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Evaluation of Drought Tolerant Safflower (*Carthamus Tinctorius* L.) Genotypes under Drought Prone Areas of Sub -zone V of Jharkhand

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ABSTRACT: *The experiment was conducted at Zonal Research Station, Chianki (Birsa agricultural University, Ranchi), Palamau during rabi, 2013-14 and 2014-15. The sixteen drought tolerant safflower genotypes viz., JSI-116, PBNS-72, AKS-204, AKS/GM (V-2724), AKS-307, AKS-210, NARI-57, AKS/S-41, AKS-311, AVT-10-1, AVT-10-2, AVT-10-3, AVT-10-4, AVT-10-5, AVT-10-6 and A-1 (NC) were sown in the randomized block design with three replications. The data were recorded and analyzed for ten yield and yield attributing characters viz., grain yield(q/ha), days to 50% flowering, days to maturity, plant height, number of primary branches per plant, number of secondary branches per plant, number of effective capitulum per plant, number of seeds per capitulum, 100 seed weight and RWUE(kg/ha/mm) to identify the most suitable genotypes for Western Plateau of Jharkhand. The characters viz., primary branches per plant were found non-significant effect in both the years. It has clearly indicated that there was significant difference in yield among the genotype studied at also it has varied for yield contributing characters during 2014-15 where as Non-significant mean performance was observed for yield during 2013-14. On the basis of Pooled mean of two years i.e. 2013-14 and 2014-15 the genotypes i.e. AKS-204 and AKS/GMU -2724 had given highest yield of 13.98q/ha and 13.45 q/ha respectively therefore these genotypes may be recommended for its cultivation in the farmers field and they may be used in future breeding programme for developing the promising genotypes for farmers used.*

Key words: *scenario, safflower, drought prone area, yield contributing traits.*

INTRODUCTION

Safflower (*Carthamus tinctorius* L.) is one of the important rabi oilseed crop mainly grown in residual soil moisture conditions. Safflower is a tap-rooted annual crop which can tolerate environmental stresses including salinity and water stress (Lovelli and al., 2007). The crop is also cultivated in poor management. In India, safflower is sown in an area of 4.30 lakh hectares with the production and productivity of 2.0 million tonnes and 465 kg/ha, respectively. The important safflower growing state are Maharashtra, Karnataka, Andhra Pradesh, Madhya Pradesh, Orissa and Bihar. In Karnataka, it has occupied an area of 1.10 lakh hectares with the production of 0.72 lakh tonnes. The safflower oil has got immense health benefit particularly for heart patients even then the area under safflower has been declining year after year due to biotic and abiotic stresses (Hegde *et al.*, 2003). Among these, yield loss due to moisture stress has become a major concern in recent times in view of successive drought. Therefore, it is worthwhile to identify genotypes which manifest relatively low genotype x environment interaction effect and produce stable yield in moisture stress/drought conditions. Recent studies have indicated that the consumption of high levels of saturated fatty acids may contribute to increase blood serum cholesterol which is related to the risk of coronary heart diseases (Mensink *et al.*, 1994). The vegetable oils are a principal source of fats in the diet therefore the present trend in oilseed breeding is to reduce the concentration of saturated fatty acids (Seiler, 1996). Safflower oil contains moderate levels of saturated fatty acids (c. 10%), compared with higher contents in sunflower (c. 12%) and soybean (c. 16%) and lower contents in canola (c. 6%) (Padley *et al.*, 1994). Safflower is one of the best examples of variability for the fatty acid composition in its oil. Variants with high stearic (4%

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to 11% of the total fatty acids), high oleic (>80%), and high linoleic acid concentration (>85%) have been identified and are currently available in released materials (Fernández-Martinez *et al.*, 1993). However, no research have been undertaken to develop a safflower genotype with lower levels of saturated fatty acids. The breeding programmes to reduce saturated fats are ongoing in other oilseed crops also. As such an efforts has been made to indentify a suitable genotype of safflower which can give reasonably good yield under moisture stress condition.

MATERIALS AND METHODS

The experimental material comprised of promising genotypes along with one national check (A-1) was grown during rabi 20013-14 and 2014-15 at Zonal Research Station, Chianki, Palamau (Birsa agricultural University, Ranchi). The experiment was conducted in Randomised Block Design with three replication. The plot size of 2.7 x 4 m was used for each genotypes in each replication. Each genotype was planted with a spacing of 45 x 20 cm. Observations were recorded on ten randomly selected plant from each genotype in each replication on grain yield(q/ha), days to 50% flowering, days to maturity, plant height, number of primary branches per plant, number of secondary branches per plant, number of effective capitulum per plant, number of seeds per capitulum, 100 seed weight and RWUE(kg/ha/mm). The mean data were subjected to identify suitable genotype in drought like situation of sub-zone V (western plateau) of Jharkhand.

