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EFFECT OF SEED MOISTURE CONTENT AND STORAGE CONTAINER ON SEED VIABILITY AND VIGOUR OF SOYBEAN

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Abstract

Soybean (*Glycine max*) seed loses its viability in the storage which causes shortage in supply of quality seed and consequently hinders the expansion of soybean cultivation in Bangladesh.Losses of seed viability of soybean (*Glycine max*) in traditional storage is very common in the tropical environment. An experiment was conducted at the Seed Laboratory, Regional Agricultural Research Station, Bangladesh Agricultural Research Institute (BARI), Jamalpur in 2011 and 2012 to find out the effect of seed moisture content and types of storage container on soybean seed germination and seedling vigour. In 2011, soybean seed having 94% initial germination was stored at 8, 10 and 12% moisture levels but in 2012 seeds having 96% initial germination was stored at 6, 8, 10 and 12% initial moisture levels in four different types of storage containers viz., polythene bag, plastic pot, tin can and glass jar. weredays after storage ().The experiment was arranged in a factorial completely randomized design with three replications. In 2011, high germination of soybean seed (77-85%) was retained at 200 DAS for those stored at 8% initial seed moisture content (SMC) in any of the containers. Germination index and seedling dry matter decreased with increased initial seed moisture content irrespective of storage containers used. Tin preserved higher seed moisture contents of 9.93, 11.71 and 14.15% for seed stored at 8%, 10% and 12% initial seed moisture content, respectively. In 2012, 80-94% seed germination was retained at 200 DAS for those stored at 6% initial SMC in any of the containers. The germination declined to a range between 75.0 and 91.3% within 200 DAS at 8% initial SMC while those stored at 12% SMC showed rapid germination loss and the value showed down to between 9.3 and 22.0%. Vigour index and seedling dry matter decreased with increased initial seed moisture content irrespective of storage containers used. Tin also Seeds stored in tin container showed the higher final seed moisture contents irrespective of initial seed moisture content.

Introduction

Seed is a living entry and is subjected to various stresses which affect the quality. In storage, the viability and vigour of the seeds not only vary from genera to genera and variety to variety, but it is also regulated by many physico-chemical factors like moisture content, atmospheric relative humidity, temperature, initial seed quality, physical and chemical composition of seed, gaseous exchange, storage structure, packaging materials, etc. In order to prevent the quantitative and qualitative losses due to several biotic and abiotic factors during storage, several methods are being adopted, such as seed treatment with suitable chemicals or plant products and storing in safe containers, besides sanitation of the storage place. To combat these factors effectively,

storing the seeds in vapour proof containers like polythene bag, aluminum foils, tins or any sealed containers is found to be more useful in maintaining the desired quality of seeds for longer period, unlike those stored in moisture pervious containers like cloth bag and gunny bag. Arunnandhy and Senanayaka (1991) reported that the soybean seeds can be kept with high germination and vigour for more than one year when stored in sealed containers.

Storage containers or packaging materials are considered as one of the most important factors influencing longevity of seeds in storage. Many factors determine the longevity of seeds during storage. These includes seed moisture content, temperature, relative humidity, initial viability, stage of maturity at harvest, storage gas and initial moisture content of seed entering into storage (Tatipata, 2009). The farmers depend on their previous harvest for seeds and accordingly they preserve some portion of their harvest by indigenous methods. Generally low cost and easily available materials like earthen jar, coalter coated earthen jar, biscuit tin, kerosene tin, metal dram, gunny bag, polythene bag, dole, cow dung coated dole etc. are used as storage containers (Hossain, 1978). The farmers have different types of storage containers in order to protect the seed from moisture absorption and insect infestation. Storage container had significant effect on moisture content of wheat seed at different observation date of storing (Rahman *et al*., 2010). Seeds packed in polythene maintained high viability with time due to minimized moisture fluctuation and consequently produced more vigorous seedlings compared with those from seeds stored in jute or cloth bags which had little protection against moisture fluctuation (Karim *et al*., 2005). Starchy seeds above 12% moisture and oily seeds above 9% moisture should not be packed in moisture resistant containers. If seed could be packaged in moisture proof containers so that the relative humidity of the air around the seed remains low, then the seed equilibrium moisture remains low and the seed maintains its viability and vigour for a longer time (Poonam *et al.*, 2001; Agha *et al*., 2004). The physical properties and storage potential of seed were influenced to a very large extent by moisture content and the relative humidity of the atmosphere surrounding the seed (Kong *et al.*, 2008). Poor storage conditions greatly affect seed vigor (Simic *et al.*, 2007). Clay pots and gunny bags showed an increase in moisture content and sharp decline seed viability within a year of storage than air tight tin cans and air tight glass jar (Naznin, 2005). In sealed containers, dry seeds can not absorb moisture from the external atmosphere (Karim *et al.*, 2005). Krishnappa *et al.* (2002) found that groundnut seed stored in polyvinyl bag at 7% moisture content should the highest germination. Reports are also available that polythene bags can be used as moisture proof container (Alam and Rahman, 2005). Adequate dried seeds in sealed containers usually live longer at a given temperature than similar seeds in open containers. Soybean seeds stored in moisture proof containers retain high viability than those in moisture permeable containers (Tatipata, 2009).

