Yield and economics of *Olitorius* jute at different plant densities and topping practices

Abstract

A field experiment was conducted in *olitorius* jute at Agricultural College Farm,Bapatla during *kharif*,2019 with three plant densities [1.66 lakh plants ha^{-1} (D_1), 2.22 lakh plants ha^{-1} (D_2) and 83,333 plants ha^{-1} (D_3)] and four topping practices [T_1 (No topping), T_2 (topping at 30 DAS), T_3 (topping at 45 DAS) and T_4 (topping at 60 DAS)] in a Randomized Block Design (RBD)with factorial concept and replicated thrice. . Highest seed yield, stalk yield, gross returns, net returns and BC ratio wereobtained in crop sown at (60 cm x 20 cm) with a density of 83, 333 plants ha^{-1}(D_3), which was significantly superior over (30 cm x 20 cm) with 1,66, 666 plants ha^{-1}(D_1) and it was on par with (45 cm x 10 cm)2,22,222 plantsha^{-1}(D_2). Topping at 45 DAS (T_3) recorded highest seed yield, stalk yield, gross returns, net returns and B:C ratio and it was on par with topping at 30 DAS and 60 DAS, which was significantly superior over no topping (T_1).

Key words: *Jute, Plant density, Topping practices,Capsules,Gross returns, Net returns andB:Cratio*

Introduction

Jute is the second most important commercial fibre yielding cash crop next to cotton and it is known as “Golden Fibre”.It is one of the most important commercialbestbastfibre crops which occupies a key place in the Indian economy. Jute is also an important commercial crop of Assam, Bihar, Orissa and Eastern Uttar Pradesh earning foreign exchange and supporting nearly 7 million small and marginal farmers and industrial employees (Kumar *et al*., 2010).India is the largest producer of jute with 0.98 million hectares under cultivation with an annual production of 09.76 million bales during 2019-2020 (Ministry of Agriculture, Govt. of India). Jute is the major textile fibre as well as raw material for non-traditional and value added non-textileproducts. West Bengal occupies 70% area under jute in the country but it is mainly grown for fibrepurpose only. They depend for seed on non-jute growing states like Maharashtra,

Andhra Pradesh, Karnataka and Telangana where the weather conditions are congenial for quality seed production.

Recently,Jute has been facing a strong competition from the synthetic materials prevailing in the market. Therefore, there is a felt need to augment the jute production considerably to make its cultivation profitable to the farmers. Non-availability of quality jute seed to the farmers at lower price and at proper time is one of the major constraint. Seed production in jute can be enhanced by adopting suitable agro-techniques. Among the agro-techniques, plant density is an important yield contributing factor which can be manipulated to obtain higher yield in jute. The number of plants per unit area is positively correlated with yield. Another important factor is topping (clipping of apical buds) and when the apical buds are clipped off at the appropriate stage, it breaks the apical dominance and induces development of lateral branches which increases the seed yield by producing a greater number of capsulespod^{-1}(Roy,2013). As there is wide scope for production of good quality seed of jute in Andhra Pradesh by adopting suitable agro-techniques, a trial was conducted on "Impact of plant density and topping on seed production in *olitorius* jute (*Corchorusolitorius*L.)" in Krishna – agro climatic zone of Andhra Pradesh.

Material and Methods

The experiment was conducted at Agricultural CollegeFarm, Bapatla, Andhra Pradesh during *kharif* 2019.The experimental site is situated at an altitude of 05.49 m above mean sea level (MSL), 15^0 55'N latitude, 80^0 30' E longitude and about 08 km away from the Bay of Bengal in the Krishna Agro-climatic Zone of Andhra Pradesh, India.The soil is clay textured, with neutral pH, medium in organic carbon (0.68 %), low in available N (196 kg ha^{-1}),~~and~~ medium in available P (24 kg ha^{-1}) and high in available K (294.5 kg ha^{-1}). Climatologically, this area falls in the semi-arid tract where in a total rainfall of 623.3 mm was received in 26 rainy days during the crop growth period. The experiment was laid out in randomized block design with factorial concept and replicated thrice with two factors i.e., plant density and topping practices. i.e., 1.66 lakh plants ha^{-1} (D_1), 2.22

lakhplants ha^{-1} (D_2) and 83,333 plants ha^{-1} (D_3) and four Topping practices T_1 (No topping), T_2 (topping at 30 DAS), T_3 (topping at 45 DAS) and T_4 (topping at 60 DAS). Jute was sown on 14thAugust 2019. Recommended fertilizers @ 20 kg N, 30 kg P_2O_5 and 30 kg K_2O ha^{-1} were applied uniformly through straight fertilizers in the form of urea, single superphosphate and muriate of potash. Half of the nitrogen, entire quantity of phosphorus and potassium were applied basally. Remaining half of nitrogen was applied at 30 DAS. All the recommended cultural practices and plant protection measures were followed throughout the crop growing season. Observationlike dry matter accumulation, number of capsulesper /plants, number of seeds per capsule, seed yield and stalk yield were taken using standard procedures from five tagged plants which were tagged randomlyin each plot. Harvesting was done in month of December as per treatment and maturity of crop, respectively. The crop was threshed plot wise and seed yield obtained from net plot was converted into kg ha-^{1}. While calculating gross return, net return and B:C ratio prevalent market price for sale of jute seed was taken as Rs. 120.00 kg^{-1}.

