

Original Article

Seed Quality of Two *Corchorus* spp. Collected from Different Sources in Bangladesh

Md. Mahbubul Islam*

Chief Scientific Officer & Head, Agronomy Division, Bangladesh Jute Research Institute,
Manik Mia Ave., Dhaka, Bangladesh

ABSTRACT

Bangladesh annually requires about five thousand metric tons of jute seeds to grow in about 0.81 million hectares of land. About 10-12% of jute seeds are produced under the supervision of the Bangladesh Agricultural Development Corporation (BADC) and the rest of the seeds are produced and managed by the farmers' themselves. Due to prolonged stay in the field, this jute seed crop is affected by the traumatic events including drought, hailstorm, heavy shower, flood, diseases and insect pest infestation. This crop can become physiologically weak, leading to production of low yield of poor quality seeds. The study aimed to determine the quality of jute seeds collected from five different sources in Bangladesh. Two jute varieties, CVL-1 of *Corchoruscapsularis* L. and O-9897 of *C. olitorius* L. were used as study materials. For both varieties, treatments were comprised from five different seed sources: Bangladesh Jute Research Institute (BJRI), Bangladesh Agricultural Development Corporation (BADC), farmers' of two jute growing areas, and a local market. The experiments were laid out using completely randomized design with four replications. Results revealed that seeds from BJRI and BADC of both the jute varieties showed better quality in terms of vigor and pathogen incidence compared to seeds from farmers' and local markets. BJRI and BADC seeds showed lower moisture content and inert matter whereas these two variables were high in farmers' seed. Higher moisture content was associated with low germination and vigor index of farmers' and market seeds for both jute varieties. Lower moisture content of BJRI and BADC seeds showed higher germination and vigor index. Seeds of both the varieties started to germinate within one day and more than 70 percent was recorded on the second day. The relationship among germination, vigor index and purity were significant and positive. Based on seed quality attributes observed, BJRI seeds seem to be the best than all other seeds tested.

KEYWORDS: *Corchorus* Spp., seed quality, source, germination, vigor index

1 INTRODUCTION

Jute is a cash crop of Bangladesh. It is grown in the summer season (Kharif-I). In 2010-2011, 0.803 million ha land cultivated for jute. Production of raw jute was 1.5 million MT by volume in 2010-2011. Jute cultivation area was 6% of total land area of 13 million ha, of which 8.44 million ha belongs to agricultural land. Jute cultivation area was 10% of agricultural land area. Jute production was 26% as of all agricultural crops (IJSG, 2012).

Quality seed of high yielding variety is the key for better crop establishment and yield. Seed quality is a multiple concept comprising several components that include. Physical purity, species purity, freedom from weed seed, cultivars' purity, germination capacity, viability, vigor, seed size, seed health and moisture content (Thomson, 1979). Unless the seeds are good quality the use of other inputs and technologies of crop production would become meaningless.

Bangladesh requires about 5,000 metric tons of jute seeds of which only 12-15% is produced and distributed by Bangladesh Agricultural Development Corporation (Salim *et al.*, 1998). The rest of seeds is solely produced and utilized by the farmers'. The quality of farmers' seed is not maintained during production, processing and storage. In many cases, farmers' collect their seeds from their friends or neighbors and thus, there is no specific system to control the quality of seeds. Hence, it is conceived that the quality of seeds produced by majority of the farmers' is of low standard. Also, there is very little information regarding the level of farmers' knowledge on the production of jute seed and method of quality testing before sowing. Farmers' sometimes get good germination and good crop, but in most cases they get poor germination and a poor crop, and occasionally seeds do not germinate which results in total crop failure (Hossain *et al.*, 1994a; Islam, 2009).

The quality status of jute seed at farm level is very poor and farmers' are normally ignorant of seed quality and quality evaluating tests. Farmers' are not aware of the germination percentage, vigor value, pathogens associated with seeds and percentage of moisture in their seeds. Although, there are many researches on the quality of the seed, no effort has yet been made to evaluate the quality of seed at farm level despite 75% of the total requirements of the jute seed are solely

*corresponding author: mahbub_agronomy@yahoo.com

p-ISSN: 2599-4875 e-ISSN: 2599-4980

©Cebu Technological University, R. Palma St. corner M.J. Cuenco Ave., Cebu City, 6000 Philippines

produced and distributed by the farmers'. If it is possible to address and appreciate the seed growers about their seed problems and help understand them to assess quality of jute seeds, they could establish it as a profitable enterprise.

Kenaf seed germination percentage and vigor index were affected significantly due to seed moisture content at different month of testing during the period of storage. Aluminum foil bag, plastic pot, polythene bag and tin container at 8% and 10% moisture maintained more than 80% germination after 12 months of storage while those stored at 12% maintained above 80% germination for up to 6 months. On the other hand, seeds stored in aluminum foil bag, plastic pot, polythene bag and tin container at 14% SMC reached below 80% germination after 8 months of storage. Germination percentage and seed vigor index and moisture content of kenaf seed at different months of testing during storage period varied significantly (Mollah *et al.*, 2015).

Farmers' conventionally sow seeds in the month of March-April for fiber production and a part of the crop is kept for seed production. The seeds of the remnant part of fiber crop get matured in the month of October. Due to prolonged stay in the field, this seed crop is affected by the traumatic events like drought, hailstorm, heavy shower, flood, diseases and insect pest infestation and it becomes physiologically weak and produces low yield of poor quality seeds (Ali, 1984; Hossain *et al.*, 1994a). Subsistent jute farmers' sometimes cannot afford the public-sector seeds. In Bangladesh, there are many jute seed sources, and it is important to determine their quality. Therefore, the present study was designed to assess the quality attributes and vigor of jute seeds collected from different seed sources in Bangladesh.

