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Productivity and Quality of Different Varieties of *Olitorius* Jute Seed Produced in Western Odisha

Sitangshu Sarkar

Crop Production Division, ICAR-Central Research Institute for Jute and Allied Fibres, Nilgunj, Barrackpore, Kolkata-700 120, West Bengal, E-mail: sarkaragro@gmail.com

Abstract: Field experiment was conducted for two consecutive years (2010-2011) at Sambalpur in western Odisha to study the feasibility of producing olitorius jute seed and assessing the quality of the seed produced. The jute seed yield for 6 olitorius varieties varied between 933 kg/ha (cv. JRO 8432) and 725 kg/ha (cv. S 19) which were comparable in general for olitorius jute seed productivity, might be due to favourable climatic condition (initial good distribution of monsoon rain and later dry spell at seed maturity stage) and proper crop management practices. The germination percentage of all the tested varieties was always better (99 to 85%) than the prescribed minimum level of 80%. Speed of germination was the highest in JBO 2003H (91.83) & JRO 524 (90.57) and the lowest in JRO 8432 (49.87). The maximum vigour index was for S 19 (1950) closely followed by JRO 204 (1853). The net return per rupee investment was the maximum in JRO 8432 (1.18) due to higher seed yield, followed by JRO 524 (1.05) and JRO 204 (0.80).
Keywords: Jute; Corchorus olitorius; seed yield; seed quality; western Odisha

1. Introduction

Importance of jute in the agrarian economy of eastern India especially West Bengal, Bihar, Assam and Odisha is well established. Around 5000 tonnes of quality seed is required for sowing about 0.8 million hectare of jute area now under cultivation in India, while the annual seed production of certified seeds is only to the tune of 1500 to 2000 tonnes and it can cover only around 35% of total jute acreage in India. In India, jute seed is traditionally produced in the drier areas of Andhra Pradesh, Maharashtra and Karnataka states. Whereas, the same seed is transported to the jute fibre growing states like West Bengal, Bihar, Odisha, Assam and other north-eastern states. Timely availability of jute seed in the fibre producing states is not ensured; moreover, long distance transportation cost adds to the price of jute seed which often goes beyond the purchasing power of common farmers. In Odisha the jute fibre growing districts are Kendrapara, Balasore, Bhadrak, Cuttack, Keonjhar, Jajpur etc. The jute fibre area in Odisha is about 11,880 ha with a productivity of 17.41 q/ha (Panda and Ranasingh, 2013). So, Odisha needs about 83,160 kg of jute seed every year for which she depends on jute seed producing southern or western states. The western part of Odisha might be suitable for jute seed production, at least up to the extent to meet own requirement. Moreover, to achieve higher jute fibre productivity for Odisha, timely ensured supply of quality jute seed is a necessity. But so far, there were no systematic effort to study the feasibility of producing jute seeds in the drier areas of western Odisha. In spite of topography, soil condition and rainfall variability during the monsoon season, traditionally only paddy is grown in the western Odisha region, which is unproductive and not profitable (Sarkar *et al.*, 2013[a]). Therefore, with an aim to produce quality jute seed in western Odisha and to enhance farmers profitability, the present study on feasibility of growing jute seed of recent *olitorius* varieties (*since olitorius areas are more than 90% of total jute area*) were tried in Sambalpur district of western Odisha.

