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INFLUENCE OF STORAGE CONDITIONS AND CONTAINERS ON SEED STORABILITY OF JAMUN (*SYZIGIUM CUMINI*)

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ABSTRACT A comprehensive laboratory experiment was conducted to study the Influence of storage conditions and containers on seed storability of Jamun (*Syzigium cumini*) in college of Forestry, Sirsi, UAS, Dharwad. The study was conducted with two factors completely randomized design (CRD) with 3 replications for each treatment. The cleaned seeds are equally divided into 8 Parts, four samples were stored in ambient condition and other four samples were stored in refrigerated condition along with different containers viz open bowl, cloth bag, air tight container and polythin bag respectively. Tha samples were were drawn at fourthnight intervels and sown in the nursery bed. For each replication 100 seeds were sown to explore the effect of storage conditions and containers on seed germination. The jamun seeds are highly respond to cold temperature due to arrest of metabolic activity at low temperature. Storage of jamun seeds under refrigerated condition gave 73.88% germination and was maintained up to 75 days from the date of harvest. Seeds stored in airtight jar have shown best performance by recording maximum germination of 74.44 % when compared to all other containers. The speed of germination was shown the gradually decreasing trend during the storage period in jamun. Fresh seeds stored in refrigerator condition found significant and recorded maximum root and shoot length and seedling vigor index compared to ambient condition. Airtight container was the best for seed storage container in jamun, as it act as impermeable and keeps moisture at constant level by which seed viability can be restored up to 3 months. In general as advancement in seed storage in jamun leads to decline in seed germination.

KEYWORDS : Sorage, containers, germination root length and vigour index

INTRODUCTION

Syzigium cuminii, commonly known as jamun, is a member of the Myrtaceae family. It is one of the most widely distributed tropical fruit trees in India and is found both in wild and cultivated conditions. The fruit is favourite among the locals and the seed is used as a traditional preparation for treating diabetes (Prince *et al.* 1998). It is a minor fruit crop of tropical and subtropical region. Mature fruit is fleshy, purplish berry 20 mm in diameter and up to 25 mm long (Mbuya *et al*., 1994), containing a single seed (Arathi *et al.,* 1996). Some fruits have 2 to 5 seeds tightly compressed within a leathery coat and some are seedless (Morton, 1987).

The fruiting season of jamun in India extends through late May to July. The tree produces seeds every year. Seeds continue to be viable for three to five months after maturity. Prolonging the viability of seeds until next fruiting season would facilitate the availability of seeds for various plantation programmes and also for use of local farmers throughout the year. Freshly harvested jamun seeds gave better germination percentage within 1-2 weeks and may loose their viability soon after shedding (Mbuya *et al*., 1994; Patil *et al*., 1997).

Jamun seeds have high moisture content and therefore remain sensitive to desiccation. The limited storage potential of recalcitrant seeds is a big problem in the maintenance of seed banks for long term conservation. Sub zero, and in some cases higher than zero temperature significantly damage the recalcitrant seeds, therefore temperature cannot be reduced greatly. Therefore jamun seeds were difficult to store for longer term and thus are sensitive to drying (Mittal *et al*., 1999; Ouedraogo *et al*., 1999; Pritchard *et al*., 1999; Srimathi *et al*., 2001). This situation may limit the scope of modification in seed storage environment and even difficult to improve the storage life of recalcitrant seeds (King and Roberts, 1979; Roberts *et al.,* 1984).

Seed viability can be retained, in short term, if the seeds have maintained above critical moisture content i.e. 40-50% (Ouedraogo *et al.,* 1999; Srimathi *et el.,* 2001). The survival of seeds during short term storage also depends on storage environment and seed moisture content. The jamun seeds lost their viability within 2-3 weeks when stored at 25-30^{0}C (Rawat and Nautiyal, 1997; Srimathi *et al.,* 1999). The objective of present studies was to determine the desiccation sensitivity and optimum moisture content for long term storage (if possible) in Jaman seeds. Hence, the present study was aimed at finding suitable storage moisture content, temperature and container for storage of *S. cuminii* seeds.

