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# Quality Evaluation of Jute Seeds Collected from Different Sources

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**Abstract**: Laboratory experiments were carried out to assess the quality of jute seeds collected from two different seed sources viz. Bangladesh Jute Research Institute (BJRI) while the other was farmer's seed. Each source consisted of two species, namely *Corchorus olitorius* and *Corchorus capsularis*. Two varieties of *olitorius* viz. O-9897 and O-4 and two varieties of *capsularis* viz. CVL-1 and CVE-3 were included in the experiments. Quality of jute seed was better in BJRI source than farmer's source. Quality of farmer's seeds deteriorated mostly during processing and storing period. Poor quality of farmer's seed was associated with higher content of inert matter and higher initial moisture content. Higher initial moisture content subsequently reduced germination and vigour of farmer's seed. Due to accelerated ageing, *olitorius* seed deteriorated completely by three days and *capsularis* seed by seven days. Earlier deterioration of *olitorius* seed indicated its more vulnerability to poor storage environment. The varietal difference with in species was not remarkable in quality of jute seed.

**Key words**: Jute, seed, source, vigour

## Introduction

Jute (*Corchorus* sp.) is considered as the main cash crop of Bangladesh. It covers about 4.14% of total cropped area and accounts for about 16% of total foreign exchange through export of raw jute and jute products (Anonymous, 1997). Besides, jute fibre and jute sticks are largely used for different domestic purposes. In addition, jute plants improve soil productivity because of its massive leaf fall and root proliferation in the field.
Jute is predominately grown for fibre and thus little attention is given to its seed production. Conventionally, farmers grow jute seed along with the fibre crop. Jute crop requires few months more to produce seeds and farmers keep some plants at the corner of the field during harvesting of fibre crop. After harvesting fibre crop, the seed crop remains almost uncared for a long period. Due to long stay in the field, the seed crop is affected by diseases and insects and produces poor quality seed. Quality jute seeds of improved variety itself provides about 20% additional yield although there is an acute shortage of quality seed in every year (Hossain *et al.*, 1994). It requires about 4000 metric tons of jute seeds of which only 12 to 15% is produced and distributed by the Bangladesh Agricultural Development Corporation (Salim *et al.*, 1998). Rest jute seed is solely produced and utilized by the farmers themselves. The quality of these farmer's seeds are not controlled carefully during production, processing or storing period. Due to unawareness of seed quality, farmers sow jute seed whatever they store in their houses or purchase from the local market. From these seeds, farmers sometimes get good germination and a good crop, sometimes poor germination and a poor crop and occasionally the germination is almost nil which results in total crop failure (Hossain *et al.*, 1994). Jute seed quality however does not vary only from farmer to farmer, but also from source to source, species to species and even from variety to variety of each species. Information relating such variability of jute seed quality is very scanty under Bangladesh condition. Moreover, the category and extent of jute seed quality of different sources, species and varieties are yet to be elucidated. This study therefore, was undertaken to assess and compare the quality of jute seeds collected from different sources.

## Materials and Methods

**Seed collection:** Qualities of different sources of jute seeds were evaluated at the Bangabandhu Sheikh Mujibur Rahman Agricultural University during February to September, 2000. Seeds were collected from two different sources, one was Bangladesh Jute Research Institute (BJRI) and the other was farmer's seed. Two varieties of *C. olitorius* voz. O-9897, O-4 and two varieties of *C. capsularis* were CVL-1 and CVE-3. Farmer's seeds were collected from Rangpur and Natore region representing *Olitorius* and Belkuchi and Shahzadpur representing *Capsularis* growing areas of Bangladesh. The seeds were collected immediately after the harvest of jute crop.

**Laboratory test:** Before starting laboratory test, initial moisture content and 1000 seed weight of each seed sample was measured. Seed moisture content was determined from a sample of 5g in an infrared moisture meter (Model F-1A). The 1000 seeds of jute randomly counted from the pure seed by multi auto counter and were measured in an electronic balance (Model FX-300M). Then the sample seeds were subjected to the following laboratory test.

**Germination test and speed of germination**: One hundred pure seeds of each sample were placed in petri dishes containing filter paper soaked with distilled water. The petri dishes were placed in an incubator at 30 $^{0}$C for 5 days. Germination counts were made every day upto the completion of germination at fifth day. A seed was considered to be germinated as seed coat ruptured, plumule and radicle came out upto 2 mm length. Germination percentage was calculated using the following formula (Krishnasamy and Seshu, 1990).