Use of proper storage container to maintain the quality of farmers stored seed and preserving the seed viability should be an important consideration to reduce seed loss and increase crop yield (Samajpati *et al.*, 1978). In view of the above facts, the present study was undertaken to determine appropriate moisture content for seed storage and storage container for reducing the loss of soybean seed viability. .

Materials and Methods

An experiment was conducted at Regional Agricultural Research Station Farm, Jamalpur during the period from May to December 2011 and 2012 with a view to study the effect of storage container and initial seed moisture content on germination and vigour of soybean seed. Soybean variety Shohag (PB1) collected from Bangladesh Agricultural Research Institute (BARI), Joydebpur, Gazipur. The crop was grown 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 triple set on the cemented floor to about 8% seed moisture content (SMC) in the 1st year and 6.5% SMC in

the 2nd year. Just before final storage the seed was re-hydrated at 70% RH for required period of time to obtain target moisture content of 8, 10 and 12% for the 1st year and 6.50, 8, 10 and 12% for 2nd year. Four types of storage containers viz., polythene bag, plastic pot, tin can and glass jar were used in the experiment. The seed (500 g) was stored in the respective containers on 14 May 2011 and 18 May 2012 respectively. Each container was completely filled with seed as per experimental specification and then made air tight. The experiment was arranged in a factorial completely randomized design with three replicates. The seed was tested for different quality parameters at 40, 80, 120, 160 and 200 days after storage (DAS). The containers were kept in the laboratory under ambient room condition. The quality parameters tested were seed moisture content, germination percentage, vigour index, and seedling dry matter.

Seed moisture content was measured using high constant temperature oven dry method following ISTA rules (1999). About 5-8g of seeds were taken in the aluminum dish and dried in the oven at 130 °C for 2 hours (until constant weight reached). Then the moisture content was calculated as follows:

$$\text{Moisture content (\%)} = \frac{W_1 - W}{W_1 - W_2} \times 100$$

Where,
W = Weight of blank aluminum dish with lid
W_1 = Weight of seed plus aluminum dish with lid before drying
W_2 = Weight of seed plus aluminum dish with lid after drying

Germination percentage
Germination test was done in sand culture method. Two third of a plastic dish (20 cm diameter and 15 cm deep) was filled with sterilized sand having 60% water holding capacity. Randomly collected 100 seeds from each container were placed into the sand for the germination test. The germination dishes were placed in the germination cabinet and seedling evaluation was done at 8 days after placing the test. The number of normal seedlings per dish was regarded as the germination percentage.

Germination index (GI)
Germination index of seed was estimated from the seed set in the germination test by calculating the germination index following the formula below given by Association of Official Seed Analysts. 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 plumule length of 2 cm or more was considered as germinated.

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

Seedling dry matter
The normal seedlings from each germination dish was collected and washed with running tap water and surface dried. Then the seedling was dried in the oven at 70 °C temperature for 48 hours (until constant weight reached).

Data analysis was done statistically following the analysis of variance (ANOVA) technique and the means were compared by Duncan's Multiple Range Test (Gomez and Gomez, 1984).

