

RESEARCH PAPER

ADVANCE RESEARCH JOURNAL OF
C R P
IMPROVEMENT
Volume 8 | Issue 1 | June, 2017 | 66-69
••••• e ISSN-2231-640X

DOI :
10.15740/HAS/ARJCI/8.1/66-69
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Effect of plant population on yield and yield components of safflower cultivars in rainfed condition of Vidarbha region

■ P.C. UKE¹, S.C. VILHEKAR AND E.R. VAIDYA¹

AUTHORS' INFO

Associated Co-author :

¹Oilseeds Research Unit (DR.
P.D.K.V.) AKOLA (M.S) INDIA

Author for correspondence:

S.C. VILHEKAR

Oilseeds Research Unit (DR.
P.D.K.V.) AKOLA (M.S) INDIA
Email: soniavilhekar111@gmail.com

ABSTRACT : This study was carried out to develop best suitable plant population of two safflower cultivars in rainfed condition. The experiment was conducted at Oilseeds Research Unit Dr. P. D. K. V, Akola, during 2015-16 using a Factorial Randomized Block Design with three replications. Plant population were 1.66, 1.11, 0.83, 0.66 and 0.55 lakh plants/ha and cultivars included were Annigeri-1 and NARI 38. Branches per plant, effective capsules per plant, 100 seed weight and harvest index were significantly decreased as plant population increased. With increasing plant population, seed yield and biological yield were increased. The highest seed yield was obtained from plant population 1.66 lakh/ha (1150 kg/ha) which was at par with 1.11 lakh/ha plant population (1121 kg/ha) and lowest seed yield was recorded in 0.55 lakh/ha plant population (916 kg/ha). National check Annigeri-1 yielded higher seed yield than NARI-38 mainly due to higher number of effective capsules per plant. Similar trend was noticed in gross return, net return and B:C

KEY WORDS : Safflower, Plant population, Variety

How to cite this paper : Uke, P.C., Vilhekar, S.C. and Vaidya, E.R. (2017). Effect of plant population on yield and yield components of safflower cultivars in rainfed condition of Vidarbha region. *Adv. Res. J. Crop Improv.*, 8 (1) : 66-69, DOI : 10.15740/HAS/ARJCI/8.1/66-69.

Paper History : Received : 08.02.2017; Revised : 03.05.2017; Accepted : 13.05.2017

Safflower is an important oilseeds crop of Vidarbha region of Maharashtra mainly grown after short duration legumes. The maximum yield potential of safflower can be realized by adopting suitable agronomic practice like use of fertilizer dose, timely sowing and maintaining optimum plant density (Sakir and Baslama, 2005). It is more drought resistance than other oilseeds and can produce good yield in dry region, while its salt tolerance is a valuable asset as the area affected by some degree of salinity steadily increases.

Safflower (*Carthamus tinctorius* L.) is an annual, broadleaf oilseed crop of the Compositae adapted mainly to dry land and irrigated cropping systems. It has been grown for centuries, primarily for its colorful petals to

use as a food coloring and flavoring agent, for vegetable oils and also for preparing textile dye. Safflower is an important oilseed crop with 35-40 per cent oil. Research linking health and diet has increased the demand for the oil, which safflower has the highest poly unsaturated/saturated ratios of any oil available. It is nutritionally similar to olive oil, with high levels of linoleic acid, but much less costly.

Omidi and Sharifmogadas (2010) reported maximum seed yield safflower happens at the highest plant density (40 plant/m²) and maximum oil yield observe at 20 plant/m². Pourhadian and Khajehpour (2009) concluded with increasing planting density number of branches/plant, seeds/head, heads/plant and seed yield (one plant)

significantly decreased. The purpose of the present study was to develop the ideal plant population for crop diversification.

