ISSN 0258-7122
Bangladesh J. Agril. Res. 39(4): 709-716, December 2014

EFFECT OF THICKNESS OF POLYTHENE BAG ON SEED QUALITY OF SOYBEAN

M. R. ALI[1], M. M. RAHMAN[2] AND K. U. AHAMMAD[3]

Abstract

An experiment was conducted at the Seed Laboratory of Regional Agricultural Research Station (RARS), Jamalpur during the period from May to November 2010 to study the effect of thickness of polythene bags on quality of soybean seed during storage. Seven levels of thickness of polythene bags viz. i) 0.02mm, ii) 0.03mm, iii) 0.04mm, iv) 0.05mm, v) 0.06mm, vi) 0.07mm and vii) 0.08mm were include as treatment in the trial. Seed moisture content, germination percentage, vigor and seedling dry matter weight were taken during May to November 2010 at two month intervals. Results showed that during the storage period the lowest seed moisture content and highest germination percentage, vigor index, seedling dry matter weight and field emergence were found for seed stored in 0.08mm thickness polythene bags. The germination of seed at two months after storage ranged between 76% to 95.3% and that was between 0% and 90.7% after six months of storage under ambient room condition. Soybean seed could be stored safely at ambient condition with more than 80% germination for six months by keeping them in polythene bags having thickness between 0.03mm to 0.08mm with 8% seed moisture content.

Keywords: Soybean, polythene thickness, seed moisture, viability, vigour.

Introduction

There is a huge potentiality of soybean as a new and alternate crop in Bangladesh but it's horizontal expansion is limited due to lack of supply of quality seed to the farmers for sowing. This problem is in fact associated with the rapid decline of soybean seed viability in storage. Therefore, soybean seed harvested from Rabi season crop can not be successfully stored as seed for planting in the next Rabi season (Woodruff, 1998). The container in storage determines the longevity of seed in storage. Harrington (1972) observed that seed deterioration increased as the moisture content increased. Kreyger (1963) reported that seed can maintain its viability for a longer time if it is dried thoroughly and stored in sealed container. Arulnandhy and Senanayaka (1988) concluded that soybean seed can be stored with good viability for at least one year if stored in sealed containers at seed moisture content below 10%. In storage, seed moisture content (SMC) comes into equilibrium with the adsorption and desorption phenomenon. Rahman *et. al.* (1994) stated that groundnut seed could be kept safe after drying down to

---

[1]SSO, RARS, Bangladesh Agricultural Research Institute (BARI), Jamalpur, [2]Professor, Department of Agronomy, Bangladesh Agricultural University (BAU), Mymansingh, [3]Senior Scientific Officer, RARS, BARI, Jessore, Bangladesh.

safe moisture level and storing in a sealed polythene bag. Reports are also available that polythene bags can be used as a moisture proof container (Arulnandhy and Senanayaka, 1988). However, information on the effect of thickness of polythene bags on viability of soybean seed in storage is scarce. Therefore, the present experiment was conducted with a view to study the effect of thickness of polythene bags on soybean seed quality.

Materials and Method

The experiment was conducted at the laboratory of Regional Agricultural Research station, Jamalpur during the period from May to November 2010 to study the effect of thickness of polythene bag on germination and vigor of soybean seed variety Shohag (PB-1). Seven levels of polythene bags with different thickness viz. 0.02mm, 0.03mm, 0.04mm, 0.05mm, 0.06mm, 0.07mm and 0.08mm were used as experimental treatment. The crop was grown in the field of Regional Agricultural Research Station, Jamalpur with proper agronomic management. The crop was harvested at full maturity and after proper processing, cleaning and drying the seed was stored in polythene bags until used for experimentation. The seed was dried in the sun on a tripale set on the cemented floor to about 8% initial seed moisture content (SMC). The seed was stored in the respective polythene bag with above different thickness on 14 May 2010. Each polythene bag (14 cm× 8 cm) was completely filled with 1 kg seed as per experimental specification and then made air tight. The containers were kept in the laboratory under ambient room condition. The seed was tested for different quality parameters at 0, 60, 120 and 180 days after storage (DAS). The quality parameters tested were seed moisture content, germination percentage, vigour index, seedling dry matter, field emergence.