2. Materials and Methods

A field experiment was conducted for two consecutive years during the *kharif* seasons of 2010 and 2011 at the Sisal Research Station (a regional research station of ICAR-CRIJAF), at Bamra, in Sambalpur district of Odisha to study the feasibility of growing *olitorius* jute crop for seed production and assessing the quality of the produced seed. The experimental field was located at 22.041°N, 84.295°E, 267 m AMSL. The experiment soil was acidic in reaction *p*H (1:2.5 w/v) in water 5.20, low in organic carbon 3.2 g/kg, having available nitrogen of 187.5 kg/ha, available phosphorus of 33.4 kg/ha and available potassium of 113.5 kg/ha. The mean rainfall of the experimental field during the 23rd to 40th standard meteorological weeks were 882.7 mm. In the field experiment, five recently developed improved *olitorius* jute varieties namely JRO 8432 (Shakti Tossa), JRO 128 (Surya tossa), JRO 204 (Suren), S 19 (Subala), JBO 2003H (Ira) and one earlier developed popular variety (JRO 524 or Navin) were taken for seed production. The six varieties were the 6 treatments replicated 4 times with each plot size of 6 x 5 m^2 (30 m^2) arranged in RBD. Seeds of all the varieties were sown on 4th July in 2010 and on 8th July in 2011. The seed crops were harvested on 15th November in 2010 (at 133 days crop age) and on 12th November in 2011 at 127 days crop age depending on the attainment of maturity of the jute seed crops. At the time of final land preparation, cow dung manure @ 5 kg/m^2 was applied. Out of the total recommended dose of N (60 kg/ha), P_2O_5 (60 kg/ha) and K_2O (60 kg/ha), full dose of P_2O_5 and K_2O were applied as basal at the time of final land preparation. Nitrogen was applied in 3 equal split doses (15 kg/ha) coinciding final weeding (30 DAS), just after topping (45 DAS) and at the time of active branching (65 DAS). The jute seed crop was grown mainly as rainfed in both the years, however only one light irrigation was given at the time of pod formation. Topping was done at 47 DAS and at 44 DAS in 2010 and 2011, respectively, depending upon the general growth of the jute seed crop reaching knee height. Two manual weeding at 15 and 30 DAS were provided to the jute seed crop. Standard plant protection measures were followed as recommended for *olitorius* jute seed crop. Biometrical observations on plant height (cm) at harvest, number of branches/plant, number of pods/plant, number of seeds/pod, test weight (1000 seed weight in g), and seed yield per net plot were recorded. The harvested seeds were then sundried and tested for quality parameters. Seed quality parameters like germination, speed of germination, seedling dry matter (SDM), seedling vigour index (SVI), were assessed in the laboratory. Randomly selected 1000 seeds (7.50 ± 0.05% moisture) were weight up to 3 decimal places in a precision balance (Sartorius Research, Germany) to measure the test weight. Germination test on top of filter paper (Whatman no. 1) was conducted as suggested by Khandakar and Bradbeer, 1983. Mean dry weight (oven dried at 65 °C for 24 hours) of 20 randomly selected normal seedlings collected from each petridish after 96 hours of incubation was considered as seedling dry matter (SDM). Seedling vigour index was calculated by multiplying total germination count (after 96 hours of incubation) with SDM as suggested (Ram *et al*., 1991). Speed of germination was computed by dividing the number of normal seedlings removed each day by the day on which they are removed from 4 replications of 100 seeds and by adding the quotients of daily counts divided by the number of days of germination as depicted below (Sen and Ghosh, 2006):

$$\text{Speed of germination} = \frac{n1}{d1} + \frac{n2}{d2} + \frac{n3}{d3} + \frac{n4}{d4}$$

where, $n_1 \ldots n_4$ are the number of seedlings removed corresponding to the day number of removal i.e., $d_1 \ldots d_4$

3. Results and Discussion

3.1 Seed yield parameters

3.1.1 Plant height at harvest

The plant heights of different varieties of *olitorius* jute crop grown in Sambalpur were varied significantly (Table 1). The highest plant height was recorded for JBO 2003H (254 cm), followed by JRO 524 (245 cm) and the lowest plant height was 213 cm for JRO 128.

3.1.2 Total number of branches per plant

The number of branches among the different *olitorius* varieties not differed significantly (Table 1). However, JRO 204 and S 19 produced the maximum number of branches (7/plant) closely followed by JRO 524 (6.5/plant).

3.1.3 Number of pods per plant

Number of pods/plant differed significantly among the different *olitorius* varieties considered in this experiment (Table 1). The maximum number of pods/plant was observed in JRO 8432 (30.5) and JBO 2003H (30), closely followed by JRO 524 (29.7). Whereas, S 19 produced the minimum number of pods/plant (26).

Table 1. Yield parameters and seed yield of different varieties of *olitorius* jute at western Odisha (pooled data of two years)

Varieties	Plant height (cm)	No. of branches/plant	No. of pods/plant	No. of seeds/pod	1000 seed weight (g)	Seed yield (kg/ha)
JRO 524	245	6.50	29.7	227	1.902	875
JRO 8432	225	6.25	30.5	214	1.837	933
JRO 128	213	6.50	27.0	251	1.747	767
JRO 204	237	7.00	27.0	223	1.842	733
S 19	236	7.00	26.0	217	1.962	725
JBO 2003H	254	6.25	30.0	247	1.847	751
LSD (0.05)	24.19	NS	2.97	9.70	0.112	60.6

3.1.4 Number of seeds/pod

Number of seeds/pod also differed significantly among the different *olitorius* varieties (Table 1). The maximum number of seeds/pod was recorded in JRO 128 (251) and JBO 2003H (247), closely followed by the number of seeds/pod obtained in JRO 524 (227). The minimum number of seeds/pod was recorded in JRO 8432 (214).

3.1.5 Test weight

Test weight of (1000 seed weight) of *olitorius* jute seed differed significantly among the different varieties (Table 1). The highest 1000 seed weight of 1.962 g was measured for S 19, followed by JRO 524 (1.902 g). The lowest test weight was found in JRO 128 (1.747 g). Similar values for jute seed produced at Paschim Medinipur district was reported earlier (Sarkar and Banerjee, 2014).