2 MATERIALS AND METHODS

The study was conducted at the Agronomy laboratory, Crop Management Department, Agronomy Division of Bangladesh Jute Research Institute (BJRI), Dhaka. The seeds of jute varieties CVL-1 of *Corchorus capsularis* L. species and O-9897 of *Corchorus olitorius* L. species were used as study materials. The treatments consisted of five sources of seeds CVL-1 and that of O-9897. They were obtained from the BJRI, BADC, farmers' of two jute growing areas and local market. The farmers' and local market seeds of CVL-1 were collected from Manikganj and Kishoreganj and that of O-9897 from Faridpur and Rangpur jute growing areas.

At least 250 g of farmers' seed samples were collected from 20 farmers of each jute growing areas. The local market seed samples were collected from local markets of the same areas as farmers'. Primary seed samples of farmers' and local market were mixed thoroughly to make a composite sample for both the species. About 500 g of each composite samples were taken as submitted samples. The submitted seed samples were kept in brown paper bags. All the seed samples collected from different seed sources were

labeled properly and preserved in Gene Bank of BJRI at 20o-C until the samples were used for conducting experiments. Working seed samples were taken time to time from the preserved seed samples as per requirement. The experiment was designed by Completely Randomized Design with five replications. Total procedure was maintained following the rules of ISTA (ISTA, 1999). The seeds were collected immediately after the harvest of jute seed crop. All seed quality attributes data were collected and analyzed statistically. Percentage data of seed germination, seed moisture content, and presence of pathogens were analyzed after square root transformation. Treatment mean differences were adjudged following level of significance (0.05 and 0.01%) (Gomez and Gomez, 1984).

Determination of Moisture content: Moisture content of the seeds of different sources was tested for both CVL-1 and O-9897. The collected seed samples were tested in the laboratory for moisture content following the oven-dry method (Khandakar, 1980). About 2 g seeds of each sample were weighed and kept in the oven for 24 hours at 100°C.

$$\text{Moisture content (\%)} = \frac{(m_2 - m_3)}{(m_2 - m_1)} \times 100$$

Where,

m_1 = weight of crucible + lid

m_2 = weight of crucible + lid + fresh seed and

m_3 = weight of crucible + lid + dried seed

Determination of seed purity: Fifteen grams of each working sample was measured with an analytical balance and carefully examined and separated on purity board into the following: i) Pure seed, ii) Other seeds, and iii) Inert matter (SCA, 2000). After separation, the component parts were separately weighed and percentage of each component was worked out and recorded. All the three components were weighed together to verify any loss due to handling.

Determination of seed germination: Germination test was carried out in an incubator at 30±1o-C. One hundred seeds with four replications were evenly distributed on the top of four filter papers placed in four glass petri dishes. The seeds and filter papers were kept moist throughout the test period by adding water. Seeds that germinated were counted and recorded daily until the fifth day. A seed was considered to have germinated if the seed coat ruptured and radicle came out up to 0.2 cm or length. Germination percentage was calculated using the following formula (Krishnasamy and Seshu, 1990; Islam, 2009).

$$\text{Germination (\%)} = \frac{\text{Number of seeds germinated}}{\text{Number of seeds tested}} \times 100$$

Determination of 1000- seeds weight: For 1000 seed weight determination, one thousand seeds of jute were randomly counted from each pure seed sample and weighted in an electronic balance (Model-PC-180). Thousand seeds weight was also calculated at specific moisture content by following Seed Testing Manual (SCA, 2000).

$$1000 - \text{seed weight} = \frac{\text{Weight of 1000 - seeds (100 - moisture content at counting)}}{100 - \text{Weight at which moisture content is required}}$$

Determination of seed Vigor: This test was conducted in the laboratory with same procedure as that of laboratory standard germination test. Vigor (Vigor value) was calculated by following the method of Jain and Saha (1971).

$$V = \frac{a}{1} + \frac{b}{2} + \frac{c}{3} + \dots$$

Where, V= Vigor value, and a, b and c are the number of seeds that germinated after 1st, 2nd and 3rd days from the start of germination test. The final count was made at the end of 5th day. Co-efficient of germination was calculated from above recorded data using the formula of Copeland (1976 Islam, 2009).

$$\text{Co - efficient germination} = \frac{100 (A_1 + A_2 + \dots + A_x)}{A_1 T_1 + A_2 T_2 + \dots + A_x T_x}$$

Where, A = number of seed germinated, T = time corresponding to A and x = number of days to final count.

Evaluation of seedling growth: Seedlings obtained from standard germination test were used for seedling growth. Normal and abnormal seedlings were classified according to the rules of the Association of Official Seed Analysts (AOSA, 1981). Seedling shoot and root lengths (cm) were measured on 5th day of the germination test. Ten seedling samples from each petri dish were collected randomly. Shoot and root lengths (cm) of individual seedlings were recorded. Ten seedlings were counted to form one replication and three replications were formed in this way for each treatment. The shoot and roots were dried at 70°C for 72 hours for dry matter yield. Length and weight basis root-shoot ratio was calculated by following the method of Khandakar (1994) to estimate root efficiency to support production.

$$\text{Root - shoot ratio (length)} = \frac{\text{Root length (cm)}}{\text{Shoot length (cm)}}$$

$$\text{Root - shoot ratio (weight)} = \frac{\text{Root weight (g)}}{\text{Shoot length (g)}}$$

Assessment of seed pathogen: Pure seed samples were examined in the Pathological Laboratory of the BJRI to observe the association of pathogen with the seeds. After germination, seeds were examined with the microscope and the following pathogens were recorded.

