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Improving castor (*Ricinus communis*) productivity through different sowing schedules and genotypes under rainfed condition

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Key words: Sowing schedules, Varieties, Yield, Castor

Abstract

Field experiment was conducted at Tapioca and Castor Research Station during 2014 -15 on evaluation of different sowing schedules (August, September, October and November) and varieties/ hybrids (DCS -107, DCH - 177, GCH - 7 and YRCH – 1) in castor. Among the sowing dates, sowing of castor at 2nd fortnight of August has recorded significantly higher kernel yield (705.8kg/ha) followed by September (497.0kg/ha) over October and November sown plots due to deficit in rainfall. Among the varieties/hybrids tested GCH7 has recorded significantly higher mean kernel yield (597.7kg/ha) in all dates of sowing over other genotypes. GCH7 and DCH 177 have recorded significantly higher kernel yield by taking sowing during 2nd fortnight of August (1046 and 927.6kg/ha).

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Introduction

Castor is the most important commercial oilseed crop of India as it has diversified uses and medicinal value. Castor oil is unique among vegetable oils because it is the only commercial source of a hydroxylated fatty acid (ricinoleic acid). This unique fatty acid comprises around 90% of the castor oil. Ricinoleic acid has proven effectiveness in inhibiting the growth of various species of viruses and bacteria. From an energy point of view, castor oil is the best vegetable oil for producing biodiesel because it does not require heat and the consequent energy that is needed when other vegetable oils are transformed into biodiesel (Reager *et al*., 2016). In Tamil Nadu it is cultivated in an area of 4000 ha and with a poor productivity of 312kg/ha whereas, the national productivity is 1902kg/ha. Hence, there is lot of scope for improving the productivity. Sowing of crop at optimum time along with other agronomic factors and choosing the best variety is the key feature to get maximum production of any crop including castor.

Determining suitable planting date plays an important role in conformation of plant growth stages with desirable environmental conditions which results in maximum yield. Castor crop grown during rainy season is often affected by early/mid/terminal drought leading to partial loss or even complete crop failure. Planting date which is a non-monetary input in crop production can influence the castor yield that varied from 89 to 1954kg ha^{-1} among four locations and six planting dates in the States of Mississippi and Tennessee (Baldwin and Cossar, 2009).

The ratio of female to male flowers is highly sensitive to environmental conditions. The proportion of female flowers is reduced by temperatures above 30°C (Neeraja *et al*., 2010). Planting date also impacted the occurrence of pests and diseases in the State of Rio Grande do Sul, Brazil (Zuchi *et al*., 2010). In South India, the rainy season crop is severely affected by botrytis grey rot (BGR) caused by *Botrytis ricini*, due to rains associated with low temperature, fog and more than 90% relative humidity when crop is at flowering/capsule development stage (Sudhakar *et al*., 2010).

Hence, scientific works are needed to determine the proper sowing date in a specific zone for optimising quantitative and qualitative production of castor and varietal selection for getting higher yield.

Materials and methods

Experimental site

Field experiment was conducted at Tapioca and Castor Research Station during 2014 -15 on evaluation of different sowing schedules and varieties/ hybrids in castor. Soil type is red sandy soil with low nitrogen status, medium phosphorus and high potassium.

Evaluating different castor varieties in different sowing schedules

Sowing was taken on II fortnights of August'14 (25.8.2014), September (25.9.2014), October (17.10.2014) and November (14.11.2014) as per the technical programme. DCS -107, DCH – 177, GCH - 7 and YRCH - 1 were raised in different sowing schedules in split plot design with a plant spacing of 90x60*cm*. Growth attributes, yield attributes and yield were recorded.

Results and discussion

Plant height is significantly higher in sowing at second fortnight of September in all the tested varieties/hybrids. As in this treatment, the crop received sufficient quantity of rainfall favouring the increased vigour at early stage and continued for the entire cropping period.

There was no significant difference in plant height among the varieties/hybrids. Number of nodes to primary raceme is significantly higher in varieties viz., DCS 107 and GCH 7 followed by DCH 177 and YRCH1 and was no significant difference in number of nodes to primary raceme among the different sowing dates. Number of spikes per plant is significantly higher in sowing at second fortnight of August and September in all the tested varieties which is the strong yield attributing parameter of castor resulted in more yield. There was no significant difference in number of spikes among the tested varieties/hybrids.

Table 1. Effect of sowing schedule and varieties/hybrids on plant height (cm) under rainfed condition.

	V1 (DCS107)	V2(DCH177)	V3 (GCH7)	V4(YRCH 1)	Mean
S1 (Aug'14)	46.53	40.36	45.03	51.37	45.82
S2 (Sep'14)	104.87	113.43	120.43	91.53	107.57
S3 (Oct'14)	86.08	68.70	68.10	62.30	71.30
S4(Nov'14)	69.67	54.83	69.40	39.53	58.36
Mean	76.79	69.3	75.7	61.18	
	SEd	CD (0.05)			
S	4.60	11.24			
V	7.20	NS			
S at V	13.28	NS			
V at S	14.39	NS			

Table 2. Effect of sowing schedule and varieties/hybrids on number of nodes toprimary raceme in rainfed condition.

