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JRC 9057 (Ishani): a newly developed white jute (*Corchorus capsularis* L.) variety for enhanced fibre yield and improved quality textile fibre

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Abstract

Jute is one of the most affordable natural fibers and it is second only to cotton in amount produced and variety of uses of vegetable fibers. Jute fibres are eco-friendly, biodegradable and recyclable in nature and hence it create pollution free environment. In modern era of growing environmental friendly crops, the role of jute as 'Green Crop' may be highlighted and the significance of this commercial crop will be not only to produce fibre for industries as raw material but also the equivalent impact on balancing and conditioning the soil-air-environment. So the production of jute fibres assumes high socio-economic as well as environmental significance. Among the two species of jute (*Corchorus olitorius* L. and *Corchorus capsularis* L.) fibre made from *C. capsularis* is whiter and of a higher quality than that made from *C. olitorius*. The cultivation of white jute (*C. capsularis* L.) is very specific and native to India particularly to Eastern states. The white jute can be grown comparatively in low land situation and even under moisture stress and water logged situation. Keeping in mind, a variety (JRC 9057) of high yielding and better quality fibre have been developed from the selection of the progenies of JRC 698 X CIJ 121 following pedigree method. The selection has been made for quality textile fibre coupled with high yield. For this purpose, pedigree of CIJ 121 was selected for quality and JRC 698 was used to incorporate high yield. This variety is mainly suitable for low and medium land rainfed situation and areas where jute is cultivated followed by transplanted aman paddy.

Keywords: White jute (*Corchorus capsularis* L.), finer fibre, textile fibre, pedigree selection and high yielding

Introduction

Jute is known as the 'Golden Fibre of India' due to its golden brown colour and its importance that impart 0.42% of gross cropped area, provides livelihood to more than 40 lakh farm families. It also provides direct and indirect employment to another 10 lakh people in the industrial sector. The fibre is extracted from the cut stems by retting in water, removing the soft tissue, curing the fibre and drying it. In terms of usage, production and global consumption, jute is second only to cotton. It is used for making sacks, bags, carpets, curtains, fabrics and paper. It is the fibre used to make hessian sacks and garden twine. *C. olitorius* and *C. capsularis* are the main sources of jute. The world production is concentrated in India and Bangladesh, where the crop grows well in the Ganges and Brahmaputra floodplains and delta region.

Jute is environmentally friendly as well as being one of the most affordable fibres; jute plants are easy to grow, have a high yield per acre and, unlike cotton, have little need for pesticides and fertilizers. Jute is a bast fibre, like flax and hemp, and the stems are processed in a similar way. Jute is extracted from the bark of the white jute plant, *Corchorus capsularis* and to a lesser extent from tossa jute (*C. olitorius*). Jute fibres are very long (1 to 4 metres), silky, lustrous and golden brown in colour. In contrast to most textile fibres which consist mainly of cellulose, jute fibres are part cellulose, part lignin. Cellulose is a major component of plant fibres while lignin is a major component of wood fibre; jute is therefore partly a textile fibre and partly wood. Jute is the most important bast fibre crop of the world being cultivated in Eastern India, Bangladesh, Nepal and some South East Asian countries, and is second only to cotton in terms of production and variety of uses (Islam *et al.*, 2013) ^[1].

Now a day, jute is facing a tough competition from synthetic fibres, it is apparent that production of one ton of polypropylene emits 3.7 tonnes of CO₂, whereas one hectare of jute consumes around 15 tonnes of CO₂ in 100 days indicating the environment friendly effect of jute fibre. So in recent days, the demand for natural fibre based products is increasing continuously.

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There is a great demand for quality fibre in the industry for the production of value added diversified jute based products. The variety JRC 9057 (ishani) has a good combination of better fibre yield and improved quality textile fibre. This variety has also best amalgamation of tenacity (17.31g/tex) and fineness (1.31 tex) which may be used for the production of finer count blended yarn. It is expected that this variety will meet the requirements of the farmers as well as the industry.

Breeding objectives: To improve a white jute variety with higher yield and productivity with superior fibre quality useful in textile industries and resistance to biotic stresses than the established checks viz. JRC 698 and JRC 321.

Parentage and breeding techniques utilized: The variety JRC 9057 (ishani) has been developed by the Division of Crop Improvement, ICAR-Central Research Institute Jute & Allied Fibres (ICAR-CRIJAF), Barrackpore from the selection of progenies of JRC 698 X CIJ 121 following pedigree method. The selection has been made for quality textile fibre coupled with high yield. For this purpose, pedigree of CIJ 121 was selected for quality and JRC 698 was used to incorporate high yield.