Results and Discussion

Drymatter accumulation

Thehighestdrymatteraccumulationwasobtainedwithadensityof83,333plantsha^{-1}(D_3)anditwason parwithplantdensityof2, 22,222plantsha^{-1}(D_2). Lowestdry matteraccumulationwas observed with a densityof1, 66,666plantsha^{-1}(D_1).Amongthetoppingpractices, maximumdry matteraccumulationwasobtainedwithtoppingat45DAS(T_3)whichwassignificantlysuperioroverno topping (T_1). It was on par with topping at 30 DAS(T_2) and topping at 60 DAS (T_4).In jute where D_3 with 83,333 plants ha^{-1} recorded maximum dry matter accumulation.(Table 1) This might be due to more per plant accumulation of dry matter at a wider spacing tried at 60 cm x 20 cm and also due to more vigour and less competition from neighboring plants. These results are in accordance with the findings of Sangeetha (2015) and Das *et al.* (2018). Topping at initial stages (30 DAS) or at later stages (60 DAS) might not have favored the jute crop in increasing the branches whereas topping at (45 DAS) might have led to more branches leading to more dry matter accumulation. These results corroborate the findings of Das *et al*. (2018).

Yield attributes

Number of capsules per plant and number of seeds per capsule were found to be significantly influenced by plant densities only. Maximum number of capsules per plant and number of seeds per capsule were recorded with a plant density of 83, 333 plants ha^{-1} (D_3) which was significantly superior over other two plant densities *i.e.*,2,22,222 $plantsha^{-1}$(D_2)and 1,66,666 $plantsha^{-1}$(D_1).The enhancement in number of capsules per plant under the influence of wider spacing might be on account of maximum number of primary and secondary branches $plant^{-1}$ at the same spacing which resulted in increasing in capsule weight per plant. The superiority of individual plant performance at wider spacing might be attributed to less plant competition for nutrients, space, solar radiation etc. which finally led towards better growth and development of plant resulting in increasing in number of branches $plant^{-1}$, number of capsules $plant^{-1}$ and finally increase in number of seeds $capsule^{-1}$. The results are in close conformity with findings of Tripathi*et al*. (2013) andNirmal Kumar *et al.* (2015).

Seed and Stalk yield

Maximum seed yield of 2388 kg $ha^{-1}$and stalk yield of 6812 kg ha^{-1}in jute was obtained in crop sown with (60 cm x 20 cm) with a density of 83, 333 plants ha^{-1}(D_3), which was significantly superior over (30 cm x 20 cm) with 1,66, 666 plants ha^{-1}(D_1) and it was on par with (45 cm x 10 cm)2,22,222 $plantsha^{-1}$(D_2). Topping at 45 DAS (T_3) recorded highest seed yield (2463 kg ha^{-1})and stalk yield (6718 kg ha^{-1}), it was on par with topping at 30 DAS and 60 DAS, which was significantly superior over no topping (T_1). In wider spacing, less competition between plants and more availability of various resources lead to maximum yield, topping at appropriate stage *i.e.*, 45 DAS lead to increase in various yield attributes along with more branches per plant accumulating more dry matter and finally resulting in more yield when compared to no topping and topping at 60 DAS. These results are in tune with the findings of Tripathi*et al*. (2013), Ghosh and Das (2015) and Patra*et al*. (2017).

Economics

The highest gross returns, net returns and BC ratio were obtained with (D_3) 83, 333 plants ha^{-1} followed by (D_2) 2,22, 222 $plantsha^{-1}$and the lowest gross returns, net returns and BC ratio were noticed from crop sown with 1,66,666 $plantsha^{-1}$. Among the

topping practices, highest gross returns, net returns and BC ratio were obtained with topping at 45 DAS (T_3) followed by T_2 and T_1. Lowest gross returns, net returns and returns per rupee invested were obtained with no topping (T_1) (Table 2).At wider spacing with topping, the number of branches, increased leading to more dry matter accumulation, more number of capsule per plant,and increased number of seeds per plant which finally resulted in increasing the seed yield which lead to increased gross returns, net returns and BC ratio. These results are in agreement with the findings of Das *et al*. (2018) and Pushpa (2013).

