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Effect of different storage conditions on the viability of seeds of *Bambusa arundinacea*

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Summary

Seeds of *Bambusa arundinacea* were stored under four conditions including low temperature having an initial moisture content of 11% over anhydrous calcium chloride in a partially evacuated/non-evacuated desiccator at room temperature (24 °C to 34 °C) and also over the laboratory shelf in a plastic container at room temperature (control). Seeds from different treatments were sown at monthly intervals on polyurethane foam sheets and observations on percentage of germination recorded over a period of 413 days. Rapid loss in viability of the control seeds occurred within two months while in other storage conditions deterioration was gradual, reaching 10% or less after 413 days.

Résumé

Influence de différentes conditions de conservation sur la viabilité des semences de Bambusa arundinacea

Les semences de *Bambusa arundinacea* ont été conservées dans quatre conditions qui étaient: une température basse et une teneur en eau initiale de 11%, en présence de chlorure de calcium anhydre, dans un dessiccateur sous vide partiel ou non, à la température ambiante (24 °C à 34 °C) et à l'air libre, dans un conteneur en plastique, à la température ambiante (témoin). Les semences ayant subi ces différents traitements ont été semées chaque mois sur des feuilles de mousse de polyuréthanne et le pourcentage de germination a été suivi pendant 413 jours. Une perte rapide de viabilité des semences témoins était observée en deux mois, alors que dans les autres conditions de conservation la détérioration était progressive et atteignait 10% ou moins après 413 jours.

Zusammenfassung

Der Einfluß verschiedener Lagerungsbedingungen auf die Lebensfähigkeit von Samen von Bambusa arundinacea

Samen von *Bambusa arundinacea* wurden unter vier verschiedenen Bedingungen gelagert einschließlich tiefer Temperatur bei einem Anfangsfeuchtigkeitsgehalt von 11% über wasserfreiem Calciumchlorid in einem teilweise evakuiert/nicht evakuierten Exsikkator bei Zimmertemperatur (24–34 °C) und auch über dem Labortisch in einem Plastikbehälter bei Zimmertemperatur (Kontrolle). Samen der verschiedenen Varianten wurden in monatlichen Abständen auf Polyurethanschaumplatten ausgesät, und die Beobachtungen zur prozentualen Keimfähigkeit über einen Zeitraum von 413 Tagen registriert. Innerhalb von zwei Monaten trat ein rascher Lebensfähigkeitsverlust des Kontrollsaatgutes ein, während unter anderen Lagerungsbedingungen der Keimfähigkeitsverlust allmählich eintrat und nach 413 Tagen 10% oder weniger erreichte.

Introduction

Bambusa arundinacea (Retz.) Willd., a large thorny bamboo found throughout Kerala, grows in the plains as well as in the hills up to about 1000 m above mean sea level (msl). It flowers gregariously over large areas after an interval of about 45 years in India (Blatter, 1929; Blatter and Parker, 1929; Watanabe and Hamada, 1981). Occasional sporadic flowering also occurs but does not produce as many viable seeds as in gregarious flowering. To meet the ever increasing demand of bamboo as a raw material for paper and pulp, poles, construction of household articles, etc. there is an urgent need to increase the production of bamboos by raising them in plantations. Though propagation of bamboos using culm, branch cuttings and nodal chips has been demonstrated (Surendran and Seethalakshmi, 1985), unreliable estimates of age of the parent culm may prove disastrous if flowering occurs within a few years of raising the plantation; all the vegetative propagules generally die along with the death of the mother clumps after flowering (Hasan, 1977; Banik, 1980). However, the poor viability of seeds and flowering at long intervals in *B. arundinacea* pose practical problems in utilising them as a propagation material. A practical solution to this appears to lie in prolonging the viability of seeds so that they are made available whenever required. The literature contains little information on a suitable method for storage of bamboo seeds (White, 1947, Gupta and Sood, 1978). With this in view, preliminary studies were undertaken to find out the effect of different storage conditions on the viability of seeds of *B. arundinacea*.

