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Effect of containers and storage conditions on germination of wheat seed

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Abstract

The present investigation entitled, "Effect of container and storage condition on germination of wheat seed" was conducted during 2020-21 at Seed Technology Research Unit (STRU), M.P.K.V., Rahuri for laboratory observations which were evaluated in factorial completely randomized design (FCRD) with three replications. The experiment consist of four varieties viz., Godavari (V₁), Panchavati (V₂), Tapovan (V₃) and Trimbak (V₄), two storage conditions viz., ambient storage (S₁) and storage at low temperature (20°C) (S₂), Five storage container such as Gunny bag (C₁), Cloth bag (C₂), Polythene bag (C₃), High density polyethylene (HDPE) bag (C₄) and Pro-grain bag (C₅) and three seed type age fresh seed (A₁), revalidated first (RvdIst) seed (A₂) and revalidated second (RvdIInd) seed (A₃). The observations on germination percentage was recorded at monthly interval up to twelve months at storage condition. The study revealed that, among the varieties, significant differences were observed. The germination percentage (88.04%) was better in respect of variety Godavari followed by Panchavati, Tapovan and Trimbak. Among the storage conditions, storage at low temperature (20 °C) i.e. cold storage, condition was found better for germination of wheat. Among storage containers, seeds stored in polythene bag showed good germination percentage followed by pro-grain bag and HDPE bag. However lowest germination percentage was observed from gunny bag storage container. The seeds stored in polythene bag were better in maintaining germination (88.16%) up to 12th months under cold storage conditions. Germination percentage (93.20%) were formed better in the fresh seed. The study suggested that seeds stored in polythene bag under cold storage condition could be useful to prolong the 32th month's storage life of wheat seeds. The wheat seeds can maintain the 85.68% germination percentage, at the age of 34th months which is above Indian minimum seed certification standards (IMSCS) (85%).

Keywords: Wheat, storage bag, storage container, revalidate seed, germination percentage

1. Introduction

Wheat (*Triticum aestivum* L.) was one of the first domesticated food crops and for 8000 years has been the basic staple food of the major civilisations of Europe, West Asia and North Africa. Today wheat is grown on more land area than any other commercial crops and continues to be most important food grain source for human [4]. Wheat is an important food crop and primarily grown in a wide range of environments [14]. Wheat's importance can be determine by the fact that it accounts for nearly half of all cropped land in South Asia [6]. Wheat seeds are a necessary and essential component in the development of wheat. In a seed production operation, maintaining good seed germination and vigour from harvest to planting is critical. During storage seed deterioration occurs, leading to reduction of vigour, germination percent, and decreasing seedling growth rate. Temperature and moisture content are the important factors, which influence the viability of seeds during storage [11]. Seeds must be properly stored in order to maintain an acceptable level of germination and vigour until the time of planting. Seeds can be kept in good storage condition by storing them in a climate with a desirable relative humidity level or by storing them in moisture-proof containers [3, 5]. Packaging container and storage duration significantly affected viability and seedling vigour [12]. Seed weight loss is limited, and moisture is retained once the bag is sealed hence the quality and amount of stored grains are maintained [1].

There is an increasing awareness of saving both time and expense that are realised by using suitable moisture- proof containers for storing valuable breeding stocks. However, seeds carried over to the second planting season require drying and packing in moisture barrier containers to prevent loss of viability and vigour [7]. Modern packaging uses different types of methods and materials to keep seeds at their original quality from the time they are harvest to the time they are planted [10].

The objective of this research was to study the effect of some storage conditions on the viability and vigour of seeds of wheat seeds stored for 12 months using five different packages.

2. Materials and Methods

The present investigation was conducted during 2020-21 at Seed Technology Research Unit (STRU) Laboratory at M.P.K.V., Rahuri (Maharashtra state).

2.1 Experimental Material

2.1.1 Seed

The seeds of four varieties were procured from wheat specialist, Agriculture Research Station, Niphad, Dist. Nashik (Maharashtra state).

