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Yield attributes, seed yield and net returns of rainfed castor as influenced by plant geometry and nitrogen levels

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ABSTRACT

Field experiment was conducted at dry land farm, S.V.Agricultural College, Tirupati campus of Acharya N G Ranga Agricultural University to study the performance of rainfed castor (Cultivar Kranthi) under varied levels of nitrogen with different planting patterns during *kharif* 2002. The experimental site is situated at an altitude of 182.9 m above mean sea level (MSL), $79^0 36^1$ E longitude and $13^0 27^1$ N latitude, located in the Southern Agro climatic zone of Andhra Pradesh.The study was laid out in a randomized block design with factorial concept, replicated thrice, comprising of four planting patterns, Viz., 90x20 cm (P_1), 60x30 cm (P_2), 45x40cm (P_3) and 75x24cm (P_4) and three nitrogen levels viz., 40 Kg ha^{-1} (N_1), 60 Kg ha^{-1} (N_2), and 80 Kg ha^{-1} (N_3). The highest number of spikes plant^{-1}, capsules spike^{-1}, longest spikes, seed yield and net returns were recorded with the planting pattern of 60x30 cm with application of nitrogen @ 80 kg ha^{-1} whereas they were lowest with planting pattern of 75X24 cm along with application of nitrogen @ 40 kg ha^{-1}. The planting pattern 45 X40cm took more number of days to attain 50 per cent flowering which was at par with planting pattern of 60X30 cm along with the application of nitrogen @ 80 kg ha^{-1}.

Key words : Rainfed castor, Plant geometry , Nitrogen levels, Yield attributes, Seed yield and Net returns.

INTRODUCTION

The productivity of castor in Andhra Pradesh is very low, because castor is grown on marginal and sub-marginal soils under rainfed conditions, coupled with incidence of a host of biotic stresses like pests and diseases such as *Heliothis* and *Botrytis*, besides low input use by the resource poor farmers and poor level of crop management. As a consequence, cultivation of castor during *kharif*, under rainfed conditions has become less remunerative.

Enhanced production is possible mainly through appropriate agro techniques such as genotypes sown at optimum time, maintaining optimum plant stand and judicious use of nutrients. The present study was, therefore, designed to obtain reasonably higher level of productivity of castor by selecting the suitable planting pattern and nitrogen levels in the southern agro-climatic zone of Andhra Pradesh.

MATERIALS AND METHODS

The experiment was conducted at dry land farm, S.V.Agricultural College, Tirupati during *kharif* 2002. The experiment was laid out in a randomized block design with factorial concept, replicated thrice comprising of four planting patterns. Viz., 90x20 cm (P_1), 60x30 cm (P_2), 45x40cm (P_3) and 75x24cm (P_4) and three nitrogen levels viz., 40 Kg ha^{-1} (N_1), 60 Kg ha^{-1} (N_2), and 80 Kg ha^{-1}(N_3). The entire quantity of P_2O_5 (40 kg ha^{-1}) and half the quantity of N was applied as a basal dose. The remaining half of N was equally applied as top dress at 40 and 70 DAS. The soil of the experimental field was in sandy loam texture having neutral pH, 223.7 Kg ha^{-1} available N, 22.7 Kg ha^{-1} available P and 315 Kg ha^{-1} available K. A total rainfall of 416.5 mm was received in 33 rainy days.

Number of spikes plant^{-1} :

The total number of spikes on each of the five tagged plants were counted and the average was worked out and expressed in number of spikes plant^{-1}.

Number of capsules spike^{-1} :

The total number of capsules from each spike of each of the tagged plants in every plot was counted and average number of capsules spike^{-1} was recorded.

Spike length :

Length of the spike was measured in centimeters with a linear meter scale on each of the five-tagged plants. The average was worked out and expressed as mean length of spikes.

Days to 50 per cent flowering:

Number of days taken to 50 per cent flowering was counted from sowing date to the day on which 50 per cent of plants in each plot flowered and expressed in

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number of days.

Seed yield :

Seed yield was recorded from net plot area, weighed and expressed in kg ha^{-1} during the crop period.

Net monetary returns:

Net monetary returns were calculated by deducting the cost of cultivation from gross monetary returns for each treatment.

RESULTS AND DISCUSSION

Yield attributes, seed yield and net returns and their interaction were significantly influenced by planting pattern and nitrogen levels (Table 1 and 2).

The highest number of spikes plant^{-1} and the highest number of capsules spike^{-1} were recorded with the planting pattern of 60x30 cm, which was significantly superior to the other three planting patterns tried (Table 1).