RESEARCH PROCEDURE

The experiment was conducted on vertisols at Oilseeds Research Unit Dr. Panjabrao Deshmukh Krishi Vidyapeeth Akola, during 2015-16. The experiment comprised of five plant spacing *viz.*, 30 x 20 cm (1.66 lakh/ha), 45 x 20 cm (1.11 lakh/ha), 60 x 20 cm (0.83 lakh/ha), 75 x 20 cm (0.66 lakh/ha), 90 x 20 cm (0.55 lakh/ha) and two genotypes, *viz.*, Annigeri-1 and NARI-38, laid out in Factorial Randomized Block Design with three replications. The soils of the experimental site had pH 8.10 with medium nitrogen (210 kg/ha) and phosphorus (26 kg/ha) and high in potassium (465 kg/ha). The crop was sown on 30th September 2015 and harvested on 8th February 2016. All recommended package of practice were followed. Rainfall received during the season (June-March) 2015-16 was 646.9 mm. During crop growing period *i.e.* September to March 165.2 mm rainfall was received. There was no rain during crop growth period.

The purpose of the present study was to evaluate optimum plant population in yield of safflower varieties in rainfed condition of Vidarbha region.

RESEARCH ANALYSIS AND REASONING

The findings of the present study as well as relevant discussion have been presented under following heads :

Morphological traits :

The plant densities significantly influenced plant height, number of branches per plant and number of capsules per plant (Table 1) whereas plant height and branches/plant were higher at 0.66 lakh/ha (75 x 20 cm) and 0.55 lakh plant/ha (90 x 20 cm), respectively. Omidi and Sharifmogadas (2010) reported there are significant differences between different plant densities. The number of branches and plant height showed significant difference amongst cultivars (Table 1). Annigeri-1 produced higher branches/plant (9.99) and number of capsules per plant (25.26) than NARI-38 whereas NARI-38 (63.40 cm) had higher plant height in comparison to Annigeri-1. The obtained result is comparable with that of Uke *et al.* (2009).

Seed weight was not significantly influenced by changed in the plant population from 0.55 to 1.66 lakhs plants/ha. Cultivars had significant effect on the 100 seed weight. National check Annigeri-1 recorded a significantly higher 100 seed weight (4.66 g) as compared to NARI-38 (3.93 g). Environmental conditions such as interplant competition can adversely influence seed development by inhibiting

Table 1: Effect of plant population on yield, yield components and economics of safflower cultivars in rainfed condition of Vidarbha region

Treatments	Plant height (cm)	No. of branches	No. of capsules	100 seed wt. (g)	Seed yield (kg/ha)	Biological yield (kg/ha)	Harvest index (%)	Oil content %	Oil yield (kg/ha)	GMR (Rs.)	NMR (Rs.)	B:C
Plant population Lakh												
P ₁ : 1.66 Lakh/ha.	55.50	6.48	13.83	4.07	1150	6569	17.41	26.06	299	33341	14071	1.73
P ₂ : 1.11 Lakh/ha.	60.58	8.32	22.49	4.25	1121	5945	18.90	26.28	294	32510	13490	1.71
P ₃ : 0.83 Lakh/ha.	57.50	7.91	23.65	4.42	1046	5572	16.77	25.85	270	30341	11451	1.61
P ₄ : 0.66 Lakh/ha.	67.17	11.42	32.02	4.42	955	5420	19.96	27.14	258	27705	9835	1.55
P ₅ : 0.55 Lakh/ha.	59.17	11.20	26.83	4.33	916	5148	18.95	26.95	246	26563	9473	1.55
S.E. _±	1.72	0.39	1.59	0.17	53.46	256	-	0.44	14.37	-	-	-
C.D. (P=0.05)	SIG.	SIG.	SIG.	NS	158.82	762	-	NS	NS	-	-	-
Varieties												
V ₁ : A1	56.57	9.99	25.26	4.66	1168	6510	18.16	25.97	303	33869	15441	1.83
V ₂ : NARI-38	63.40	8.14	22.27	3.93	907	4952	18.64	26.94	244	26315	7887	1.43
S.E. _±	1.09	0.25	1.01	0.11	33.81	162	0.93	0.28	9.09	-	-	-
C.D. (P=0.05)	3.24	0.74	2.99	0.32	100.45	482	-	0.83	27.01	-	-	-
Interaction	SIG.	NS	NS	SIG.	SIG.	NS	-	SIG.	SIG.	-	-	-

NS=Non-significant

photosynthesis and other metabolites required during the seed filling stage.