MATERIALS AND METHODS:

A comprehensive laboratory study entitled Influence of storage conditions and containers on seed storability of Jamun (*Syzigium cumini*) was undertaken at Department of Forest Biology and Tree Improvement, College of Forestry, University of Agriculture Sciences,The seeds were collected from Sirsi forest area (podambayl) Karnataka. After collection of fresh, black ripened fruits, they are depulped by rubbing with sand and they were washed in water 2to3 times.The seeds are sown in nursery bed for recording different observation. The experiment were Carried out in seed science & technology laboratory.

The cleaned seeds are equally divided into 8 Parts, among which 4 samples are stored in ambient condition and other 4 samples are stored in refrigerated condition along with different containers *viz* open bowl, cloth bag, air tight container and polythin bag respectively. Seeds will be stored in different storage conditions and containers for 75 days. The sample will be drawn at fortnight interval, and each sample is divided into two parts, one part is used to check moisture content of seed and another is sown in nursery bed to evaluate germination parameter. A Completely Randomized Design (CRD) with two factors was adopted 3 replications for each treatment. For each replication 100 seeds were sown to explore the effect of storage Conditions and containers on seed germination. Tha samples were were drawn at fourthnight intervels and sown in the nursery bed.

The treatment details are as follows

Factor-1 Storage conditions

- S_1 – Ambient condition (Room condition)
- S_2 – Refrigerator condition (+10°c)

Factor-2: Containers

- C_1 – Open condition
- C_2 – Cloth bag
- C_3 – Air tight container
- C_4 – Polythin bag

Daily observations were taken for 28 days from the date of sowing. The observations on seed germination percentage, speed of germination, shoot length, root length, and seedling vigour index were recorded as

A. Division of samples for storage

B. Seeds stored in ambient condition

C. Seeds stored in refrigerated condition

D. Sowing of seeds

Plate-1: Experiment materials

RESULTS AND DISCUSSION

The influence of storage condition on moister content was not found significant up to 45 days of stoarge. However, the moister content variation was found significant after 60days of seed stooge. Seeds stored refrigerated condition showed gradual reduction moisture content from 68.20 to 31.64% and in ambient condition from 62.42 to 17.84 % (Table-1). The gradual decrease in moister content in both the conditions was due to the desiccation sensitivity of recalcitrant seeds in jamun. This study is in confirmative with experiment conducted by Shrimathi *et.al.,*(2001) in Jamun.

The influence of storage conditions on germination percent has not found significant up to 60 days of seed storage. However, as advancement in seed storage, the germination percent was found significant and recorded maximum germination percent in refrigerated condition with 73.88 % when compared to ambient condition. The least germination percent is recorded in ambient condition with 48.88 % after 75 days of storage. The germination percent not found significant due the containers has up to 4th forth night of seed storage. The seeds stored in airtight jar has shown best performance by recording maximum germination of 74.44 % when compared to all other containers. The least germination percent was recorded in cloth bag with 72.22 %. Among, the interaction between the storage conditions and containers, seeds stored in air container under refrigerator condition has shown significantly higher germination percent (77.77 %) followed by S_1C_3 (73.33 %) and lower in S_1C_2 and S_1C_1 with 72.33 % and 71.11 % respectively (Table-2).

The germination percent was shown the gradually decreasing trend during the storage period. This may due to the desiccation sensitivity of recalcitrant seeds in jamun. These seeds also show the phenomenon of recalcitrance (loss of viability due to decrease in moister content) (Shrimathi *et.al.,*(2001).

The influence of storage condition on speed of germination has found non-significant during storage. However, seeds stored under refrigerated condition recorded maximum speed of germination of 0.15 when compared to ambient condition. The least speed of germination has recorded in ambient condition with 0.14. The influence of containers on speed of germination has exhibited non-significant variation during the experimentation. The maximum speed of germination was recorded from seeds stored in air tight jar (0.24) and the least was recorded in cloth bag (0.13). The interaction effect between conditions and containers has shown non-significant during the experimentation. However, S2C3 has recorded maximum speed of germination with 0.27 followed by S_1C_1 with 0.26 and lower in S_2C_2 and S_1C_2 with 0.23 and 0.21 respectively. The speed of germination was shown the gradually decreasing trend during the storage period in Jamun, This may be due to the decrease in moisture content as the storage period prolongs and also due to the decrease in availability of minerals from the seed germination. These results of present study were in line with investigations made by Anandalakshmi *et al.,*(2005) in jamun The influence of storage condition and root length has found non-significant during experimentation. The maximum root length recorded in ambient condition with 7.95 cm and the least in ambient condition with 5.18 cm. The maximum root length recorded from cloth bag container with 8.3 cm and the least is recorded seeds stored in open bowl with 5.03 cm. The interaction effect between the storage condition and containers has shown non-significant difference during the experimentation. However, S_2C_1 has recorded maximum root length of 8.36 cm followed by S_2C_2 with 8.3 cm and lower in S_1C_3 and S_1C_2 with 7.36 cm and 7.16 cm respectively. The gradual reduction root length was observed in progress of storage period during the experimentation. The decreasing trend of root length is may be due to less availability of plant growth promoters for the growth of young seedlings. This study corroborate with results of Shrimathi *et.al.,*(2001) in Jamun.