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

The speed of germination of seed sample was monitored by counting the germinated seedling at an interval of 24 h and continued for five days. Co-efficient of germination and vigour index were calculated using the following formula (Copeland, 1976).

$$\text{Co-efficient of germination} = \frac{100\,(A_1 + A_2 + \dots A_x)}{A_1T_1 + A_2T_2 + \dots A_xT_x}$$

where,

A = Number of seed germinated
T = Time corresponding to A
x = Number of days to final count

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$$\text{Vigor index} = \frac{\text{Number of seeds germinated (1st count)}}{\text{Number of days to first count}} + \dots + \frac{\text{Number of seeds germinated (last count)}}{\text{Number of days to last count}}$$

**Evaluation of seedling**: Seedlings obtained from standard germination test were used for seedling evaluation. Normal or abnormal seedling were classified according to the rules of the association of official seed analysts (Anonymous, 1981). Seedling shoot and root length was measured on day 5 of the germination test. Ten plant samples from each petri dish were harvested and shoot and root length of individual plant was recorded. The shoot and root were also dried at 70 °C for 72 h for dry matter yield.

**Electrical conductivity test**: For electrical conductivity test, 2 gm seeds of each sample were taken in a conical flask containing 50 ml de-ionized water and incubated at 20 °C for 20 h. After 20 h, water of the beaker containing seeds was decanted in order to separate the seeds. The electrical conductivity of the decanted water containing seed leachate was measured with a conductivity meter (Model-CM-30ET).

**Accelerated ageing test**: The seeds were kept in a ageing chamber at 45 °C and 100% relative humidity for different duration of 1, 2, 3, 4, 5, 6 and 7 days. After accelerated ageing, seeds were dried in the sun and the percentage survival of the seeds was determined by standard germination test at 30 °C (Delouche and Baskin, 1973). For ageing of seed, wire mesh net (9 x 9 mesh size) were used to make trays of 18 x 3.5 x 3 $cm^3$ to contain 1000 to 1200 seeds. An iron sheet was used to fabricate 30 x 20.5 x 7.5 $cm^3$ box. The box had two inner ridges, which raised to lengthwise 2 cm height to hold the wire mesh trays with seeds above the water level. The boxes with 10 mm water were put inside an incubator. A gap of 10 mm was maintained between the water surface and the wire mesh trays with seeds. The boxes were covered with lids and kept airtight so that no vapour can escape from the ageing box.

**Statistical analysis**: All the samples of jute seeds were assessed by different laboratory methods. The percentage data were transformed to angular values for statistical analysis. The data were analyzed in three-factor (2 x 2 x 2) completely randomized design corresponding to two levels of seed source, two levels of jute species and two levels of varieties. Analysis of variance was done according to Gomez and Gomez (1984). The means were compared using least significance difference (LSD) test.

## Results and Discussion

**Seed moisture:** There was no remarkable varietal difference in seed moisture content although seed sources showed significant difference in seed moisture content (Table 1). Jute seed collected from farmers of different location contained higher moisture than the BJRI source. Jute seed of BJRI contained 7.76 to 9.70% moisture, whereas, farmer's seed contained 10.42 to 10.81% moisture during the storing time. Higher moisture content in the farmer's seed was associated with lower number of sunning during drying period. As seed is highly hygroscopic living material, it absorbs moisture from air if it is stored in an environment where relative humidity is higher than seed moisture content (Copeland, 1976). Low moisture content in BJRI seed was the resultant of proper sunning and storing in optimum storage environment. Low moisture content in BJRI seeds indicated its better planting value as Khatun and Sobhan (1985) reported that jute seed with a moisture content of 4 to 7% maintained more than 85% viability upto twelve months even at room temperature.

In general, jute seeds of *Capsularis* species are bigger than that of *Olitorius* seeds (Table 1). Seed size (1000 seed weight) of *Olitorius* species varied from 1.93 to 1.99g and that of *Capsularis* ranged from 3.20 to 3.60g over the seed sources. Seed size also varied to some extent due to variation of seed sources. Irrespective of species bigger seed size was observed in BJRI seed than that of farmer's jute seed. Higher seed size in BJRI source may be due to better grading during the seed processing time. As seed size differ from location of pod in the plant and location of seeds in the pod, seed grading may help in collecting better seed size for future use. Lack of knowledge about seed grading might be the possible cause of lower size of farmer's jute seed.