RESULTS AND DISCUSSION

The mean performance of sixteen genotypes for ten yield and yield contributing characters was studied in two years continuously i.e. 2013-14 and 2014-15 during rabi season. It clearly indicated that there was significant difference in yield among the genotypes studied and at also it has varied for yield contributing characters during 2014-15 wheres non-significant mean performance was observed for yield during 2013-14. The AVT-10-5, AVT-10-2 and AKS-311 was earliest in flowering and flowered in 81 days. The number of primary branches per plant and number of secondary branches per plant was observed highest in AKS-310 which clearly indicated that the number of primary branches per plant and number of secondary branches per plant had direct effect on the yield *per se* of the genotypes studied. The number of effective capitulum /plant were highest in AKS-310 followed by AKS-204 which were 20.33 and 21.33 respectively during 2013-14. whereas number of seed per capitulum, AKS-204 and AKS/GMU-2724 respectively during 2013-14. The number of effective capitulum per plant and no. of seed per capitulum had direct effect for increasing the yield in the genotypes of AKS-204 and AKS/GMU-2724. The AKS-204 had given the yield of 12.74q/ha whereas AKS/GMU-2724 (12.30q/ha). These two genotypes (AKS-204 and AKS/GMU-2724) may be considered as best genotypes for their recommendation for cultivation in the farmers field in rainfed condition. The 100 seed weight was highest in two genotypes i.e. JSI-116 and AVT - 10 -3 whereas RWUE which was calculated in kg/ha/mm was highest in AKS-204 (13.65) followed by AVT-10-3 (13.07) (Table 1). The results of all the sixteen genotypes during 2013-14 has clearly indicated that the AKS-204 and AKS/GMU-2724 may be considered for their cultivation in farmers field with their further used in breeding programme for development of promoting genotypes for rainfed ecology of Western Plateau of Jharkhand. These results are in close agreement of (Fernández-Martinez *et al.*, 1993). During the year 2014-15 JSI-116 and PBNS-72 were earliest in flowering and flowered in 74 days. The highest number of primary branches per plant was observed in the genotypes AKS/GMU-2724 (11.87) followed by AKS-204 (10.73) and AKS-310 (9.80). Whereas number of secondary branches per plant was observed highest in the genotype AKS-204 (18.40) followed by AKS/GMU-2724(17.93) and AVT-10-6(17.27) which clearly indicated that the number of primary branches per plant and number of secondary branches per plant had direct effect on yield *per se* of the genotype studied. The number of effective capitulum per plant was highest in genotype JSI-116 (17.80) followed by the genotype AKS -307(15.40) and PBNS-72()14.47) where as number of seed per capitulum was highest observed in the genotype AKS/GMU-2724(23.60) followed by PBNS-72(22.96). The number of seed per capitulum had direct effect for increasing the yield in the genotype AKS/GMU-2724. The AKS/GMU-2724 had given the yield (13.45q/ha) so it may be considered as best genotype for it recommendation for cultivation in the farmers fields in rainfed condition. The 100 seed weight were highest in genotype AVT-10-5(8.0) followed by AVT 10-4-AVT10-2(7.67) and AVT-10-1 (7.63) whereas RWUE was highest in the genotype AKS-204(18.2) followed by AKS/JMU-2724(16.81), AVT-10-1(16.4) and AKS-311(16.31) (Table 2). The results of all the sixteen genotypes during 2014-15 has

Table 1
Mean performance of sixteen genotype for yield and ancillary characters of safflower during Rabi-2013-14

SlNo	*Name of Entries*	*Grain yield (q/ha)*	*Days to 50% flowering*	*Days to Maturity*	*Plant ht. (cm)*	*No. of Primary*	*No of secondary branch*	*No. of effective capitulum/ Plant*	*No. of seed/ capitu lum*	*100 seed weight (g)*	*RWUE (kg/ha/ mm)*
1.	JSI-116	11.12	89	127	109.13	7.07	11.87	15.93	26.40	7.17	11.19
2.	PBNS-72	9.87	91	127	105.53	5.87	9.40	18.13	24.07	6.50	10.57
3.	AKS-204	12.75	88	127	98.60	10.73	17.97	21.33	33.53	7.00	13.65
4.	AKS/GMU-2724	12.30	90	124	114.40	11.87	15.13	16.80	33.00	6.33	13.17
5.	AKS-307	11.79	86	125	107.60	7.80	17.73	19.40	22.20	6.83	12.62
6.	AKS-310	10.69	85	125	121.53	9.80	23.13	22.33	28.33	5.17	11.45
7.	NARI-57	10.00	92	127	119.93	7.93	16.47	17.67	28.93	4.83	10.71
8.	AKS/S-41	9.04	85	124	107.60	6.00	16.02	18.27	23.20	6.33	9.68
9.	AKS-311	9.37	81	121	108.33	8.67	15.53	19.13	21.60	4.83	10.03
10.	AVT-10-1	11.24	83	122	109.13	9.87	17.07	17.80	30.67	6.83	12.03
11	AVT-10-2	11.16	81	121	107.27	6.20	15.07	16.93	30.53	7.00	11.95
12	AVT-10-3	12.21	88	124	113.13	6.60	19.20	17.80	30.67	7.17	13.07
13	AVT-10-4	10.16	82	122	110.07	6.47	13.60	14.73	22.93	7.50	10.88
14	AVT-10-5	10.20	81	121	97.20	7.60	13.27	13.00	29.00	7.33	10.92
15	AVT-10-6	11.01	85	123	105.00	7.13	23.33	21.27	24.27	6.50	11.79
16	Local check (A-1)	11.12	84	123	93.53	7.93	16.33	23.47	24.07	5.00	11.19
	SEm+	**.687**	1.119	1.319	3.336	1.443	1.081	1.367	1.562	.0367	-
	CD at 5%	**1.985**	3.233	3.812	9.360	4.169	3.123	3.950	4.513	1.060	-
	CV %	**11.141**	2.264	1.845	5.760	32.922	11.477	12.892	9.992	9.939	-

