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STUDIES ON JAMAN (*Syzygium cuminii* L. Skeels) SEED STORAGE BEHAVIOUR

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Studies were undertaken to explore the storage behaviour of Jaman (*Syzygium cuminii* L. Skeels) seeds. Seeds were dried down to different moisture levels. Mean germination percentage was the highest (99.1%) at ambient moisture content (60%). Reduction in seed moisture content showed significant loss in viability depicting recalcitrant storage behaviour. Seed germination speed was high (11.51) at 60% moisture but was adversely affected when dried to 18%. Time to get 50% germination was also significantly increased (18 days for 30% moisture compared to 7.4 days for control) with the passage of desiccation period. Maximum electrical conductivity (1010 µScm^{-1}) was recorded at low moisture level (18%) which resulted in considerable reduction in seed viability and germination speed. These studies revealed that Jaman seeds are sensitive to desiccation tolerance and their storage behaviour may be recalcitrant.

Key words: Jaman, desiccation tolerance, EC, germination, viability

INTRODUCTION

Seeds are classified in two categories: orthodox and recalcitrant, on the basis of their storage behaviour (Roberts, 1973). Recalcitrant seeds are characterized by their nature of desiccation sensitivity (Pammenter and Berjak, 1999). Jaman 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 can not be reduced greatly. 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).
Jaman (*Syzygium cuminii* L. Skeels) is an evergreen fruit tree belonging to family Myrtaceae. 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).
Freshly harvested Jaman 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). Therefore its seeds are considered 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). 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 al.*, 2001). The survival of seeds during short term storage also depends on storage environment and seed moisture content, for example, seed lost viability within 2-3 weeks when stored at 25-30°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.

MATERIALS AND METHODS

Plant Material

Jaman seeds were collected from the Experimental Fruit Garden, Institute of Horticultural Sciences, University of Agriculture, Faisalabad. About 6 kg fruit was obtained and seeds were properly separated from pulp. Extracted seeds were washed in a running tap water to remove the seed mucilage. Seeds were treated with NaOCl 10% for 10 minutes for surface sterilization (Mumford and Grout, 1979).

Moisture Content Determination

Seed moisture content was determined using samples of 25 seeds at 103°C for 17 hours (ISTA, 1996) at each sampling time and was expressed on dry weight basis. The test was replicated five times (5 seeds/replication).

Seed Treatment and Germination Test

The seed lot with ambient moisture content (60%) was air dried to achieve 45, 30 and 18% moisture levels at 25°C and kept in aluminum foil bags at 15°C until use. Seed germination tests were carried out according to ISTA (1996). The seed material was selected randomly from each treatment and placed in 5 Petri dishes (14 cm) on Whatman No.1 double filter paper. Seeds were moistened regularly with autoclaved distilled water and placed at 30°C. There were five replicates each of 20 seeds.

Fig. 1: Effect of Desiccation on Mean Germination Percentage (%) of *Syzygium cuminii* Seeds

