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Seed Viability and Vigour Tests in Jute (*Corchorus* spp.)

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Abstract: Seeds of two jute species (*Corchorus capsularis* L. and *C. olitorius*) were collected from two different locations. Viability / germination test (laboratory standard and pot-culture), Vigour test (speed of germination, hot test and cold test) and other tests (germination after 48 hours and rate of germination) were used to know seed potentiality. The seed lots of *C. capsularis* were differed significantly in pot culture, speed of germination, cold and germination after 48 hours tests. In *C. olitorius* seed lots differed significantly in laboratory standard germination, pot-culture, hot and cold tests ($p = 0.01$). The highest germination of 92% in *C. capsularis* and 96% in *C. olitorius* were found in laboratory standard germination and the lowest of 11% and 16% in *C. capsularis* and *C. olitorius* respectively for cold test. The locations differed due to vigour and other potentiality tests. However, the difference were insignificant in viability / germination tests. The highest germination of 88% was found in *C. olitorius* for both the locations Faridpur and Rangpur and lowest 16% in *C. capsularis* of Manikgonj. Highest correlation ($r = 98^{**}$) was found in pot-culture with hot test of *C. capsularis* and in laboratory standard germination with pot-culture of *C. olitorius* ($r = 97^{**}$). Rate of germination showed negative but significant correlation with all other tests.

Key words: Jute seed, viability, vigour, correlation

Introduction

High quality seed is a prerequisite for higher and reliable yield of crops. Germination is the emergence and development from the seed embryo of those essential structures which for the kind of seed being tested. It indicates the ability to develop into a normal plant under favorable conditions in the soil (ISTA, 1976). Usually laboratory germination tests are used to obtain a general indication of capacity of seeds to produce plants in the field. High germination percentage may not be necessarily in good plant stand and establishment rather high germination percentage raises high expectation of field emergence. Seed vigour determine the potential for rapid, uniform emergence and development of normal seedling under a wide range of field conditions (McDonald, 1980). Germination in a favorable condition is the physical expression of a seed lot on question of its viability. However, mere germination test cannot quantitate the quality of the seed. There are several tests available to estimate seed vigour of which speed of germination, hot test, cold test etc. are mach in use (ISTA, 1987). There is lack of information about farm level seed lots of different location specific jute seed quality potential tests. In that respect an experiment was conducted with jute seed to verify their performance in viability, vigour and other seed potential tests.

Materials and Methods

The experiment was conducted at Agronomy Laboratory, Bangladesh Jute Research Institute, Dhaka during the year 1999-2000. Seeds of two jute species (*Corchorus capsularis* and *C. olitorius*) were used as crop materials. Among the four locations Manikgonj and Kishorgonj were specified for *capsularis* and Foridpur and Rangpur for *olitorius* jute. Seed samples were collected from twelve different jute seed lots of each *Corchorus*

species and of six from each location. Germination not less than 80% and about 9-10% moisture content were allowed at the time of seed samples used.

The tests of viability, vigour and other tests for seed potentiality were done by different methods as follows:

Viability/Germination test

Laboratory standard germination test: One hundred seeds of each replicated sample were allowed to germinate on top of a filter paper in 5ml. tap water in plastic petri dishes. The test was conducted in an incubator at 30 ± 1 °C. The germination was recorded after 120 hours and then calculated the germination percentage (ISTA, 1966).

Pot-culture test: Fifty seeds of each replicated sample were sown in a 30cm. earthen pot. The earthen pots were filled with farm soil and watered regularly. Total germination per sample was calculated after 7 days.

Vigour test

Speed of germination test: The test was conducted in laboratory with the same procedure as laboratory standard germination test. Vigour (Vigour value) was calculated following (Jain and Saha, 1971) $V = a/1 + b/2 + c/3 + \dots$ where, V = Vigour value, and a, b and c are the number of seeds germinated after 1, 2 and 3 days. The final count was made at the end of 5th day.

Hot and cold test: Hot and cold tests were also conducted in the incubator. The temperature for hot test was 40 °C and for cold was 20 ± 2 °C. Each of every replicated samples seed germination was calculated after 48 hours for hot test and 120 hours for cold test (ISTA, 1987).

Other potentiality tests

Germination after 48 hours: This test was same as laboratory standard germination test however, the final count of germinated seeds were made after 48 hours.

Rate of germination: The rate of germination was calculated using the following formula of Krishnasamy and Seshu (1990)

$$\text{Rate of Germination} = \frac{\text{Number of seeds germinated at 48 hours}}{\text{Number of seeds germinated at 120 hours}} \times 100$$

Complete Randomized Design (CRD) with five replications was followed in each test and the data were statistically analyzed by Gomez and Gomez (1976).

