



Effect of Different Storage Containers used for Storing Seeds and Management Practices on Seed Oil and Protein Content after Different Times of Storage in O-9897 Varieties

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Abstract – The experiments were conducted in the laboratory of Plant Pathology Department, Bangladesh Jute Research Institute (BJRI), Manik Mia Avenue, Dhaka; Seed Pathology Center, Bangladesh Agricultural University (BAU), Mymensingh, Oil Seed Division, Bangladesh Agricultural Research Institute (BARI). The experiments were conducted during the period 15 January 2010 to 5 March 2012. Nine different types of containers viz. tin pot, plastic pot, poly bag, gunny bag, gunny bag lined with polythene, earthen pot, cloth bag, brown paper and IIRI poly bag, two level of moisture contents viz. farmers' condition (13%) and recommended moisture condition (9.5%) by Bangladesh Gazette (2010) were used for the present study. Seeds were stored for 12 months and examined after 4, 8 and 12 months of storage. Among the nine containers, tin pot was found better and brown paper was found poorest performance in respect of seed oil and protein content. The findings of the present study also reveal that recommended moisture content (9.5% moisture content in seed) was better than moisture content at farmers' condition. So, Quality of jute seeds can be maintained by storage in tin pot and recommendation moisture content (9.5%).

Keyword – Effect, Storage Container, Storage Condition, Management, Seed Oil, Protein.

I. INTRODUCTION

Jute is one of the main cash crops of Bangladesh. It is also one of the cash crops of the Bangladesh economy. It accounts for 6% of the foreign currency earnings from exports (Islam, 2009). Bangladesh is the second largest producer of jute after India, with its production of about 9.9 lakh tons of jute fibre, of which, 51% is used as mill consumption, 44% is used as raw jute export, and 5% is used domestically.

Millions of people earn their livelihood from agricultural and industrial activities based on jute and allied fibres crops. Moreover, beyond the farmland and factory, jute and jute goods keep alive the transport sector, the service sector like banks and insurance and the agro-industrial job market. The jute crop also greatly improves the soil fertility status by incorporating organic matter to the soil through decomposition of shaded leaves and plant residues and helps in breaking plough-pans through its long taproots. Also, jute and jute goods have been recognized as being friendly to the environment. Jute is mostly grown in the Indo-Bangladesh region and in some

countries of Southeast Asia. Among the jute growing countries of the world, Bangladesh ranks second in respect of production (Islam, 2007). Two species of jute (*Corchorus capsularis* and *Corchorus olitorius*) are cultivated in Bangladesh. The land and climatic conditions of Bangladesh are congenial for the production of high quality jute. In Bangladesh, about 0.709 million hectares of land was under jute cultivation and the total yield was 8.40 million bales (BBS, 2011, IJSG website, 2012-13). As per Khandakar (1987), Bangladesh annually needs about 4000 metric tons of jute seeds of which only 12-15% is produced and supplied by the Bangladesh Agricultural Development Corporation (BADC). The rest of the seeds, about 85% or more of the requirement, are produced and managed by farmers' (Hossain *et al.*, 1994a). BADC produces 300 tons of seed and distributes them to the farmers. BADC produces jute seeds through contact growers. Seed deterioration occurs during storage. Different physiological and biochemical changes occur in naturally aged seeds during the process of deterioration. Sung (1996) reported that ageing of seed in storage was enhanced due to lipid peroxidation and ultimately lost seed viability. This loss of viability was most pronounced in oil rich seeds because of high susceptibility to peroxidation of polyunsaturated fatty acids present in the seeds (Priestly and Leopold, 1983). Lipid peroxidation is associated with depletion of lipid reserves resulting in production of free fatty acids that finally results in the loss of seed viability (Basra *et al.*, 2003). Seed is the most important and vital input for crop production. Quality seeds of an improved variety itself provide 20 % additional yield of the crop (Hossain, *et al.*, 1994b). One of the major constraints responsible for low yield of jute in our country is mainly due to sowing of diseased or unhealthy seeds. Considering the above facts, the present study was carried out with the objective was to maintain oil and protein content in seed for produce quality jute seeds in storage condition.