- i) *Macrophomina phaseolina* (Stem rot),
- ii) *Botrydiplochia theobromae* (Black band) and
- ii) *Colletotrichum corchori* (Anthracnose).

3 RESULTS AND DISCUSSION

Moisture content

Seed sources showed significant difference in seed moisture content (Table 1). The highest moisture of 14% was obtained in market seeds of CVL-1 and 13% in farmers' seed of Rangpur of O-9897. In CVL-1, farmers' seed of Kishoregonj location and seed's

moisture content were insignificant ($p > 0.05$). However, in O-9897 farmer seed of Rangpur was statistically identical to local market seed. Jute seed collected from farms of different locations contained higher moisture than BJRI and BADC sources. Jute seed of BJRI and BADC of CVL-1 and O-9897 contained 9.3% and 10.8%; 9.4% and 10% moisture respectively, whereas, farmers' and local market seed contained much higher moisture content of 13.6, 13.9 and 13.9% in CVL-1 and 11.9, 12.9 and 12.1 in O-9897 (Table 1). Low moisture content in BJRI and BADC seeds might be due to proper sun drying and storage. Lower moisture content of BJRI and BADC seeds had better planting value as Sobhan and Khatun (1986) reported that jute seed with a moisture content of 4 to 7% maintained more than 85% viability up to twelve months even at room temperature. The above results are in partial conformity with those of Islam *et al.* (1999) and Islam *et al.* (2002) who reported variations in moisture content of jute, kenaf and reselle seeds and it is in full agreement with that of Hossain *et al.* (1994b) who observed all categories of farmers' (ranged 5-10 per cent).

Germination

Rate of germination of different seeds varied widely due to sources for both the species (Fig. 1 and 2). It was found that jute seed started to germinate within a day and most seeds germinated (>70%) on the second day. However, all the seeds of different sources of both species required four to five days to complete germination. Seeds of CVL-1 germinated faster than O-9897 within the first day. BJRI and BADC seeds of both species germinated faster than all other seed sources. The highest germination of 95% was found for O-9897 and 89% for CVL-1 with BJRI sources, followed by BADC 92% for O-9897 and 87% for CVL-1.

The germination percentage differed significantly ($P < 0.05$) due to different seed sources. Lower but above 80% germination was observed in farmers' seeds of different locations and local market sources for both the varieties. The standard percentage of germination was 80% for both the jute species. Lower germination rates were observed in case of seeds of CVL-1 seeds. The lowest germination (81%) was observed in CVL-1 seed of farmers' in Manikgonj while 82% in local market sources and 85% in Kishoreganj. The highest (89%) germination was observed in BJRI seeds for CVL-1 seed followed by BADC seed (87%) (Table 1). Verma and Arora (1978) observed jute variety CVL-1 seeds required eight days while O-9897 five days to complete germination at 30°C. Germination percentage was however enhanced with increased temperature. Jain and Saha (1971) reported that more than 90% seed of both the species germinated within the first day at 30°C.

Irrespective of seed sources, germination in O-9897 was lower (ranged from 25 to 35%) than CVL-1 (about 42 to 68%). Hossain *et al.* (1994) observed that

seed samples collected from different survey sites gave mean germination rate ranging from 31-66% when applied to all categories of farmers', which was far below the expected or recommended minimum rate of 80 per cent. It was very unfortunate that about 50 per cent seed samples contained moisture above 10.22 to 13.38 per cent. So, those samples were very uncertain to retain proper seed viability. Lower germination of farmers' seed may be due to higher infestation of pathogen which have negative relationship between pathogen per cent and germination of jute seeds. Islam *et al.* (1999) and Islam *et al.* (2002) reported that germination percentage differed significantly among the jute, kenaf and reselle.

Thousand seeds weight

The seeds of CVL-1 have higher weight than that of O-9897 (Table 1). Thousand seed weight of CVL-1 species varied from 3.14 to 3.38g and that of O-9897 ranged from 1.76 to 2.11g. Farmers' and local market seed weights were statistically identical. The lowest seed weights were observed in BJRI seed (3.14g) for CVL-1 variety. Lower seed weight was observed in BJRI and BADC in O-9897, whereas higher seed weights were found in farmers' seeds of two locations and local market seeds. As seed size differs for location of pod in the plant and location of seeds in the pod, seed grading may help in collecting better seed weight for future use. Lack of knowledge about seed grading

might be the possible cause of lower size of farmers' and local market seed. At Manikgonj and the lowest in Kishoreganj. On the other hand, in O-9897, the highest seed size was found in BJRI seed followed by BADC. The lowest (2.11g) was observed in farmers' jute seed of Rangpur (Table 1). Talukder and Ali (1977) reported that *C. capsularis* L. fruits are 1.0 to 1.5 cm in diameter, and round. Seeds, 7 to 10 in number are arranged in two rows without transverse partition in each of 5 chambers. There are 35 to 50 seeds in each fruit. On the other hand, in *C. olitorius* L. the fruit contained 25 to 40 seeds arranged in a single row having transverse partition between the seeds. There are 125 to 200 seeds in each fruit of *C. olitorius* L. Jute seed are not round. They are pyramidal in shape having 4-5 faces. The *C. olitorius* L. seeds are smaller than *C. capsularis* L. Talukder and Akanda (1994) reported that among the pre-harvest factors, the effect of photoperiod is presumably very high on the quality of jute seed because, jute crop planted under exorbitant short photoperiodic condition gives lower 1000-seed weight and lower seed viability. Islam *et al.* (1999) revealed that number of seed per litter, volume per kg seeds, germination percentage, vigor value and moisture percentage differed significantly among the crops jute, kenaf and reselle. Choudhury (1994) reported that germination capacity of jute seeds correlated with seed weight. The seed weight factor influenced total germination as well as speed of germination.

