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YIELD VARIATION DUE TO NIPPING OF BRANCHES IN COMBINATION WITH POPULATION MANIPULATIONS IN CASTOR (*RICINUS COMMUNIS* L.)

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SUMMARY

An experiment was conducted during *rabi*, 1998 to assess whether there will be any yield reduction, if the crop duration is shortened by growing the crop upto primaries/secondaries/tertiaries and whether this yield reduction can be compensated by manipulating the plant population, in castor (var. DCS-9). Different treatments tried were; keeping only primaties (P) with sppacing of 30 x 15, 30 x 30, 45 x 30, 60 x 30cm, primary and secondary (P+S) branches with spacing of 45 x 30, 60 x 30, 90 x 30 cm and all the branches i.e. control with spacing of 90 x 30 cm. Dry matter, seed yield per plant were significantly more in control, but seed yield m^{-2} was on par with 30 x 15 cm with primary, 60 x 30 cm with P + S and control plants than all other treatments. Harvest index was significantly more (59.4%) with P + S treatment under 60 x 30 cm which shows that assimilate translocation especially from stem reserves increased with closer spacing. Therefore, spacing of 60x 30 cm with branches upto secondaries is more advantageous in castor than the normal spacing of 90 x 30 cm with all branches and long duration. The crop duration was reduced by 50 days under the spacing of 30 x 15 cm with primaries, but the yield was on par with control. It is concluded that plant types of short duration with single spike should be developed in castor to fit into different cropping systems.

Key words: **Castor, nipping, spacing, yield.**

INTRODUCTION

Castor is an indeterminate crop as it continues to grow as long as the moisture is available in the soil. In order to fit into cropping system, annuality is desirable. Though annuality could not be achieved in strict sense, its duration was brought down to accommodate it into regular cropping sequence. Present day cultivars take 6-7 months for the tertiaries to come to harvest. Reducing the cropping period further, enables the farmer to take up another crop in *rabi/* summer. Therefore, an attempt was made to study whether there will be any yield reduction if the crop is harvested after the primaries/secondaries/tertiaries and whether this yield reduction can be compensated by manipulating population. So far, no work has been done in this direction. This investigation was conducted to study the effect of nipping of branches in combination with population manipulations.

MATERIALS AND METHODS

An experiment was conducted during *rabi*, 1998 using DCS-9 variety in the Narkhoda farm of DOR with eight treatments. The experiment was laid out in RBD with three replications. After thorough ploughing of the land, plots of 9 x 3.6 m were made for each treatment. Sowing was done after seed treatment with thiram @ 3g/ kg seed. Basal dose of N: P: K @ 20: 20: 0 was applied and top dressing of 20 kg N ha^{-1} was given one month after sowing. Irrigation, weeding and plant protection measures were taken depending on the requirement. The treatments include; keeping only primary (P) with spacings of 30 x 15, 30 x 30, 45 x 30, 60 x 30 cm, keeping primary and secondary branches (P+S) with spacings of 45 x 30, 60 x 30, 90 x 30 cm and keeping all the branches with normal spacing of 90 x 30 cm i.e. control. Observations on plant height, node number, internodal length, stem girth, leaf number, dry matter partitioning, yield and yield components were recorded.

RESULTS AND DISCUSSION

Plant population and total spike number in different treatments were presented in Table 1. Plant population was significantly more in 30 x 15 P followed by 30 x 30 P and rest of the treatments was on par. Though plant population was more, total spike number was on par in 30 x 15 P, 45 x 30 PS, and 60 30 PS and control treatments.

Table 1. Plant population and number of spikes in different treatments.

Treatment		Plant population/m²	Total spike number /m²
1.	30 x 15 P	22	22
2.	30 x 30 P	11	11
3.	45 x 30 P	7	7
4.	45 x 30 PS	7	21
5.	60 x 30 PS	6	6
6.	60 x 30 PS	6	18
7.	90 x 30 PS	4	12
8.	Control	4	20
	SEm±	**1.08**	**1.89**
	CD (0.05)	**3.29**	**5.72**
	CV (%)	**22.5**	**22.4**

Plant height increased in closely spaced plants with fewer branches as there was competition for sunlight due to closer spacing (Table 2). Height increase was mainly due to increased internodal length, as node number is a genetic character which was not influenced by any of these treatments. Among all the treatments, 30 x 15 P recorded significantly more plant height and internodal length. Kennedy *et al.* (1991) also reported increased plant height with removeal of squares for 3 (or) 6 weeks at weekly intervals in cotton. Stem girth was significantly more in plants grown with normal spacing of 90 x 30 cm than that of less closely spaced plants. Closer spacing and keeping only upto primaries i.e. 30 x 15 P and 30 x 30 P resulted in thin and tall plants.