Seed moisture content: Seed moisture content was measured using constant temperature by oven dry method following ISTA rules (1999). About 5-8 g of seeds were taken in the alluminium dish and dried in the oven at 130 ^{0}C for two hours. Then the moisture content was calculated as follows:

$$\text{Moisture content (\%)} = \frac{W1-W}{W1-W2} \times 100$$

Where,

W = Weight of blank aluminium dish with lid

W_1 = Weight of seed plus aluminium dish with lid before drying

W_2 = Weight of seed plus aluminium dish with lid after drying

Germination percentage: Germination test was done at 0, 60, 120 and 180 DAS following sand culture method. The sand was collected from the Brahmaputra river and was sterilized three days sun drying. Randomly collected 50 seeds in three replicates per bag were used for germination test. Before germination test the sand was properly moistened to about 60% water holding capacity. Seedling evaluation was done at 7 days after placing the test. The number of normal seedlings, abnormal seedlings and dead seeds were recorded respectively as per ISTA rules (1999). The sum of three replicates per bag was used and the germination was expressed in percentage.

Vigour index: Vigour index of seed was estimated from the seed set in the germination test by calculating the vigour index following the formula below given by AOSA (1983). The number of seedling was counted at each day at the same time from the day after seed set until the last count was made. The seedling emerged each day having radical length of 2 cm or more was considered as germinated.

$$\text{Vigour index} = \frac{\text{No. of seedling at 1}^{st}\text{ count}}{\text{Days to 1}^{st}\text{ count}} + \ldots + \ldots\ldots + \frac{\text{No. of seedling at final count}}{\text{Days to final count}}$$

Seedling dry matter: The normal seedlings from each germination lot were collected, washed with running tap water and surface dried. The seedlings were then dried in the oven at 70 ^{o}C for 72 hours (until constant weight reached) and the weight expressed seedling^{-1} basis.

Field emergence: At the end of the storage period (180 DAS), randomly selected 100 seeds from each seed lot in three replications were sown in the well prepared field. The number of seedlings emerged each day were counted up to 15 days after sowing. Field emergence was calculated using the above formula.

Data analysis was done following the analysis of variance (ANOVA) technique and mean differences were adjusted by Duncan’s Multiple Range Test (DMRT) with a computer package programme MSTAT-C (Gomez and Gomez, 1984).

Results and discussion

Seed moisture content (SMC)

The Polythene thickness of polythene had significant effect on final seed moisture content of soybean seed at different days after storage (DAS) (Table 1). At 60 days after storage (DAS) the highest seed moisture content (13.41%) was found with seeds stored in 0.02mm thick polythene bag and lowest (8.25%) was with the seeds stored in 0.08mm thick polythene bag and it was statistically significant with rest of the treatment (Table 1). For 120 DAS, the highest SMC was obtained from the seeds stored in 0.02mm thick polythene bag and lowest was achieved from 0.08mm thick polythene bag and it was statistically significant with other treatments. Similar trend was found in case of 180 DAS (Table 1). For poor thickness 0.02mm polythene bag could not protect moisture entrance into the bag. As a result seed moisture content into the bag was increased gradually. But 0.08 mm thickness of polythene bag protected moisture entrance into the bag. As a result seed moisture content into the bag was low. Similar result was observed by Alam and Rahman (2005) found the similar result who reported that seeds stored in 0.02mm thickness of polythene showed the highest seed moisture content.

Germination percentage

Germination percentage of soybean seeds was affected significantly by thickness of polythene bag. At 60 days after storage (DAS) the highest germination (95.3%) was found seeds stored in 0.08mm thick polythene bag and it was statistically similar with rest of the treatments except 0.02mm thick polythene bag (Table 1). The lowest (76.0%) germination was found from the seeds stored in 0.02mm thick polythene bag. After 120 DAS the highest germination (92.3%) was recorded from the seeds stored in 0.08mm thick polythene bag and the lowest germination (0.0%) was with 0.02mm thick polythene bag. The germination of seed dropped progressively with the length of storage time and the germination of seeds became 90.7% for the seeds stored in 0.08mm thick polythene bag and 0% for seeds stored in 0.02mm thick polythene bag and same trend was found incase of 180 DAS and field emergence (Table 1). Small thickness of 0.02mm polythene bag could not protect moisture entrance into the bag. As a result seed moisture content into the bag was increased gradually and metabolic activity of seeds increased as a result seeds viability was lost at 120 DAS. But big thickness 0.08 mm of polythene bag protected moisture entrance into the bag. As a result seed moisture content into the bag was low and metabolic activity into seeds was low as a result seeds viability was high. Similar result was observed by Alam and Rahman (2005) who reported that 0.02mm thickness of polythene showed the lowest germination percentage.