Materials and methods

Mature fallen seeds of *B. arundinacea*, were collected from different clumps growing in Parambikulam (750 m above msl), central Kerala, during the first week of April 1985. Before utilising the seeds in the experiment they were air dried to approximately 11% moisture content and transferred to plastic containers which were stored in the laboratory with a temperature range 29 °C to 34 °C and relative humidity of approximately 68%. A total of 80 seed lots having 150 seeds each were prepared and transferred to wax-paper bags and their mouth folded. Each of the following four treatments

Table 1. Details of the treatments given in storing seeds of *Bambusa arundinacea*

Storage place	Temperature (°C)	Relative Humidity (%)	Pressure
T1. Freezer	–3 to 0	Not measured	Atmospheric pressure
T2. Desiccator	24 to 34	Not measured	Partial vacuum
T3. Desiccator	24 to 34	Not measured	Atmospheric pressure
T4. Laboratory Shelf	24 to 34	57 to 90	Atmospheric pressure

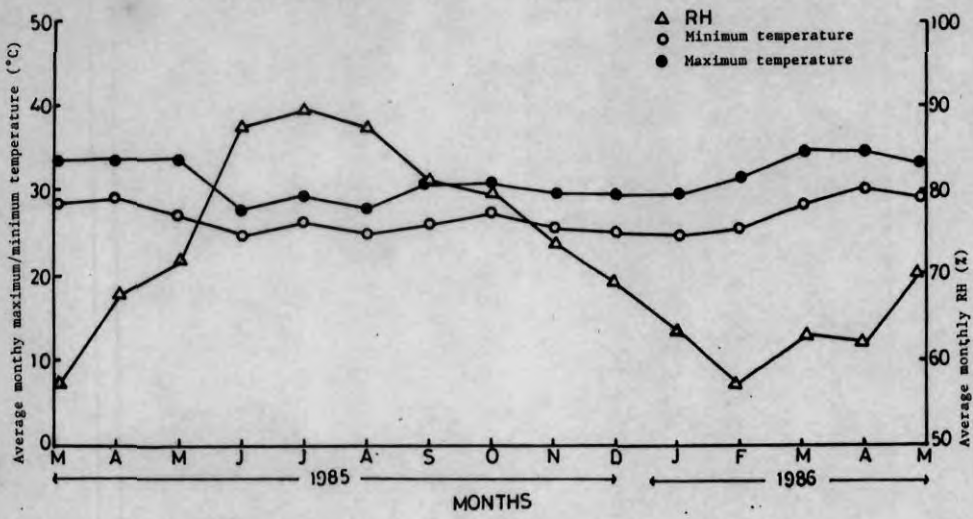

Figure 1. Climatological data recorded during the experimental period.

were given with 20 bags in each (table 1).

Replicate bags from each of the four treatments were removed at monthly intervals and seed viability tested using polyurethane foam sheet (Chacko, 1983), soaked in 1% active ingredient Bavistin. The method involves sowing seeds on foam sheets of size (30 × 30 × 1.2 cm) kept in plastic trays having filtered water. The number of seeds germinated with in the first week of sowing were counted in each treatment separately. The experiment continued for 413 days. Seed samples of control (T4) were tested separately at weekly intervals to assess rapid loss in germinability. Throughout the experimental period, temperature and relative humidity (RH) at room temperature were recorded (figure 1). The changes in percentage germination over time under the different storage treatments were characterised by second degree polynomials and the differences in the patterns were compared.

Results and discussion

The polyurethane foam technique was convenient for testing the germinability of seeds of *B. arundinacea*. Seeds started germinating at day three onwards and within a week germination was completed. The initial germinability of seeds was 74% which is better than that reported previously (52.3%) (Banik, 1980). Seeds stored in treatments T1, T2 and T3 retained some viability after 413 days whereas in T4, seeds became totaly nonviable after two months of storage. In treatments T1, T2 and T3 the decrease in viability was gradual, at 79 days the germination being 48.6%, 39.3% and 40.0% respectively. However, in T4 it declined rapidly to zero, during the same period. At the completion of the experiment the germination percentage in T1, T2 and T3 treatments decreased to 2.0% 2.0% and 0.0%. These treatments did not differ among them-