Table 1. Quality attributes of CVL-1 and O-9897 seed as affected by seed sources

Treatments (Seed sources)	Moisture Content (%)	1000-seed weight (g)	Germination (%)	1000-seed weight at 9% moisture (g)
CVL-1				
BJRI	9.26 d (3.13d)	3.14b	89a (9.44a)	3.13
BADC	10.78 c (3.36c)	3.24b	87ab (9.37ab)	3.18
Farmer (Manikgonj)	13.02 b (3.68b)	3.36a	81d (9.01d)	3.27
Farmer (Kishoreganj)	13.87 a (3.79a)	3.38a	85bc (9.22bc)	3.20
Local market	13.93 a (3.80a)	3.36a	82cd (9.09cd)	3.21
Level of significance	0.01	0.05	0.01	-
O-9897				
BJRI	9.44c (3.15c)	1.76b	95a (9.75a)	1.75
BADC	9.96c (3.23c)	1.87b	92a (9.64a)	1.85
Farmer (Faridpur)	11.85b (3.51b)	2.17a	82b (9.10b)	2.10
Farmer (Rangpur)	12.84a (3.65a)	2.11a	84b (9.19b)	2.02
Local market	12.13b (3.55b)	2.05a	83b (9.15b)	1.98
Level of significance	0.01	0.01	0.01	-

In a column data having common letter(s) do not differ significantly by DMRTat 5% and 1% level of probability. Transformed data in the parenthesis.

Seed purity

Percentage of pure seeds was higher for both the species in BJRI sources followed by BADC. In CVL-1 farmers' seeds of Manikgonj (Table 2). In O-9897 species the highest purity of 99.4% was found in BJRI seed, which was statistically identical with BADC

the highest percentage of pure seed (99.68%) was found in BJRI seeds, which was followed by BADC (97.7%). In contrast, the lowest (80.4%) purity was observed in (98.0%). The highest 85.0% purity was found in Rangpur farmers' seed. However, local market seeds showed much better (94.3%) purity than that of CVL-1

(85.7%) (Table 2). The percentage of inert matter also varied significantly ($p < 0.05$) due to different seed sources. Inert matter was the highest (19.57%) in farmers' seed source of Mankigonj followed by farmers' of Kishoregonj (18.0%) and local market sources (14.2%) in CVL-1 seeds. However, lowest inert matter (0.36 per cent) was found in BJRI sources with second lowest (2.2%) in BADC (Table 2). On the other hand, Table 1.4 shows that the lowest percent inert matter (0.47%) was present in BJRI followed by BADC (1.91%). The highest percent of inert matter (15.34%) was observed in farmers' seed of Rangpur. Second highest inert matter (13.41%) was found in farmers' seed collected from Faridpur (Table 2). Higher purity of seed in BJRI and BADC sources were due to processing of seeds on cemented threshing floor. The use of kacha floor during seed processing at farm level resulted in higher accumulation of inert matter in the farmers' seeds. The study showed that the purity percentage of farmers' seeds, however, was better in case of O-9897 seeds. O-9897 seed is produced in the high land of Faridpur and Rangpur area. Farmers' of those areas were more careful during jute seed processing and avoid mixture of inert matter in the jute seeds (Table 2). Islam *et al.* (2002) studied different categories (breeder seed, foundation seed, certified seed and farmers' seed) of jute seeds for purity, viability, vigor, green yield and dry fiber yield of varieties O-9897 and CVL-1. Purity of breeder seed was found the best in all respects and of farmers' seed were the poorest.

Presence of pathogen

The presence of pathogens in the farmers' seed sources was higher in both the jute species (Table 2). BJRI seed showed no pathogen in both CVL-1 and O-9897 seeds. BADC seed source of O-9897 showed only *Macrophomina phaseolina* and *Botrydiploidia theobromae* (Table 2) while only saprophyte observed in trace amount (0.40%) in BADC source for CVL-1 seeds. *Botrydiploidia theobromae* was absent in all the seed sources of CVL-1 although a higher amount was present in all the seed sources except BJRI for O-9897. The higher *Macrophomina phasiolina* was present in farmers' and local market seed sources of CVL-1, while it was lower in O-9897 (Table 2). *Colletotrichum corchori* was present in farmers' and local market seed sources in CVL-1 although it was the highest (7.6%) in local market source and 1.24% in farmers' source of farmers' seeds of Manikgonj. The lower per cent (0.99%) of *C. corchori* was present in O-9897 seeds of Faridpur. Saprophytes were higher in O-9897 seeds. The highest (15.40%) appeared in farmers' seed of Rangpur and the lowest (7%) in local market sources for O-9897 seeds (Table 2). On the other hand, 0.4% saprophyte was observed in BADC seed for CVL-1. The highest amount (7.8%) appeared in Kishoregonj seeds. For both the species, seed sources differed significantly for the pathogens presence (Table 2).

The pathogens invaded seeds in the field during

seed development while steel in fruits apart from during processing on the threshing floor. However, these pathogens may be destroyed if well sun dried (Khandakar and Bradbeer, 1983). Khandakar (1983) observed very negligible percentage of those pathogens at Baiderbazar (Narayanganj) and Kalampur (Manikgonj) jute seed growing areas. Sultana and Biswas (1992) studied the percentage of infection and viability of seeds from healthy and diseased pods of stem-rot and anthracnose affected jute plants along with disease free plants of D-154. They observed germination below the standard of National Seed Board, Bangladesh from diseased pods. Furthermore, seeds from healthy pods of both healthy and diseased plants gave 98% and 95% germination respectively.