Field emergence

Field emergence of soybean seeds were affected significantly by thickness of polythene bag. At 180 DAS the highest field emergence 88.0% was found with 0.08mm thick polythene bag and it was statistically similar with rest of the treatments except 0.02mm thickness polythene bag. The lowest field emergence 0.00% was found from the those seeds stored in 0.02mm thickness polythene bag (Table 1). The poor thickness of 0.02mm polythene bag could not protect moisture entrance into the bag. As a result seed moisture content into the bag was high and metabolic activity into the seeds were increased gradually as a result seed viability was lost. But 0.08 mm thickness of polythene bag protected moisture entrance into the bag. As a result seed moisture content into the bag was low and metabolic activity into the seeds were low as a result seed viability was high. Similar result was observed by Alam and Rahman (2005) who reported that 0.02mm thickness of polythene showed the lowest field emergence.

Table 1. Effect of polythene thickness on soybean seed moisture content and germination percentage.

Polythene thickness (mm)	Moisture (%) at different days after storage (DAS)				Germination (%) at different DAS				Field emergence at 180 DAS
	0	60	120	180	0	60	120	180	
0.02	8.12	13.41a	17.27a	17.83a	100 (89.64)	76.0 b (60.75)	0.00d (0.33)	0.00c (0.33)	0.0b (0.33)
0.03	8.12	8.42b	8.70b	9.03b	100 (89.64)	87.3 a (69.24)	83.3c (65.96)	80.7b (64.00)	77.3a (61.60)
0.04	8.12	8.40b	8.67b	9.00b	100 (89.64)	89.3 a (71.20)	85.3bc (67.49)	82.0b (64.92)	82.0a (64.90)
0.05	8.12	8.36b	8.65b	8.95b	100 (89.64)	91.3 a (72.98)	85.7bc (67.79)	83.3b (65.94)	82.7a (65.46)
0.06	8.12	8.33b	8.59b	8.87b	100 (89.64)	92.7 a (74.67)	88.7abc (70.34)	85.3ab (67.55)	83.3a (65.96)
0.07	8.12	8.28b	8.53b	8.81b	100 (89.64)	93.3 a (76.12a)	90.0ab (71.80)	86.0ab (68.06)	84.0a (66.45)
0.08	8.12	8.25b	8.49b	8.76b	100 (89.64)	95.3a (77.84)	92.3a (73.93)	90.7a (72.28)	88.0a (69.91)
F-test		**	**	**	-	**	**	**	**
CV (%)		1.75	3.78	5.35	-	5.86	3.41	3.57	3.88

CV= Coefficient of variation, **= Significant at 1% level, In a column, figures having similar letter(s) do not differ significantly, [a]Figures in parenthesis indicates the Arc Sine transformed value.

Vigour index

Vigour index of soybean seeds was affected significantly by thickness of polythene bag. At 60 DAS the highest vigour index (28.02) was found with the seeds stored in 0.08mm thick polythene bag the lowest (23.48) was found from the seeds stored in 0.02mm thick polythene bag but all are statistically non significant (Table 2). After 120 DAS the highest vigour index (24.13) was recorded from 0.08mm thick polythene bag and it was statistically non significant with rest of the treatments except 0.02mm thick polythene bag. The lowest vigour index (0.0) was with the seeds stored in 0.02mm thick polythene bag. The Same trend was found incase of 180 DAS (Table 2). The poor thickness of 0.02mm polythene bag could not protect moisture entrance into the bag. As a result seed moisture content into the bag was high and metabolic activity into the seeds were increased gradually as a result seed viability was lost. But 0.08 mm thickness of polythene bag can protected moisture entrance into the bag. For this reason seed moisture content into the bag was low and metabolic activity into the seeds was also low. As a result seed viability was high. Thus those seeds stored in 0.08mm thickness of polythene bag showed higher vigour index than those seeds stored in 0.002mm thickness of polythene bag. The vigour index was decreased with the advancement of storage period. Similar result was observed by Alam and Rahman (2005) who reported that the seeds stored in 0.02mm thickness of polythene showed the lowest vigour index.

