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Influence of Hybrids and Nitrogen Levels in *kharif* Castor under Krishna Agro-Climatic zone of A P

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ABSTRACT

A field experiment was conducted on clay soils of the Agricultural College Farm, Bapatla during *kharif,* 2017-18 under rainfed conditions with three hybrids of castor (V_1 : PCH 111, V_2 : GCH 4 and V_3 : Western Maruthi) and four nitrogen levels (N_1 : 60 kg ha^{-1}, N_2 : 80 kg ha^{-1}, N_3 : 100 kg ha^{-1}and N_4 : 120 kg ha^{-1})evaluated in a Randomized Block Design with factorial concept and replicated thrice. The results revealed that highest drymatter production, yield attributes and castor bean yield were higher in PCH 111 hybrid with120 kg N ha^{-1}.

Key words: *Castor, Hybrids, Nitrogen*

Castor (*RicinuscommunisL.*) a member of Euphorbiaceae family, is one of the important non-edible oilseed and industrial crops of India and has prestigious place in Indiansub continent from times immemorial**.** India is the world leader in castor seed and oil production with about 55 % of world castor area and 70% of world castor production. In India, it is mostly confined to Gujarat, Andhra Pradesh, Rajasthan, Tamil Nadu, Karnataka and Orissa. It is grown in arid and semi-arid regions because of its deep root system (Patel *et al.* 2009). Castor oil is considered as versatile industrial raw material because it contains about 85-90% of ricinoleic acid and 12 hydroxy fatty acids. It is different from other vegetable oils in the sense that it does not freeze even under adverse temperatures of -12 to -18º C and thus it is the best lubricating agent particularly for high speed engines and aeroplanes.Castor occupied an area of 10.61 lakh hectares with a production of 17.5 lakh tonnes and productivity of 1600 kg ha^{-1} during 2015-16 in India (http: indiastat.com, 2015-16). Castor is the second most important oilseed crop of Andhra Pradesh next to groundnut. In A.P it is cultivated in 48,000 ha with a production of 27,000 tonnes and productivity of 600 kg ha^{-1}(www.indiastat.com, 2014-15). It is mostly confined to rainfed regions in A.P and also gradually spreading to Krishna Agro-climatic zone of A.P comprising Krishna, Guntur and Prakasam districts.In Krishna agro climatic zone, it is cultivated in the uplands, but the potential yields are not fully exploited. Inadequate or imbalanced supply of nutrients has been identified as one of the critical constraint limiting oilseeds production. Nitrogen is one of the major factors limiting crop yield of castor hybrids (Pashazadeh and Basalma, 2012).Hence, there is a scope for increasing castor area during *kharif* season by identifying the suitable hybrids along with proper nitrogen management.

MATERIAL AND METHODS

A field trial was carried out on clay soil of Agricultural College Farm, Bapatla during *kharif*, 2017-2018. The soil was slightly alkalinein reaction and low in organic carbon(0.3%), low in available nitrogen (200 kg ha^{-1}) and high in available phosphorus(28.7 kg ha^{-1}) and available potassium (307 kg ha^{-1}). The experiment was laid out in randomized block design with factorial conceptand replicated thrice. The treatments consisted of factor–A with three hybrids*viz.*,V_1(PCH 111), V_2 (GCH 4) and V_3 (Western Maruthi) and factor-B with four nitrogen levels *viz.*, N_1 (60 kgN ha^{-1}), N_2 (80 kg N ha^{-1}), N_3 (100 kg N ha^{-1}) and N_4 (120 kg N ha^{-1}).The crop was sown on 3rdAugust, 2018by dibbling one seed hill^{-1} with the help of bamboo pegs and nylon ropes.A total of 686.6mm rainfallreceived during crop growth period in 28 rainy days. Gap filling was done at 13 DAS by keeping one seedling hill^{-1}. Nitrogen was applied in the form of urea (46%N) as per the treatments in 3 splits *i.e.,* ½ at the time of sowing, ¼ at 30-35 DAS and ¼ at 60-65 DAS. A common dose of 40 kg P_2O_5 and 30 kg K_2O ha^{-1} was applied in the form of single superphosphate (16% P_2O_5) and muriate of potash (60% K_2O) respectively, at the time of sowing.The observation on growth parameters *viz.,*drymatter accumulationand yield parameters *viz.,*number of capsules spike^{-1}, test weight, castor beanyield and stalk yield were analysed by using standard procedures.