Special recommendation of this variety: Jute is basically a rainfed crop and sowing is generally done with the onset of northwestern monsoon from March to mid-April to facilitate harvesting in July. It has to face water stagnation in later stage of growth. Thus, premature flowering resistance and flood tolerant variety can be effective to combat with this crop

season. With these characteristics the variety JRC 9057 will ensure effective premature flowering resistance along with its suitability to grow in low laying area. This variety provided 9.35% higher yield as compared to JRC 698 that will ensure better profitability to farmers.

This variety can be sown even in first week of March, as it possesses premature flowering resistance like other *C. capsularis* varieties and may be laying area also. At present, jute product diversification needs quality fibre. Jute based geo-textile needs more strength but textile industry needs finer fibre. The finer quality of fibre along with higher fibre strength of JRC 9057 can be suitably utilized for manufacturing jute-cotton blended yarn and fabrics. This variety is also resistance to diseases and pest will help to ensure better productivity.

Area of adaptability and production ecology: Jute is basically a rainfed crop and sowing is generally done with the onset of northwestern monsoon from March to mid-April to facilitate harvesting in July. White jute variety, JRC 9057 is mainly suitable for mid and highland rainfed situation of high humid areas having alternate rain and sunshine and areas where jute is cultivated followed by transplanted aman paddy under rainfed agro-ecosystem. This variety is adapted to entire white jute growing belt of India such as Bihar, Orissa, Uttar Pradesh, Maharashtra, Chhattisgarh, Andhra Pradesh and Assam etc for sowing during March to last week of April.

Salient varietal characteristics: The salient features are narrated in a tabular format below-

S. No.	Characters	Features
1.	Growth habit	Medium branching with rudimentary auxiliary buds on leaf axils
2.	Stem	Cylindrical
3.	Stem color	Green stem with light red pigmentation, 1.5-2.2cm in diameter
4.	Plant height (cm)	335-350
5.	Leaf shape	Ovate-lanceolate
6.	Leaf length and breadth ratio	2.76
7.	Leaf color	Green
8.	Leaf area (cm ²)	34.5
9.	Leaf angle	52°
10.	Fruit	Non-dehiscence
11.	Pod colour	Green
12.	Pod shape	Capsule type in shape
13.	Seed coat color	Chocolate brown
14.	Harvestable maturity (from seedling to flowering for early March sown crop)	100-120 days
15.	Harvestable maturity (Seed to seed for early August sown crop)	140-150 days
16.	Flower: Petal color	Yellow
17.	Days to flowering (50%)	115-130 days
18.	Seed test weight (g)	3.0-3.2g
19.	Fibre yield (Average)	28.06q/ha
20.	Stick yield (Average)	65.0q/ha
21.	Fibre strength (g/tex)	17.31g/tex
22.	Fibre fineness (tex)	1.31tex
23.	Fibre grade	W ₄ (Good)
24.	Resistant to diseases	Higher tolerance to stem rot and jute semilooper

Selection of field/land preparation: Due to small seeds, land should be brought to fine tith by 2-3 ploughing and harrowing. The soil should have sufficient moisture at the time of germination.

Seed treatment: To reduce the incidence of seed borne pathogens seed treatment with Bavistin (2g/kg) or Captan (5g/kg) or Diathane M-45 (5g/kg) and dry in shade overnight before sowing may be done. Carbaryl (0.1%) or Cypermethrin (0.03%) may be recommended for the management of the hairy caterpillar, stem weevil etc.

Sowing time: Suitable sowing time for fibre production is 15th March to 15th April to facilitate harvesting in July. It may be sown in 1st week of March as JRC 9057 ensures premature flowering resistance and flood tolerance. Optimum sowing time for seed production of this variety is in between 1st week of August to 2nd week of September.

Reaction to disease & pest control: JRC 9057 variety exhibits higher tolerance to stem rot (most damaging diseases) and jute semilooper than both the check varieties. This variety showed 13.90% and 87.76% more tolerant to stem rot than checks JRC 698 and JRC 321 respectively.

Harvesting: Approximate time for harvesting of JRC 9057 variety is 100-120 DAS for better quality fibre and higher fibre yield. For seed production, the variety attains its seed to seed maturity in about 140-150 days.