Results and Discussion

In *C. capsularis* the interaction between seed lots and locations were significant in pot-culture, speed of germination, hot test and germination after 48 hours. The highest pot culture of 75%, speed of germination of 64%, hot test of 68% and germination after 48 hours of 78% were found at Manikgonj. However viability, cold test and rate of germination showed insignificance. The highest

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Table 1: The interaction effect of different seed (*Corchorus capsularis* L) lots of different locations in different seed potentiality tests

Location & Seed Lot (Manikgonj = M and Kishorgonj = K)	Viability Test		Vigour Test			Other potentialities	
	Lab. std. germi. (%)	Pot-culture (%)	Speed of germi. (V.V)	Hot test (%)	Cold test (%)	Germi. after 48 hours (%)	Rate of germi. (%)
M1	83	58	58	52	17	73	85.09
M2	83	62	59	53	11	74	89.35
M3	92	75	64	68	17	78	92.76
M4	82	55	56	50	18	71	86.58
M5	88	71	63	63	12	78	92.97
M6	85	63	61	56	18	76	91.56
K7	84	63	57	52	19	71	88.65
K8	84	63	61	52	19	75	88.28
K9	86	63	61	53	22	76	88.37
K10	89	72	62	58	22	77	87.52
K11	81	62	49	50	19	64	75.19
K12	88	67	62	60	21	77	88.50
LSD _{0.01}	NS	8.18	4.96	6.13	NS	5.65	NS

NS = Non significant

Table 2: The interaction effect of different seed (*Corchorus olitorius* L) lots of different locations in different seed potentiality tests

Location seed lot (Faridpur = F and Rangpur = R)	Viability test		Vigour test			Other potentialities	
	Lab. std. germ. (%)	Pot-culture (%)	Speed of germi. (V.V)	Hot test (%)	Cold test (%)	Germi. after 48 hours (%)	Rate of germi. (%)
F1	96	76	50	64	29	74	76.08
F2	90	71	49	55	17	73	82.11
F3	84	75	50	60	24	75	88.29
F4	85	63	47	56	21	71	82.53
F5	82	58	48	56	27	72	87.80
F6	82	60	51	61	16	77	92.90
R7	93	76	57	69	30	85	92.39
R8	92	75	57	74	32	85	93.39
R9	85	63	51	54	26	76	88.41
R10	85	60	53	63	21	79	93.41
R11	88	71	55	64	19	82	93.18
R12	87	68	52	62	22	78	89.66
LSD at 0.01	NS	9.50	5.29	5.23	NS	5.26(0.05)	NS

NS = Non significant

Table 3: Performance of different seed potentiality tests at different locations for *C. capsularis* and *C. olitorius*

Locations	Viability Test		Vigour Test			Other potentialities	
	Lab. std. germ. (%)	Pot-culture (%)	Speed of germi. (V.V)	Hot test (%)	Cold test (%)	Germi. after 48 hours (%)	Rate of germ. (%)
Manikgonj	86	64	60.00	57.00	16.00	63	90.47
Kishorgonj (<i>C. capsularis</i>)	85	65	57.00	54.00	21.00	61	86.52
Average	86	65	59.00	56.00	19.00	62	88.50
LSD 0.01	NS	NS	2.02	NS	2.17	1.69(0.05)	NS
Faridpur	88	67	49.00	59.00	23.00	69	85.13
Rangpur (<i>C. olitorius</i>)	88	69	54.00	64.00	25.00	76	92.30
Average	88	68	52.00	62.00	24.00	73	88.72
LSD 0.01	NS	NS	2.16	2.13	2.01	2.90	NS

NS = Non significant

Table 4: Correlation coefficient of different seed potentiality tests in *Corchorus capsularis*

	Viability Test		Vigour Test			Other potentialities	
	Lab. std. germ.	Pot-culture	Speed of germi.	Hot test	Cold test	Germi. after 48 hours	Rate of germ.
Lab. std. germ.	1	0.88**	0.25	0.83**	0.86**	0.46	-0.53*
Pot culture		1	0.71**	0.98**	0.96**	0.65*	-0.62*
Speed of germi.			1	0.65*	0.71**	0.86**	-0.82**
Hot test				1	0.56*	0.73**	-0.76**
Cold test					1	0.33	-0.71**
Germi. after 48 hours						1	-0.45
Rate of germ.							1