RESULTS AND DISCUSSION

Drymatter accumulation

Drymatter accumulation at harvest with PCH 111 (V_1) with (6663 kg ha^{-1})was significantly higher when compared with GCH 4 (V_2) (5419 kg ha^{-1}) and Western Maruthi(V_3) (5892 kg ha^{-1}) at harvest. The increase in drymatter accumulation with PCH 111 was 22.9 per cent, over GCH 4 (V_2) while it was 13.0 per cent, with Western Maruthi. The superior performance for maximum drymatteraccumulation by PCH 111 and Western Maruthiover GCH 4 at might be due to its genetic makeup having more plant height and more number of branches per plant resulting in better biomass production (Table 1). GCH 4was medium in stature, which was apparent from its plant height and produced lower drymatter throughout the crop growth compared to other hybrids.Chauhan and Yakadri, (2004) and Lakshmi and Sambasiva Reddy (2006) also observed similar response.Application of 120 kg N ha^{-1}) recorded significantly highest drymatter over 60 kg N ha^{-1} and 80 kg N ha^{-1}levels. However, the accumulation of drymatter was comparable between 100 kg N ha^{-1} and 120 kg N ha^{-1}.The probable reason for such a positive response upto 120 kg N ha^{-1} was availability of nitrogen in synchrony with crop need which has resulted in good vegetative growth, better root development and efficient photosynthesis and finally accumulated more drymatter. Such increase in drymatter with the application of nitrogen was also reported by Sarada Devi *et al.* (2002) and Lakshmi and Sambasiva Reddy (2006).

Yield attributes

Castor hybrid, PCH 111 recorded significantly higher number of capsules per primary spike (90) over rest of the hybrids, whereas the hybrid Western Maruthi recorded significantly lowest number of capsules per primary spike (67). More plant height, higher drymatter accumulation and a better source-sink relationship established in PCH 111 hybrid might have resulted in greater number of capsules primary spike^{-1} than Western Maruthi which might be due to inefficient drymatter partitioning These findings are in consonance with those ofChauhan and Yakadri, (2004).

With respect to levels of nitrogen, maximum number of capsules per primary spike were recorded when 120 kg N ha^{-1} was applied and it was significantly superior to other rates of nitrogen application. Similarly, 100 kg N ha^{-1} recorded 79 capsules per primary spike which was significantly superior to that of 80 kg N ha^{-1} and 60 kg N ha^{-1}. Capsules per primary spike recorded with 60 kg N ha^{-1}were 67 which were significantly less compared to rest of the nitrogen levels, however, it was on par with that of 80 kg N ha^{-1}. The increase in number of capsules primary spike^{-1} was in the order of 31.9, 23.9, 11.3 per cent, with 120, 80 and 100 kg N ha^{-1}, respectively. This shows that increased availability of nitrogen in sufficient quantities increased the drymatter accumulation of plants, which might have acted as a source to supply nutrients to reproductive parts *i.e.* flowers and capsules which might have increased the number of capsules primary spike^{-1}. These results are in agreement with the findings of Hanumantahappa*et al.* (2011).

The data on test weight recorded indicated that hybrids and nitrogen levels failed to reach the level of significance and their interaction also remained non-significant. However, a numericallyincrease in nitrogen levels from 60 - 120 kg N ha^{-1} improved the test weight (g) in increasing trend.

Yield

Castor hybrid, PCH 111 recorded maximum bean yield of 2703 kg ha^{-1} which was significantly superior to Western Maruthiwith 1899 kg ha^{-1}. However, the bean yield was comparable between GCH 4 and PCH 111 (Table 1). There was 42.3 per cent increase in bean yield with PCH 111 over Western Maruthi. In PCH 111 and GCH 4 more number of capsules spike^{-1}might have contributed to the maximum bean yield when compared with other hybrids. These are physiologically important yield attributes, which have a positive correlation with bean yield of castor and also due to delayed senescence of leaves which helped these hybrids to produce more photosynthates, thus increasing the assimilatory efficiency. The lowest seed yield recorded in Western Maruthimight be due to poor source- sink relationship and lower yield attributes. The present results are in conformity with those of Lakshmi and Sambasiva Reddy (2006) and Torres *et al.* (2016).

There was progressive and significant increase in castor bean yield with each successive increment in nitrogen levels. Application of 120 kg N ha^{-1} significantly enhanced the bean yield (2781 kg ha^{-1}) over rest of the nitrogen levels but it remained on par with 100 kg N ha^{-1} and it was 38.0 per cent higher than that of 60 kg N ha^{-1}.The per cent increase in castor bean yield was to the tune of 28.8 and 11.0 with 120 kg N ha^{-1} over 80 kg N ha^{-1} and 100 kg N ha^{-1}.