2.2 Treatment details

2.2.1 Variety (4)

V₁: Godavari, V₂: Panchavati, V₃: Tapovan, V₄: Trimbak

2.2.2 Storage condition (2)

S₁: Ambient condition, S₂: Storage at low temperature (20°C)

2.2.3 Storage container (5)

C₁: Gunny bag, C₂: Cloth bag, C₃: Polythene bag, C₄: HDPE bag, C₅: Pro - grain bag

2.2.4 Age of Seed (3)

A₁: Fresh seed, A₂: Revalidated -I (RvdIst), A₃: Revalidated -II (RvdIInd).

Details of seed samples

Sr. No.	Crop	Variety	Stage	Seed Age Type	Age symbol	Age of the seed on Jan 2020 from date of harvest (month)
1	Wheat	Godavari (NIDW-295)	Nucleus	Fresh	A ₁	12
2				RVD-I	A ₂	34
3				RVD-II	A ₃	46
4	Wheat	Panchvati (NIDW-15)	Nucleus	Fresh	A ₁	12
5				RVD-I	A ₂	34
6				RVD-II	A ₃	46
7	Wheat	Tapovan (NIAW-917)	Nucleus	Fresh	A ₁	12
8				RVD-I	A ₂	34
9				RVD-II	A ₃	46
10	Wheat	Trimbak (NIAW-301)	Nucleus	Fresh	A ₁	12
11				RVD-I	A ₂	34
12				RVD-II	A ₃	46

2.3 Germination percentage (%)

The germination percentage was tested according to ISTA Rule [2]. 100 seeds from each treatment were kept for germination in four replication in germinator at 20°C temperature and at 70 per cent relative humidity for 8 days using between paper method. Germination percentage was computed on base of normal seedling with the formula given below.

$$\text{Germination (\%)} = \frac{\text{Number of normal seedling}}{\text{Total numbers of seeds}} \times 100$$

3. Results and Discussion

Effect of varieties, storage conditions, storage containers and seed ages on germination% of wheat seed

3.1 Effect of varieties on germination of wheat (%)

The data on germination percentage are presented in Table 1. The germination percentage differed due to the varieties. The variety Godavari (V₁) recorded significantly highest germination (88.04%) in the month of January at the age of 12th months than other varieties. However, the variety Trimbak (V₄) recorded lowest germination (85.06%) in the month of January at age of 12th months.

3.2 Effect of storage conditions on germination of wheat (%)

Among the storage condition the storage of wheat seed at low temperature (20 °C) i.e. cold storage (S₂) was recorded significantly higher germination (87.04%) in the month of January at the age of 12th months.

3.3 Effect of storage containers on germination of wheat (%)

The significantly higher germination percentage (88.16%) was observed in Polythene bag followed by Pro-grain bag (87.04%) and HDPE bag (86.48%) in the month of January at the age of 12 months. However the significantly lower germination percentage was observed in Gunny bag (85.00%) in the month of January at the age of 12th months.

3.4 Effect of seed age on germination of wheat (%)

The seed age had significant effect on germination percentage. The germination percentage was significantly highest in fresh seed (92.26%) in the month of January at the age of 12th months and maintained germination (85.39%) up to the month of July i.e. at the age of 18th months as per IMSCS. However RvdIst recorded germination (85.68%) in the month of January at the age of 34th months. Seed germination decreased with the increase in storage period. Similar findings had also reported by [8, 9, 13].

Table 1: Effect of variety, storage condition, storage container, and seed age on germination (%) wheat