Under 60 X 30cm spacing, the branching pattern was better, with more number of branches resulting in the production of more number of spikes plant^{-1}. Spike production was found directly related to the number of branches (Hafeezuddin Khan, 1974). Number of spikes plant^{-1} and capsules spike^{-1} were found to be the highest with 80 Kg N ha^{-1}, while they were at their lowest with 40 Kg N ha^{-1}. More number of branches per plant coupled with better nutrition would have resulted in production of

Table 1 : Yield attributes, seed yield and net returns of *rainfed* castor as influenced by plant geometry and nitrogen levels

Treatments	Spike length (cm)	No. of capsules spike^{-1}	No. of spikes plant^{-1}	Days to 50 % flowering	Seed yield (kg ha^{-1})	Net returns (Rs ha^{-1})
Planting patterns (cm)						
P_1 (90 X 20)	25.72	42.70	5.48	52.62	1851.00	17511
P_2 (90 X 20)	28.62	49.79	6.62	54.94	2083.00	20754
P_3(90 X 20)	27.11	47.97	6.35	55.65	1932.00	18645
P_4 (75 X 24)	25.47	41.56	5.21	53.88	1720.00	15672
SEm ±	0.30	0.35	0.01	0.35	16.30	246
CD (P = 0.05)	0.88	1.02	0.04	1.02	48.00	718
Nitrogen levels (kg ha^{-1})						
N_1 (40)	23.36	43.45	5.75	53.75	1777.00	16560
N_2 (60)	25.04	45.46	5.89	54.88	1907.00	18283
N_3 (80)	26.33	47.61	6.10	55.92	2007.00	19595
SEm±	0.26	0.30	0.01	0.30	13.24	284
CD (P = 0.05)	0.77	0.88	0.04	0.88	39.00	829

Table 2 : Interaction effects of plant geometry and N levels on yield attributes, seed yield and net returns of rainfed castor.

Treatments	No. of capsules spike^{-1}	No. of spikes plant^{-1}	Seed yield (kg ha^{-1})	Net returns (Rs ha^{-1})
P_1 N_1	37.50	5.22	1678.00	15184
P_1 N_2	43.64	5.43	1897.00	18150
P_1 N_3	46.97	5.80	1979.00	19199
P_2 N_1	48.84	6.47	1912.00	18460
P_2 N_2	49.74	6.59	2108.00	21104
P_2 N_3	50.80	6.79	2229.00	22699
P_3 N_1	46.66	6.27	1879.00	17998
P_3 N_2	47.87	6.37	1905.00	18262
P_3 N_3	49.40	6.42	2013.00	19675
P_4 N_1	40.81	5.05	1636.00	14596
P_4 N_2	40.60	5.18	1716.00	15616
P_4 N_3	43.28	5.40	1808.00	16805
SEm±	0.60	0.20	27.37	492
CD (P = 0.05)	1.76	0.08	80.00	1436

more number of spikes plant^{-1} and capsules spike^{-1}. Similar result was reported by Mathukia and Modhwadia (1993). Days to 50 per cent flowering were significantly influenced by different planting patterns. The planting pattern of 45 x 40 cm took more number of days to 50 per cent flowering which was at par with planting pattern of 60 x 30 cm, but significantly superior to two other planting patterns. Castor crop flowered at the earliest with the planting pattern of 90 x 20 cm, which took significantly lesser number of days than under the planting pattern of 75 x 24 cm. Nitrogen levels significantly influenced the days to 50 per cent flowering. Among different nitrogen levels, 80 kg N ha^{-1} resulted in more number of days to attain 50 per cent flowering and it was significantly longer than two other lesser levels of N, with significant disparity between any two of the three levels tried. The lowest number of days to 50 per cent flowering was recorded with application of 40kg N ha^{-1}.Significant interaction effect with respect to days to 50 per cent flowering between planting patterns and nitrogen levels, was not traceable. The highest seed yield of castor was realized with the planting pattern of 60x30 cm, which was significantly superior to the remaining planting patterns tried, while the lowest seed yield was associated with planting pattern of 75x24 cm. Planting pattern of 60 x 30 cm has recorded 21% increase in the seed yield over 75 x 24 cm planting pattern. The higher seed yield under the planting pattern of 60x30 cm, seems to be the optimum spacing for obtaining higher yields due to more number of branches plant^{-1}, number of spikes plant^{-1}, capsules spike^{-1}, and hundred seed weight. It could also been noticed that the seed yield was also higher with the optimum spacing compared to deviated planting patterns. Similar findings were also reported by a number of researchers (Weiss, 1966, Reddy *et al.*, 1975; DOR, 1992 and DOR, 1993).The highest seed yield of castor was produced with 80 Kg N ha^{-1}, which was however, significantly superior over the other two nitrogen levels. The lowest seed yield was recorded with the application of 40 Kg N ha^{-1}. Application of nitrogen at 40 and 60 kg N ha^{-1} resulted in the decrease of seed yield by 11 and 5%, respectively compared to 80 kg N ha^{-1}. Adequate nitrogen supply has promoted the growth and increased yield attributes such as number of spikes plant^{-1} and capsules spike^{-1} and seed weight of castor resulted in the highest seed yield, as noticed in the present investigation confirms the documented evidence of Hafeezuddin khan (1974), Ganga saran and Gajendragiri (1987). The highest net monetary returns of castor was recorded with planting pattern of 60 x 30 cm, could be attributed to higher seed yield. Nitrogen at 80 Kg ha^{-1} has resulted in the highest net returns, which were significantly superior over other two nitrogen levels, while the lowest were associated with 40 Kg N ha^{-1}. The highest net returns of castor could be attributed to higher yields of castor. The highest net returns of castor recorded with planting pattern of 60 x 30 cm, along with the application of 80 kg N ha^{-1}. This could be attributed to higher seed yield.

In conclusion, the study revealed that growing of rainfed castor with a planting geometry of 60x30 cm along with application of 80 kg N ha^{-1} was found economical for Southern – Zone of Andhra Pradesh

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