gross returns (Rs. 30947/ha), net returns (Rs.2228/ha) and B:C ratio (0.9) than other sowing dates respectively (Anonymous, 2014).

Table.1 Influence of planting time on Seed and oil yield, oil content, and economics of different safflower varieties

Treatments	Seed yield (kg ha^{-1})	Oil content (%)	Oil Yield (kg ha^{-1})	GMR	COC	NMR	B:C ratio
				(Rs. ha^{-1})			
Sowing dates							
D_1: Recommended date of sowing*(26.09.2016)	950	29.19	277	28025	19550	8475	1.43
D_2: 15 days after recommended date of sowing (D1) (14.10.2016)	1118	29.92	333	32981	19550	13431	1.69
D_3: 30 days after recommended date of sowing (D1) (28.10.2016)	830	29.89	247	24485	19550	4935	1.25
SE m±	21.8	0.39	7.71	644	-	-	-
C.D.at 5%	75.6	**NS**	26.69	2229	-	-	-
Varieties							
V_1: A-1	1120	27.1	306	33040	19550	13490	1.69
V_2: NARI-6	788	29.4	233	23246	19550	3696	1.19
V_3: NARI-57	911	31.6	287	26875	19550	7325	1.37
V_4: PKV Pink	1045	30.5	318	30828	19550	11278	1.58
SE m±	25.2	0.41	8.63	744	-	-	-
C.D. @ 5%	73.2	1.19	25.04	2159	-	-	-
C.V.%	9.04	5.24	14.94	9.04	-	-	-
Interaction	**Sig.**	**NS**	**Sig.**	**Sig.**	-	-	-

Table.2 Interaction effect of planting time and varieties on seed yield of safflower

Planting time	Varieties				Mean Yield (kg ha^{-1})
	A-1	NARI-6	NARI-57	PKV Pink	
D_1-26.09.2016	1152	702	841	1107	950
D_2-14.10.2016	1308	921	1087	1155	1118
D_3-28.10.2016	898	741	805	873	830
Mean	1120	788	911	1045	
SE m+	43.7				
CD @ 5%	126.7				

Table.3 Interaction effect of planting time and varieties on oil yield of safflower

Planting time	Varieties				Mean Yield (kg ha^{-1})
	A-1	NARI-6	NARI-57	PKV Pink	
D_1-26.09.2016	324	187	271	327	277
D_2-14.10.2016	361	276	339	357	333
D_3-28.10.2016	231	234	252	270	247
Mean	306	233	287	318	
SE m+	14.9				
CD @ 5%	43.4				

Table.4 Yield contributing characters influenced by different sowing dates and varieties

Treatments	Plant height (cm)	No. of effective capsules plant^{-1}	No. of branches per plant^{-1}	Test wt. (g)
Sowing dates				
D_1: Recommended date of sowing* (26.09.2016)	63.9	28.2	8.1	4.16
D_2: 15 days after recommended date of sowing (D1) (14.10.2016)	96.4	33.9	8.3	4.47
D_3: 30 days after recommended date of sowing (D1) (28.10.2016)	88.1	24.4	7.1	3.89
SE m±	2.47	0.96	0.24	0.07
CD @ 5%	8.53	3.31	0.83	0.22
Varieties				
V_1: A-1	81.1	41.3	9.5	6.1
V_2: NARI-6	90.7	21.2	7.0	3.4
V_3: NARI-57	81.2	27.8	8.3	3.8
V_4: PKV-Pink	78.4	25.2	6.5	3.5
SE m±	2.20	0.90	0.34	0.08
C.D. @ 5%	6.39	2.60	0.99	0.23
C.V.%	11.9	41.3	15.1	6.7
Interaction	**NS**	**Sig.**	**Sig.**	**NS**

Effect of varieties

Significantly higher seed yield was observed in variety A-1 (1120 kg ha-1) followed by PKV Pink (1045 kg ha-1) and lowest seed yield was recorded in NARI-6 (788 kg ha-1). Similar trend was also observed in respect of B:C ratio. These findings are in concurrence with those of Patel *et al.*, (1996) and Patel *et al.,* (1997). This might be due to the higher values of the yield attributes viz. number of effective capitula plant-1 and 100 seed weight. Similar results were reported by Anonymous, 2000. They reported that the variety A-1 recorded highest seed yield (1847 kg ha-1) than PH-3 (1764 kg ha-1) and JLSF-95-01 (1750 kg ha-1) respectively.