Leaf number was more if the branches were more. Leaf dry weight (LDW), stem dry weight (SDW) and total dry matter (TDM) plant^{-1} were significantly more in control plants followed by plants in which spikes were retained up to secondaries with normal spacing followed by 45 x 30 PS and 60 x 30 PS treatments which were on par with each other. Leaf number m^{-2} was more for control followed by 30 x 15P. But LDW was more with 30 x 15 P followed by 30 x 30 P. Whereas SDW and TDM were more or less equal in control and closely spaced plants of 30 x 15 P. Though spike length and effective spike length

Table 2. Variations in growth parameters under different treatments of plant populations and branching pattern.

Treatment	Plant height (cm)	Node Number	Internodal length (cm)	Stem girth (cm)	Leaf number plant^{-1} (90 DAS)		Leaf weight at maturity g plant^{-1}		Stem weight at maturity g plant^{-1}		TDM g plant^{-1}	
30 x 15 P*	68.3	10	6.8	4.5	4	(88)	8.7	(191.4)	9.9	(217.8)	47.6	(1047.2)
30 x 30 P	63.2	11	6.0	4.9	4	(44)	9.0	(99.0)	16.1	(177.1)	69.1	(760.1)
45 x 30 P	56.2	11	5.5	5.5	4	(28)	9.0	(63.0)	14.1	(98.7)	75.5	(528.5)
45 x 30 PS**	51.5	10	5.4	5.5	8	(56)	6.6	(46.2)	19.9	(3.93)	116.6	816.2
60 x 30 P	39.9	11	4.3	4.9	5	(30)	7.1	42.6)	9.9	(59.4)	61.3	(367.8)
60 x 30 PS	45.6	11	5.1	5.2	7	(42	7.4	(44.4)	18.4	(110.4)	114.6	(687.6)
90 x 30 PS	46.1	10	5.0	5.7	6	(24)	6.7	(26.8)	22.9	(91.6)	149.1	(596.4)
Control	52.8	10	5.4	7.5	26	(104)	17.7	70.8)	50.3	(201.2)	258.8	(1035.2)
General Mean	52.9	10.4	5.5	5.5	8.1		9.0		20.2		111.6	
SEm±	**4.06**	**0.44**	**0.37**	**0.18**	**0.94**		**0.83**		**0.91**		**8.40**	
CV (%)	**13.28**	**7.34**	**11.75**	**5.79**	**20.17**		**15.84**		**7.78**		**13.04**	
CD (0.05)	**17.09**	**NS**	**1.12**	**0.77**	**3.97**		**3.47**		**3.82**		**35.36**	

* Keeping only primary stem. TDM-total dry matter.
** Keeping primary and secondary branches. DAS-days after sowing.
Figures in parenthesis indicate values m^{-2}.

of primaries were not significantly influenced by nipping and population manipulation. Control plants and 60 x 30 P plants recorded more spike length and effective spike length than all other treatments (Table 3). Keeping only primaries resulted in production of more number of capsules (30 x 30 P, 45 x 30 P and 60 x 30 P) than those along with secondary and tertiary order branches.

Capsule weight, seed weight, test weight and oil content were significantly more in those plants that were with wider spacing with primary, secondary and tertiary order branches. Yield of secondary order branches followed similar trend. Seed yield per plant was more in control followed by 90 x 30 PS and 60 x 30 PS (Table 4). Seed yield m^{-2} was on par with 30 x 15P, 45 x 30 PS and control plants and were significantly superior to all other treatments. Hegde and Reddy (1987) recorded a decline in yield with nipping of rainfed castor especially when only a single spike was maintained. Harvest index (HI) was significantly more (59.4%) with 60 x 30 PS and all other treatments were on par with one another. Though LDW, SDW and TDM was equal in control, 30 x 15 P, 60 x 30 PS, yeild was on par in these 3 treatments and HI was very high with 60 x 30 PS though its TDM at harvest was less which shows that a closer spacing of 60 x 30 cm than normal (90 x 30 cm) with only upto secondary branches increased the translocation efficiency especially that of stem reserves to the sink. Generally, photosynthate translocation from stem reserves to sink is very less in castor, but a closer spacing of 60 x 30 cm with branches upto secondaries impproved this important trait in castor which resulted in high HI values as against poor HI values in castor.

Yield advantage was more with 60 x 30 PS (279 kg m^{-2}) as comapred to other treatments over control. The growth duration was also reduced by one week compared with control (Table 4). Though seed rate was more (23 kg

Table 3. Variation in spike characters under different treatments of plant populations and branching pattern.

