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Effect of Sowing dates on Yield and Yield Attributes of Safflower Genotypes

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A B S T R A C T

In order to investigate the "effect of Sowing Date on Yield and Yield Attributes of Safflower Genotypes", an experiment was conducted on a split plot design with 4 replications during the year 2015-16 at AICRP on Safflower, VNMKV, Parbhani (M.S.). The experiment consisted of 9 treatment combinations comprising 3 sowing dates (15th October, 30thOctober and 15th November) as main plots and 3 cultivars (Annigiri-1, NARI-6 and NARI-57) as subplots. The result showed that sowing of safflower on 15th October recorded significantly higher Yield and Yield attributing characters viz.; weight of capitula (74.85 g plant^{-1}), number of seeds capitula^{-1} (27.55), seed index (3.71 g), seed yield (1042 kg ha^{-1}), straw yield (3210 kg ha^{-1}) and biological yield (4252 kg ha^{-1}) as compared to 30th October and 15th November sowing date respectively. Among the cultivars of safflower, Annigiri-1 noted higher yield and yield attributing characters viz., weight of capitula (74.55 g plant^{-1}), number of seeds capitula^{-1} (27.14), seed index (4.27 g), seed yield (1019 kg ha^{-1}), straw yield (3426 kg ha^{-1}) and biological yield (4445 kg ha^{-1}) over NARI-57 and NARI-6. From the study it can be concluded that combination of cultivar Annigiri-1 sown on15th October performed best among all other treatment combinations.

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 acid78%) which plays an important role in reducing the blood cholesterol level. Ithas been under cultivation in India either for it's colored florets and much valued oil. Generally it is known as *Kusum or Kardi*. As safflower is a salt tolerant crop, hence suitable for command areas of Jayakwadi and Purna. It has wider range of elasticity both in rainfed as well as irrigated conditions due to its deep root system, xerophytic characters, thorniness and waxy coating of leaves, thus reducing the

moisture use as compared to other *rabi* crops. The cost of cultivation of safflower crop is low with highest B:C ratio with minimum irrigations. This will result into increase in productivity of safflower there by sustaining the production in irrigated command areas. Safflower is a member of the family Compositae and originally grown for the flowers that were used in making red and yellow dyes.

Safflower has a promising future as a salinity and drought resistant crop that has both spring and autumn types. Sowing date is very important in agricultural production management decisions, especially at region having environmental restrictions such as sooner or later coldness or serves (Emami *et al.,* 2011). Cultivar selection is also a key management component in any cropping system even more critical in sowing date for crop production (Soleymani *et al.,*2011). All the varieties may not be suitable for timely as well as late sowing. The differences in production of timely sown and late sown crops may be attributed to the unfavourable temperature prevailing at different growth stages, such as low temperature at the time of germination which may delay crop emergence. Low temperature may also slow down the growth and development of the crop, resulting in the accumulation of insufficient biomass and shortening of crop duration (Sooraj Chandra *et al.,* 2015). 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 (Daltalab *et al.,*2013). Therefore, in order to obtain safflower with high yield and quality, it is essential to determine the suitable growth conditions and cultivation techniques. So the aim of this study was to evaluate the "Effect of sowing dates on yield and yield attributes of safflower genotypes".

Materials and Methods

To evaluate the "Effect of sowing dates on yield and yield attributes of safflower genotypes", an experiment was conducted during the year 2015-16 at All India Coordinated Research Project on safflower, at VNMKV, College of Agriculture, Parbhani (M.S.). A set of 9 treatment combinations comprising 3 dates of sowing (15th October, 30th October and 15th November) as main plots and 3 cultivars (Annigiri-1, NARI-6 and NARI-57) as subplots laid out in split plot design with 4 replications. The soil of experimental field was a typical medium black soil (vertisol), soil pH (7.79), EC (0.24 dsm^{-1}), low in organic carbon (0.41 %), medium in available nitrogen (201.57 kg ha^{-1}) and available phosphorus (10.72 kg ha^{-1}) but high in available potash (717.38 kg ha^{-1}). For ensuring good germination, healthy and good quality seeds were used with 20 kg ha^{-1} with planting geometry of 45 x 20 cm. The recommended dose of fertilizer (60 N + 40 P_2O_5kg/ha) was applied in safflower. Full dose of $P_2O_5$and half dose of N were applied at the time of sowing in the furrow below the seed. Remaining half dose of N was applied at stage of crop at 30-35 DAS. Soil moisture was not sufficient for crop growth so one uniform irrigation was given to the crop at 50 DAS. The data was analyzed by the method of "Analysis of Variance" as described by Panse and Sukhatme (1985).