Khandaker (1994) stated that most of the fungal pathogens and a good number of saprophytes of bast fiber crops are seed borne. Infected seeds are primary source of seed borne diseases. The highest percentage of *Macrophomina* (51%), *Botrydiploidia* (79%), *Colletotrichum* (66%) infections were observed in Dhabdhabey (JAES) with CVE-3 and CVL-1 (Chandina), although above 15% *Macrophomina* and *Colletotrichum* infected seeds were found and not recommended for sowing. Hossain *et al.* (1994) conducted a survey on six different jute-growing areas of Bangladesh. With the seed samples of all the survey sites, the occurrence of pathogenic fungi mainly *M. phaseolina*, *B. theobromae* and *C. corchori*, which cause stem rot, black band and seedling blight diseases respectively, were frequently found at the rate of total 2.33 to 6.47 percent. Besides, saprophytic fungi observed at the rate of 0.64 to 32.55 percent. Seeds of Chandina and Kishoregonj (desi jute growing area) carried enormous saprophytes and those from Jessore, Faridpur, and Manikgonj (Tossa and Deshi jute seed growing areas, respectively) also carried saprophytes at a harmful rate. They also reported higher percentage of pathogens (above 6%) with seed samples collected from Manikgonj, Kishoregonj and Chandina (Deshi, jute growing area) sites and in contrast at a lower rate (2.33-3.70%) in Faridpur, Rangpur and Jessore sites.

Two sets of experiments were conducted for CVL-1 and O-9897 seed obtained from different sources. The index of different sources of seeds of CVL-1 and O-9897 varied significantly (Tables 3). The highest vigor index (76.35) was observed at BJRI sources and the lowest (64.02) at farmers' seed sources of Kishoregonj in CVL-1. On the other hand, in O-9897 the highest vigor index (63.63) was found in BJRI sources and the lowest (46.59) in farmers' of Faridpur. In O-9897, in terms of vigor index there was no significant difference between the two sources of BJRI and BADC. However, local market source and farmers' sources of different locations differed statistically in respect of vigor index. Vigor index in local market seed was higher than that of farmers' seed of Rangpur and Faridpur. On the contrary, the vigor index differences were significant in case of BJRI and BADC seed sources of CVL-1 BJRI seed were superior than BADC in this respect (Table 3).

Table 2. Purity and seed health of CVL-1 and O-9897 seeds as affected by seed sources

Treatments (Seed sources)	Pure Seed (%)	Other seed (%)	Inert Matter (%)	Pathogen (%)			Sap.
				<i>M.P.</i>	<i>B.T.</i>	<i>C.C.</i>	
CVL-1							
BJRI	99.58	0	0.36	-	-	-	-
BADC	97.70	0	2.17	-	-	-	0.40c (0.88c)
Farmer (Manikganj)	80.36	0	19.57	3.80a (2.05a)	-	7.60a (2.84a)	5.00b (2.32b)
Farmer (Kishoreganj)	82.08	0	17.88	3.40ab (1.96ab)	-	4.00b (2.12b)	7.80a (2.88a)
Local market	85.71	0	14.23	2.00b (1.57b)	-	4.00b (2.11b)	3.20b (1.90b)
Level of significance	-	-	-	0.05	-	0.01	0.05
O-9897							
BJRI	99.44	0	0.47	-	-	-	-
BADC	97.98	0	1.91	1.60b (1.44b)	0.80c (1.09c)	-	-
Farmer (Faridpur)	86.48	0	13.41	1.85b (1.53b)	4.60a (2.26a)	1.24	15.40a (3.97a)
Farmer (Rangpur)	85.04	0	15.34	1.40b (1.37b)	3.20b (1.91b)	0.00	12.00a (3.53a)
Local market	94.34	0	5.65	2.60a (1.76a)	1.40c (1.37c)	0.99	7.00b (2.72b)
Level of significance	-	-	-	0.01	0.01	NS	0.01

M.P. = *Macrophominaphaseolina*, *B.T.* = *Botridiplodiatheobromeae*, *C.C.* = *Coletroticumcorchori* and *Sap.* = Saprophyte.

In a column data having common letter(s) do not differ significantly by DMRT at 1% level of probability. Transformed data in the parenthesis.

