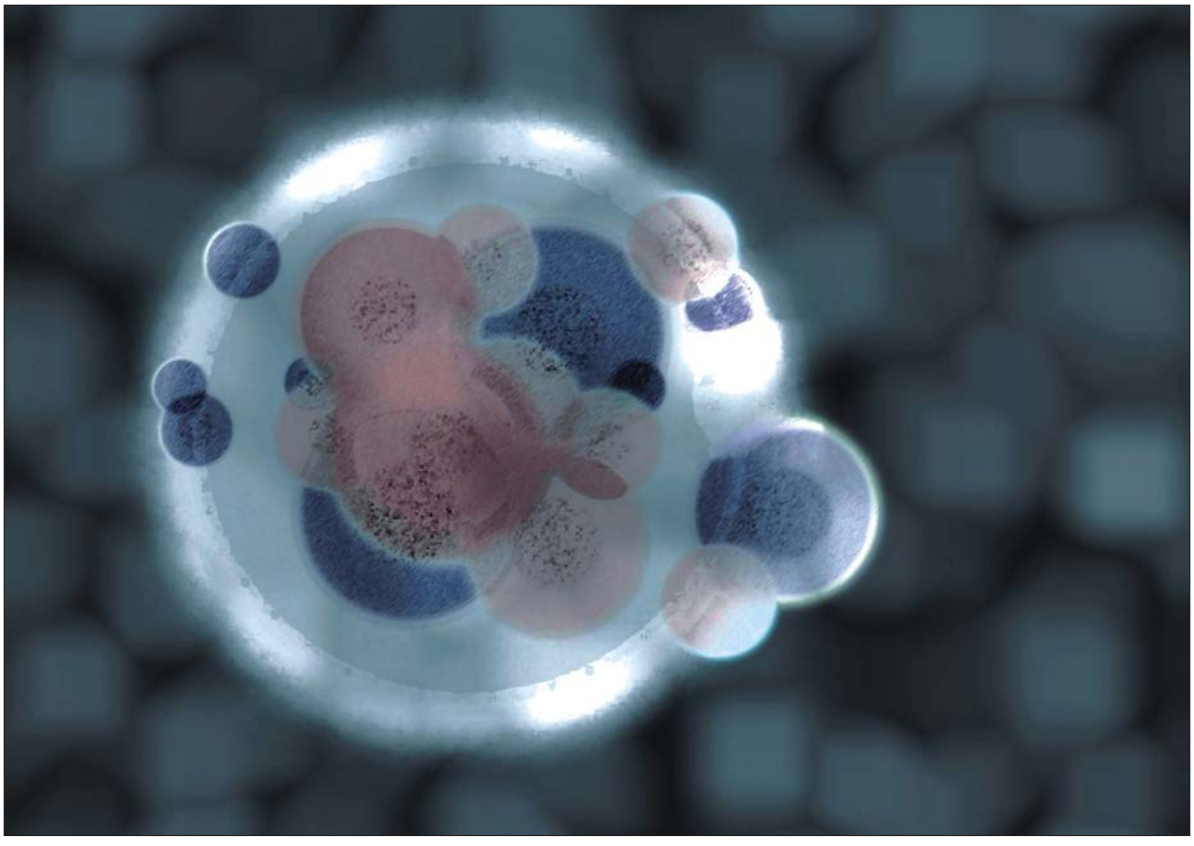

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Effect of Seed Filling Period on Quality of White Jute (*Corchorus capsularis* L.) Seed

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Abstract: An experiment was conducted at Agronomy Division, Bangladesh Jute Research Institute, Dhaka in 1997 and 1998 with white jute (*Corchorus capsularis* L.) varieties CVL-1 and CVE-3 to study the seed filling period and attainment of physiological maturity of white jute seeds and its effect on seed quality attributes. In white jute, physiological maturity of seed attains at 60 days after anthesis irrespective of variety and there was significant positive correlation between seed filling period and seed quality attributes. Seed filling period (SFP) and effective seed filling period (ESFP) were 36 and 21.2 days in both the varieties respectively. The single seed filling rate (SSFR) was 0.08 mg/seed/day and total seed sink filling rate (TSSFR) was 10.25 kg/ha/day in both the varieties also. A significant positive correlation among the seed attributes with the seedling dry weight, vigour and emergence percentage in both CVL-1 and CVE-3 indicated that germination percentage and emergence percentage influenced crop establishment.