Results and Discussion

Number of capitula plant^{-1}

Number of capitula per plant is important yield contributing character to judge the seed yield of safflower crop. Data presented in Table 1, revealed that sowing date showed a significant variation on number of capitulaplant^{-1}. The maximum capitula plant^{-1} (35.33) was recorded with 15th October sown

crop, which was significantly superior over 30th October and 15th November sown crop. Similar result was found by Emami *et al.,* (2011).

The maximum capitula plant^{-1} (35.31) was recorded by cultivarAnnigiri-1followed by NARI-57 (34.69) and minimum capitula was recorded by cultivar NARI-6 (30.62). These findings confirm those of Anonymous 2012. The data revealed that combinations of sowing dates and safflower cultivar did not differ significantly for number of capitula plant^{-1} (Table 1).

Weight of capitula (g plant^{-1})

The data in Table 1, showed that the maximum weight of capitula plant^{-1} (74.85g) was observed on15th October sown crop and minimum weight of capitula (71.84 g) was found at 15th November crop. Odivi *et al.,* (2013) reported that delay in sowing resulted generally decrease in the yield attributes.

Increase in different yield attributing characters on15th October sowing might be due to more availability of favorable environmental condition at the vegetative and reproductive phase of the crop and might be due to better uptake of nutrients and translocation of photosynthates during the reproductive phase of the crop, thus increasing the size and weight of seeds.

A perusal of data indicated that the maximum weight of capitula (74.55 g) was recorded with Annigiri-1,whereas, minimum weight of capitula (71.71 g plant^{-1}) was found with safflower cultivar NARI-6. The interaction effect was not evident.

Number of seeds capitula^{-1}

As per Table 1, the highest number of seeds capitula^{-1} (27.55) was obtained by the 15th October sown crop. It was significantly superior over other sowing dates followed by 30th October sowing. Among the cultivars of safflower, the highest number of seeds per capitula (27.14) was obtained under Annigiri-1, which was significantly superior over NARI-57 and NARI-6. The variation in these yield attributing parameters of the cultivars might be related to inherent differences and high vigour in these cultivars.

The mean pertaining to number of seeds capitula^{-1} in different treatment combinations were subjected to statistically analyzed, which revealed that there was no significant difference between combination of sowing dates and safflower cultivar (Table 1). These findings confirm those of Daltalab *et al.,* (2013).

Seed Index (g)

The data (Table 1), showed that seed index was not influenced by sowing date. The cultivar Annigiri-1registered the highest seed index (4.27g) which was significantly superior over cultivar NARI-6 and NARI-57. The interaction effect was not found significant (Table 1). Similar results were reported by Ali Reza Badri *et al.,* (2011).

Seed yield (kg ha^{-1})

Seed yield is the most economical character for evaluating the superiority of the treatment over the other. The data presented in Table 2, indicated that dates of sowing brought about significant variation in seed yield. The highest seed yield (1042 kg ha^{-1}) was obtained under 15th Octobers own crop, which was significantly superior over30th October and 15th November sown crop. This increase in yield might be due to more yield attributes viz.; number of capitula plant^{-1}, weight of capitula plant^{-1} (g), number of seedscapitula^{-1}and seed index.

