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Seed yield and net returns of drip irrigated late *Kharif* castor (*Ricinus communis* L.) as influenced by plant geometry and nitrogen levels

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ABSTRACT

An experiment was conducted during the late *Kharif* season of the year 2006-07 and 2007-08 at Agricultural Research Station for Irrigated crops, A.A.U. Thasra, Gujarat, to evaluate productivity and economics of castor under varying levels of planting geometry (Pair row planting (180-60-180 cm) × 60 cm and 120 × 60 cm), drip irrigation (0.4, 0.6 and 0.8 ADFPE) and nitrogen (100 % RDN through spot application, 50 % RDN through fertigation and 100 % RDN through fertigation). Pair row planting (180-60-180) × 60 cm recorded maximum seed yield net return than 120 × 60 cm. The seed yield was significantly the highest (2841 kg/ha) under drip irrigation treatment I_3 (0.8 ADFPE). Application of 100 % RDN through fertigation (N_3) recorded significantly the highest seed yield (3037 kg/ha) and net returns (Rs. 47126) as well as CBR (1:4.46) and Net CBR (1:3.46) as compared to treatments N_2 (50% RDN through fertigation) and N_1 (100% RDN through spot application).

Key words : Castor, Planting geometry, Drip irrigation, Nitrogen, Fertigation

INTRODUCTION

The major castor growing states in the India are Gujarat, A.P., Rajasthan, Tamil Nadu, Karnataka, and Orissa. With the availability of short stature early hybrids, its cultivation in the middle Gujarat is increasing year by year. Castor (*Ricinus communis* L.) is an important non-edible oilseed crop of middle Gujarat grown as rainfed as well as irrigated under assured irrigation condition. Potential crop production and net return can be obtained, if its nitrogen and water requirements are provided through proper method during growth period. Planting geometry also becomes an important factor in the crop production under adequate supply of moisture and nutrients.

MATERIALS AND METHODS

An experiment was conducted at the Agricultural Research Station for Irrigated Crops, Anand Agricultural University, Thasra, Dist. Kheda (Gujarat) during two consecutive late *Kharif* seasons of the year 2006-07 and 2007-08. The experiment was laid out in the split plot design, replicated quadruplicate. The soil of the experimental field was sandy clayloam in the texture, having good drainage capacity and neutral pH. It was low in organic carbon and nitrogen, medium in available phosphorus and high in available potash. The treatment comprised of two levels of spacing (Pair row planting (180-60-180 cm) × 60 cm and 120 × 60 cm), three levels of irrigation (drip irrigation at 0.4, 0.6 and 0.8 ADFPE) and three levels of nitrogen (100 % RDN through spot application, 50 % RDN through fertigation and 100 % RDN through fertigation). Combinations of levels of spacing and irrigation were relegated in to the main plot as main plot treatments and levels of nitrogen were assigned to the sub plot as sub plot treatments.

Full dose of phosphorus (50 kg/ha) was applied as basal in the form of single super phosphate and in fertigation 30 % nitrogen as a basal dose and remaining nitrogen was applied in a four equal splits, each at a one month interval, while in spot application treatment 50 % as a basal dose and remaining nitrogen in two split at two months interval. (RD: - Recommended dose of fertilizer 75 kg N + 50 kg P_2O_5 ha^{-1}).Nitrogen applied as per treatment and 50 kg P_2O_5 ha^{-1} as a common application as basal dose

Drip system was laid out in such a way that the main pipe was connected with head unit. The line was divided into three sub main having separate controlling valves for I_1, I_2 and I_3 drip irrigation levels. Lateral lines connected with sub main were laid out at a distance of 120 cm in normal planting and 240 cm in pair row planting. The drippers were placed on lateral lines at a distance of 120 cm in normal planting and 60 cm in pair row planting. The crop was sown in second fort night of September. The drip irrigation schedule was started after one month of monsoon cessation. The drip irrigation treatments were given at an alternate days based on fraction of pan evaporation of two days. Daily pan evaporation measured with the help of USDA Class-A pan evaporimeter.

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RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been presented under following heads :

Effect of plant geometry:

Methods of castor planting had significant effect on yield attributes and yield of castor (Table 1). The maximum number of spikes per plant, length of main spike, number of capsules per main spike, number of capsules per plant were recorded in pair row planting (180-60-180 cm) x 60 cm) as compared to normal planting (120 x 60 cm). Seed yield was significantly affected due to levels of spacing. Treatment S_1 (pair row planting 180-60-180 cm x 60 cm) registered significantly the highest seed yield (2734 kg/ ha) as compared to treatment S_2 (120 x 60 cm). The per cent increase in seed yield under treatment S_1 was at the extent of 5.91. It might be due to optimum space available per plant and ultimately more availability of nutrients, moisture, light and consequently better growth and development of plant which finally increased seed yield. The above findings are akin to those reported by Thadoda *et al*. (1996) and Porwal *et al*. (2006). Pair row planting (180-60-180 x 60) registered the highest net realization (Rs. 36522/ha) with the CBR and net CBR values of 1: 3.01 and 1: 2.01, respectively.