*, ** significant at 1 and 5% level of significance

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Table 5: Correlation coefficient of different seed potentiality tests in *Corchorus olitorius*

	Viability Test		Vigour Test			Other potentialities	
	Lab. std. germ.	Pot-culture	Speed of germi.	Hot test	Cold test	Germi. after 48 hours	Rate of germ.
Lab. std. germ.	1	0.97**	0.41	0.63*	0.91**	0.54*	-0.99**
Pot-culture		1	0.77**	0.71**	0.92**	0.62*	-0.84**
Speed of germi.			1	0.94**	0.69*	0.79**	-0.56*
Hot test				1	0.63*	0.79**	-0.65**
Cold test					1	0.32	-0.84**
Germi. after 48 hours						1	-0.52*
Rate of germ. Not Needed							1

*, ** significant at 1 and 5% level of significance

germination in pot-culture was 75% in Manikgonj and lowest 55% was also found at the same location. The highest value by speed of germination showed 64 at Manikgonj and lowest 49 was at Kishorgonj. The highest germination after 48 hours (78%) was observed at Manikgonj and lowest 64% was collected from Kishorgonj (Table 1). These results confirmed the earlier report (Islam, 1997).

In *C. olitorius* the interaction between seed lots and locations differed significantly in pot culture, speed of germination, hot test and germination after 48 hours). However, laboratory standard germination, cold test and rate of germination were insignificant. The highest values of pot culture, speed of germination, hot test and germination after 48 hours were 76, 57, 74 and 85%; and the lowest values were 58, 47, 55 and 71% respectively (Table 2). The results are in agreement with Wang and Hampton (1989). They stated that germination did not differ significantly among the six seed lots of Red clover and ranged from 88 to 92%. Happ (1993) stated that standard germination results showed no significant difference in germinability among the three perennial ryegrass (*Lolium perenne* L.).

The vigour tests (Speed of germination, hot test and cold test) and other potentiality test (germination after 48 hours) differed significantly due to locations (Manikgonj and Kishorgonj for *C. capsularis*). However, in case of viability tests (laboratory standard germination and pot- culture), hot test and rate of germination the locations showed insignificant results. The highest values of speed of germination, hot test, cold test and germination after 48 hours were 60% (Manikgonj), 57%(Manikgonj), 21%(Kishorgonj) and 63%(Manikgonj) respectively. Similar results were found in case of *C. olitorius*, where Faridpur and Rangpur were the two locations. Speed of germination, hot test and cold test and germination after 48 hours differed significantly due to location. Laboratory standard germination, pot- culture and rate of germination were insignificant. The highest values of speed of germination, hot test and cold test and germination after 48 hours were 54, 64, 25 and 76% in Rangpur respectively (Table 3). Islam (1996) also revealed the similar results.

In *C. capsularis* the correlation coefficient of laboratory standard germination with pot culture, hot test, and cold test were significant. The correlation with rate of germination was significant but negative. The coefficient of laboratory standard germination with speed of germination and germination after 48 hours were insignificant. All other correlation coefficients among different potentiality tests were significant except cold test with germination after 48 hours and negative insignificant coefficient was found in germination after 48 hours with rate of germination. It was indicated that the correlation coefficients of rate of germination with all other tests were negative. Among the correlation combinations the highest coefficient of $r=0.98^{**}$ was found in pot culture with hot test and followed by pot culture with cold test $r=0.96$ and pot culture with laboratory standard germination of $r=0.88$ (Table 4). These results are in agreement with Egli and Tekrony (1995).

In *C. olitorius* the correlation coefficient of laboratory standard germination with pot culture, hot test, cold test, and germination after 48 hours were significant. Rate of germination with laboratory standard germination was significant but negative. Only speed of germination showed insignificant correlation coefficient with laboratory standard germination. All other

correlation combinations showed significant coefficients except cold test with germination after 48 hours. Similar performances were found in case of correlation in rate of germination with all other potentiality tests, were negative. The highest correlation coefficient of $r=0.97$ was found at the combination of laboratory standard germination with pot culture, followed by $r=0.94$ of speed of germination with hot test and $r=0.92$ of pot culture with cold test (Table 5). These results are also in agreement with Egli and Tekrony (1995).

From the above results, it can be concluded that different seed potentiality tests, laboratory standard germination than pot-culture in viability test, hot test followed by speed of germination and cold test in vigour test and rate of germination than germination after 48 hours in other seed potentiality tests showed better performance. In both the jute species the correlation coefficient between laboratory standard germination with pot-culture, hot test and cold test were higher and significant.

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