Treatments		Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Variety (V)													
V ₁	Godavari	88.04 (70.18)	86.77 (69.04)	85.75 (68.15)	84.73 (67.31)	83.83 (66.58)	81.79 (64.97)	80.62 (64.09)	78.76 (62.72)	76.47 (59.81)	74.39 (59.71)	72.37 (58.11)	68.84 (56.15)
V ₂	Panchavati	86.92 (69.12)	86.20 (68.54)	85.28 (67.72)	84.32 (66.92)	83.55 (66.29)	81.52 (64.70)	80.35 (63.84)	78.52 (62.53)	76.31 (60.95)	74.46 (59.73)	71.93 (58.36)	68.99 (56.22)
V ₃	Tapovan	85.97 (68.31)	85.06 (67.54)	84.19 (66.83)	83.16 (66.02)	82.09 (65.18)	80.12 (63.69)	78.81 (62.75)	76.79 (61.34)	74.78 (59.81)	72.88 (58.71)	70.77 (57.34)	67.77 (55.47)
V ₄	Trimbak	85.06 (67.39)	84.23 (66.84)	83.48 (66.25)	82.44 (65.45)	81.44 (64.67)	79.40 (63.18)	78.11 (62.25)	76.16 (60.89)	74.05 (58.95)	72.92 (58.85)	70.03 (56.88)	67.48 (55.31)
S.Em (±)		0.12	0.15	0.15	0.16	0.15	0.13	0.13	0.15	0.14	0.18	0.12	0.13
CD at 5%		0.34	0.41	0.42	0.45	0.42	0.38	0.37	0.42	0.38	0.50	0.33	0.36
Storage condition													
S ₁	Ambient storage	85.95 (68.25)	84.83 (67.38)	83.88 (66.60)	82.80 (65.74)	81.86 (65.02)	79.85 (63.51)	78.62 (62.62)	76.73 (61.29)	74.56 (59.81)	72.66 (58.56)	70.44 (57.14)	67.55 (55.35)
S ₂	Cold storage	87.04 (69.26)	86.30 (68.60)	85.47 (67.88)	84.53 (67.11)	83.59 (66.34)	81.57 (64.77)	80.32 (63.84)	78.39 (62.45)	76.25 (60.95)	74.25 (59.61)	72.11 (58.20)	68.99 (56.22)
S.Em (±)		0.09	0.10	0.11	0.11	0.11	0.10	0.09	0.11	0.10	0.13	0.08	0.09
CD at 5%		0.24	0.29	0.30	0.32	0.30	0.27	0.26	0.29	0.27	0.36	0.23	0.25
Storage container													
C ₁	Gunny bag	85.00 (67.53)	84.09 (66.78)	83.10 (65.99)	81.80 (64.99)	81.00 (64.37)	78.95 (62.86)	77.72 (61.99)	75.84 (60.69)	73.64 (59.22)	71.58 (57.88)	69.41 (56.49)	66.76 (54.89)
C ₂	Cloth bag	85.80 (68.20)	84.91 (67.46)	84.19 (66.85)	83.13 (66.00)	82.09 (65.21)	79.93 (63.57)	78.81 (62.76)	76.93 (61.45)	74.81 (59.99)	72.94 (58.76)	70.54 (57.21)	67.44 (55.28)
C ₃	Polythene	88.16 (70.02)	86.99 (69.16)	86.23 (68.52)	85.30 (67.73)	84.35 (66.94)	82.44 (65.41)	81.10 (64.40)	79.11 (62.96)	77.01 (61.45)	74.99 (60.09)	72.90 (58.70)	69.80 (56.72)
C ₄	HDPE bag	86.48 (68.73)	85.64 (67.98)	84.56 (67.12)	83.66 (66.40)	82.58 (65.56)	80.71 (64.13)	79.42 (63.18)	77.50 (61.82)	75.31 (60.31)	73.47 (59.09)	71.42 (57.76)	68.35 (55.82)
C ₅	Pro-grain bag	87.04 (69.27)	86.21 (68.58)	85.30 (67.72)	84.43 (67.00)	83.61 (66.33)	81.51 (64.71)	80.33 (63.83)	78.39 (62.43)	76.24 (60.93)	74.28 (59.61)	72.09 (58.18)	69.00 (56.22)
S.Em (±)		0.14	0.16	0.17	0.18	0.17	0.15	0.15	0.17	0.15	0.20	0.13	0.14
CD at 5%		0.38	0.46	0.47	0.50	0.47	0.42	0.41	0.47	0.43	0.56	0.37	0.40
Age of seed (A)													
A ₁	Fresh seed	92.26 (73.95)	91.36 (73.04)	90.59 (72.20)	89.58 (71.25)	88.71 (70.44)	86.68 (68.65)	85.39 (67.58)	83.49 (66.07)	81.16 (64.30)	81.06 (64.21)	76.97 (61.34)	74.15 (59.46)
A ₂	RVD I st	85.68 (67.73)	84.64 (66.96)	83.59 (66.15)	82.66 (65.44)	81.51 (64.57)	79.45 (63.07)	78.27 (62.24)	76.40 (60.96)	74.35 (59.60)	73.25 (58.90)	70.37 (57.03)	67.25 (55.10)
A ₃	RVD II st	85.50 (64.58)	80.70 (63.68)	79.84 (63.36)	78.75 (62.59)	77.96 (62.03)	76.00 (60.69)	74.76 (59.87)	72.78 (58.57)	70.70 (57.25)	68.83 (56.08)	66.49 (54.64)	63.41 (52.79)
S.Em (±)		0.11	0.13	0.13	0.14	0.13	0.12	0.11	0.13	0.12	0.16	0.10	0.11
CD at 5%		0.30	0.35	0.37	0.39	0.37	0.32	0.32	0.36	0.33	0.44	0.28	0.31