Key words: Seed filling period, Seed quality, White jute

Introduction

The seeds meeting required standards of purity, germination and other attributes are referred to as seeds quality (Agrawal, 1996). A quality seed is a product of the rate of dry matter gain and duration of seed filling period. The crop establishment depends on seed quality and, among others, the physiological maturity (PM) of seeds ensures the seed quality (Crookston and Hill, 1978). The PM denotes a stage of development of a seed that indicates cessation in dry matter gain at maturity. Recently researchers have identified some visible indicators of PM of seeds for different crops like maize (Daynard and Duncan, 1969), sorghum (Eastin *et al*., 1973), soybean (Crookston and Hill, 1978) etc. The PM of white jute (*Corchorus capsularis* L.) seed could also be identified with some visual characters viz. the brownish colour of seed coat, dryness of the pods etc. (Talukder and Akhanda, 1994). PM of seeds could be measured by the duration of seed filling period. Daynard *et al*. (1971) reported that in corn seed filling period and yield of seed are positively correlated. Yield and quality of soybean seeds decrease due to harvest prior to the attainment of physiological maturity (Fehr *et al*., 1977). However, information regarding the seed filling period and its effect on seed quality of Jute is lacking. Only little is known in this regard (Talukder and Ali, 1979; Talukder and Akhanda, 1994). Therefore, the present work was undertaken to study the seed filling period and attainment of physiological maturity of white jute seeds and its effect on seed quality attributes.

Materials and Methods

Present experiment was conducted with white jute (*Corchorus capsularis* L.) varieties CVL-1 and CVE-3 both in laboratory and at field of Agronomy Division, Bangladesh Jute Research Institute, Dhaka in two consecutive years 1997 and 1998. The experiment was laid out in a Randomized Complete Block Design (RCBD) and replicated thrice. Seeds were sown on end of March. The crop was grown following standard methods of cultivation (Anonymous, 1992). Pest and disease management programmes were taken what and whenever necessary. Data were collected for date of emergence, germination, vigour value, seedling dry weight and effective seed filling period (ESFP). Percent germination and emergence of seedlings were calculated at 24, 48 and 96 hours after placing of seeds in the petridishes and sowing of seeds in laboratory condition and at the field respectively. Germination percentage and vigour value of seeds, used as seed quality attributes, were calculated following the standard methods (Agrawal, 1996). Harvesting of pods were started after 30 days of anthesis until the pods and plants become dry (field dry) with ten days intervals. In each harvest, pods were collected randomly from ten selected plants and dried in the sun. Seeds were removed from the dry pods, sun dried for five days and weighted.

Plants were also harvested after physiological maturity of pods. The visual indicators of physiological maturity of seeds considered were (a) characteristic colour of mature seed coat, (b) half of the pod brown and (c) all leaves senesced and the pods and plants become dry (field dry). After harvest seeds were cleaned, sun dried for five days and weighted.

Single seed filling rate (SSFR), total seed sink filling rate (TSSFR), effective seed filling period (ESFP), seed filling period (SFP) were calculated following methods of Daynard *et al*. (1971) and Smith and Nelson (1986).

Results and Discussion

The relationship between seed filling period and seed quality attributes, germination and vigour value of seeds, were presented in Fig. 1 and 2. Regression analysis showed that the germination percent and vigour value increased with the maturity of seeds. The best-fitted response curve was found to be linear. Talukder and Ali (1979) reported the similar result. There was no significant difference in germination percent between seeds harvested at 60 days after anthesis and certified seed standard (Agrawal, 1996) and produced seedling with higher vigour compared to individuals from the earlier harvested seeds. These results confirmed the earlier report (Talukder and Ali, 1979).

The cessation of dry weight increment in CVL-1 and CVE-3 was attained at 60 days after anthesis. Seed filling period (SFP) and effective seed filling period (ESFP) were 36 and 21.2 days respectively in both the varieties. The single seed filling rate (SSFR) and total seed sink filling rate (TSSFR) were 0.08 mg/seed/day and 10.25 kg/ha/day respectively in both the varieties also.

There was significant positive correlation among the seed attributes with the seedling dry weight, vigour value and

Table 1: Correlation coefficients (r) among seed and seedling attributes

Seed attributes	Seedling dry weight	Vigour value	Emergence percentage
Germination (%)	0.49**	0.98**	0.81**
Emergence (%)	0.34^{ns}	0.73**	

**Significant at $p<0.01$ level, ns = not significant

Table 2: Relationship of germination (%) and emergence (%) and seedling dry weight as shown by coefficient of determination (R^2) at field and laboratory condition

	Emergence (Field)	Emergence (Laboratory)
Germination %	0.21*	0.40**
Emergence %	$Y = 0.85^{-3}\text{-}0.39^{-5}$ $X_1 + 0.39^{-5}X_2$	$Y = 0.11^{-3}\text{-}0.45^{-7}$ $X_1 + 0.59^{-6}X_2$

**Significant at $p<0.01$, *$p<0.05$ levels

Table 3: Correlation coefficient of dry matter accumulation in seeds at physiological maturity (PM), at effective seed filling period (ESFP)

Vareity	PM		ESFP	
	1997	1998	1997	1998
CVL-1	0.97**	0.97**	0.96*	0.95*
CVE-3	0.99**	0.99**	0.98**	0.98**