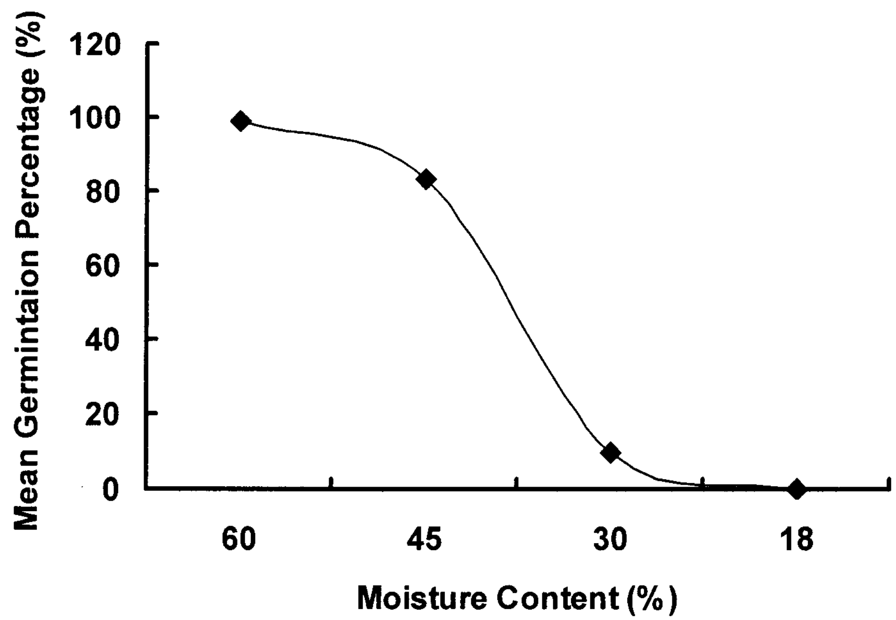


Fig. 2: Effect of Desiccation on Germination Speed of *Syzygium cuminii* Seeds

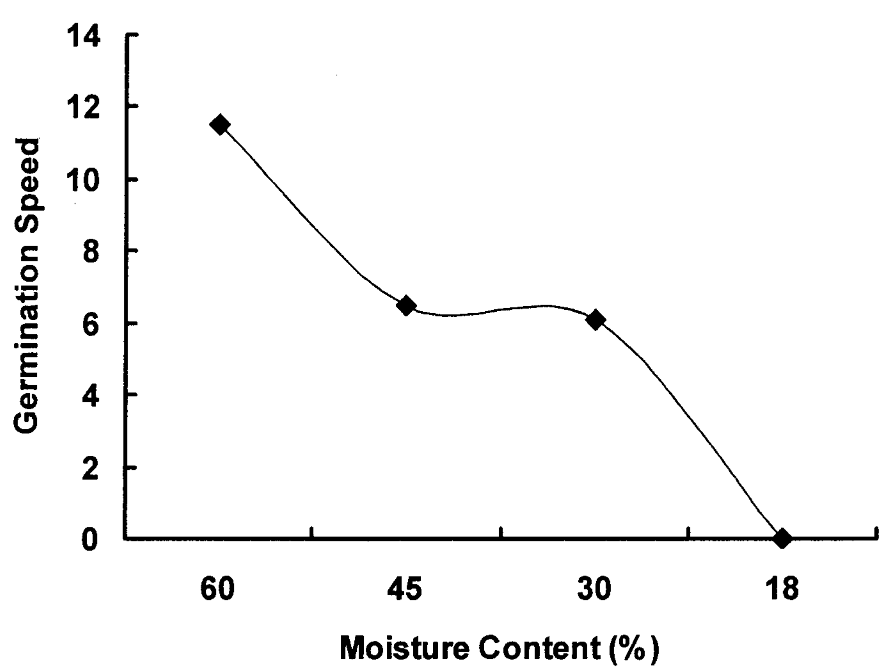


Fig. 3: Effect of Desiccation on Time to Get 50% Germination

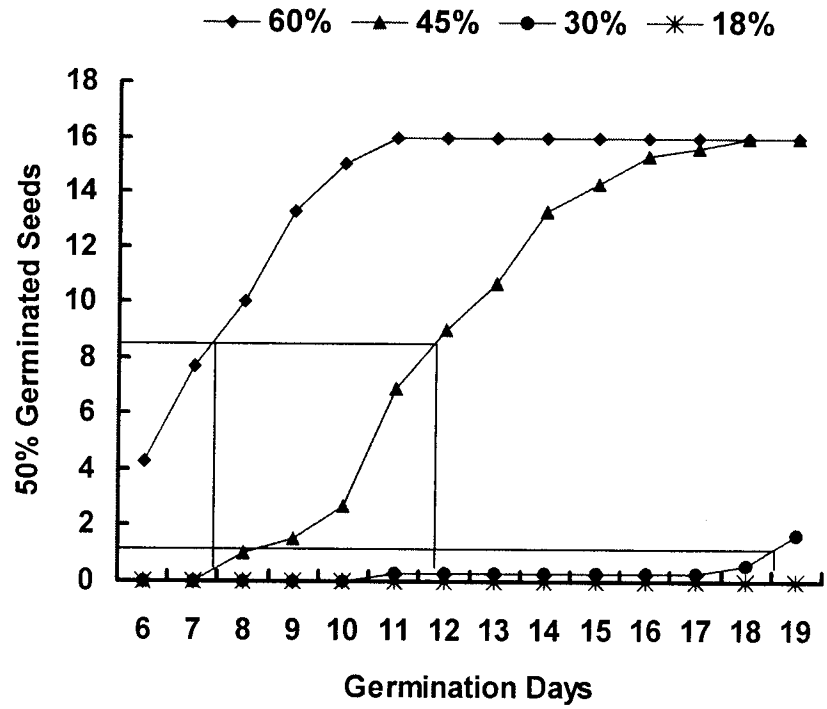
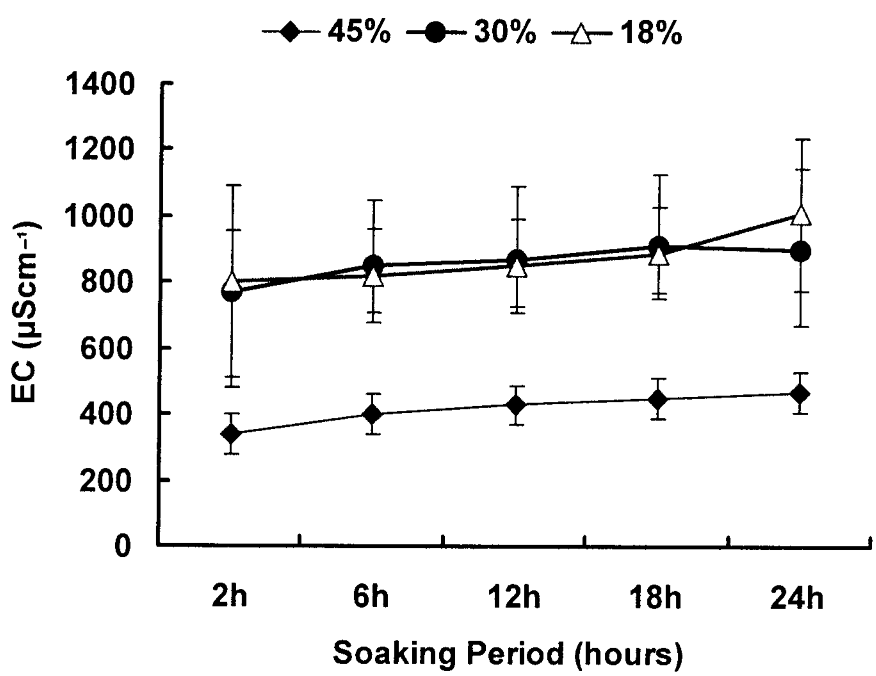


Fig. 4: Effect of Desiccation on Seed Content Leakage at Different Moisture Levels



Seed Germination Speed

The seed germination speed was measured in all treatments (moisture content levels) at 30°C after every 24 hours by using Kotowski's formula (1926).

$$\text{Germination speed} = \frac{\sum n}{\sum (n \times Dn)} \times 100$$

n = number of seedlings germinated on day Dn.
Dn = number of days from sowing corresponding n.

Time to get 50% germination

Time taken by seeds to get 50% germination is also an important parameter in determining their vigour. It was calculated by the following formula proposed by Coolbear *et al.*, (1984) and worked out graphically.

$$T50 = ti + \frac{[(N+1)/2 - nj] \times (tj - ti)}{nj - ni}$$

Electrical Conductivity Test

Single seed from each treatment (20 replications) was soaked in 3 ml deionized water for 24 hours at 25°C (Khan *et al.,* 2003). The leachate conductivity was measured using digital Nikon EC meter. Observations were recorded, when the EC meter reading became stable, at predetermined intervals (2, 6, 12, 18, and 24 hours) in deionozed water.