Effect of interaction

Interaction effect on seed and oil yield was found significant. The highest seed yield were found with Annigeri-1 (1308 kg ha-1) followed by PKV-Pink (1155 kg ha-1) when sown at 14th October 2016. The interaction effect on oil yield also found significant. The highest oil yield 361 kg ha-1 was produced by Annigeri-1 when sown at 14th October 2016.

From present investigation it can be concluded that, sowing on 14th October 2016 and variety Annigeri-1 followed by PKV Pink is best interaction for obtaining greater seed and oil yield.

References

Anonymous, 2000. Evaluation of AVHT-II entries under different sowing dates under irrigated conditions, Annual Progress Report (Safflower), Hyderabad (India), 1999-2000; pp: 103-107.

Anonymous, 2011-12. Project director (DOR), Hyderabad, Progress report.

Anonymous, 2014. Evaluation of AVHT-II entries under different sowing dates under irrigated conditions, Annual Progress Report (Safflower), Hyderabad (India), 2013-2014; pp: 103-106.

Anonymous. 2016. Status paper on oilseeds, Department of Agrl. and Co-operation. pp:57-58.

Daltalab, B., HKazemi-Arbat, and E. Khalilv and Behrouzyar. 2013. 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). *Intl. J. Farm. & Alli. Sci*., 2(3): 66-69.

Dashora, P. and R.P. Sharma, 2006. Effect of sowing date, irrigation and sulphur nutrition on yield attributes, yield and oil content of safflower. Crop research (Hissar), 31(1): 56-57.

Deokar, A.B and F. B. Patil, 1978. Analysis of parameters of variability in some Indian varieties of safflower. J. Maharashtra. Agric. Univ. 3 (1): 69-70.

Deokar, A.B; N. D. Patil, B.S. Manke and M.S. Munde, 1984. Response of safflower to different dates of sowing. J. Maharashtra. Agric. Univ. 9(1): 67-69.

Hegde, D.M. 1999. Integrated nutrient management for sustainability of oilseed based cropping system, Paper presented in training course on soil fertility management in cropping system at TNAU, Coimbatore, 28 July-17 August 1999. *Training manual*. Pp: 32-37.

Koduri, M.R., Q. Kelarastaghi and D. Darvishi, 2003. Effect of planting dates on growth and development stages and yield of safflower (*Carthamus tinctorius L.)* cultivars.

Iranian J. of Medical and aromatic plants. Res. 19 (4): 411-423.

Kolsarici O., Y.K. Sergek and M.D. Kaya 2006. Determination of suitable variety, sowing date and row distance in safflower(*Carthamus tinctorius L.*) under central Anatolia conditions. Sesame and safflower newsletter.21: 98-101.

Panse, V.G. and P.V. Sukhtame, 1971. Statistical Methods for Agriculture Workers Indian Council of Agricultural Research, New Dehli.3rd Edition, PP 341.

Patel, B. M., S.G. Sadaria, V.D. Khanpara, B. B. Kaneria and R. K. Mathukia, 1996. Yield, quality and economics of safflower as influenced by different sowing date, Gujarat Agric. Univ. Res. J. 22(1): 124-126.

Patel, B. M ; S.G. Sadaria, V.D. Khanpara, B. B. Kaneria, R. K. Mathukia,1997. Performance of safflower (*Carthamus tinctorius L.*) varieties under different sowing dates. Gujrat Agric. Univ. Res. J. 22(1): 133-135.

Piper, C. S. 1966. Soil and plant analysis 4th edition, 135-206. Interservice publisher. Inc, New York, 1950.

Rajput G.R., V.S. Khawle, P.S. Mankar, S.K.Sharma and M.D. Kumbhare, 2007. Effect of sowing dates and nutrient management in safflower. J. Soils and crops 17(1):110-113.

Reddy, P.S. and D.A.Patil, 1995. Safflower Package of Practices for production. Published by I.C.A.R. Hydrabad

Sahu, J. and N.S. Thakur. 2013. Response of date of sowing on yield and yield attributes of safflower culitivars. *The Bioscan*, 11 (1): 503-507.

Soleymani, A., S.A. Emami, H. S. Mohamad and L. NaranJani. 2011. Evaluation of suitable planting dates and autumn safflower cultivars under climatic condition of Isfahan, Iran. *Res. On Crops*, 12(1): 155-162.