Results and Discussion

Seed moisture content (SMC)

Storage container and initial seed moisture content had significant effect on final seed moisture content of soybean seed at 40, 80, 120, 160 and 200 DAS in 2011 and 2012 (Table 1). In 2011, the lowest seed moisture content of seeds stored in glass jar at 8% initial SMC were 8.08, 8.21, 8.31, 8.51 and 8.73% at 40, 80, 120, 160 and 200 DAS, respectively and percent moisture increased 1.00, 2.63, 3.87, 6.37 and 9.12% while the highest seed moisture content was observed from those seeds stored in metallic can at 12% initial SMC were 12.64, 13.08, 13.51, 13.87 and 14.15% at 40, 80, 120, 160 and 200 DAS, respectively and % moisture increased 5.33, 9.00, 12.58, 15.58 and 17.92% (Table 1). This result are in agreement with the findings of Naznin (2005) who reported that air tight tin can showed an increase in moisture content and sharp decline seed viability within a year of storage than air tight glass jar. In 2012, the lowest seed moisture content of seeds stored in glass jar at 6% initial SMC were 6.57, 6.61, 6.83, 7.12 and 7.38% at 40, 80, 120, 160 and 200 DAS, respectively and percent moisture increased 0.87, 1.83, 5.50, 10.33 and 14.67% while the highest seed moisture content was observed from those seeds stored in metallic can at 12% initial SMC were 12.40, 12.66, 13.02, 13.45 and 13.85% at 40, 80, 120, 160 and 200 DAS, respectively and % moisture increased 3.33, 5.50, 8.05, 12.08 and 15.42% (Table 1).

Germination percentage

Storage container and initial seed moisture content had significant effect on final seed moisture content of soybean seed at 40, 80, 120, 160 and 200 DAS in 2011 and 2012 (Table 1). In 2011, the lowest seed moisture content of seeds stored in glass jar at 8% initial SMC were 8.08, 8.21, 8.31, 8.51 and 8.73% at 40, 80, 120, 160 and 200 DAS, respectively and percent moisture increased 1.00, 2.63, 3.87, 6.37 and 9.125% while the highest seed moisture content was observed from those seeds stored in metalic can at 12% initial SMC were 12.64, 13.08, 13.51, 13.87 and 14.15% at 40, 80, 120, 160 and 200 DAS, respectively and percent moisture increased 5.33, 9.00, 12.58, 15.58 and 17.92% (Table 2). This result are in agreement with the findings of Naznin (2005) who reported that air tight tin can showed an increase in moisture content and sharp decline seed viability within a year of storage than air tight glass jar. In 2012, the lowest seed moisture content of seeds stored in glass jar at 6% initial SMC were 6.57, 6.61, 6.83, 7.12 and 7.38% at 40, 80, 120, 160 and 200 DAS, respectively and percent moisture increased 0.87, 1.83, 5.50, 10.33 and 14.67% while the highest seed moisture content was observed from those seeds stored in metalic can at 12% initial SMC were 12.40, 12.66, 13.02, 13.45 and 13.85% at 40, 80, 120, 160 and 200 DAS, respectively and percent moisture increased 3.33, 5.50, 8.05, 12.08 and 15.42% (Table 2).

Germination index

The interaction effect of initial seed moisture content and storage container on germination index was statistically significant at each of the observation dates during the storage period both in 2011 and 2012. The interaction of glass jars with 8% initial SMC showed higher germination index than metallic can container with 12% initial SMC at each of the observation dates for both the years. In 2011, the germination index of seeds kept in glass jar with 8% initial SMC were 25.41, 21.26, 17.53, 14.15 and 10.44 at 40, 80, 120, 160 and 200 DAS, respectively and it was statistically similar to 8% initial SMC in polythene bag and plastic pot at each of the observation dates and those seeds stored in metatlic can container with 12% SMC were 2.11 and 0.09 at 40 and 80 DAS, respectively. Those seeds stored in metallic can, plastic pot and polythene bag with 12% initial SMC completely lost viability at 120 DAS and no seedling was found (Table 3). In 2012, the germination index of seeds kept in glass jar with 6% initial SMC were 30.69, 29.22, 25.32, 21.76 and 12.58 at 40, 80, 120, 160 and 200 DAS, respectively and it was statistically similar to those seeds stored in polythene bag and plastic pot with 6% and 8% initial SMC. The corresponding values for seeds stored in metallic can container with 12% initial SMC were 20.85, 16.49, 10.48, 3.61 and 0.60 at 40, 80, 120, 160 and 200 DAS, respectively (Table 3).