3.1.6 Seed yield

In general the seed yield of all the *olitorius* jute varieties were comparatively better which might be due to favourable weather and appropriate crop management. The seed yield of different *olitorius* varieties differed significantly at Sambalpur (Table 1). The highest seed yield obtained was 993 kg/ha

in JRO 8432 and 875 kg in JRO 524. Seed yield of all other *olitorius* varieties were very similar and varied narrowly (between 767 and 725 kg/ha). The jute seed yield obtained at western Odisha was much better than the seed yield recorded in *terai* region of West Bengal (Patra *et al*., 2016). It was reported (Bhattacharjee *et al*., 2000) that with proper nutrient management the *olitorius* jute seed yield from fertile southern part of West Bengal might reach up to 1182 kg/ha ($N_{60}P_{60}K_{60}$ kg/ha). It was also reported that in Gangetic West Bengal condition, the highest jute seed yield of 759 kg/ha was obtained in JRO 524 with 40 kg K_2O (Mondal *et al*., 2003). Similar efforts for jute seed yield maximization had been taken for West Bengal, Maharashtra and Tamil Nadu (Sarkar *et al*., 2013[b]).

3.2 Seed quality parameters

3.2.1 Germination

Germination of the produced jute seeds of all the varieties were assessed and it differed significantly among the varieties (Table 2). The highest germination% was recorded in JBO 2003H (99%), JRO 524 (98.33%) and JRO 204 (97.50%). In case of JRO 8432 and JRO 128, the germination % was comparatively lower (85.8-85.0%). The observed germination percentage of all the varieties were well above the minimum standard germination percentage of 80% prescribed for jute (Anonnymous, 2013).

Table 2. Seed quality of different varieties of olitorius jute produced at western Odisha (Pooled data of two years)

Varieties	Germination %	Speed of germination	Seedling weight (mg)	Vigour index
JRO 524	98.33	90.57	17.0	1672
JRO 8432	85.00	49.87	17.0	1445
JRO 128	85.83	64.35	12.0	1030
JRO 204	97.50	67.17	19.0	1853
S 19	97.50	61.62	20.0	1950
JBO 2003H	99.00	91.83	18.0	1782
LSD (0.05)	6.87	12.54	1.63	154.80

3.2.2 Speed of germination

Speed of germination of jute seeds varied significantly among the different *olitorius* varieties (Table 2). The computed data on the speed of germination of jute seeds produced at Sambalpur revealed that there are distinct 3 groups of jute seed belong to 3 speed of germination groups. In the '*fast germinating group*', the varieties are JBO 2003 H (91.83) and JRO 524 (90.57); in the '*medium germinating group*', the varieties are JRO 204 (67.17), JRO 128 (64.35) and S 19 (61.62). JRO 8432 (49.87) belongs to the '*slow germinating group*'.

3.2.3 Seedling dry weight

The total dry weight of seedlings (20 nos.) differed significantly among different varieties (Table 2). The highest 20 seedlings weights were recorded in S 19 (20 mg) closely followed by JRO 204 (19 mg). Whereas, the lowest seedling weight was recorded in JRO 128 (12 mg).

3.2.4 Vigour index

Seed vigour index differed significantly among the different varieties (Table 2). The maximum vigour index were recorded in S 19 (1950), followed by JRO 204 (1853). The lowest vigour index was recorded in JRO 128 (1030).

Table 3. Seed production economics of different varieties of olitorius jute at western Odisha (Pooled data of two years)

Varieties	Cost of cultivation (₹ ha^{-1})	Gross return (₹ ha^{-1})	Net return (₹ ha^{-1})	Net return per rupee investment
JRO 524	42,685	87,500	44,815	1.05
JRO 8432	42,685	93,300	50,615	1.18
JRO 128	42,685	73,300	30,615	0.72
JRO 204	42,685	76,700	34,015	0.80
S 19	42,685	72,500	29,815	0.70
JBO 2003H	42,685	75,100	32,415	0.76

3.3 Jute seed production economics

The total cost of production for one ha of jute seed was ₹ 42,685/ha at Sambalpur (Table 3). The highest net return was obtained in case of JRO 8432 (₹ 50,615/ha) followed by JRO 524 (₹ 44,815/ha) due to higher seed yield and assuming that the price of jute seed for all the varieties are same (i.e. ₹ 100/kg). Similarly the net return per rupee investment was the maximum in JRO 8432 (1.18) closely followed by JRO 524 (1.05). However, in the days to come the price of jute seed may vary according to the variety preferred by the farmers due to specific traits in a variety. Therefore, the profitability might be increased even if the total seed yield may be comparatively lesser than JRO 8432.

4. Conclusion

From the field study, it could be concluded that quality *olitorius* jute seed production can be taken up in Sambalpur, Sundargarh and adjacent areas owing to congenial climatic condition during July-November/December and the endeavour is better remunerative than the traditional paddy cultivation for western Odisha.

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