The influence of storage condition shoot length has found non-significant up to 3rd forth night of seed storage. Seeds stored under refrigerated condition has recorded maximum shoot length with 6.16 cm when compared to ambient condition. The least shoot length was observed after 75 days of storage under ambient condition with 5.04 cm. The influence of container on shoot length has not shown significant variation during the experimentation. The maximum shoot length was recorded in air tight jar (9 cm) and the least shoot length was observed in poly bag with 4.98 cm. The combined effect storage conditions and containers has shown non-significant difference throughout storage period. The S_1C_4 has recorded maximum shoot length with 5.83 cm followed by S_2C_2 (5.73 cm). and lower in S_1C_3 and S_1C_2 with 4.76 cm and 4.43 cm respectively. The shoot length was shown gradually decreasing trend during the experiment. The decreasing trend of root length is may be due to less availability of plant growth promoters for the growth of young seedlings.

The influence storage condition on seedling vigor index has not found significant up 30days of seed storage. Seed stored under refrigerated condition found significant for vigour index values over ambient condition. The maximum vigor index of 1071.77 was recorded in refrigerated condition compared to ambient condition. There was gradual decrease in seedling vigor index as the storage period prolongs. The least seedling vigor index has recorded in ambient condition (685.61) at 75 days after storage. The influence containers on seedling vigor index has shown not significant up to 2nd forth night interval. The air tight jar has performed best with 1103.88 seedling vigor index when compared to all other containers. The least seedling vigor index has recorded in cloth bag (539.33). The interaction of storage conditions and containers showed non-significant difference up to 60 days of storage. However, S_1C_4 recorded maximum seedling vigor index with 866.4 followed by S_1C_1 (860.4) whereas, S_1C_2 (809.3) and S_1C_3 (760.1) recorded lower seedling vigor index during the experimentation. The vigor index was followed decreasing trend during the experimentation, This may be due to non availability of stored food materials and growth promoters form the seed as the storage period prolongs. The results present study was in confirmative with Mazhar Abbas *et al.,*(2003) in jamun.

Table -1 Influence of storage conditions on seed moister content variation in Jamun.

Seed moisture content (%)						
Storage period (Days)	**Initial**	**15 days**	**30 days**	**45 days**	**60 days**	**75 days**
Storage condition (S)						
S_1-Refrigerated	68.20	54.66	51.33	49.68	41.33	31.64
S_2 –Ambient	65.42	54.34	44.83	31.43	23.35	17.84
SEM±	**1.03**	**1.57**	**1.66**	**2.6**	**2.04**	**2.42**
CD	**NS**	**NS**	**NS**	**NS**	**6.17**	**7.32**

Table-2 Influence of storage conditions and containers on seed germination in Jamun.

Germination (%)						
Storage period (Days)	**Initial**	**15 days**	**30 days**	**45 days**	**60 days**	**75 days**
Storage condition (S)						
S_1-Refrigerated	99.77	81.66	78.88	73.33	73.88	66.66