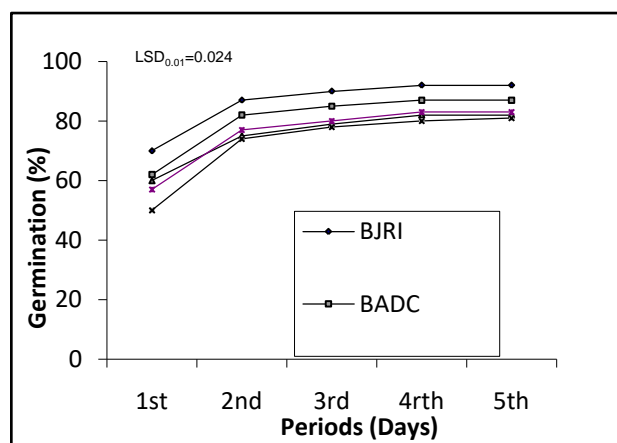


Fig. 1. Germination rate of CVL-1 seeds as affected by seed sources

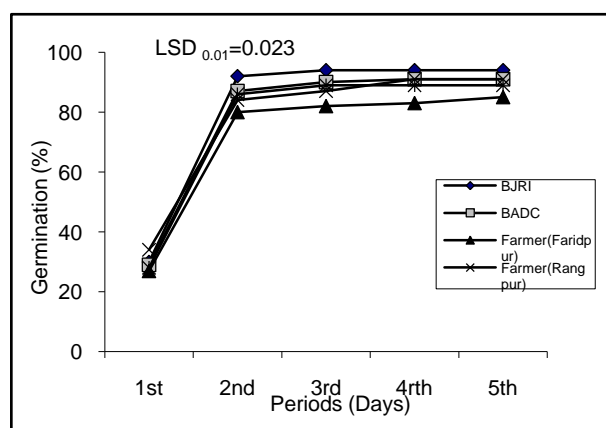


Fig. 2. Germination rate of O-9897 seeds as affected by seed sources

Seed vigor

From this vigor evaluation test, germination percentage after one day and coefficient of germination were calculated and evaluated. Speed of germination test after one day it was observed that the trend of germination of CVL-1 seeds was higher than O-9897 seeds. After one day about 50-65% seeds germinated in CVL-1, however in case of O-9897 seeds only 25- 35% seeds germinated. From this test, it was further observed that after two days maximum number of seeds of CVL-1 and O-9897 completed their germination. Even after two days a few number of seeds took five days to germinate. Usually jute seed lots need five days to complete germination (ISTA, 1985). In case of CVL-1 and O-9897 seeds germination percentage after 48 hours differed significantly due to different seed sources (Tables 3). In case of CVL-1 the highest germination (86.60%) was found in BJRI seed. Similar result was observed in O-9897. About 87% BJRI seeds germinated followed by BADC and farmers' seed of Mankigonj for CVL-1 and Faridpur for O-9897. The lowest germination (75.80) after two days in CVL-1 was found in farmers' seeds of Kishoregonj and in O-9897 it was 71% in farmers' seeds from Rangpur.

Coefficient of germination (%) of CVL-1 and O-9897 seeds differed significantly due to seed sources (Table 3). The higher coefficient of germination was found in CVL-1 than those of O-9897 seed sources. The highest value (80.86) was found in CVL-1 seeds of BJRI source and 60.53 in O-9897 seeds collected from farmers' of Faridpur. Coefficient of germination was statistically similar in BJRI, BADC and farmers' seed for CVL-1. However, except BADC seeds, there were

nosignificant variation among other seed sources of O-9897 (Table 3).

Haque and Khandakar (1992) reported that the *C. olitorius* L. seed remained dormant when it contained high level of moisture after harvest and germination percentage increased rapidly with drying of seeds. The germination percentage increased from 18 to 92% when the moisture decreased from 40 to 8% due to drying. Islam (1996) found that the germination of jute seed after 48 hours was a good guide to vigour and the laboratory germination was 15-20% higher than field emergence. Islam *et al.* (2002) reported in their seed potentiality assessment that the seed lot of *C. capsularis* L. differed significantly in pot culture, speed of germination, coldtest and germination after 48 hours tests. In *C. olitorius* L. seed lot differed significantly in laboratory standard germination, pot-culture, hot temperature test and cold tests. The highest germination of 92% in *C. capsularis* L. and 96% in *C. olitorius* L., respectively for cold temperature treatment germination tests. *C. capsularis* L. differed due to vigour and other potentiality tests.

Yamauchi and Tun (1996) reported positive correlation between vigour index and germination and they suggested that the faster germination indicate the

success of plant establishment under field condition. Hossain *et al.* (1994b) reported that the correlation coefficient (r) values varied among sites 0.75 to -0.96, where seed moisture content ranged 5 to 20% and seed germination ranged 00-98%. The authors also estimated regression equation of seed moisture content and seed germination. The mean regression equation appeared at $Y = 98.67 - 3.34x$. From this equation, they estimated seed viability of 80% with the adjustment of seed moisture content of 5.62%. In the same report, they further stated that seed moisture content had very high and positive correlation with the association of fungal pathogen. The correlation coefficient @ values ranged 0.33 to 0.86 at six sites. Islam *et al.* (2002) reported that the highest correlation ($r=98^{**}$) was found in pot culture with hot temperature treatment germination test of *C. capsularis* L. and in laboratory standard germination with pot-culture of *C. olitorius* L. ($r=97^{**}$). Rate of germination showed negative but significant correlation with all other tests.

Vigor index was positively correlated with coefficient of germination in CVL-1 jute seed sources (Fig. 3). The relationship was significant in O-9897 also (Fig. 4).

Table 3. Vigor index and coefficient of germination of CVL-1 and O-9897 seed as affected by seed sources

Treatments (Seed sources)	Vigor Index	Germination after 48 hours (%)	Coefficient of germination
CVL-1			
BJRI	76.35a	86.60a (9.33a)	80.86a
BADC	73.52b	83.80b (9.18b)	78.60a
Farmer (Manikganj)	71.03c	82.40c (9.10c)	79.24a
Farmer (Kishoreganj)	64.02e	75.80e (8.73e)	67.40c
Local market	68.56d	78.40d (8.88d)	75.38b
Level of significance	0.01	0.01	0.01
O-9897			
BJRI	63.63a	87.00a (9.35a)	60.53
BADC	61.75a	82.60b (9.12b)	59.11a
Farmer (Faridpur)	46.59d	71.00c (8.45c)	56.55b
Farmer (Rangpur)	53.00c	82.60b (9.11b)	58.88a
Local market	56.68b	79.00b (8.92b)	58.32a
Level of significance	0.01	0.01	0.01

In a column data having common letter(s) do not differ significantly by DMRTat1% level of probability. Data at the parenthesis are square root transforme

Seedling growth and dry matter

Seedling growth and dry matter were assessed for both CVL-1 and O-9897 seeds collected from different sources. In case of CVL-1 seed, shoot length and root length differed significantly due to different seed sources (Table 4). The highest shoot length (6.10 cm) was found in BJRI and the lowest (5.08cm) in farmers' of Kishoregonj in CVL-1. In CVL-1 jute, shoot length was like BJRI, BADC, farmers' seed of Manikgonj and Local market seed (Table 4). In case of root length, all

sources showed statistically similar results except farmers' seed of Manikgonj. A root length of 3.94 cm was observed in CVL-1 of BJRI seeds and the lowest (2.90 cm) in farmers' seed of Mankigonj.