**Germination test**: Germination rate of seeds varied widely due to sources and varieties of jute seeds (Fig. 1). It was observed that jute seed started to germinate within one day and most of the seeds (>80%) germinated in second day. However, all the varieties of two species required five days to complete germination. The variety CVE–3 of BJRI germinated faster (71.84%) at day 1 but ultimately the variety O-9897 showed the highest (97.80%) germination percentage. Irrespective of species, seeds of all the jute varieties not less than 91%. On the contrary, the variety O-4 of farmer's source showed the best germination rate all through five days starting from day 2. The variety O-9897 followed the germination pattern of O-4 and those two varieties germinated more than 80% at the end. Lower germination rates were observed in case of seeds of *Capsularis*. Farmer's seeds of CVL-1 and CVE-3 germinated only 71.32 and 74.46% respectively. The lower germination percent of those two varieties associated with the presence of higher number of dead seeds which may be due to higher moisture content in the farmer's seeds. Higher seed moisture contributed to poor seed viability, and higher the seed moisture content lower is the seed longevity (Khandakar, 1983). Lower germination of farmer's seed may be due to higher infestation of pathogen which have negative relationship between pathogen percent and the germination of jute seeds (Hossain *et al.*, 1994).

**Seedling characteristics**: Shoot length of jute seedlings did not vary significantly, but other growth parameters like root length, shoot dry weight, root dry weight and total seedling weight varied significantly over the sources and species of jute (Table 2). Irrespective of sources and variety, *Capsularis* produced better seedling growth than *Olitorius*. Total seedling dry weight of *Capsularis* was around 1.7 mg in BJRI source and around 1.4 mg in farmer's source which were around 1.0 and 0.80 mg in *Olitorius* respectively. In this experiment the higher seed size may contribute to higher seedling DM as also obtained by Talukdar and Ali (1977). The differences in root length of different jute seedlings was also remarkable which varied from 2.00 cm in 0-9897 of farmers' source to 4.38 cm in CVE-3 of BJRI seeds. Despite root dry weight, shoot dry weight of jute seedling also contributed maximum towards the seedling growth. Shoot dry weight of CVL-1 of BJRI was the highest (1.32 mg) and the lowest (0.60 mg) was recorded from the seedling of 0-9897 of farmer's seeds. As a result, the variety CVL-1 of BJRI produced the highest seedling dry weight and 0-9897 of farmer's seeds produced the lowest.

**Electrical conductivity**: There is no varietal difference in electrical conductivity test of jute seed but it differed widely between the seed sources. Irrespective of varieties, electrical conductivity was much higher in farmer's jute seeds than that of BJRI seeds. Electrical conductivity of BJRI seeds was around 0.249 ms $cm^{-1}$, whereas, it was 0.473 ms $cm^{-1}$ in farmer's seeds (Table 1). The higher electrical conductivity of farmer's jute seeds was associated with higher initial moisture content. Higher moisture content might have increased respiratory activities of seeds and shortened the seed lives. The cellular membranes of short lived seeds became more weaker and permitted cell contents to easy escape into water which increased the electrical conductivity of farmer's seeds. Higher electrical conductivity of deteriorated seeds also observed by Schuttle and Loepold (1984) in soybean and

Table 1: Results on seed moisture control, 1000 seed weight, electrical conductivity, germination and vigour of jute seed under test