Seedling dry matter

The interaction of initial seed moisture content and storage container had significant effect of on seedling dry matter at each of the observation dates during the storage in 2011 and 2012. The interaction effect of glass jar with 8% initial SMC showed higher seedling dry matter than metalic can container with 12% initial SMC at each of the observation dates for both the years. In 2011, the seedling dry matter of seeds in glass jar with 8% initial SMC were 0.127, 0.124, 0.122, 0.117 and 0.112 g seedling^{-1} at 40, 80, 120, 160 and 200 DAS while those values for seeds stored in metallic can container with 12% initial SMC were 0.078 and 0.076 g seedling^{-1} at 40 and 80 DAS, respectively. Seeds with 12% initial SMC stored in metalic can, plastic pot and polythene bag completely lost viability at 120 DAS and no seedling was found (Table 4). In 2012, the seedling dry matter of seeds in glass jar with 6% SMC were 0.116, 0.112, 0.108, 0.106 and 0.101 g seedling^{-1} at 40, 80, 120, 160 and 200 DAS while those values for seeds stored in metallic can container with 12% initial SMC were 0.086, 0.084, 0.080 and 0.077 g seedling^{-1} at 40, 80, 120 and 160 DAS, respectively and it was statistically at par to plastic pot and polythene bag with 12% initial SMC. Those seeds stored in metalic can, polythene bag and plastic pot with 12% initial SMC completely lost viability at 200 DAS and no seedling emergence was found (Table 4).

Table 1. Interaction effect of initial seed moisture content and storage container on final seed moisture content of soybean seed at different days after storage (DAS) storage in 2011 and 2012

Initial SMC × container	Seed moisture content (%)									
	2011					2012				
	40 DAS	80 DAS	120 DAS	160 DAS	200 DAS	40 DAS	80 DAS	120 DAS	160 DAS	200 DAS
M_1C_1	-	-	-	-	-	6.58d	6.72i	6.89l	7.29e	7.85gh
M_1C_2	-	-	-	-	-	6.59d	6.75i	6.99k	7.32e	7.78gh
M_1C_3	-	-	-	-	-	6.68d	6.93h	7.25j	7.77de	8.23fg
M_1C_4	-	-	-	-	-	6.57d	6.61j	6.83m	7.12e	7.38h
M_2C_1	8.15g	8.42h	8.58h	8.87j	9.12j	8.14c	8.44h	8.66h	8.87d-e	9.09e
M_2C_2	8.15g	8.30i	8.46h	8.70k	8.92k	8.11c	8.24g	8.36i	8.49cde	8.80e
M_2C_3	8.33f	8.73g	9.18g	9.46i	9.93i	8.19c	8.42f	8.84g	9.14b-e	9.69d
M_2C_4	8.08g	8.21i	8.31h	8.51l	8.73l	8.10c	8.22g	8.35i	8.50cde	8.70ef
M_3C_1	10.20e	10.46e	10.77e	11.06f	11.42f	10.39b	10.60d	10.92d	11.24ab	11.64b
M_3C_2	10.14e	10.38ef	10.63ef	10.94g	11.25g	10.34bb	10.56d	10.78e	11.12ab	11.59b
M_3C_3	10.49d	10.75d	11.33g	11.34e	11.71e	10.31b	10.57d	10.89d	11.23ab	11.77b
M_3C_4	10.07e	10.32f	10.42f	10.61h	10.90h	10.21b	10.32e	10.45f	10.61bc	10.90c
M_4C_1	12.27b	12.61b	12.86b	13.11b	13.40b	12.38a	12.5b8	12.92b	13.31bcd	13.67a
M_4C_2	12.20bc	12.43c	12.75b	12.90c	13.14c	12.35a	12.46c	12.80c	13.15a	13.62a
M_4C_3	12.64a	13.08a	13.51a	13.87a	14.15a	12.40a	12.66a	13.02a	13.45a	13.85a
M_4C_4	12.11c	12.34c	12.45c	12.62d	12.83d	12.33a	12.56b	12.79c	13.10a	13.51a
CV (%)	6.79	5.70	4.45	8.49	7.51	5.93	7.40	6.27	4.20	7.71

In a column, values having similar letter(s) do not differ significantly by DMRT

Note: C_1= Polythene bag, C_2= Plastic pot, C_3= Metalic can, C_4= Glass jar, M_1= 6.5 MC, M_2= 8% SMC, M_3=10% SMC, M_4= 12% SMC

Table 2. Interaction effect of initial seed moisture content and storage container on germination and field emergence of soybean seed at different DAS in 2011 and 2012