II. MATERIALS AND METHODS

Experimental sites and period

The experiments were conducted in the laboratory of Plant Pathology Department, Bangladesh Jute Research Institute (BJRI), Manik Mia Avenue, Dhaka; Seed Pathology Center, Bangladesh Agricultural



University (BAU), Mymensingh, Oil Seed Division, Bangladesh Agricultural Research Institute (BARI). The experiments were conducted during the period 15 January 2010 to 5 March 2012.

Varieties used

Seed of O-9897 was used. 110 kg O-9897 seeds collected from one farmer in Monirampur, Jessore.

Containers used

For this experiment nine different types of storage containers were used, viz. T₁= Tin pot, T₂= Plastic pot, T₃= Poly bag having 25 µm thickness, T₄= Gunny bag, T₅= Gunny bag lined with polythene, T₆= Earthen pot, T₇= Cloth bag, T₈= Brown paper and T₉= IRRI Poly bag (Super Grain bag II Z) having 78 µm thickness.

Moisture content of seeds

Seeds having two level of moisture were used, viz.

- i) Recommended moisture content (9.5%) as per reference of Khandakar and Bradbeer (1983) and Bangladesh Gazette (2010).
- ii) Farmers' condition

Bio-chemical analysis (protein and oil %)

Procedure of protein analysis

Total soluble protein estimation

Seed extracts were prepared according to Kalpana and Rao (1997) and the total soluble proteins were estimated according to Lowry *et al.* (1951) as described below.

Reagents used

- i) 0.2 M phosphate buffer solution of p^H 7.5: a) K₂HPO₄ (17.418 g) was dissolved in distilled water and was made the volume up to 500 ml with distilled water and b) KH₂PO₄ (13.609 g) was dissolved in distilled water and was made the volume up to 500 ml with distilled water. Then solution (b) was slowly added to 500 ml of solution (a) until the p^H reach to 7.5.
- ii) Lowry solution: Reagent (a) NaOH (4 g) + Na₂CO₃ (20 g) dissolved in distilled water and was made up to 1 L with distilled water. Reagent (b) CuSO₄ (0.25 g) + Na-K tartarate (0.5 g) dissolved in distilled water and was made the volume 50 ml with distilled water. Then by dissolving 1 ml reagent (a) into 50 ml reagent (b), the solution was kept 1 day in ambient temperature. Discard the solution, and the Lowry solution was prepared.
- iii) Phenolpholin reagent: Phenolpholin solution was made by dissolving 1 ml phenolpholin to 1 ml distilled water.

Procedure

Jute seed (100 mg) was grounded with 5 ml of phosphate buffer using a pestle and mortar and centrifuged. The precipitates were washed twice with 5 ml of phosphate buffer, and made up to volumes of 20 ml with distilled water. This extract solution was used to estimate protein content. 0.5 ml extract was taken in a test tube and 2.5 ml Lowry solution was added, and incubated for 20 minutes. Then 0.25 ml phenolpholin reagent was added and shaken by hand. After developing colour, the optical density was measured within 20 minutes at 660 nm wave length by a double beam spectrophotometer (Model: HITACHI 200-20, Japan), and the total soluble protein was estimated as mg g⁻¹ fresh weight by using the standard curve.

Procedure of oil analysis (Soxhlet extraction)

The method described by Akbar *et al.* (2009) was used with slight modification. The seed kernels (3g) were grounded using a mechanical method and defatted in a soxhlet apparatus. The extraction was carried out by using three different solvents such as hexane, isopropanol, and petroleum ether. The process continued for 6 hours. Solvent was removed by vacuum evaporation and exposure to heat in a drying oven at 50°C. The amount of oil recovered was calculated as percentage of total oil present in jute seed kernels. Each extraction was run in triplicate and the final value is the average of all.