Table.1 Mean comparison for experimental characteristic

Treatments	No of capitula/ plant	Weight of capitula/ plant(g)	No of seed/ capitula	Seed Index(g)
Sowing dates				
D_1 : 15th October	35.33	74.85	27.55	3.71
D_2 : 30th October	34.76	73.63	26.64	3.60
D_3 : 15th November	30.53	71.84	23.28	3.60
S.E. ±	0.27	0.34	0.21	1.17
C.D. at 5%	0.80	1.34	0.63	NS
Varieties				
V_1 : Annigiri-1	35.31	74.55	27.14	4.27
V_2 : NARI-6	30.62	71.71	24.47	3.01
V_3 : NARI-57	34.69	74.07	25.87	3.63
S.E. ±	0.35	0.68	0.48	0.06
C.D. at 5%	1.05	2.02	1.43	0.20
Interaction				
S.E. ±	0.61	1.18	0.83	0.12
C.D. at 5%	NS	NS	NS	NS
G.M.	33.54	73.44	25.82	3.64

Table.2 Mean comparision for experimental characteristic

Treatments	Seed yield (Kg ha^{-1})	Straw yield (Kg ha^{-1})	Biological yield (Kg ha^{-1})
Sowing dates			
D_1 : 15th October	1042	3210	4252
D_2 : 30th October	972	2938	3910
D_3 : 15th November	818	2439	3257
S.E. ±	23.17	78.56	101.23
C.D. at 5%	81.74	233.24	300.31
Varieties			
V_1 : Annigiri-1	1019	3426	4445
V_2 : NARI-6	857	2613	3470
V_3 : NARI-57	956	2547	3503
S.E. ±	29.12	91.46	120.37
C.D. at 5%	87.19	268.76	357.10
Interaction			
S.E. ±	40.13	158.02	208.49
C.D. at 5%	NS	NS	NS
G.M.	944	2863.3	3806

The results are in close association with findings of Emami *et al.,* (2011). Among the cultivars, maximum seed yield (1019 kg ha^{-1}) was recorded with Annigiri-1which wassignificantly higher over NARI-6 and NARI-6 also recoded significantly higher seed yield as compared to NARI-57 cultivar.(Table 2). Similar results were reported by Muralidharudu *et al.*,(1989) and Hulihalli *et al.*,(1997).

Among interaction of dates of sowing and cultivars of safflower, the data was not found evident. All the cultivars performed significantly poorer seed yield. The findings are in close confirmity with Sheykhlou *et al.*, (012).

Straw yield (kg ha^{-1})

The data showed in Table 2, indicated that the highest straw yield (3210 kg ha^{-1}) was obtained under 15th Octobers own crop which was superior over 30th October and 15thNovember sown crop. In case of straw yield the cultivar Annigiri-1was found superior over other cultivars due to taller plant. The positive effect of date of sowing on straw yield may bedue to the pronounced growth during early stages of crop. It resulted that higher plant height and dry matter accumulation and ultimately tended in realization of higher straw yields.

Interaction of sowing dates and cultivars of safflower was not found significant in case of straw yield. This may due to taller plant. Similar result was found by Sheykhlou *et al.*, (2012).

Biological yield (kg ha^{-1})

Table 2, indicated that the highest biological yield (4252 kgha^{-1}) was obtained under 15th Octobers own crop which was superior over 30thOctoberand 30thOctobersown crop also gave significantly highest biological yield over 15thNovember sown crop. Heidari Zadeh (2004) reported that postponing the sowing date in addition to temperature increase in developmental stages of germination to flowering which shortening this period cause to yield component production period encounter with high temperature and reduced the total plant dry weight although number of heads per plant, seeds index and seed yield more affected by it in comparison to biomass yield. The cultivar Annigiri-1registered significantly higher biological yield (4445 kg ha^{-1}) over NARI-57 and NARI-57also gave significantly highest biological yield over NARI-6during the investigation.

Among interaction of dates of sowing and cultivars of safflower, the data presented in Table-2 had not significant effect on biological yield. The findings are in close confirmity with Sheykhlou *et al.*, (2012).

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