Initial SMC ×container	Germination (%)									
	2011					2012				
	40 DAS	80 DAS	120 DAS	160 DAS	200 DAS	40 DAS	80 DAS	120 DAS	160 DAS	200 DAS
M_1C_1	-	-	-	-	-	94.7abc	93.3a-e	92.7ab	90.7abc	90.0a
M_1C_2	-	-	-	-	-	97.3a	96.0ab	93.3ab	92.7ab	91.3a
M_1C_3	-	-	-	-	-	91.3a-d	90.0b-e	88.0bc	85.3bc	80.0b
M_1C_4	-	-	-	-	-	97.3a	96.7a	96.0a	95.3a	94.0a
M_2C_1	89.7ab	88.0ab	86.0ab	83.3ab	80.0ab	94.00abc	94.7abc	93.3ab	91.33abc	90.3a
M_2C_2	90.0ab	89.0a	87.0ab	84.7ab	82.3ab	94.7abc	94.0a-d	92.7ab	92.0abc	90.7a
M_2C_3	86.0ab	84.3abc	81.0bcd	79.3bc	77.3bc	88.7cd	88.0de	85.3c	84.7c	75.0b
M_2C_4	91.7a	90.7a	89.0a	87.0a	85.0a	95.3ab	94.0a-d	93.3ab	92.7ab	91.3a
M_3C_1	84.3b	78.7c	55.0d	71.0d	68.0d	88.7cd	91.3a-e	69.33d	55.3de	44.7c
M_3C_2	85.3b	81.3bc	76.7cd	74.0cd	72.7cd	94.0abc	88.7cde	65.3de	47.3f	42.0c
M_3C_3	75.7c	70.3d	63.3e	58.3e	52.7e	88.7cd	87.3e	50.0f	48.7cf	46.7c
M_3C_4	87.3ab	84.7abc	82.3bc	83.3ab	78.3b	91.3a-d	90. 7a-e	59.3e	57.3d	54.0c
M_4 C_1	24.7f	6.7f	0.0g	0.0g	0.0g	86.0d	72.0fg	52.0f	26.0g	10.7d
M_4 C_2	37.3e	9.3f	0.0g	0.0g	0.0g	88.7cd	72.7f	50.0f	24.7g	10.0d
M_4 C_3	19.3g	2.7f	0.0g	0.0g	0.0g	75.0fg	66.0g	40.0g	16.7h	9.3d
M_4 C_4	58.3d	46.7e	37.0f	29.0f	21.0f	89.3bcd	70.7fg	41.3g	24.0gh	22.0d
CV (%)	4.46	6.58	6.12	6.25	6.16	4.82	5.27	5.29	7.08	9.76

DAS= Days after sowing,

In a column, values having similar letter(s) do not differ significantly by DMRT

Note: C_1= Polythene bag, C_2= Plastic pot, C_3= Metallic can, C_4= Glass jar, M_1= 6% SMC, M_2= 8% SMC, M_3=10% SMC, M_4=12%SMC

Table 3. Interaction effect of initial seed moisture content and storage container on germination index of soybean seed at DAS storage in 2011 and 2012

Initial SMC ×container	Germination index									
	2011					2012				
	40 DAS	80 DAS	120 DAS	160 DAS	200 DAS	40 DAS	80 DAS	120 DAS	160 DAS	200 DAS
M_1C_1	-	-	-	-	-	29.01abc	28.95a	24.29ab	21.44a	12.05a
M_1C_2	-	-	-	-	-	29.74abc	28.98a	21.52a-d	19.85ab	11.88a
M_1C_3	-	-	-	-	-	28.11a-e	26.41bc	18.04d-h	15.73cd	9.27b
M_1C_4	-	-	-	-	-	30.69a	29.22a	25.32a	21.76a	12.58a
M_2C_1	25.22a	20.75ab	16.13ab	13.27b	9.89ab	28.34a-d	27.15ab	21.43a-d	20.25ab	10.12ab
M_2C_2	24.41a	22.00a	16.95ab	13.78ab	10.23a	28.92a-d	28.55a	20.67a-f	18.27a	10.56a
M_2C_3	23.35ab	20.25ab	15.21b	11.46c	9.13b	26.50cde	23.21d	16.64e-h	15.79cd	8.57b
M_2C_4	25.41a	21.26ab	17.53a	14.15a	10.44a	29.28ab	28.69a	23.00abc	21.60a	10.30ab
M_3C_1	22.80ab	17.00c	11.40c	8.62e	7.48c	25.85de	24.13d	20.41d-g	13.27de	4.05cde
M_3C_2	23.12ab	17.41c	12.05c	8.90e	7.58c	27.92b-e	23.90d	19.40c-h	10.70ef	3.58cde
M_3C_3	20.70b	14.35d	7.64d	6.23f	5.62d	27.90b-e	20.62e	11.63ij	8.43fg	5.57bcd
M_3C_4	23.48a	19.43b	12.92c	9.66d	8.23c	29.23ab	25.01cd	21.07a-e	13.27de	5.64bcd
M_4 C_1	6.04d	0.64f	0.00f	0.00f	0.00f	21.84df	19.84e	15.83ghi	8.75f	0.94de
M_4 C_2	6.01d	0.67f	0.00f	0.00f	0.00f	25.54e	19.72e	15.07hij	5.57gh	095e
M_4 C_3	2.11e	0.09f	0.00f	0.00f	0.00f	20.85b-e	16.49f	10.48j	3.61h	0.60e
M_4 C_4	10.44c	9.83e	4.39e	2.50g	2.31e	27.04b-e	19.18e	16.13f-i	9.80f	8.01abc
CV (%)	8.60	8.60	6.34	5.46	8.34	5.57	5.11	7.76	8.04	6.04