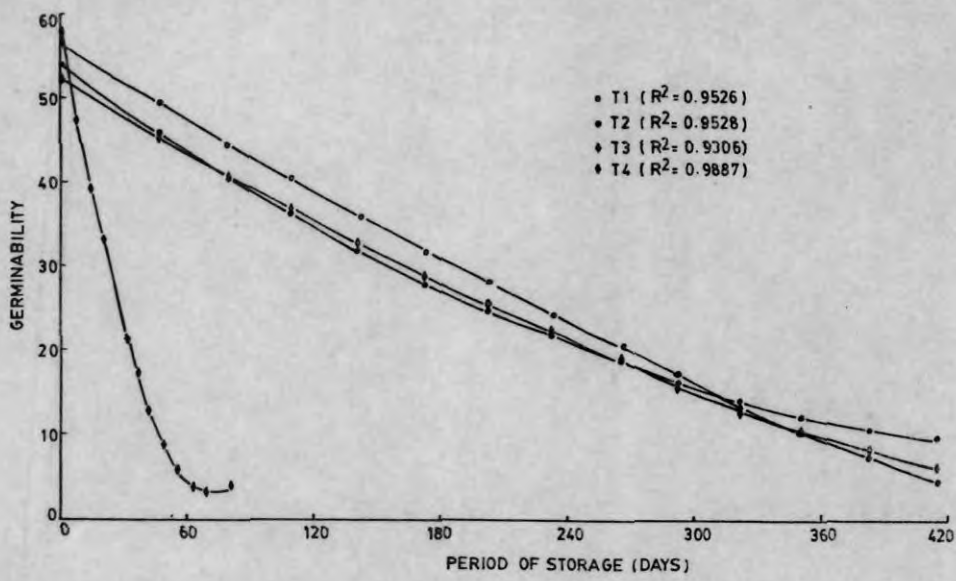

Figure 2. Germinability (as percentage of germination transformed to angular values) of *B. arundinacea* seeds under different storage conditions.

selves, but they differed significantly from T4 both at two months and one year of storage (figure 2).

In general, our findings conform to the earlier observations of White (1947) that storage over calcium chloride at room temperature (21° to 32°C) is effective for seeds of *B. arundinacea*, however, the results of the untreated (control) seeds were different. In the present work, the untreated seeds lost their viability within 60 days, whereas in White's experiments it took nearly 148 days. In another species of bamboo, *Dendrocalamus strictus* Nees., (Gupta and Sood, 1978) storage of seeds over calcium chloride helped to prolong the viability for more than 34 months. However, their same stock lost complete viability with in a period of eight months. Seeds of *B. arundinacea* appear to loose viability faster as compared to *D. strictus*. Further experiments to prolong the viability of seeds of different bamboo species are in progress.

Various factors such as moisture content (MC), temperature, relative humidity (RH) and spermoplane microflora affect germinability of seeds (Roberts, 1972, 1983; Christensen, 1973; Harrington, 1972). The initial MC of seeds of *B. arundinacea* which was 11% (on dry weight basis), showed a gradual increase in treatments T1 and T4 and a decrease in T2 and T3 (figure 3). The increase in RH in the laboratory from June onwards would have contributed to the increase in weight of seeds in T4. The storage over anhydrous calcium chloride, brings about the reduction in weight of seeds in T2 and T3. Further, the storage in partially evacuated (T2) and non-evacuated desiccator (T3) helps to provide an atmosphere of anaerobic condition and low oxygen level respectively which may help to minimise respiration. For seeds stored in freezer

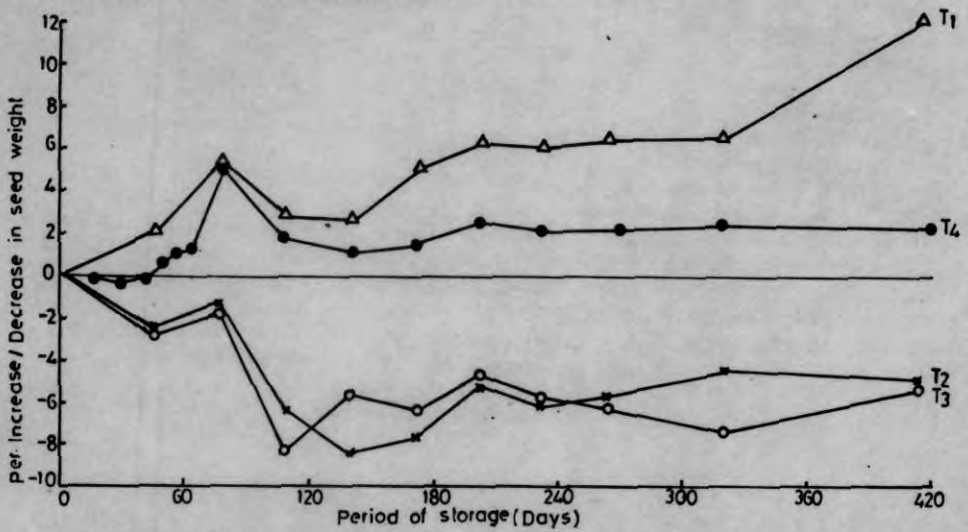

Figure 3. Percentage increase/decrease in weight of *B. arundinacea* seeds during the period of storage. The increase in weight of seeds stored in the freezer (T1) is unexpected.

(T1), low temperature possibly reduces the rate of metabolic activities and inactivation of enzymes, helping to retain seed viability. However, the periodical opening and closing of the containers for sowing the seed lots during the experimental period might have also affected the storage atmosphere to a limited extent. Filter paper cultures revealed the presence of *Aspergillus, Cephalosporium, Chaetomium, Fusarium, Penicillium* and *Trichoderma* on the seeds. This could have also contributed towards decline in germinability.

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