Note: The values in parenthesis are arc sin value

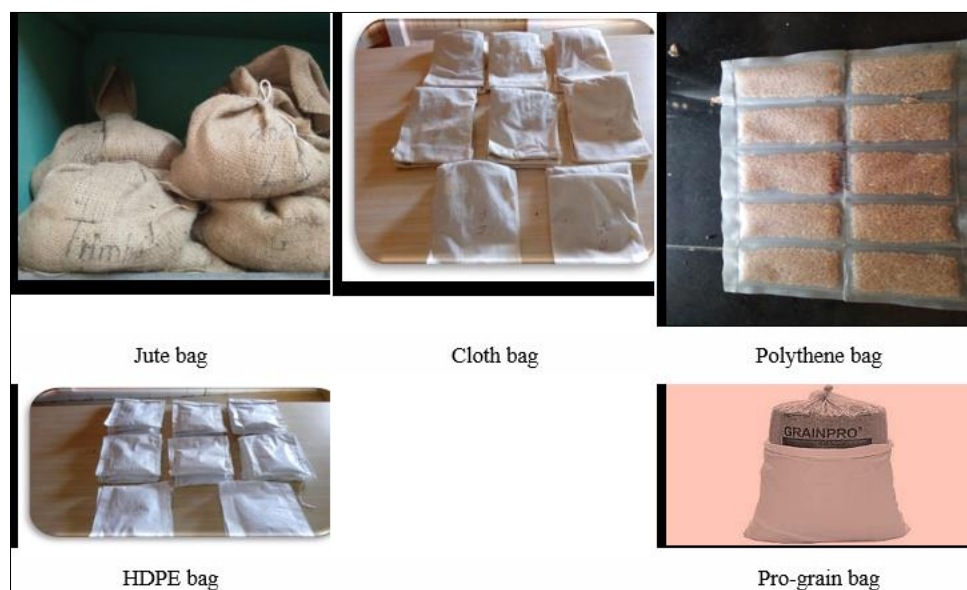


Fig 1: Storage containers used to store wheat seed

4. Conclusion

Polythene bags are effective at creating a moisture barrier. They help to protect seeds from excess moisture, which can cause them to rot or become susceptible to fungal growth. Polythene bags maintain a relatively stable temperature inside, which is essential for seed longevity. They prevent extreme temperature fluctuations that can harm seeds. Polythene bags are durable and resistant to tearing, which ensures that the seeds remain protected during handling and storage as compare to cloth and gunny bags. Prograin bags may not provide the same level of moisture resistance as polythene bags. The seeds samples were stored in five containers under ambient condition and cold storage conditions up to the 12th month's duration of which seeds maintained minimum seed certification standards and samples were drawn at monthly intervals for ascending the germination percent of wheat. The Rvd 1st seed of variety Godavari (V₁) stored in polythene bag under cold storage condition recorded significantly highest germination (85.68%) upto the 34th months which is above IMSCS.

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