Rainfall: 93.4 mm

Table 2
Mean performance of sixteen genotype for yield and ancillary characters of safflower during Rabi-2014-15

SlNo	*Name of Entries*	*Grain yield (q/ha)*	*Days to 50% flowering*	*Days to Maturity*	*Plant ht. (cm)*	*No. of Primary branch*	*No of secondary branch*	*No. of effective capitulum/ Plant*	*No. of seed/ capitu lum*	*100 seed weight (g)*	*RWUE (kg/ha/ mm)*
1.	JSI-116	10.20	74	123	85.07	5.27	14.27	17.80	20.27	7.17	12.75
2.	PBNS-72	9.48	74	120	84.27	8.27	15.00	14.47	22.96	6.67	11.85
3.	AKS-204	13.98	79	124	103.47	4.87	18.40	11.17	20.33	6.67	18.2
4.	AKS/GMU-2724	13.45	76	119	93.13	6.13	17.93	13.47	23.60	6.83	16.81
5.	AKS-307	8.18	76	123	89.67	5.23	17.17	15.40	20.87	7.50	10.23
6.	AKS-310	9.34	77	121	101.93	6.47	14.87	13.47	19.93	6.00	11.67
7.	NARI-57	10.95	79	124	99.93	6.07	16.40	14.07	20.47	6.17	13.68
8.	AKS/S-41	9.80	83	122	105.07	6.73	11.97	13.80	20.63	6.33	12.25
9.	AKS-311	13.05	81	119	98.93	6.27	8.27	9.47	17.67	5.50	16.31
10.	AVT-10-1	13.12	82	122	84.47	6.67	12.93	13.00	18.80	7.63	16.4
11	AVT-10-2	9.41	80	118	96.73	5.27	8.80	11.90	18.47	7.67	11.77
12	AVT-10-3	11.62	82	117	100.20	5.80	8.13	10.27	15.67	7.50	14.53
13	AVT-10-4	10.88	83	123	89.20	4.57	16.60	9.73	18.60	7.67	13.6
14	AVT-10-5	10.70	81	121	89.13	4.33	13.67	9.93	20.67	8.00	13.38
15	AVT-10-6	11.47	83	117	101.73	5.80	17.27	12.40	19.80	7.00	14.34
16	Local check (A-1)	11.39	82	123	100.13	5.57	12.20	11.07	22.00	6.83	14.23
	SEm+	**0.638**	1.166	1.632	3.136	.763	1.121	0.984	1.439	0.442	-
	CD at 5%	**1.845**	3.369	4.715	9.060	2.206	3.239	2.844	4.157	1.177	-
	CV %	**10.003**	2.540	2.338	5.707	22.693	13.291	13.552	12.436	11.033	-

Rainfall: 80 mm

Table 3
Mean performance of sixteen genotype of two years during (2013-14 and 2014-15)

SlNo	*Name of Entries*	*2014-15 Grain Yield (q/ha)*	*2013-14 Grain Yield (q/ha)*
1.	JSI-116	10.20	11.12
2.	PBNS-72	9.48	9.87
3.	AKS-204	13.98	12.75
4.	AKS/GMU-2724	13.45	12.30
5.	AKS-307	8.18	11.79
6.	AKS-310	9.34	10.69
7.	NARI-57	10.95	10.00
8.	AKS/S-41	9.80	9.04
9.	AKS-311	13.05	9.37
10.	AVT-10-1	13.12	11.24
11	AVT-10-2	9.41	11.16
12	AVT-10-3	11.62	12.21
13	AVT-10-4	10.88	10.16
14	AVT-10-5	10.70	10.20
15	AVT-10-6	11.47	11.01
16	Local check (A-1)	11.39	11.12
	SEm+	**0.638**	**.687**
	CD at 5%	**1.845**	**1.985**
	CV %	**10.003**	**11.141**

clearly indicated that the AK/GMU-2724 may be considered for their cultivation in the farmers fields alongwith it further use in breeding programme. These results were similar to the observation made by (Lovelli and al., 2007).

On the basis of Pooled mean of two years i.e. 2013-14 and 2014-15 the genotypes i.e. AKS-204 and AKS/GMU -2724 had given highest yield of 13.98q/ha and 13.45 q/ha respectively therefore these genotypes may be recommended for its cultivation in the farmers field and they may be used in future breeding programme for developing the promising genotypes for farmers used.

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