RESULTS AND DISCUSSION

Seed Moisture Content and Germination Percentage

Jaman seeds showed considerable reduction in the moisture content during storage. Seed moisture content was reduced upto three levels viz: 45%, 30% and 18%. The capability of seeds to germinate was greatly affected and showed significant ($P<0.05$) decline with reduction in moisture content (Figure 1). No seed was germinated from seeds having 18% moisture content. Seeds with high initial moisture content (60%) and those which were dried to 45% moisture content showed maximum mean germination percentage (93.28% and 83.2%, respectively). Germinability of seeds began to fall as moisture content decreased below 45%. At 30% moisture level only 9.8% seeds retained thier viability and were able to germinate. The loss in mean germination percentage indicated that Jaman seeds are sensitive to desiccation. The results are in accordance with the findings of Mittel *et al.*, 1999; Pritchard *et al.*, 1999 and Srimathi *et al.*, 2001. The same behaviour was observed in recalcitrant *Araucaria angustifolia* embryos. The critical moisture content at which viability was completely lost was 25-30% (Corbineau *et al.*, 1997).

Studies on some other recalcitrant species for example seeds or embryos of *Araucaria hunstenii, Aesculus hippocastanum* and species of *Inga, Camellia, Quercus, Landolphia* and *Acer* also showed no germination or reduced growth following dehydration to 20-30 or 30-41% moisture content respectively (Berjak *et al.*, 1993; Finch-Savage, 1992; Hong and Ellis, 1990; Pammenter *et al.*, 1992; Pritchard, 1991, Pritchard *et al.*, 1995 and Tompsett and Pritchard, 1993). The results are also in accordance with the desiccation trials on *Shorea leprosula* seeds (Usep, 1999). All seeds of *S. leprosula* when dried up to 20% moisture content completely lost their germinability.

Germination Speed

Germination speed is an important criterion to measure seed vigour. Significant ($P<0.05$) reduction in germination speed was observed with decrease in moisture content. It was the highest (11.51) in seeds having maximum seed moisture content (60%). The germination speed of 45%, 30% and 18% moisture content treatments were 6.51, 6.07 and 0, respectively. The results suggested that Jaman seeds did not tolerate the desiccation and therefore zero germination speed was observed at low (18%) moisture content (Fig. 2).

Time to get 50% germination

Results showed that ability of seeds to get 50% germination was reduced considerably with decrease in moisture content (Fig. 3). Time taken by seeds for 50% germination was also significantly ($P<0.05$) increased (18 days for 30% compared to 7.4 days for control) with the passage of desiccation period. Similar findings were previously described by Thanos *et al.* (1989) and Sivritepe and Dourado (1995) suggested that desiccation considerably increased the germination time.

Electrolyte Leakage

Electrolyte leakage from *S. cuminii* seeds increased progressively with the reduction in moisture content (Fig. 4). A noticeable increase in electrolyte leakage was observed when moisture content decreased upto 18%. Experiment on measure of electrolyte leakage suggested that seed vigour and viability were sensitive to desiccation. Reduction in moisture content increased electrolyte leakage (Fig. 4). It suggested that there is a linear relationship between desiccation and seed membrane damage. While electrical conductivity and membrane damage are also directly related events. (Khan *et al.*, 2003). Most recalcitrant seeds, as reported, are sensitive to desiccation and loose their viability at low moisture content (Dussert, *et al.,* 1999; Ellis, 1991; Khan *et al.*, 2003; Pammenter, *et al.*, 1997;

Pritchard, *et al.*, 1999). Therefore results indicate that higher moisture content is essential to keep the recalcitrant seeds viable. It may also be considered that higher moisture level in these seeds maintains connection among seed membrane contents and prevents from damage. As desiccation starts, seed contents and membranes start to squeeze under water loss pressure which possibly leads to membrane damage. It is suggested that *S. cuminii* seeds may considered recalcitrant in nature as they showed sensitivity to desiccation and exhibited high electrolyte leakage.

CONCLUSION

The *S. cuminii* seeds are clearly desiccation sensitive and did not tolerate drying up to 18% moisture. Mean germination percentage and germination speed were decreased with the reduction in moisture content. Loss in seed viability and vigour were found to be associated with increased electrolyte leakage as the moisture content reduced below 30%. Thus the Jaman seeds are not tolerant to desiccation and appear to be recalcitrant in nature.

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