Treatment	Primary spike characters						
	Spike length (cm)	Effective spike length (cm)	Capsule number plant^{-1}	Capsule weight (g plant^{-1})	Seed weight (g plant^{-1})	Test weight (g)	Oil content (%)
30 x 15 P*	25.2	22.5	36	27.4	17.4	20.5	31.0
30 x 30 P	29.9	26.3	45	41.7	26.5	22.9	32.7
45 x 30 P	35.1	31.7	51	48.8	31.2	24.7	32.1
45 x 30 PS**	27.7	24.0	26	29.9	20.3	29.2	41.4
60 x 30 P	31.7	28.5	44	42.0	27.2	23.2	32.4
60 x 30 PS	27.7	24.3	28	33.6	22.8	30.5	41.5
90 x 30 PS	29.3	24.9	30	35.5	23.6	30.4	41.9
Control	33.7	31.5	35	47.1	32.7	32.8	43.7
General Mean	30.05	26.71	36.7	38.3	25.2	26.9	37.1
SEm±	**2.22**	**2.15**	**3.50**	**4.03**	**2.70**	**1.26**	**0.93**
CV (%)	**12.78**	**13.95**	**16.53**	**18.24**	**18.55**	**8.10**	**4.33**
CD (0.05)	**NS**	**NS**	**14.75**	**12.22**	**8.19**	**3.81**	**2.81**
	Secondary spike characters						
45 x 30 PS	17.8	14.7	18	39.8	27.3	25.8	39.3
60 x 30 PS	20.5	17.9	19	31.0	44.8	27.6	40.6
90 x 30 PS	24.3	20.4	23	55.8	39.9	26.4	39.6
Control	26.0	23.7	24	63.7	45.2	28.7	42.7
	Tertiary spike characters						
Cotrol (90 x 30 cm)	12.1	9.4	10	35.0	24.5	28.5	44.0

* Keeping only primary stem.

** Keeping primary and secondary branches.

Table 4. Effect of different treatments on seed yield and harvest index.

Treatment	Seed yield g pl^{-1}	Seed yield gm^{-2}	Harvest index (%)
30 x 15 P*	17.4	387	36.9
30 x 30 P	26.5	294	39.7
45 x 30 P	31.2	231	43.3
45 x 30 PS**	47.4	350	40.9
60 x 30 P	27.2	152	44.8
60 x 30 PS	67.6	279	59.4
90 x 30 PS	63.5	232	42.8
Control	102.3	379	39.6
General Mean	47.9	300.4	43.4
SEm±	**1.50**	**12.16**	**2.19**
CV (%)	**5.43**	**7.01**	**8.72**
CD (0.05)	**6.32**	**51.20**	**9.20**

* Keeping only primary stem.

** Keeping primary and secondary branches.

against 15 kg in control), it is less than that of very closely spaced plants of 30 x 15 P (90 kg ha^{-1}). Gross returns were similar in these 3 treatments, but if seed cost is considered which is a major input in castor, the net return is not high in 30 x 15 P, but treatment 60 x 30 PS still showed net returns closer with control (Table 5). Closely spaced plants (30 x 15 P), compeleted its life cycle within 103 days, where as control plants took 152 days to give similar yield per unit area (Table 5). By saving 50 days duration, another short duration legume can be sown. Very high seed cost may be compensated if duration advantage, saving in maintenance of the crop, yield advantage of the secondary legume crop etc. were taken into account. This

Table 5. Effect of different treatments on economic returns.

Treatment	Duration (DAS)	Seed rate (kg ha^{-1})	Gross returns (Rs ha^{-1})	Net returns (Rs ha^{-1})
30 x 15 P*	103	90	5800	3550
30 x 30 P	107	45	4400	3275
45 x 30 P	110	30	3460	2710
45 x 30 PS*	145	30	5255	4505
60 x 30 P	110	23	2280	1705
60 x 30 PS	145	23	5680	5105
90 x 30 PS	145	15	3480	3105
Control	152	15	5680	5305

DAS = Days after sowing

closer spacing with less duration is advantageous when we want to grow castor as an intercrop.

This study indicates that a closer spacing of 60 x 30 cm with branches upto secondaries is more advantageous in castor than the normal spacing of 90 x 30 cm with all branches and long duration. With closer spacing of 30 x 15 cm with primatries, crop duration has been reduced by 50 days while yield remained similar to that of control. Hence, plant types of short duration with single spike can be developed in castor to fit into different cropping systems.

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