S_2 –Ambient	97.44	80.55	72.77	65.55	61.66	48.88
SEM±	**1.03**	**2.57**	**1.66**	**2.6**	**2.04**	**2.42**
CD	**NS**	**NS**	**NS**	**NS**	**6.17**	**7.32**
Containers (C)						
C_1-Clothbag	98.88	81.11	74.44	65.55	63.33	52.22
C_2-Bowl	98.88	84.44	68.89	65.55	62.22	58.88
C_3-Polybag	97.77	78.88	78.88	71.11	71.11	55.55
C_4-Airtight Jar	98.88	80	81.11	75.55	74.44	64.44
SEM±	**1.47**	**3.64**	**2.35**	**3.68**	**2.88**	**3.42**
CD	**NS**	**NS**	**NS**	**NS**	**8.72**	**NS**
Interactions						
S_1C_1	97.77	84.44	82.22	71.11	71.11	66.66
S_1C_2	100	82.22	73.33	66.66	72.33	68.88
S_1C_3	95.55	82.22	75.55	73.33	73.33	64.44
S_1C_4	97.77	77.78	84.44	82.22	77.77	66.66
S_2C_1	100	77.77	66.66	60	48.89	37.77
S_2C_2	97.77	86.66	64.44	64.44	51.11	48.89
S_2C_3	100	75.55	82.22	68.88	71.11	46.66
S_2C_4	100	82.22	77.78	68.89	75.55	62.22
SEM ±	**2.07**	**5.15**	**3.33**	**5.21**	**4.08**	**4.84**
CD	**NS**	**NS**	**NS**	**NS**	**12.34**	**NS**

Table-3 Influence of storage conditions and container on speed of germination in Jamun.

Speed of germination						
Storage period (Days)	**Initial**	**15 days**	**30 days**	**45 days**	**60 days**	**75 days**
Storage condition						
S_1-Refrigerated	0.23	0.17	0.17	0.15	0.15	0.13
S_2 –Ambient	0.24	1.41	1.23	0.15	0.14	0.14
SEM±	**0.011**	**0.875**	**0.756**	**0.006**	**0.007**	**0.006**
CD	**NS**	**NS**	**NS**	**NS**	**0.021**	**NS**
Containers (C)						
C_1-Clothbag	0.24	0.19	0.18	0.16	0.15	0.13
C_2-Bowl	0.22	0.16	0.16	0.15	0.15	0.14
C_3-Polybag	0.26	0.18	0.17	0.13	0.16	0.13
C_4-Airtight Jar	0.24	2.63	2.3	0.16	0.15	0.15
SEM±	**0.015**	**1.237**	**1.069**	**0.009**	**0.01**	**0.008**
CD	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
Interactions						
S_1C_1	0.26	0.18	0.17	0.15	0.15	0.12
S_1C_2	0.21	0.15	0.17	0.16	0.15	0.15
S_1C_3	24	0.19	0.19	0.13	0.16	0.11
S_1C_4	0.22	0.15	0.16	0.17	0.15	0.15
S_2C_1	0.23	0.207	0.2	0.16	0.14	0.15
S_2C_2	0.23	0.16	0.15	0.14	0.15	0.13
S_2C_3	0.27	0.17	0.15	0.14	0.16	0.15
S_2C_4	0.25	5.1	4.44	0.15	0.15	0.15
SEM ±	**0.022**	**1.75**	**1.512**	**0.012**	**0.014**	**0.012**
CD	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

Table-4 Influence of storage conditions and containers on root length in Jamun.

Rootb length (cm)						
Storage period (Days)	**Initial**	**15 days**	**30 days**	**45 days**	**60 days**	**75 days**
Storage condition						
S_1-Refrigerated	7.75	7.65	6.75	6.09	5.48	5.24
S_2 –Ambient	7.95	7.34	6.59	6.38	5.64	5.18
SEM±	**0.31**	**0.304**	**0.34**	**0.34**	**0.24**	**0.21**
CD	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
Containers (C)						
C_1-Clothbag	8.3	7.41	6.08	5.86	5.56	5.13
C_2-Bowl	7.73	7.21	7.01	5.91	5.23	5.03
C_3-Polybag	7.26	7.73	6.8	6.03	5.4	5.23
C_4-Airtight Jar	8.11	7.61	6.8	7.13	6.05	5.45
SEM±	**0.45**	**0.43**	**0.48**	**0.49**	**0.34**	**0.42**
CD	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
Interactions						
S_1C_1	8.23	7.9	6.06	5.4	5.46	5
S_1C_2	7.16	6.9	6.8	5.5	5.46	5.16
S_1C_3	7.36	8.2	6.9	6.1	4.86	5.7
S_1C_4	8.26	7.6	7.2	7.2	6.13	5.1
S_2C_1	8.36	6.9	6.1	6.3	5.66	5.26
S_2C_2	8.3	7.5	7.2	6.3	5	4.9
S_2C_3	7.16	7.2	6.7	5.9	5.93	4.76
S_2C_4	7.96	7.6	6.3	7	5.96	5.8
SEM ±	**0.9**	**0.6**	**0.68**	**0.69**	**0.49**	**0.42**
CD	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

Table-5 Influence of storage conditions and containers on shoot length in Jamun.