Seed yield and economics :

Seed yield of safflower was significantly influenced by different plant population and genotypes (Table 1). Increasing the plant population increased the yield of safflower but it was at par with the recommended plant population. The 1.66 lakh plant population recorded (1150 kg/ha) seed yield but it was at par with the 1.11 lakh plant population (1121 kg/ha) along with gross return of Rs. 33341/- and net return of Rs. 14071/- and B:C 1.73. Decrease in plant population reduced the seed yield of safflower. These results are in conformity with that of Kubsad *et al.* (2007). Among the two genotypes, significantly highest seed yield was recorded with variety Annigeri-1 *i.e.* is 1168 kg/ha whereas NARI 38 recorded 907 kg/ha (Table 1).

Interaction effect was found to be significant. The safflower variety Annigeri-1 recorded the highest seed yield for 1.66 lakh plant population (1423 kg/ha) and NARI-38 (877kg/ha) as compared to normal plant population (1.11 Lakh/ha) (Table 2).

Oil content and yield :

The plant population has no significant influence on oil content and oil yield. There was significant difference in oil yield between different plant populations (Table 1). Average oil yield ranged from 246 kg/ha (0.55 lakh/ha plant population) to 299 kg/ha (1.66 lakh/ha plant population). Annigeri-1 (303 kg/ha) produced a significantly higher oil yield than the NARI-38.

It is obvious that oil content was not significantly affected by environmental factors such as plant population but more affected by genotype.

The safflower variety Annigeri-1 recorded the highest oil yield (366 kg/ha) with 1.66 Lakh/ha plant population (Table 3).

Biological yield :

Biological yield was significantly affected with plant population and genotype. Result showed that the highest biological yield (6569 kg/ha) was obtained with 1.66 lakh/ha plant population which was significantly superior over the other plant population whereas the lowest biological yield was observed in 0.55 lakh/ha plant population (5148 kg/ha). With increase in plant population, fewer flowers transformed to seeds due to severe competition and as a

Table 2 : Interaction effect of plant population and varieties on seed yield of safflower

Plant population	Varieties		Mean yield
	A-1	NARI-38	
P ₁ :1.66 Lakh/ha.	1423	877	1150
P ₂ :1.11 Lakh/ha.	1293	949	1121
P ₃ :0.83 Lakh/ha.	1106	986	1046
P ₄ :0.66 Lakh/ha.	1048	863	955
P ₅ :0.55 Lakh/ha.	969	863	916
Mean	1168	907	
S.E. _±		76	
C.D. (P=0.05)		225	

Table 3: Interaction effect of plant population and varieties on oil yield of safflower

Plant population	Varieties		Mean yield
	A-1	NARI-38	
P ₁ :1.66 Lakh/ha.	366	231	299
P ₂ :1.11 Lakh/ha.	334	253	294
P ₃ :0.83 Lakh/ha.	285	256	270
P ₄ :0.66 Lakh/ha.	278	239	258
P ₅ :0.55 Lakh/ha.	253	240	247
Maen	303	244	
S.E. _±		20.3	
C.D. (P=0.05)		60.4	

result fewer seeds per heads were formed.

Among the varieties, Annigeri-1 yielded highest biological weight (6510 kg/ha) than NARI-38 (Table 1). Interaction effect of plant population and cultivar was found to non-significant. The obtained result was comparable with Kubsad *et al.* (2007) and Uke *et al.* (2009).

Harvest index :

The highest harvest index was obtained (19.96%) by 0.66 lakh/ha plant population. As regards to varieties NARI-38 has highest harvest index 18.64 per cent (Table 1).

Conclusion :

It was concluded that planting density of safflower mainly decreased seed yield in rainfed condition due to reduction of 100 seed weight, branches per plant and effective capsules per plant. National check variety Annigeri-1 responded to 1.66 and or 1.11 lakh plant population per ha which produced highest seed yield than the other treatments.

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