Root-shoot ratios were same in BJRI and BADC seed. However, the highest root-shoot ratio was found for farmer seed of Kishoregonj and the lowest (0.53cm cm⁻¹) in Manikgonj. However, this ratio was-18.46 percent in farmers' seed of Manikgonj and 12.31 per cent in farmers' seed of Kishoreganj and 3.08 percent in local market seed sources against BJRI seed. The

increase or decrease of the root-shoot ratios against BADC was same as BJRI seed (Table 4).

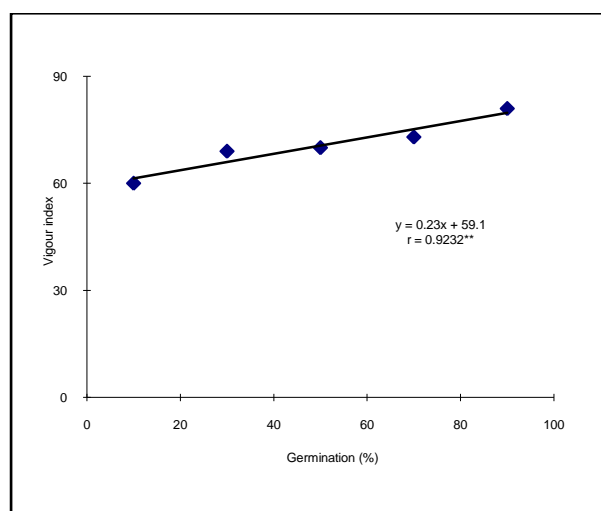


Fig. 3. Relationship between vigor index and germination percentage of CVL-1 seed as affected by seed sources.

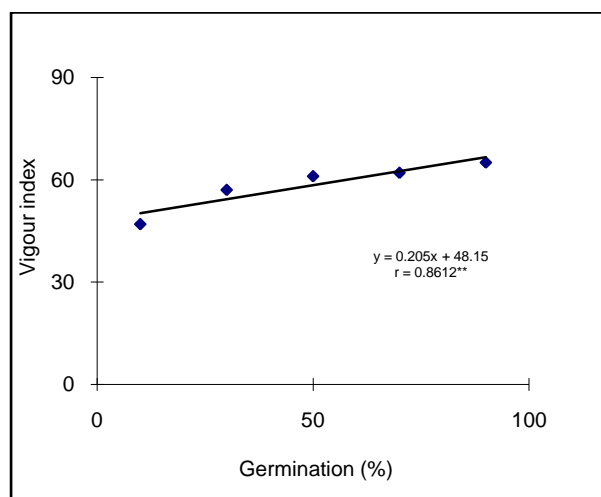


Fig. 4. Relationship between vigor index and germination percentage of O-9897 seed as affected by seed sources

Development of a normal seedling from the seed is an essential requirement in the maintenance of seed viability. A normal seedling essentially should have a well-developed root system, some intact hypocotyls, two cotyledonary leaves and plumule with developing green leaves (Islam, 2009).

In O-9897, the highest shoot length (4.90cm) was recorded in BJRI seed, which was similar to BADC (4.64cm). The lowest shoot length (3.72cm) was recorded in farmers' seed of Faridpur. BJRI and BADC sources had similar yet the highest root length (3.40cm). The lowest root length (2.40cm) in contrast was recorded in farmers' seed of Faridpur (Table 4). The highest root shoot ratio (0.73%) was observed in BADC seed and the lowest (0.65%) in farmers' seed of Faridpur. Root-shoot ratio increase or decrease against BJRI sources showed 5.8% increase in BADC and

4.35% in local market seeds. Although 1.45% decrease in farmers' seed of Rangpur and 5.80% in farmers' seed of Faridpur were observed (Table 4). The ratios were found to have decreased (10.96%) in farmers' seed of Faridpur, 6.85% in farmers' seed of Rangpur and 1.37% in local market seed against BADC sources (Table 4). Similar results were reported by Islam (2009).

As regard CVL-1 shoot dry weight of BJRI and BADC seeds were similar. However, BJRI seed gave the highest shoot dry weight. On the other hand, farmers' of two locations and local market seed sources showed statistically similar shoot dry weight (Table 5). In terms of root dry weight, the highest was observed in BJRI source but it was similar to BADC. Farmers' and local market seeds showed no statistical differences in root dry weight. Root-shoot ratio and seedling dry weight was insignificant due to different seed sources (Table 5). In O-9897 jute the highest shoot dry weight (0.67mg) was obtained in BJRI followed by BADC seed (0.64mg). The lowest (0.51mg) in contrast was found in farmers' seed of Faridpur. The highest root dry weight (0.26mg) was in BJRI followed by (0.24) in BADC. The lowest (0.15mg) was found in farmers' seed of Rangpur. Root-shoot ratio was highest 0.39mg mg⁻¹ in BJRI and the lowest 0.28mg mg⁻¹ was observed in farmers' seed of Rangpur. The ratio was similar (0.35mg mg⁻¹) for farmers' seed of Faridpur together with local market (Table 5). The total seedling dry weight differed significantly due to different seed sources. The seedling weights of BJRI (0.94mg) and BARC (0.89mg) were statistically alike and the highest than those of reminder sources. In contrast, the lowest seedling dry weight (0.69mg) was observed in farmers' seed of Rangpur. In terms of total seedling dry weight, farmers' of two locations and local market sources were statistically similar (Table 5). Delouche and Baskin (1973) reported that loss of storage potential was one of the specific consequences of seed deterioration, which decreased germination rate and increased incidence of seedling abnormalities.