Shoot length (cm)						
Storage period (Days)	**Initial**	**15 days**	**30 days**	**45 days**	**60 days**	**75 days**
Storage condition						
S_1-Refrigerated	8.6	6.86	6.86	6.16	5.73	5.04
S_2 –Ambient	8.1	6.41	6.6	5.45	5.61	5.39
SEM±	**0.35**	**0.3**	**0.32**	**0.22**	**0.22**	**0.115**
CD	**NS**	**NS**	**NS**	**0.68**	**NS**	**0.346**
Containers (C)						
C_1-Clothbag	7.9	6.08	6.2	6.2	5.78	5.283
C_2-Bowl	8	7.13	6.86	5.61	5.45	5.083
C_3-Polybag	8.4	6.75	7.08	5.28	5.93	4.98
C_4-Airtight Jar	9	6.6	6.8	6.13	5.53	5.51
SEM±	**0.5**	**0.42**	**0.46**	**0.32**	**3.13**	**0.16**
CD	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
Interactions						
S_1C_1	8.93	6.3	6.73	6.8	5.6	5.13
S_1C_2	8.4	7.6	6.7	6.23	5.63	4.43
S_1C_3	8.4	7.03	6.9	5.43	5.96	4.76
S_1C_4	8.7	6.53	7.13	6.2	5.73	5.83
S_2C_1	6.86	5.86	5.66	5.6	5.96	5.43
S_2C_2	7.7	6.66	7.03	5	5.26	5.73
S_2C_3	8.53	6.46	7.26	5.13	5.9	5.2
S_2C_4	9.43	6.66	6.46	6.06	5.33	5.2
SEM ±	**0.71**	**0.6**	**0.65**	**0.45**	**0.44**	**0.229**
CD	**NS**	**NS**	**NS**	**NS**	**NS**	**0.693**

Table-6 Influence of storage conditions and containers on seedling vigor index in Jaman.

Seedling vigour index						
Storage period (Days)	**Initial**	**15 days**	**30 days**	**45 days**	**60 days**	**75 days**
Storage condition						
S_1-Refrigerated	1597	1192	1072	900.9	826.3	685.6
S_2 –Ambient	1599	1111	962.2	776.2	698.2	519.2
SEM±	**40.59**	**57.07**	**35.22**	**39.42**	**29.68**	**29.95**
CD	**NS**	**NS**	**106.5**	**119.3**	**89.76**	**90.56**
Containers (C)						
C_1-Clothbag	1600	1095	918.8	799.2	719.8	539.3
C_2-Bowl	1559	1215	948.7	749.3	667.6	595.4
C_3-Polybag	1535	1154	1097	803.3	802.3	569.4
C_4-Airtight Jar	1698	1142	1104	1002	859.4	705.3
SEM±	**57.41**	**80.71**	**49.8**	**55.75**	**41.98**	**42.35**
CD	**NS**	**NS**	**150.6**	**168.6**	**126.9**	**NS**
Interactions						
S_1C_1	1676	1197	1052	871.8	860.4	671.6
S_1C_2	1557	1199	980.4	777.3	809.3	667.1
S_1C_3	1500	1263	1045	848.4	769.1	675.3
S_1C_4	1657	1110	1209	1106	866.4	728.4
S_2C_1	1523	993.3	785.6	726.8	579.1	407.1
S_2C_2	1562	1231	916.9	721.3	525.8	523.8
S_2C_3	1570	1046	1148	758.2	835.6	463.6
S_2C_4	1740	1174	998.4	898.4	852.4	682.2
SEM ±	**81.19**	**114.1**	**70.42**	**78.85**	**59.37**	**59.9**
CD	**NS**	**NS**	**NS**	**NS**	**179.5**	**NS**

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