DAS= Days after sowing,
In a column, values having similar letter(s) do not differ significantly by DMRT
Note: C_1= Polythene bag, C_2= Plastic pot, C_3= Metalic can, C_4= Glass jar, M_1= 6% SMC, M_2= 8% SMC, M_3=10% SMC, M_4= 12% SMC

Table 4. Interaction effect of initial seed moisture content and storage container on seedling dry matter (g) of soybean at different DAS during storage in 2011 and 2012

Initial SMC ×container	Seedling dry matter (g seedling^{-1})									
	2011					2012				
	40 DAS	80 DAS	120 DAS	160 DAS	200 DAS	40 DAS	80 DAS	120 DAS	160 DAS	200 DAS
M_1C_1	-	-	-	-	-	0.113b	0.111a	0.104ab	0.098d	0.093c
M_1C_2	-	-	-	-	-	0.114ab	0.107b	0.105a	0.103bc	0.099b
M_1C_3	-	-	-	-	-	0.095b	0.106b	0.101abc	0.092e	0.086d
M_1C_4	-	-	-	-	-	0.116a	0.112a	0.108a	0.106a	0.101a
M_2C_1	0.112b	0.111c	0.108c	0.104c	0.099c	0.112b	0.110ab	0.100a-d	0.086f	0.055f
M_2C_2	0.123a	0.119b	0.116b	0.122b	0.106b	0.109b	0.104c	0.104ab	0.101c	0.088cd
M_2C_3	0.104c	0.107d	0.103d	0.099d	0.093d	0.094b	0.106b	0.098a-d	0.091e	0.084e
M_2C_4	0.127a	0.124a	0.122a	0.117a	0.112a	0.111b	0.106b	0.101abc	0.100c	0.098b
M_3C_1	0.102c	0.101e	0.098e	0.093e	0.087e	0.104b	0.100cd	0.087bcd	0.085f	0.054f
M_3C_2	0.114b	0.111c	0.108c	0.103c	0.097c	0.107b	0.103c	0.087bcd	0.087f	0.081e
M_3C_3	0.096d	0.094f	0.091f	0.086f	0.079f	0.086c	0.104c	0.097a-d	0.090e	-
M_3C_4	0.116b	0.113c	0.110c	0.106c	0.100c	0.110b	0.103c	0.100a-d	0.098c	0.095c
M_4 C_1	0.081g	0.080h	0.000h	0.000h	0.000h	0.100b	0.099d	0.084cd	0.084f	-
M_4 C_2	0.084ef	0.082h	0.000h	0.000h	0.000h	0.092b	0.096e	0.084d	0.083f	-
M_4 C_3	0.078g	0.076c	0.000h	0.000h	0.000h	0.086c	0.084e	0.080d	0.077g	-
M_4 C_4	0.088e	0.086g	0.082g	0.076g	0.065g	0.109b	0.103c	0.092a-d	0.097d	0.084e
Sign. level	**	**	**	**	**	**	**	**	**	**
CV (%)	4.86	6.00	7.60	8.61	5.91	6.92	7.04	8.63	5.73	8.09

DAS= Days after sowing, In a column, values having similar letter(s) do not differ significantly

Note: C_1= Polythene bag, C_2= Plastic pot, C_3= Metallic can, C_4= Glass jar, M_1= 6% Seed moisture content (SMC), M_2= 8% SMC, M_3=10% SMC, M_4= 12% SMC,

Conclusion

It is concluded that seeds stored in polythene bag or plastic container showed the germination performance similar to those in glass jar. Thus, the study revealed that soybean seed can be stored in polythene bag or plastic pot after drying to 6 to 8% SMC for retaining high viability.

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