The interaction effect between hybrids and nitrogen levels on total castor bean yield presented in (Table 2) indicated that maximum bean yield of 3396 kg ha^{-1} was attained with PCH 111 at 120 kg N ha^{-1}. However, it was statistically on par with PCH 111 at 100 kg N ha^{-1} with 3320 kg ha^{-1} and GCH 4 at 120 kg N ha^{-1} with 2934 kg ha^{-1}. This might be due to higher drymatter accumulation and better yield attributes (Table 2).

The increase in bean yield of castor due to more synchrorous availability of 'N' as per crop need

Table 1. Drymatter accumulation at harvest, yield attributes and bean yield of castor as influenced by hybrids and nitrogen levels

Treatment	Drymatter accumulation (kg ha^{-1})	No.of capsules spike^{-1}	Test weight (g/100 beans)	Castor bean yield (kg ha^{-1})	Stalk yield (kg ha^{-1})
Hybrids					
V_1 - PCH 111	6663	90	26.5	2703	5299
V_2 - GCH 4	5419	72	26.4	2494	4233
V_3 - Western Maruthi	5892	67	26.7	1899	4848
S.Em±	141.4	1.99	0.24	84.9	182.9
CD (p = 0.05)	417.4	5.8	NS	249.2	534.9
Nitrogen levels (kg ha^{-1})					
N_1 - 60	5543	67	26.1	2015	4294
N_2 - 80	5808	71	26.2	2159	4699
N_3 - 100	6105	79	26.9	2505	4810
N_4 - 120	6508	88	27	2781	5370
S.Em±	163.2	2.3	0.28	98.1	210.6
CD (p = 0.05)	478.8	6.7	NS	287.8	617.7
Interaction (V X N)					
S.Em±	282.8	3.99	0.48	169.9	364.8
CD (p = 0.05)	NS	NS	NS	498.5	NS
CV (%)	8.1	9	3.2	12.4	13.1

NS- Not significant **CD**- Critical difference **CV**- Coefficient of variation

Table2. Interactionbetween hybrids and nitrogen levels on castor bean yield(kg ha^{-1})

Hybrids	N levels (kg ha^{-1})				Mean
	N_1 -60	N_2 -80	N_3 -100	N_4-120	
V_1 - PCH 111	2035	2140	3242	3396	2703
V_2 - GCH 4	2156	2406	2498	2914	2494
V_3 - Western Maruthi	1854	1932	1775	2034	1899
Mean	2015	2159	2505	2781	
S.Em±	169.9				
CD (p = 0.05)	498.5				

with the application of 120 kg N ha^{-1} might have tended to put more vegetative growth, better root development, more drymatter accumulation and yield attributing characters which resulted in efficient photosynthesis and finally produced more bean yield. The results corroborate with the findings of Patel *et al* (2009) and Man *et al* (2017).

Maximum stalk yield of 5299 kg ha^{-1} obtained with PCH 111 was significantly superior to that of GCH 4, which recorded the lowest stalk yield (4233 kg ha^{-1}). Stalk yield of Western Maruthi (4848 kg ha^{-1}) was found on par with that of PCH 111 and superior to GCH 4. The decrease in stalk yield in GCH 4 might be due to its lowest plant height, obtained with less number of branches which in turn lead to the lowest stalk yield (Table 1).

Nitrogen levels significantly influenced the stalk yield of castor. Maximum nitrogen of 120 kg N ha^{-1} recorded significantly higher stalk yield of 5370 kg ha^{-1} when compared with 60 and 80 kg N ha^{-1} but it was statistically at par with 100 kg N ha^{-1}. Lowest stalk yield of 4294 kg ha^{-1} was recorded with application of 60 kg N ha^{-1} which was on par with 80 kg N ha^{-1}. This could be ascribed to its positive influence on both vegetative and reproductive growth of the crop which lead to increase in stalk yield. Similar findings of response of stalk yield to higher nitrogen levels was reported by Patel *et al* (2009), Akbari *et al* (2010).

CONCLUSION

It can be concluded that maximumcastor bean yield could be obtained with the application of 120 kg N ha^{-1} with hybrid PCH 111 which was comparable to 100 kg N ha^{-1} in PCH 111 and GCH 4 with 120 kg N ha^{-1}over other treatments.

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