Seedling dry matter

Seedling dry matter of soybean seeds was affected significantly by thickness of polythene bag. At 60 DAS the highest seedling dry matter (0.114 g seedling^{-1}) was found with seeds stored in 0.08mm thick polythene bag the lowest (0.097 g seedling^{-1}) was found from the seeds stored in 0.02mm thick polythene bag but all are non significant (Table 2). After 120 DAS the highest seedling dry matter (0.112 g seedling^{-1}) was recorded from the seeds stored in 0.08mm thick polythene bag and it was statistically non significant with rest of the treatments except seeds stored in 0.02mm thick polythene bag. At 120 DAS there was no seedling in case of seeds stored in 0.02mm thick polythene bag. Same trend was found incase of 180 DAS and field emergence (Table 2). The poor thickness of 0.02mm polythene bag could not protect moisture entrance into the bag. As a result seed moisture content into the bag was high and metabolic activity into the seeds was increased gradually. As a result seed viability was lost. But 0.08 mm thickness of polythene bag can protected moisture entrance into the bag. For this reason seed moisture content into the bag was low and metabolic activity into the seeds was also low. As a result seed viability was high. Thus those seeds stored in 0.08mm thickness of polythene bag showed higher seedling dry matter than those seeds stored in 0.002mm thickness of polythene bag. The seedling dry matter was decreased with the advancement of storage period. Similar result was observed by Alam and Rahman (2005) who reported that the seeds stored in 0.02mm thickness of polythene showed the lowest seedling dry matter.

Table 2: Effect of polythene thickness on soybean seed vigour index and seedling dry matter during May to December 2010.

Treatment	Vigour index at different DAS				Seedling dry matter (g seedling^{-1}) at different DAS			
	0	60	120	180	0	60	120	180
0.02	30.12	23.48	0.00b	0.00b	0.115	0.097	0.000b	0.000b
0.03	30.12	28.55	22.77a	16.90a	0.115	0.099	0.100a	0.094a
0.04	30.12	29.25	23.05a	16.43a	0.115	0.100	0.102a	0.100a
0.05	30.12	29.40	23.34a	16.56a	0.115	0.101	0.104a	0.106a
0.06	30.12	29.18	24.06a	16.73a	0.115	0.109	0.108a	0.106a
0.07	30.12	29.79	23.71a	17.02a	0.115	0.111	0.109a	0.108a
0.08	30.12	28.02	24.13a	17.46a	0.115	0.114	0.112a	0.111a
Sign. Level	-	NS	**	**	-	NS	**	**
CV (%)	-	13.10	7.58	5.86	-	8.67	5.14	12.90

CV= Coefficient of variation, NS= Not significant, **= Significant at 1% level, In a column, figures having similar letter(s) do not differ significantly

Conclusion

From the result of the study it was concluded that seeds stored at 8% initial SMC and kept in 0.03mm to 0.08mm thickness of polythene bags maintained lowest moisture content and the highest germination percentage, field emergence, vigour index and seedling dry matter.

Reference

Alam, M. M. and Rahman M. M. 2005. Effect of seed moisture content and thickness of polythene bag on germination and vigor of soybean seed. *Bangladesh J. Seed Sci. & Tech.* **9**(1&2):33-38

AOSA (Association of Official Seed Analysts). 1983. Seed Vigor Testing Handbook. Contribution No. 32 to the Handbook on Seed Testing.

Arulnandhy, V. and Senanayaka, Y.D.A. 1988. Deterioration of soybean seed stored in different container under ambient conditions. Seed Research, 16(2): 183-192. [Soybean Abst. **13**(3): 125].

Gomez, K. A. and Gomez., A.A. 1984. Statistical procedures for Agricultural Research 2nd Edn. John Willy and Sons., New York. Pp. 97-111.

Harrington, J. F. 1972. Seed storage and longevity. In: Seed Biology, Vol. 3. (T.T. Kozlowski ed). Academic Prtessed, New York, Pp. 155-214. Packaging seed for storage and shipment. Seed Science & Technology, 1. 701-709.

ISTA (International Seed Testing Association). 1999. International rules for seed testing, 1999. Supplement to Seed Science and Technology. **27:** 27-32.

Kreyger, J. 1963. GHeneral considerations concerning the storage of seeds. Proceedings of International Seed Testing Association, **28:** 327-335.

Rahman, M. M., Salam, M. U., Kashem, M. A. and Hossain, S. M. A. 1994. Effect of storage container and moisture content on the viability of shelled and unshelled groundnut seed. *Bangladesh J. Crop Sci.* **5**(1&2): 53-63.

Woodruff, M. J. (1998). Reports on the soybean: Its status, and potential for Bangladesh. Agro based Industries and Technology Development Project (ATDP). May 1998. Ministry of Agriculture and International Fertilizer Development Centre IFDC).