Yield: Under the aegis of All India Network Project on Jute & Allied Fibres (AINP on JAF), Initial Evaluation Trial (IET) were conducted in randomized block design in six locations viz. Bahrich, Kalyani, Kendrapara, Katihar, Nagaon and Coochbehar. JRC 9057 yielded 31.16q/ha fibre, that out-yielded the check varieties JRC 698 (28.84q/ha) by 8.04% and JRC 321 (27.75q/ha) by 12.29% over locations. However, highest yield was recorded in Nagaon (40.51q/ha). During Advance Varietal Trials I (AVT-I) in seven locations viz. Bahrich, Kalyani, Kendrapara, Katihar, Nagaon, Barrackpore and Coochbehar it produced 24.63q/ha that outperformed the check varieties JRC 698 (22.37q/ha) and JRC 321 (22.95q/ha) by 10.10% and 7.32% respectively. Highest yield was recorded in Coochbehar (30.15q/ha). In Advance Varietal Trials II (AVT-II), JRC 9057 (28.97%) out yielded check varieties JRC 698 (26.32q/ha) and JRC 321 (24.54q/ha) at seven locations by 10.06% and 18.05% respectively. The highest yield was recorded in Coochbehar (35.71%). The Adaptive Trials were conducted in farmer's fields at nine locations in West Bengal, Odisha, Bihar, Assam and UP. JRC 9057 (31.36q/ha) out yielded the check JRC 698 and JRC 321 by 4.47% and 6.06% respectively. The highest yield was recorded in Tejwapura, U.P. (35.80q/ha). The pooled data of all the trials indicated 9.35% and 12.42% superiority of JRC 9057 over check varieties JRC 698 and JRC 321 respectively. On an average, this variety produces 28.06q/ha fibre and 65.0q/ha stick yield. It performed better than both checks in 12 trials out of 19 over different locations.

Fibre quality: At present, jute product diversification needs quality fibre. Jute based geo-textile needs more strength but textile industry needs finer (indicating low lignin content) fibre. The finer quality of fibre along with higher fibre strength of JRC 9057 can be suitably utilized for manufacturing jute-cotton blended yarn and fabrics. The fibre of JRC 9057 have less body defects and hard root content as reported by ICAR-National Institute for Research on Jute and Allied Fibres Technology (ICAR-NIRJAFT), Tollygunj, Kolkata. JRC 9057 contributes a good combination of fibre strength 17.31g/tex that exhibits 7.60% and 3.24% stronger fibre than the check varieties JRC 698 (16.09g/tex) and JRC 321 (16.77g/tex) respectively offer an additional benefit of better fibre quality. It can also contribute finer quality fibre having fineness of 1.31tex that exhibits 4.24% and 0.85% finer fibre than the check varieties JRC 698 (1.37tex) and JRC 321 (1.32tex) respectively that offers a significant importance

in textile industry. This variety also has higher graded fibre of W₄ grade comparable with both the checks that ensure the manufacturing of jute-cotton blended yarn and fabrics.

Special recommendation for seed production: Sowing in 1st week of August to 2nd week of September is recommended for seed production with the row to row spacing of 35-40cm. Detopping should be at 30-35 DAS and rouging should be done at regular intervals.

Availability of seed: The quality seed of the variety is available at the ICAR-Central Seed Research Station for Jute & Allied Fibres (ICAR-CSRSJAF), Budbud, Burdwan, West Bengal. Seed can also be obtained from ICAR-Central Research Institute Jute & Allied Fibres (ICAR-CRIJAF), Barrackpore, Kolkata, West Bengal.

Summary: In India, only few varieties of white jute have been released so far for commercial cultivation. Farmers have very little choice to opt for suitable varieties for a particular agro-ecological situation. JRC 9057 owing to its 8-10% higher yield, better fibre tenacity as well as resistant to major diseases (stem rot) and pest (semilooper, hairy caterpillar) has become more acceptable to the farmers as compared to the existing varieties. The variety will also eliminate the risk of cultivation of few varieties in larger areas and ultimately minimize the risk of vulnerability of crop to diseases and pests as it may lead genetic diversity in niche areas of its cultivation. JRC 9057 (28.06q/ha) out yielded over check varieties JRC 698 (25.66q/ha) and JRC 321 (24.96q/ha) by 9.35% and 12.42% respectively. JRC 9057 contributes a good combination of fibre strength 17.31g/tex that exhibits 7.60% and 3.24% stronger fibre than the check varieties JRC 698 (16.09g/tex) and JRC 321 (16.77g/tex) respectively offer an additional benefit of better fibre quality. It also give better fibre fineness of 1.31 tex that exhibits 4.24% and 0.85% finer fibre than the check varieties JRC 698 (1.37tex) and JRC 321 (1.32tex) respectively. Under optimum crop management it has a yield potential of 40q/ha also. Due to these reason, it is recommended for cultivation in entire white jute growing belt of the country.



Fig 1: General view of the variety, JRC 9057 (ishani) at 35 DAS.

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