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Improving castor productivity through optimizing sowing schedule and genotypes

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ABSTRACT

Optimum sowing time with improved genotypes is one of the most important agronomic factor and non- monetary input which play an important role to exploit fully the genetic potentiality of a castor crop. Experiments were conducted for three consecutive years (2013-14, 2014-15 and 2015-16) during the Kharif season at the Zonal Agricultural and Horticultural Research Station, (13^0 57' 32" N, 70^0 37' 38" E, 606 MSL), University of Agricultural and Horticultural Sciences, Shivamogga, India, to find out the optimum sowing schedule and genotype to maximize the castor productivity. The pooled data of three years indicates that the sowing during 2nd fortnight of August has recorded significantly higher yield (2407 kg ha^{-1}) compared to the crop sown during the second fortnight of September (1946 kg ha^{-1}) or October (1259 kg ha^{-1}) or November (840 kg ha^{-1}). Among the genotypes tested GCH-177 has recorded higher grain yield (1805 kg ha^{-1}) compared to YRCH-1 (1627 kg ha^{-1}), DCS-107 (1647 kg ha^{-1}) and GCH-7 (973 kg ha^{-1}). Extended dates of sowing of castor on the 2nd fortnight of August increased the seed yield by 19 and 65%, respectively. Economics analysis showed that sowing during 2nd fortnight of August and hybrid DCH-177 recorded higher gross return (Rs 86,669 ha^{-1} and Rs 64986 ha^{-1}), net return (Rs 62,588 ha^{-1} and Rs 40905 ha^{-1}) and B:C ratio(3.6 and 2.7) respectively.

Keywords— *Castor, Cultivar, Date of sowing and Yield*

1. INTRODUCTION

Castor crop is raised on poor soils under dry land by small farmers with low inputs and poor management resulting in reduced yield and net returns in the rainfed farming system. Due to that, castor cultivation is beset with lots of problems of varying rainfall pattern, biotic and abiotic stress etc., Castor farmers in the arid and semi-arid tracts of Karnataka decide it was no longer remunerative crop which leads to declining in castor growing area (Kumar Naik *et al.* 2016). Having this issue, high yielding, drought resistant cultivar suited to rainfed as well as irrigated conditions have been developed. The productivity of castor can be increased with the use of latest castor hybrids with an optimum time of sowing.

Sowing of castor at an appropriate time during *kharif* with suitable cultivar along with other agronomic factors with desirable environmental conditions in a given agro-climatic condition is the key feature to get maximum production of any crop, So, scientific works are needed to determine the proper sowing date in a particular zone for optimizing quantitative and qualitative production of oilseeds and these aspects of crop production have not been studied so far in Zone-4 of Karnataka. Hence, a need is felt to analyze the performance of castor cultivars sown at different dates.

2. MATERIALS AND METHODS

The proposed study was conducted at the Zonal Agricultural and Horticultural Research Station, Hiriyur (13^0 57' 32" N, 70^0 37' 38" E, 606 MSL), the University of Agricultural and Horticultural Sciences, Shivamogga, India. The soil of the experimental sites belonged to medium black soil having pH of 7.7, low available nitrogen (162 kg ha^{-1}), medium available phosphorus (16.2 kg ha^{-1}) and potassium (270 kg ha^{-1}). The total rainfall received during 2013, 2014, 2015 and 2016 was 610, 852, 748 and 312 mm with 31, 40,49 and 32 rainy days respectively. Monthly climatic data for 2013, 2014, 2015 and 2016 and long-term mean (1950- 2016) are shown in figure 1. The meteorological data during the course of crop growth were obtained from Agro-Met Observatory (Gramina Krushi Mausam Sewa), Department of Agronomy, Hiriyur.