In CVL-1, seed sources positive correlation was observed in between shoot length and root length, shoot dry weight and root dry weight, shoot length and shoot dry weight and root length and root dry weight (Table 6). Of the correlations, statistically significant relationships were found between shoot dry weight and root dry weight, and shoot length and shoot dry weight. The relationship between the root and shoot length, and the root length and root dry weight were non-significant. In O-9897, relationship between shoot length and root length, shoot dry weight and root dry weight, shoot length and shoot dry weight; and root length and root dry weight were significant and positive (Table 6). In the present study, CVL-1 had shown better and higher seedling growth and seedling dry weight than O-9897.

Table 4. Shoot length, root length and root-shoot ratio of CVL-1 and O-9897 seed as affected by seed sources

Treatments (Seed sources)	Shoot length (cm)	Root length (cm)	Root- shoot ratio	Increase/decrease of root-shoot ratio against	
				BJRI (%)	BADC (%)
CVL-1					
BJRI	6.10	3.94a	0.65	-	-
BADC	5.70	3.72a	0.65	0	-
Farmer (Manikganj)	5.50	2.90b	0.53	-18.46	-18.46
Farmer (Kishoreganj)	5.08	3.72a	0.73	12.31	12.31
Local market	5.40	3.64a	0.67	3.08	3.08
Level of significance	NS	0.05	-	-	-
O-9897					
BJRI	4.90a	3.40a	0.69	-	-
BADC	4.64ab	3.40a	0.73	5.80	-
Farmer (Faridpur)	3.72c	2.40b	0.65	-5.80	-10.96
Farmer (Rangpur)	3.82c	2.60b	0.68	-1.45	-6.85
Local market	3.88cb	2.80ab	0.72	4.35	-1.37
Level of significance	0.05	0.05	-	-	-

In a column data having common letter(s) do not differ significantly by DMRT at 5% level of probability. NS= Not significant.

Table 5. Shoot and root dry weight, root-shoot ratio and seedling dry weight of CVL-1 seed as affected by seed sources

Treatments (Seed sources)	Shoot dry wt. (mg)	Root dry wt. (mg)	Root- shoot Ratio	Seedling dry weight (mg)
CVL-1				
BJRI	1.28a	0.34a	0.27	1.64a
BADC	1.27a	0.32a	0.25	1.58a
Farmer (Manikganj)	1.17b	0.28b	0.23	1.47b
Farmer (Kishoreganj)	1.18b	0.27b	0.23	1.46b
Local market	1.18b	0.28b	0.24	1.47b
Level of significance	0.01	0.01	-	0.05
O-9897				
BJRI	0.67a	0.26a	0.39	0.94a
BADC	0.64a	0.24a	0.38	0.89a
Farmer (Faridpur)	0.51b	0.18bc	0.35	0.71b
Farmer (Rangpur)	0.53b	0.15c	0.28	0.69b
Local market	0.54b	0.19b	0.35	0.74b
Level of significance	0.01	0.01	-	0.01

In a column column having common letter(s) do not differ significantly by DMRT at 1% and 5% level of probability.

The seedling from large seeds of *C. capsularis* L. (var. D-154) had much vigour than small and wrinkled seeds. It may have contributed for higher seed size and higher seedling dry matter (DM) similar to Talukder and Ali (1977). The differences in root length of different sources were also remarkable. It varied from 2.09 cm of farmers' to 3.94 cm of BJRI in CVL-1 and 2.4 cm of farmer to 3.4 cm of BJRI in case of O-9897. However, root dry weights and shoot dry weights contributed maximum towards the seedling growth of

different sources and attended the highest shoot length and root lengths in CVL-1 compared to O-9897 of farmers' seeds. As regards shoot and root length, similar trend was observed in *C. capsularis* L. and *C. olitorius* L. The highest shoot length in *C. capsularis* L. and in *C. olitorius* L. were found in BJRI seeds, however the BADC seeds occupied in the second position and the farmers' jute seed showed the lowest values in terms of shoot length of the seedlings (Islam, 2009).

Table 6. Different relationships of root length and root dry weight, shoot dry weight and root dry weight, shoot length and shoot dry weight and root length and root dry weight of CVL-1 and O-9897 seed as affected by seed sources

Jute species	Shoot length and root length	Shoot dry weight and root dry weight	Shoot length and shoot dry weight	Root length and root dry weight
CVL-1	Y=0.312x +1.8504 r= 0.4959*	Y=0.5427x - 0.3819 r= 0.9684**	Y=0.119x +0.5548 r= 0.8305**	Y=0.401x +0.1544 r= 0.5264*
O-9897	Y=0.8245x-0.5362 r= 0.9645**	Y=0.587x -0.1353 r= 0.9369**	Y=0.333x +0.0191 r= 0.9987**	Y=0.0892x-0.0563 r= 0.9110**

4 CONCLUSION

Seeds from BJRI and BADC of both the jute varieties showed better performances in terms of seed quality concern compared to seeds from farmers' and local markets. BJRI and BADC seeds showed lower moisture content and inert matter whereas these two variables were high in farmers' seed. Lower moisture content of BJRI and BADC seeds showed higher germination and vigor index. Seeds of both the varieties started to germinate within one day and more than 70 percent was recorded on the second day. The relationship among germination, vigor index and purity were highly significant and positive. Based on seed quality results observed, BJRI seeds sources of both the jute species are the best than all other seeds tested.

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