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Table 1. Drymatteraccumulation, Number of capsules plant$^{-1,}$ Number of seeds capsule^{-1}, Seed yield (kg ha^{-1}) and Stalk yield (kg ha^{-1}) of *olitorius*jute as influenced by plant density and topping practices

TREATMENTS	Drymatteraccumulation At harvest (kg ha^{-1})	Number of capsules plant^{-1}	Number of seeds capsule^{-1}	Seed yield (kg ha^{-1})	Stalk yield (kg ha^{-1})
Plant density					
D_1: 30 cm x 20 cm **(1,66,666 plants ha^{-}**	6810	40.6	124.0	1699	5048
D_2: 45 cm x 10 cm **(2,22,222 plants ha^{-}**	8335	35.0	109.6	2200	6134
D_3: 60 cm x 20 cm **(83,333 plants ha^{-1})**	9413	70.4	166.4	2388	6812
SEm±	434.1	3.00	11.28	144.6	387.5
CD (P=0.05)	1273	8.8	33.1	424	1136
Topping practices					
T_1: No topping	7172	44.9	127.2	1824	5324
T_2: 30 DAS	8292	49.4	135.2	2196	6077
T_3: 45 DAS	9286	51.1	140.1	2463	6718
T_4: 60 DAS	8021	49.2	130.8	1900	5873
SEm±	501.3	3.47	13.03	167.0	447.4
CD (P=0.05)	1470	NS	NS	489	1312
Interaction(D x T)					
SEm±	868.3	6.01	22.56	289.3	775.07
CD (P=0.05)	NS	NS	NS	NS	NS
CV%	6.1	7.1	9.8	7.9	7.5

Table 2. Gross returns (₹ ha^{-1}), Net returns (₹ ha^{-1}) and B: C Ratio of *olitorius*jut*e* as influenced by plant density and topping practices

TREATMENTS	Gross Returns (₹ ha^{-1})	Net Returns (₹ ha^{-1})	B: C Ratio
Plant density			
D_1: 30 cm x 20 cm **(1,66,666 plants ha^{-1})**	75550	48493	1.8
D_2: 45 cm x 10 cm **(2,22,222 plants ha^{-1})**	97544	69887	2.5
D_3: 60 cm x 20 cm **(83,333 plants ha^{-1})**	106010	79553	3.0
SEm±	6204.5	6204.5	0.23
CD (P=0.05)	18195	18195	0.6
Topping practices			
T_1: No topping	81066	55584	2.2
T_2: 30 DAS	97321	70339	2.6
T_3: 45 DAS	109094	81512	2.9
T_4: 60 DAS	84658	56476	2.0
SEm±	7164.3	7164.3	0.26
CD (P=0.05)	21010	21010	0.7
Interaction(D x T)			
SEm±	6204.6	6204.5	0.23
CD (P=0.05)	18195	18195	0.6
CV%	7.7	10.8	11.0

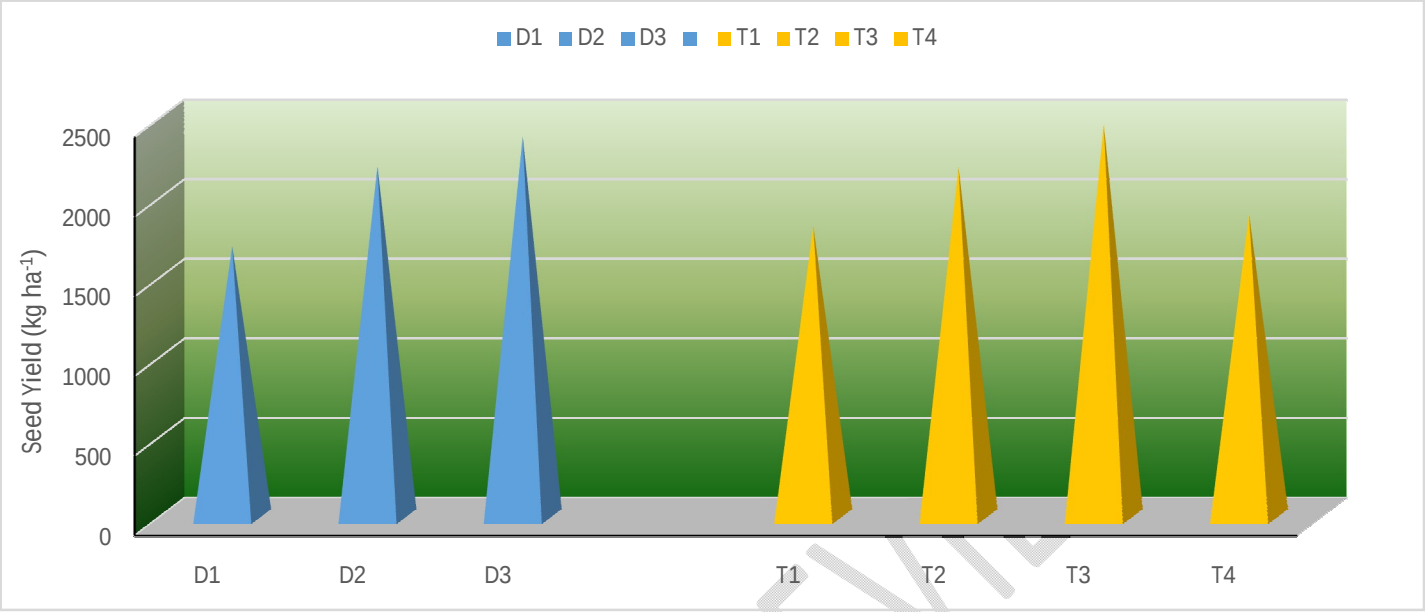

Fig. 1. Seed yield (kg ha^{-1}) of jute (*Corchorusolitorius*) as influenced by plant density and topping practices.