| Seed sources | Variety | Moisture content (%) | 1000-seed weight (g) | Electrical conductivity (ms $cm^{-1}$) | Coefficient of germination | Vigour index |
|---|---|---|---|---|---|---|
| BJRI | 0-9897 | 8.18 | 1.971 | 0.229 | 67.75 | 77.34 |
| | 0-4 | 7.76 | 1.994 | 0.231 | 62.92 | 72.15 |
| | CVL-1 | 7.96 | 3.600 | 0.219 | 70.84 | 78.44 |
| | CVE-3 | 9.70 | 3.530 | 0.249 | 77.67 | 82.95 |
| Farmer | 0-9897 | 10.81 | 1.926 | 0.373 | 52.25 | 53.49 |
| | 0-4 | 10.42 | 1.970 | 0.272 | 61.33 | 67.28 |
| | Cvl-1 | 10.45 | 3.196 | 0.471 | 60.84 | 59.18 |
| | Cve-3 | 10.72 | 3.274 | 0.473 | 58.54 | 55.63 |
| CV (%) | - | 0.68 | 0.690 | 4.800 | 1.580 | 1.71 |
| LSD (0.05) | - | 0.013 | 0.013 | 0.013 | 1.307 | 1.504 |

Table 2: Seeding characteristics of jute seeds collected from different sources

| Seed sources | Variety | Shoot length (cm) | Root length (cm) | Shoot dry weight (mg) | Root dry Weight (mg) | Total seedling dry weight (mg) |
|---|---|---|---|---|---|---|
| BJRI | 0-9897 | 2.33 | 2.32 | 0.75 | 0.29 | 1.04 |
| | 0-4 | 2.96 | 3.46 | 0.81 | 0.29 | 1.11 |
| | CVL-1 | 3.58 | 4.06 | 1.32 | 0.39 | 1.71 |
| | CVE-3 | 3.71 | 4.38 | 1.26 | 0.40 | 1.66 |
| Farmer | 0-9897 | 1.86 | 2.00 | 0.60 | 0.21 | 0.81 |
| | 0-4 | 2.77 | 3.17 | 0.73 | 0.21 | 0.94 |
| | CVL-1 | 3.18 | 3.68 | 1.06 | 0.31 | 1.37 |
| | CVE-3 | 3.41 | 2.86 | 1.05 | 0.32 | 1.37 |
| CV (%) | - | 3.14 | 4.05 | 5.21 | 4.87 | 4.43 |
| LSD (0.05) | - | NS | 0.178 | 0.058 | 0.013 | 0.071 |

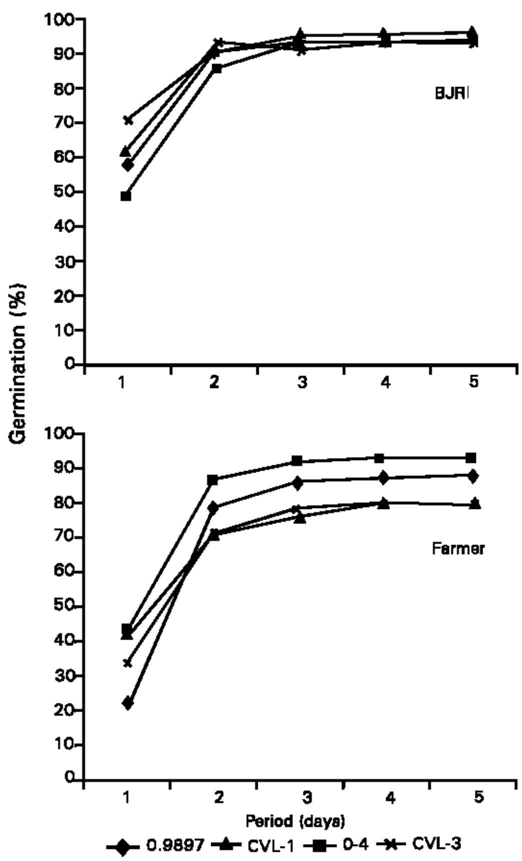


Fig. 1: Germination rate of different varieties of jute seeds collected from BJRI and farmer source