	V1 (DCS107)	V2 (DCH177)	V3 (GCH7)	V4(YRCH 1)	Mean
S1 (Aug'14)	19.9	15.6	20.2	14.1	17.4
S2 (Sep'14)	18.1	15.8	16.3	13.9	16.0
S3 (Oct'14)	14.6	13.6	15.8	14.5	14.7
S4(Nov'14)	18.3	13.6	17.9	9.7	14.9
Mean	17.8	14.7	17.6	13.1	
	SEd	CD (0.05)			
S	1.3	NS			
V	1.1	2.2			
S at V	2.3	NS			
V at S	2.15	NS			

Table 3. Effect of sowing scheduleand varieties/hybrids on number of spikes in rainfed condition.

	V1 (DCS107)	V2 (DCH177)	V3 (GCH7)	V4(YRCH 1)	Mean
S1 (Aug'14)	6.3	11.7	7.6	6.7	8.1
S2 (Sep'14)	5.7	8.2	8.3	7.4	7.4
S3 (Oct'14)	4.2	4.5	5.5	3.4	4.4
S4(Nov'14)	1.0	1.3	1.7	1.0	1.2
Mean	4.3	6.4	5.8	4.6	
	SEd	CD (0.05)			
S	0.9	2.3			
V	0.9	NS			
S at V	1.9	NS			
V at S	1.9	NS			

Table 4. Effect of sowing schedule and varieties/hybrids on kernel yield per ha in rainfed condition.

Sowing schedules	V1 (DCS107)	V2 (DCH177)	V3 (GCH7)	V4(YRCH 1)	Mean
	Kernel yield (kg/ha)				
S1 (Aug'14)	697.9	1046.0	927.6	151.2	705.8
S2 (Sep'14)	532.0	628.0	628.6	199.6	497.1
S3 (Oct'14)	111.0	165.8	411.1	115.6	200.7
S4(Nov'14)	66.0	129.9	423.4	80.8	175.0
Mean	351.5	492.5	597.7	136.8	
	SEd	CD (p=0.05)			
S	58.1	142.3			
V	46.7	96.4			
S at V	99.6	218.6			
V at S	93.4	NS			

Among the sowing dates, sowing of castor at 2nd fortnight of August has recorded significantly higher kernel yield (705.8kg/ha) followed by 2nd fortnight of September (497.0kg/ha) over October and November sown plots due to deficit in rainfall under rainfed condition. Among the varieties/hybrids tested GCH7 has recorded significantly higher kernel yield (597.7kg/ha) over other genotypes and was followed by DCH 177. There was significant interaction among sowing dates and different tested varieties. GCH7 and DCH 177 have recorded significantly higher kernel yield by taking sowing during 2nd fortnight of August

(1046 and 927.6kg/ha) followed by September (Table 4). This is mainly due to the reduction in early and terminal moisture stress during August and September and also due to more number of spikes produced and from this research, it was observed that there was a significant yield reduction due to delayed sowing as the crop expressed the terminal moisture stress. Hence, recommended to take up castor sowing during August to September. The reduction in seed yield due to delayed sowing from June was also reported by Umesha *et al*., 2018. Prakash *et al*., 2004 also revealed that the national check hybrid GCH-4, is high yielder under July first fortnight sown situation. But, for later sown situations, DCH-32 was better yielding hybrid with early nature YRCH 1 is highly susceptible to wilt infection in all sowing dates August, September, October and November over other genotypes resulted in lesser kernel yield.

Table 5. Effect of sowing schedule and varieties/hybrids on test weight (100 grain weight) in rainfed condition**.**

	V1 (DCS107)	V2 (DCH177)	V3 (GCH7)	V4(YRCH 1)	Mean
S1 (Aug'14)	35.5	31.9	30.5	27.5	31.3
S2 (Sep'14)	33.8	31.9	30.2	32.3	32.1
S3 (Oct'14)	32.6	29.7	31.4	31.6	31.3
S4(Nov'14)	31.0	27.4	30.6	27.4	29.1
Mean	33.2	30.2	30.7	29.7	
	SEd	CD (0.05)			
S	0.99	NS			
V	0.97	2.01			
S at V	1.96	NS			
V at S	1.95	NS			

There was no significant difference in test weight due to different sowing schedules. However, among the genotypes tested DCS 107 has recorded higher test weight (33.2) over other hybrids (Table 5). Interaction effect also showed no significant difference in test weight.

Conclusion

YRCH 1 is highly susceptible to wilt infection in all sowing dates of August, September, October and November over other genotypes. Among the sowing dates, sowing of castor at 2nd fortnight of August has recorded significantly higher kernel yield (705.8kg/ha) followed by 2nd fortnight of September (497.0kg/ha) over October and November sown plots due to deficit in rainfall and the crop expressed the terminal moisture stress. GCH7 and DCH 177 have recorded significantly higher kernel yield by taking sowing during 2nd fortnight of August (1046 and 927.6kg/ha)

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