Effect of drip irrigation:

The results indicated that (Table 1) levels of irrigation exerted significant influence on yield and yield attributes *viz*., length of main spike, number of spikes per plant, number of capsules per main spike, number of capsules per plant These attributes were higher under drip irrigation

Table 1 : Effect of different levels plant geometry, drip irrigation and nitrogen on growth attributes, yield attributes and yield of castor

Treatments	Length of main spike (cm)	Number of spikes per plant	Number of capsules per main spike	Number of capsules per plant	Seed yield (kg ha^{-1})	Net realization (Rs./ha)	CBR	Net CBR
Plant geometry								
S_1- Pair row planting (180-60-180 cm) × 60cm	62.94	5.57	59.07	120.00	2734	36522	1:3.01	1:2.01
S_2- 120 × 60 cm	60.92	4.82	57.03	116.34	2573	30052	1:2.40	1:1.40
S.E.±	0.36	0.07	0.47	1.22	28	--	--	--
C.D. (P=0.05)	1.03	0.19	1.35	3.53	83	--	--	--
Irrigation (Drip)								
I_1- 0.4 ADFPE	59.80	4.63	56.14	112.90	2496	35060	1:3.36	1:2.36
I_2- 0.6 ADFPE	61.50	5.38	57.66	117.75	2623	36537	1:3.29	1:2.29
I_3- 0.8 ADFPE	64.49	5.57	60.35	123.88	2841	39847	1:3.35	1:2.35
S.E.±	0.62	0.11	0.81	2.11	50	--	--	--
C.D. (P=0.05)	1.79	0.33	2.33	6.10	144	--	--	--
C.V. (%)	4.89	10.73	6.82	8.76	9.23			
Nitrogen								
N_1 - 100 % RD of nitrogen through spot application	59.33	4.42	55.57	113.32	2393	34246	1:3.52	1:2.52
N_2 - 50 % RD of nitrogen through fertigation	61.96	5.19	58.00	114.54	2531	37426	1:3.84	1:2.84
N_3 - 100 % RD of nitrogen through fertigation	64.51	5.97	60.35	126.66	3037	47126	1:4.46	1:3.46
S.E.±	0.40	0.07	0.48	1.34	31	--	--	--
C.D. (P=0.05)	1.13	0.19	1.36	3.79	86	--	--	--
C.V. (%)	4.48	8.87	5.76	7.86	7.99	--	--	--

ADFPE: Alternate Day Fraction Pan Evaporation

Table 2 : Seed yield (kg/ha) as influenced by S × N interaction

Treatments	Nitrogen (N)		
Spacing (S)	N_1-100 % RDN (Spot application)	N_2-50 % RDN (fertigation)	N_3- 100 % RDN (fertigation)
S_1-Pair row Planting (180-60-180 cm) × 60cm	2471	2557	3175
S_2- 120 × 60 cm	2314	2505	2898
S.E. ±		43.26	
C.D. (P= 0.05)		122.24	
C.V. %		7.99	

at 0.8 ADFPE (I_3) than drip irrigation at 0.6 ADFPE (I_2) and 0.4 ADFPE (I_1). Significantly the highest seed yield (2841 kg/ha) was obtained under drip irrigation treatment at 0.8 ADFPE (I_3), while significantly the lowest seed yield was noticed under irrigation level I_1 (2496 kg/ha) on pooled basis data but, it was remained at par with irrigation level I_2 (0.6 ADFPE). The magnitude of increase in seed yield under treatment I_3 (0.8 ADFPE) was to the tune of 7.70 and 12.14 per cent over treatments I_2 and I_1, respectively. The increase in seed yield under drip irrigation I_3 might be due to maintenance of favourable soil moisture status in the root zone, which in turn helped plants to maintain better turgar pressure, thus utilized moisture as well as nutrients more efficiently from wetted area and ultimately enhanced vegetative as well as reproductive growth of the crop. Similar results were also reported by Patel *et al.* (2004) and Reddy *et al.* (2006). Data presented in Table 1 indicated that the highest net realization of Rs. 39847/ha was accrued under drip irrigation treatment I_3 (0.8 ADFPE), followed by Rs. 36537 and Rs. 35060/ha under 0.6 ADFPE (I_2) and 0.4 ADFPE (I_1) treatments, respectively. However, the treatment I_1 (0.4 ADFPE) recorded the highest CBR and Net CBR values (1: 3.36 and 1: 2.36), while the lowest CBR and net CBR values were observed under the treatment I_2 (0.6 ADFPE) with 1: 3.29 and 1: 2.29, respectively. Similar results were also reported by Saila and Reddy (2003) and Patel *et al.* (2003)