Statistical analysis

Data were analysed statistically and treatments effects were compared by Duncan's Multiple Range Test (DMRT) (Gomez and Gomez, 1984).

III. RESULTS

Oil percentage

Farmers' seed

Oil percentage of farmers' seeds belonging to O-9897 variety obtained from different storage containers varied significantly from 12.21 to 14.34% (Tables 1). Rate of oil decreased depending upon storage period and storage containers and varied from 4.65 to 18.82% in O-9897 variety. Before storage, oil was 15.04% in O-9897 variety. In storage condition, oil continually was decreased depending on the storage containers and storage duration. After 12 months of storage condition the lowest oil was 12.21% in storing seeds in tin pot and highest oil was 13.48% in brown paper storing seeds (Table 1). The highest oil decrease rate 18.82% was recorded in storing seeds in tin pot followed by IRRI poly bag 16.89%, cloth bag 16.09% and earthen pot 14.36% storing seeds. Lowest decrease rate 11.84% was recorded in poly bag storing seeds.

Seeds having recommended moisture content (9.5%) by Bangladesh Gazette

Average differences of oil of recommended moisture content seeds varied significantly depending on the storage containers and time. Oil varied from 11.73 to 13.14% in O-9897 variety (Tables 2). Oil continuously decreased in storage time and varied from 3.85 to 14.75% in O-9897. Initial stage oil was 13.76%. After 12 months of storage lowest oil was 11.73% in tin pot storing seeds which was statistically similar to IRRI poly bag storing seeds 12.02% and highest 13.00% in earthen pot storing seeds which was statistically similar to poly bag storing seeds 12.78%. Lowest oil decrease was 5.22% in storing seeds in earthen pot and highest 14.75% was recorded in tin pot storing seeds (Table 2).

Protein percentage

Farmers' seed

In farmers' seed, protein varied from 17.40 to 19.50% in O-9897 (Tables 3) and decreased rate was varied from 1.32 to 11.94% in O-9897. Protein decrease rate depended on the storage time and different types of containers. The highest protein was 19.11% in tin pot storing seeds



followed by IRRI poly bag storing seeds 19.06% and lowest 17.40% was recorded in brown paper storing seeds and that was similar to gunny bag lined with polythene 18.09% (Table 2). Highest rate of protein decrease was 11.94% in storing seeds in brown paper and lowest 3.29% in tin pot storing seeds preceded by IRRI poly bag storing seeds 3.54%.

Seeds having recommended moisture content (9.5%) by Bangladesh Gazette

As per Bangladesh Gazette recommended moisture condition protein varied from 17.55 to 20.49% in O-9897 variety (Tables 4). Initial stage, recommended protein was 20.78% in O-9897 variety, respectively. The highest protein was 20.32% in tin pot followed by IRRI poly bag storing seeds 19.19% and lowest 17.25% was recorded in brown paper storing seeds which was similar to gunny bag 17.70%, gunny bag lined with polythene 18.09% and earthen pot 18.36% storing seeds (Table 4). Highest rate of protein decrease was 16.99% in brown paper storing seeds and lowest 2.21% was recorded in tin pot storing seeds.

IV. DISCUSSION

Nine different types of containers viz. tin pot, plastic pot, poly bag, gunny bag, gunny bag lined with polythene, earthen pot, cloth bag, brown paper and IRRI poly bag, two level of moisture contents viz. farmers' condition (13% in O-9897) and recommended moisture condition (9.5%) by Bangladesh Gazette (2010) were used for the present study. Seeds were stored for 12 months and examined after 4, 8 and 12 months of storage. Among the nine containers, tin pot was found better and brown paper was found poorest performance in respect of seed oil and protein content. The other containers in order of prevalence were IRRI poly bag, poly bag, plastic pot, gunny bag lined with polythene, cloth bag, gunny bag and earthen pot. Oil and protein content of seeds depended on the storage longevity. In storage condition, oil and protein content decreased. Branimir *et al.* (2007) studied influence of storage condition on oil content of maize, soybean and sunflower. They reported that storage longevity was negatively associated with oil content under storage conditions at 12°C/60%, decrease of seed oil content was less by 0.55% (maize), 1.30% (soybean) and 1.75% (sunflower) than in storage condition at 25°C/75%. Sisman (2005), Sisman and Delibas (2004) reported that during a period of three months of storage the percentage of seed oil gradually decreased with the increase of storage time. It has been reported by Raiker *et al.* (2006) and Ghasemnezhad *et al.*, (2007). Raiker *et al.* (2006) reported the declining rate in total soluble protein of jute seed with the progress of storage period.