**significant at $p<0.01$ levels * significant $p<0.05$ levels

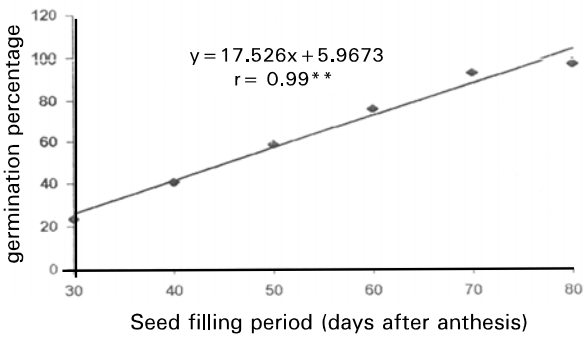

Fig. 1: Relationship between seed filling period and germinability

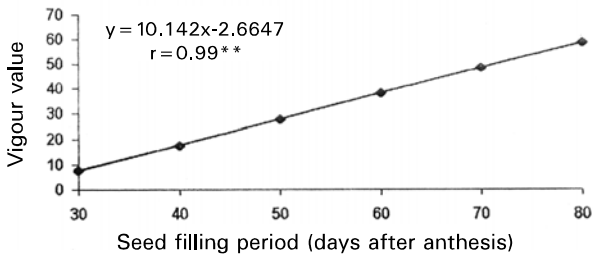

Fig. 2: Relationship between seed filling period and vigour value

emergence percentage in both varieties (Table 1) which indicated that germination percentage and emergence percentage influenced the crop establishment. In other words, the heavier seeds and the seeds having high speed of germination (vigour) and emergence had a positive response on establishment of crop population. Germination percentage showed positive correlation with seedling dry weight (r = 0.49**), vigour value (r = 0.98**) and emergence percentage (r = 0.81**). The emergence percentage also had

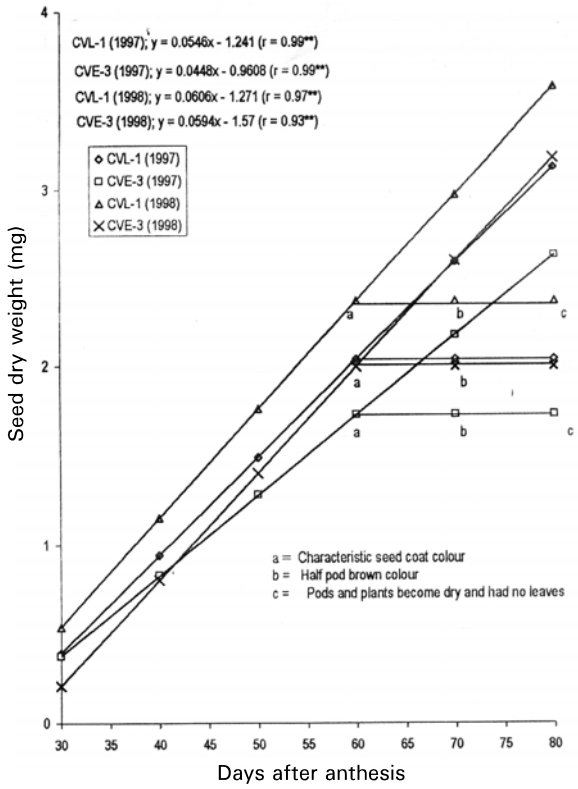

Fig. 3: Estimated physiological maturity of seed and corresponding visual indicators

positive correlation with vigour value (r = 0.73**).

Relation between germination percentage and emergence percentage of seed was significant both at field and in laboratory conditions (Table 2). The relationship in laboratory condition was highly significant over the field condition. It indicates that environmental condition, soil tilth, soil moisture etc. influence seedling emergence. Smith and Nelson (1986) found that the inter-year correlation between the various estimates of seed filling period were inconsistent between environment.

The correlation between physiological maturity (PM) and dry matter accumulation of seeds due to cultivation year was significant in both the varieties (Table 3). On the other hand, effective seed filling period (ESFP) between years (1997 and 1998) and between varieties were significant also. The CVE-3 responded well in both PM and ESFP attributes compared to CVL-1. Phenological events indicate a common positive relation between PM and ESFP. The PM and ESFP were more constant in relation to environmental effects. These results are in full agreement with Tsunoda (1964) in rice and with Stoy (1965) in spring wheat.

Characteristic seed coat colour (a), half pod brown colour (b) and, pods and plants become dry and had no leaves (c) was attained at 60, 70 and 80 days after anthesis, respectively in both the year 1997 and 1998 irrespective of variety (Fig. 3). Seed dry weight increases with period of time in earlier stages of harvesting. However, there is no difference in later stages (a, b and c) of harvesting. Physiological maturity indicated that the point of intersection of the mature seed weight with regression lines. These results confirmed the earlier report

(Talukder and Akhanda, 1994). Crookston and Hill (1978) also reported that regression analysis over time showed linear weight gain in seeds prior to PM of seeds.

From the above results, it could be concluded that in case of white jute the PM of seed attains at 60 days after anthesis irrespective of variety. There was significant positive correlation between seed filling period and seed quality attributes. The seed filling period (SFP), effective seed filling period (ESFP), single seed filling rate (SSFR) and total seed sink filling rate (TSSFR) were 36 days, 21.2 days, 0.08 mg/seed/day and 10.25 kg/ha/day respectively in both the varieties.

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