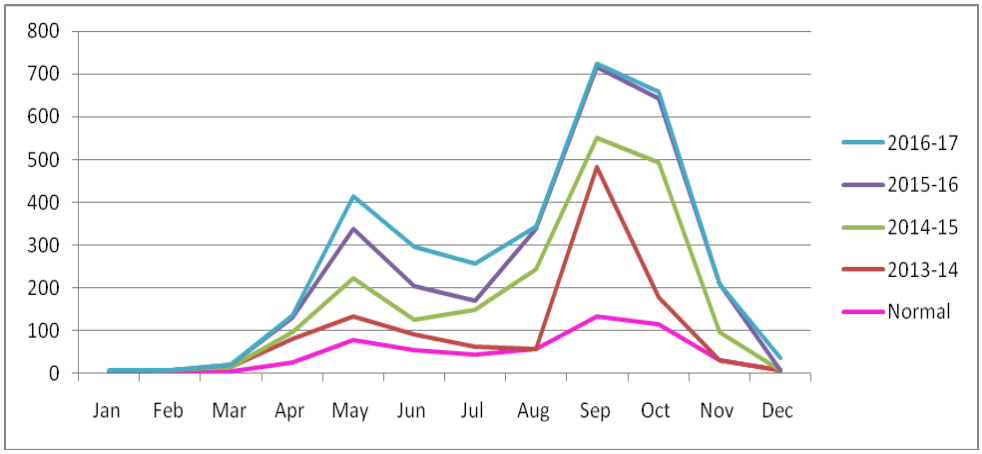

Fig. 1: Rainfall during 2013 to 2016 compared with Normal at ZAHRS, Hiriyur

3. EXPERIMENTATION PROCEDURE

The Field experiments were conducted for three consecutive years (2013-14, 2014-15 and 2015-6) during the *Kharif* seasons at Zonal Agricultural and Horticultural Research Station, Hiriyur, Karnataka to find out the optimum sowing schedule and genotype to maximize the castor productivity. In this experiment, the responses of four genotypes of castor have been evaluated under four levels varying sowing dates under rainfed conditions. The land was ploughed across the slope after the receiver of pre-monsoon showers and ridged using a tractor for three consecutive years during summer followed by 2-3 harrowing with blade harrow after rains. The field experiment was set up in a split-plot design with three replications and four sowing dates (2nd fortnight of August, the 2nd fortnight of September, the 2nd fortnight of October and the 2nd fortnight of November) were assigned to the plots. The site was previously cropped to safflower. Seeds of castor hybrids DCH- 177, DCS-107, YRCH-1 and GCH-7 were obtained from Indian Institute of Oilseeds Research, Hyderabad and the hybrids were officially released for commercial use in India. Two castor seeds were sown per hill on ridges by hand dibbling at recommended spacing of 90 cm (between rows) x 60 cm (plant to plant) with a depth of 8-10 cm and plot size of 7.2 X 6.0 meter. Seeds were treated with bavistin @ 3g kg^{-1} seed to protect plants from seed borne diseases. Compound fertilizer [NPK (12:32:16)] at @ of 20 kg N, 40 kg P_2O_5 and 20 kg K_2O ha^{-1} as basal dose followed by top dressing with an additional 20 kg N ha^{-1} each at 35-40 and 65-70 days after sowing were applied for three consecutive years. At two weeks after sowing, the seedlings of castor crop were thinned to 1 plant per hill. Two hand weeding and mechanical weeding was carried out at 30 and 60 days after sowing. Mechanical weeding was carried out by power tiller. Acephate 50 S Pat the rate of 1.25 kg ha^{-1} was applied with a hand operated knapsack sprayer to control semi-looper (*Achoea Janata* L.) during the damage. Physiological maturity in castor was attained when any of the capsules turned brown, the main spike was harvested 90-120 days after sowing (DAS), and the subsequent pickings were taken up at an interval of 30 days. The matured spikes were cut by using secateurs and dried for few days for easy threshing. Threshing was done by the mechanical thresher. Five plants were randomly selected from net plot area and tagged. Observations on growth characters, yield attributes and yield were noted during this study. B: C ratio was worked out by dividing gross return by the cost of the treatment. The crop was raised using the recommended package of practices.

4. RESULTS AND DISCUSSION

4.1 Effect on yield and yield attributing characters

During *Kharif* 2013-14, 2014-15, and 2015-16 it was observed that, among different dates of sowing the 2nd fortnight of August sowing was recorded significantly higher seed yield (2427, 2553 and 1712 kg ha^{-1} respectively) followed by 15th September sowing (1717, 2409, and 1712 respectively) and comparison with different genotypes (DCH- 177, DCS-107, YRCH-1 and GCH-7) DCH-177 was recorded higher seed yield (1510, 2461 and 1444 kg ha^{-1} respectively) followed by YRCH-1(1416,2055, and 1411 respectively). Regarding economics, the 2nd fortnight of August sowing and hybrid DCH-177 recorded the highest gross returns, net returns, and B: C ratio (Table 1).