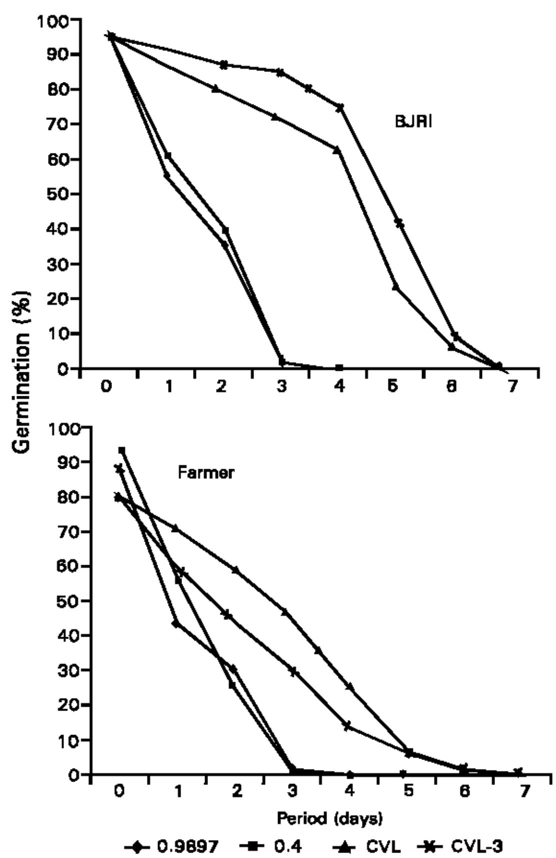


Fig. 2: Effect of accelerated ageing on germination of jute seed of different varieties collected from different sources

Powel *et al.* (1986) in french bean. There was however species difference in electrical conductivity of farmer's jute seeds. Electrical conductivity was more in *Capsularis* seeds than that of *Olitorius* seeds. This might be due to storing of *Capsularis* jute seed in tin-shed house of Belkuchi and Shahzadpur area where fluctuating temperatures might enhanced seed deterioration. There is a negative relationship between electrical conductivity and seed germination indicated that more cell leachates escaped from deteriorated seed and lowered the germination capability of jute seeds.

**Speed of germination**: Both co-efficient of germination and vigor indices were higher in the seeds of BJRI source than farmer's seeds (Table 1). Considering species difference, the values were higher in *Capsularis* seeds than *Olitorius* jute seeds. Co-efficient of germination of *Olitorius* seeds ranged from 52.25 in farmer's seeds to 67.75 in BJRI seeds. Whereas it ranged from 58.54 to 77.67 in *Capsularis* seeds of farmer's and BJRI seeds respectively. Similarly vigor indices of *Olitorius* jute seeds ranged from 53.49 to 77.34 and *Capsularis* seeds ranged from 55.63 to 82.95 representing farmer's and BJRI sources respectively. Among the varieties, CVE-3 of *Capsularis* and 0-9897 of *Olitorius* group showed the highest values of both co-efficient of germination and vigor indices of jute seeds.

**Accelerated ageing and germination**: Accelerating ageing of different sources and species of jute seeds showed a distinct scenario in germination pattern over time (Fig. 2). Germination percent of BJRI jute seeds ranged from 95.20 to 97.80 % and that of farmer's seeds 80.58 to 94.05% before ageing which decreased gradually with the increase in ageing period. In general, rate of decrease in germination was more steeper in farmer's seed than that of BJRI seeds. Among the species *C. olitorius* seeds showed rapid decreasing trend in germination than *C. capsularis* seeds. Germination of *Olitorius* seeds of both BJRI and farmer's seeds ended at the three days ageing treatment. Whereas, *Capsularis* seeds germinated still 6 day of ageing treatment. *Capsularis* seeds of BJRI source showed a slow decreasing rate of germination upto 4 day of ageing and then rapid decrease was observed at 6 day of germination treatment. On the contrary, *capsularis* seeds of farmer's source showed a quick and steady state of decreasing rate of germination upto 7 day ageing. *C. Olitorius* seeds of both BJRI and farmer's seeds showed a similar trend of decreasing rate of germination due to ageing. Mitra *et al.* (1974) reported that decrease in germination of aged seeds occurred due to declination of phosphatase activity, sugar content and alpha amylase activity. During the process of ageing, protein of high mobility are denatured (Nautiyal *et al.*, 1985). Due to ageing, it has been reported to decrease in glutamic acid decarboxylase activity in seeds (Banerjee and Ghosh, 1978). Such changes in biochemical processes in aged seeds results in either death of seeds or production of abnormal seedling at the end. Species difference in germination of aged seed indicated that *Capsularis* seeds are more capable to resist the degradation processes than that of *Olitorius* seeds.

The results revealed that jute seed quality varied with the variation of seed sources, species itself also controlled jute seed quality to some extent. Deterioration of jute seed quality occurred mostly during processing and storing time. Therefore, special attention has to be taken during processing and storing of jute seeds for better planting value in the next season.

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