Effect of nitrogen:

The length of main spike, number of spikes per plant, number of capsules per main spike and number of capsules per plant were significantly influenced due to levels of nitrogen. Application of 100 per cent RDN through fertigation (N_3) recorded higher values for all these attributes than N_2 (50% RDN through fertigation) and N_1 (100% RDN through spot application). The results in respect of seed yield revealed that nitrogen level had pronounced effect on seed yield. Nitrogen application @ 100 per cent RDN through fertigation (N_3) produced significantly the highest seed yield as compared to rest of the treatments. The increase in seed yield under treatment N_3 (100 per cent RDN through fertigation) was at the extent of 16.65 and 21.21 per cent over treatment N_2 (50 per cent RDN through fertigation) and N_1 (100 per cent RDN through spot application). All these yield attributes might have cumulatively produced higher seed yield under higher level of nitrogen. The results obtained in the present study are in accordance with the results reported by Selvaraju *et al*. (2005) and Patel *et al*. (2006). Data on net returns as influenced due to nitrogen levels showed that 100 per cent RDN through fertigation (N_3) registered the highest net realization (Rs. 47126/ha) with maximum CBR and net CBR values of 1: 4.46 and 1: 3.46, respectively. Similar results were also confirmed by Selvaraju *et al.* (2005) and Patel *et al.* (2006)

Interaction (S x N) effect on seed yield:

Data on S x N interaction (Table 2) indicated that significantly the highest seed yield (3175 kg/ha) was recorded under the treatment combination S_1N_3 (Pair row planting 180-60-180 x 60 cm with 100 % RDN through fertigation) over rest of the treatment combinations. Significantly the lowest seed yield (2314 kg/ha) was recorded under the treatment combination S_2N_1 (120 x 60 cm with 100 % RDN through spot application) on pooled basis analysis.

Conclusion:

Based on the results from the experimentation for two consecutive years it seems quite logical to conclude that potential production and profit from drip irrigated late *Kharif* castor, variety GCH-5 raised on sandy clay loam soils of middle Gujarat can be secured by sowing the castor crop in pair row planting (180-60-180 cm) x 60 cm apart and irrigated through drip at 0.8 ADFPE (Alternate day fraction pan evaporation) in conjunction with nitrogen fertigation @ 100 % recommended dose in the form of urea (30 % basal and 70% in four equal split) at one month interval

REFERENCES

Patel, K.S., Patel, G.N., Patel, M.K. and Pathak, H.C. (2003). Fertigation study in castor. *GAU. Res. J*. **28**(1-2): 85-86.

Patel, K.S., Patel, P.G., Patel, G.N., Patel, J.K. and Pathak, H.C. (2004). Feasibility of drip irrigation in castor, *Ricinus communis* L. under sandy loam soil of North Gujarat. *J. Oilseeds Res*., **21**(1): 194-195.

Patel, K.S., Patel, M.K., Patel, G.N. and Pathak, H.C. (2006). Fertigation study in castor, *Ricinus communis* L. *J. Oilseeds Res*., **23**(1): 122-123.

Porwal, M.K., Agarwal, S.K. and Khokhar, A.K. (2006). Effect of planting methods and intercrops on productivity and economics of castor (*Ricinus communis* L.) based intercropping systems. *Indian J. Agron.,* **51**(4): 274-277.

Reddy, A.P., Reddy, A.S. and Padmavathi, P. (2006). Effect of irrigation and integrated nutrient management on seed and oil yield of *Rabi* castor, *Ricinus communis* L. *J. Oilseeds Res*., **23**(2): 239-241.

Saila Sree, P. and Bhaskar Reddy, B. (2003). Effect of different levels of nitrogen and phosphorus on growth and yield of summer castor after *Kharif* rice. *J. Oilseeds Res.,* **20**(1): 93-95.

Selvaraju, N., Jegathambai, R., Vijayakumar, M., Sridhar, P. and Shanmugam, K. (2005). Fertilizer management in groundnut + castor intercropping system under rainfed conditions in Tamil Nadu. *J. Oilseeds Res*., **22**(2): 420-421.

Thadoda, N.K., Sukhadia, N.M., Malavia, D.D. and Moradia, A.M. (1996). Response of castor (*Ricinus communis L.*) G.C.H.-4 to planting geometry and N fertilization under rainfed condition. *GAU Res. J*., **21**(2): 85-87.

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