The pooled data of three years (*Kharif* 2013-14, 2014-15 and 2015- 16) revealed that, sowing during 2nd fortnight of August recorded significantly higher seed yield (2407 kg ha^{-1} followed by sowing during 15th September sowing (1946 kg ha^{-1}) and increased the seed yield by 19 and 65%, respectively, over October and November sowing (Table 1).The increment in yield components with 2nd fortnight of August sown crop was due to better expression of growth characters like plant height, Number of Branches with the synchronization of high rainfall and providing the conducive crop temperature and moisture conditions for growth and allowing more capsules spike^{-1} to form, because of sufficient time to fill at these dates of showing results in higher yield of primary spikes compared to that of September, October and November dates of sowing. However, Significantly lower seed yield with November sowed crop was due to high temperature (38^{o}C and above) prevailed during flowering resulting in the blasting of flowers and poor seed set and reduction in the length of the average growing season resulted in lower castor yield, seed weight (Weiss, 1971) and oil content. The temperature experienced by the crop sown on August at various phenological stages was favorable and that resulted in a significant increment in growth parameters, yield attributes, and yield. The present results were in agreement with the findings of earlier study Culp (1945), Domingo and Crooks (1945) and Prisemina (1929) reported that reduction in the length of the average growing season resulted in lower castor yield, seed weight, and oil content. Williams and Kittock (1969), Sesha Saila Sree *et al.* (2008) and Anonymous, (2015) reported that higher seed yields were associated with early planting, adequate moisture availability. Similarly, among the genotypes tested DCH-177 recorded highest seed yield (1805 kg ha^{-1}) over other genotypes (Table 1). The superior yield of DCH-177 was due to longer spike length, no. of capsules spike^{-1} and better branching. These findings were in line with the reports of Sesha Saila Sree *et al.* (2008) and Anonymous, (2015).

Consequences of all these benefits, sowing during 2nd fortnight of August and hybrid DCH-177 recorded higher gross return (Rs 86,669 ha^{-1} and Rs 64,986 ha^{-1}), net return (Rs 62,588 ha^{-1} and Rs 40,905 ha^{-1} and B:C ratio (3.6 and 2.7) respectively (Table 1).

Table 1: Effect of sowing schedule and genotypes on growth parameter and seed yield of castor under rain fed conditions

Treatments	Seed yield (kg ha^{-1})				Plant height up to primary raceme (cm)	Number of branches $plant^{-1}$	Number of spikes $plant^{-1}$	Primary spike length (cm)	Number of capsules per spike	Gross Returns (Rs. ha^{-1})	Net Returns (Rs. ha^{-1})	B:C Ratio
	2013 -14	2014 -15	2015 -16	Pooled								
Date of Sowing												
D1: 15th Aug	2427	2553	2242	2407	73	5.8	6.0	43	45.0	86669	62588	3.6
D2: 15th Sept	1717	2409	1712	1946	66	5.4	5.3	44	44.6	70050	45969	2.9
D3: 15th Oct.	747	2131	899	1259	65	5.1	5.5	47	46.7	45326	21245	1.9
D4: 15th Nov	224	1993	303	840	57	4.0	5.9	43	42.6	30245	6164	1.2
SEm ±	122	103	107	116	2.82	0.32	0.4	2.16	1.76			
CD(P=0.05)	407	344	359	388	9.42	1.06	1.32	7.19	5.86			
Hybrids												
H1: DCS-107	1306	2308	1327	1647	64	4.8	5.6	43	43.9	59287	35207	2.5
H2: YRCH-1	1416	2055	1411	1627	60	5.0	5.4	42	43.6	58583	34502	2.4
H3: DCH-177	1510	2461	1444	1805	75	5.7	6.3	51	48.9	64986	40905	2.7
H4: GCH-7	884	2262	973	1373	62	4.9	5.6	41	42.5	49434	25353	2.0
SEm ±	122	103	108	116	2.82	0.32	0.4	2.16	1.76			
CD(P=0.05)	352	298	311	336	8.16	0.91	1.14	6.23	5.07			
Interaction (CD)	705	596	623	672	16.32	1.83	2.29	12.46	10.14			
CV(%)	33.0	157	29	25.0	15.01	21.5	24.0	16.81	13.67			

4.2 Effect on growth parameters

The performance of castor in sowing during 2nd fortnight of August registered significantly higher plant height (73 cm) with more number of branches $plant^{-1}$ (5.8) and a number of spikes $plant^{-1}$ (6.0) as compared delayed date of sowing. Whereas, among different hybrids, DCH-177 recorded significantly higher plant height (75 cm), number of spikes $plant^{-1}$ (5.7), spike length (52 cm) and capsules $spike^{-1}$(48.9) over other genotypes (Table 1). The present findings confirmed the earlier studies made by Sesha Saila Sree *et al.* (2008) and Anonymous, (2015)

5. CONCLUSION

Based on this study it can be concluded that sowing of castor during 2nd fortnight of August is found to be optimum compared to the crop sown during the second fortnight of September or October or November. Among the genotypes tested GCH-177 is found to be a better option compared to YRCH-1, DCS-107 and GCH-7.

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