V. CONCLUSION

Therefore, the following conclusion may be drawn for storage jute seeds from the findings of this study:

- In storage period, oil and protein depend upon storage containers, duration and environmental condition.

- So, the following recommendation may be drawn for storage and production of quality healthy jute seeds from the findings of this study:
- Quality of jute seeds can be maintained by storage in tin pot and recommendation moisture content (9.5%)

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Table 1: Oil content and rate of oil decrease of farmers' seed of O-9897 in different storage containers used for storing seeds and storage conditions

Container	Oil content (%)				Rate of oil decreases (%)		
	Storing period (in months)				Storing period (in months)		
	0	4	8	12	4	8	12
T ₁		13.12 e	12.56 d	12.21 f	12.77 a	16.49 a	18.82 a
T ₂		13.80 b	13.59 ab	12.91 cd	8.24 e	9.64 c	14.16 bc
T ₃		13.68 bc	13.64 a	13.26 ab	9.04 d	9.31 c	11.84 d
T ₄		13.53 bcd	13.21 c	12.98 bc	10.04 c	12.17 b	13.70 c
T ₅	15.04	13.65 bc	13.10 c	12.99 bc	9.24 d	12.90 b	13.63 c
T ₆		13.44 cd	13.20 bc	12.88 cd	10.64 c	12.23 b	14.36 bc
T ₇		14.34 a	13.15 c	12.62 de	4.65 f	12.57 b	16.09 b
T ₈		13.32 de	13.78 a	13.48 a	11.44 b	8.38 d	10.37 e
T ₉		13.32 de	13.11 c	12.50 e	11.44 b	12.83 b	16.89 b
Level of significance		0.01	0.01	0.01	0.01	0.01	0.01

T₁= Tin pot; T₂= Plastic pot; T₃= Poly bag; T₄= Gunny bag; T₅= Gunny bag lined with polythene; T₆= Earthen pot; T₇= Cloth bag; T₈= Brown paper and T₉= IRRRI poly bag

Data in column having common letter(s) do not differ significantly at 1% level of significance

Table 2: Oil content and rate of oil decrease of seeds of O-9897 having recommended moisture content (9.5%) of seeds by Bangladesh Gazette in different storage containers and storage conditions

Container	Oil content (%)				Rate of oil decrease (%)		
	Storing period (in months)				Storing period (in months)		
	0	4	8	12	4	8	12
T ₁		12.45	12.0 c	11.73 f	9.52 a	12.79 a	14.75 a
T ₂		13.13	13.04 ab	12.43 cd	4.58 e	5.23 d	9.67 d
T ₃		13.01	12.56 b	12.78 ab	5.45 d	8.72 b	7.12 e
T ₄		12.86	12.66 b	12.50 bc	6.54 c	7.99 bc	9.16 d
T ₅	13.76	12.98	12.76 ab	12.51 bc	5.67 d	7.27 c	9.08 d
T ₆		13.10	13.23 a	13.00 a	4.80 e	3.85 e	5.52 f
T ₇		12.77	12.65 b	12.40 cd	7.19 b	8.07 b	9.88 d
T ₈		13.14	12.60 b	12.14 de	4.51 e	8.43 b	11.77 c
T ₉		12.75	12.55 b	12.02 ef	7.34 b	8.79 b	12.65 b
Level of significance		NS	0.01	0.01	0.01	0.01	0.01

T₁= Tin pot; T₂= Plastic pot; T₃= Poly bag; T₄= Gunny bag; T₅= Gunny bag lined with polythene; T₆= Earthen pot; T₇= Cloth bag; T₈= Brown paper and T₉= IRRRI poly bag

Data in column having common letter(s) do not differ significantly at 1% level of significance

NS = Not Significant

Table 3. Protein content and rate of protein decrease of farmers' seed of O-9897 in different storage containers used for storing seeds and storage conditions

Conainer	Protein content (%)				Rate of protein decrease (%)		
	Storing period (in months)				Storing period (in months)		
	0	4	8	12	4	8	12
T ₁		19.50 a	19.33 a	19.11 a	1.32 h	2.18 g	3.29 h
T ₂		18.85 bcd	18.66 abc	18.47 abc	4.61 e	5.57 d	6.53 e
T ₃		19.00 abcd	19.01 ab	18.88 ab	3.85 f	3.80 f	4.45 g
T ₄		18.60 cde	18.46 abcd	18.29 abc	5.87 d	6.58 c	7.44 d
T ₅	19.76	18.47 de	18.28 bcd	18.09 bcd	6.53 c	7.49 b	8.45 c
T ₆		18.02 ef	18.28 cd	17.72 cd	8.81 b	7.49 b	10.32 b
T ₇		19.14 abc	18.85 ab	18.64 ab	3.14 fg	4.61 e	5.67 f
T ₈		17.80 f	17.61 d	17.40 d	9.92 a	10.88 a	11.94 a
T ₉		19.35 ab	19.18 a	19.06 a	2.07 g	2.94 fg	3.54 h
Level of significance		0.01	0.01	0.01	0.01	0.01	0.01



T₁= Tin pot; T₂= Plastic pot; T₃= Poly bag; T₄= Gunny bag; T₅= Gunny bag lined with polythene; T₆= Earthen pot; T₇= Cloth bag; T₈= Brown paper and T₉= IIRRI poly bag
Data in column having common letter(s) do not differ significantly at 1% level of significance

Table 4. Protein content and rate of protein decrease of seeds of O-9897 having recommended moisture content (9.5%) of seeds by Bangladesh Gazette in different storage containers and storage conditions

Container	Protein content (%)				Rate of protein decrease (%)		
	Storing period (in months)				Storing period (in months)		
	0	4	8	12	4	8	12
T ₁		20.49 a	20.51 a	20.32 a	1.40 i	1.30 i	2.21 i
T ₂		19.05 bcd	18.75 bc	18.59 bc	8.33 e	9.77 e	10.54 e
T ₃		19.36 bc	19.13 bc	19.00 b	6.83 g	7.94 g	8.57 g
T ₄		18.27 de	18.07 cd	17.70 cd	12.08 b	13.04 b	14.82 b
T ₅	20.78	18.56 cde	18.38 bcd	18.09 bcd	10.68 c	11.55 c	12.95 c
T ₆		18.76 cde	18.67 bc	18.36 bcd	9.72 d	10.15 d	11.65 d
T ₇		19.25 bc	19.10 bc	18.87 bc	7.36 f	8.08 f	9.19 f
T ₈		18.00 e	17.55 d	17.25 d	13.38 a	15.54 a	16.99 a
T ₉		19.69 ab	19.40 b	19.19 b	5.25 h	6.64 h	7.65 h
Level of significance		0.01	0.01	0.01	0.01	0.01	0.01

T₁= Tin pot; T₂= Plastic pot; T₃= Poly bag; T₄= Gunny bag; T₅= Gunny bag lined with polythene; T₆= Earthen pot; T₇= Cloth bag; T₈= Brown paper and T₉= IIRRI poly bag
Data in column having common letter(s) do not differ significantly at 1% level of significance