INTERNATIONAL JOURNAL OF FORESTRY AND CROP IMPROVEMENT (June, 2011); 2 (1) : 57-59

RESEARCH ARTICLE

Received : March, 2011; Accepted : April, 2011

Effect of different storage temperatures on the germination behaviour of *Jatropha curcas* L. seeds

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ABSTRACT

Seeds of *Jatropha curcas* L. were stored under three different temperatures *viz.,* room temperatures (26.33 ^{o}C), 20^{o}C and 10^{o} C. Initially the data were recorded after 1 month of storage *i.e.* in February 2008 at different storage temperature thereafter; the germination and moisture content were recorded at 1, 3, 6, 9 and 12 months of storage duration. The temperature 10^{o}C significantly influenced the germination percentage and other germination parameters of Jatropha seeds when germination test was carried out in 1st month which was followed by 20^{o}C and room temperature, there after a steep decline in the germination percentage till the termination of the experiment after 12 months of storage under all temperatures.

KEY WORDS : Jatropha seeds, Storage temperature, Germination per cent, Germination speed, Germination energy, Moisture content

Shedage, S.M. and Jadeja, D.B. (2011). Effect of different storage temperatures on the germination behaviour of *Jatropha curcas* L. seeds, *Internat. J. Forestry & Crop Improv.,* **2** (1) : 57-59.

INTRODUCTION

Jatropha curcas, also known as the "Physic Nut" originated in the Caribbean. It's a drought-resistant perennial, growing well in marginal soil. Easy to establish, grows relatively quickly and lives, producing seeds for 50 years. Jatropha plant produces seeds with an oil content of 35%.. Recently bio-diesel has gained higher importance in India. For a country reeling under the burden of a large oil import bill and spiralling oil prices, seventy per cent of petroleum used in India is imported, mostly, from the volatile Persian Gulf region at the cost of more than Rs. 1,00,000 crores. This has compelled us to explore alternatives and tap the traditional wisdom. Considering the seriousness of cost of petroleum products and the pollution caused by the use of these products, many developed countries particularly Germany, Australia have ventured in to the use of vegetable oils as a better alternative to diesel. Several other western countries have invested huge sums of money in research and development to promote the use of bio diesel on a commercial scale. Fortunately, suitable initiatives have also been made by Indian government agencies, universities, research institutions and automobile industries (Anonymous, 2004), for finding out and promoting suitable bio diesel crop. Storage may be defined as the preservation of viable seeds from the time of collection until they are required for sowing. The main factors affecting on the choice are the seed characteristics of the species, the period for which it is to be stored and the cost. If more than one method is suitable to maintain viability for the required period, the simplest and cheapest will normally be chosen. Some form of container is necessary for most seed storage, to facilitate access to, and handling of, individual seed lots while keeping them separate, to make the best possible use of storage space, to provide protection against animal and insect pests and, for some seeds, to prevent passage of moisture and gases between the enclosed and the outside atmosphere.

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MATERIALS AND METHODS

The present investigation was under taken during the year 2008 -2009 at Department of Forestry and Biotechnology Laboratory, ASPEE College Horticulture and Forestry, Navsari Agriculture University, Navsari (Gujarat). The seeds used in the investigation were harvested from experimental Farm of Department of forestry ASPEE College of Horticulture and Forestry

The experiment was carried out in completely randomized design with factorial concept in three storage temperature as treatments *i.e.* 10^0 C, 20^0 C, and at room temperature (26.33^0 C) with six replications. Matured fruits from approximately five to ten plants of same age were collected during November to January 2007-08. The seeds were extracted manually and dried in the laboratory for one week. There after the seeds were separately stored at three different storage conditions *i.e.* 10^0 C, 20^0 C and at room temperature (26.33^0 C),the seeds were withdrawn at the intervals of 1, 3, 6, 9, and 12 months and the part of content was used to determine different germination parameters. Initially the data were recorded after 1 month of storage *i.e.* in February 2008.

The data obtained on seeds germination were quantified according to following parameters.

Germination Speed (GS):

Germination speed was estimated according to the method prescribed by Maguire, (1962).

$$\text{Germination speed} = \frac{G_1}{T_1} + \frac{G_2}{T_2} + \frac{Gn}{Tn}$$

where,

G_1 - Number of seeds germinated on first day.
G_2 - Number of seeds germinated on second day.
G_3 - Number of seeds germinated on third day.
T_1 - Day one
T_2 - Day two
T_3 - Day three

Germinative energy (GE %):

Germinative energy was calculated based on the percentage of the total number of seeds that had germinated up to the time of peak germination, generally taken as the higher number of germination in a 24 hr. Period by using the method of Maguire, (1962).

$$\text{G.E \%} = \frac{\text{Peak germination}}{\text{Total no. of seeds sown}} \times 100$$

RESULTS AND DISCUSSION

On an average, there was 52.90% germination after 12 month's storage compared to 75.51% germination in fresh seeds. Among the various storage temperature the seeds stored at 10^0C showed good germination per cent (79.94%) germination speed (69.83), germination energy (42.11%), and moisture content (9.86) followed by 20^oC, when seed tested during 1st month. There after steep decline in the germination percentage (59.44%), GS (41.83), GE(31.00%), and MC(8.83%) till the termination of the experiment after 12 months of storage under all temperatures, but still seeds stored under 10^oC better in all.

Three different temperatures namely room temperature, 20^oC and 10^oC reflected significant differences. The storage temperature of 10^oC outclassed all others registering maximum values for germination per cent, On the other hand the minimum values were exhibited by seeds stored at room temperature. The germinability

Table 1 : Effect of storage temperature on the per cent germination of *Jatropha curcas* seeds during different storage intervals

Treatments	Germination percentage (%)				
	1 Month	3 Months	6 Months	9 Months	12 Months
Storage conditions					
RT (26.33^0C)	70.83	66.72	60.06	54.89	47.28
20^0 C	75.78	70.50	66.44	59.39	52.00
10^0C	79.94	75.39	71.06	65.50	59.44
S.E. ±	0.371	0.353	0.313	0.443	0.294
C.D. (P=0.05)	1.06	1.00	0.89	1.26	0.84

Table 2 : Effect of storage temperature on the germination speed of *Jatropha curcas* L during different storage intervals

Treatments	Germination speed				
	1 Month	3 Months	6 Months	9 Months	12 Months
Storage conditions					
RT (26.33^0C)	60.22	49.44	43.67	36.50	29.28
20^0 C	65.33	54.94	49.22	40.78	35.67
10^0C	69.83	61.33	56.00	49.00	41.83
S.E. ±	0.635	0.731	0.671	0.583	0.502
C.D. (P=0.05)	1.81	2.08	1.91	1.66	1.43

Table 3 : Effect of storage temperature on the germination energy (%) of *Jatropha curcas* L. seeds during different storage intervals

Treatments	Germination energy (%)				
	1 Month	3 Months	6 Months	9 Months	12 Months
Storage conditions					
T_1: RT (26.33^{0}C)	36.11	34.50	32.33	28.44	22.33
20^0 C	39.89	38.56	36.83	31.44	26.61
10^0 C	42.11	41.44	40.78	39.06	31.00
S.E. ±	0.551	0.539	0.512	0.219	0.207
C.D. (P=0.05)	1.57	1.54	1.46	0.62	0.59

Table 4 : Effect of storage temperature on the moisture content (%) of *Jatropha curcas* L. seeds during different storage intervals

Treatments	Moisture per cent (%)				
	1 Month	3 Months	6 Months	9 Months	12 Months
Storage conditions					
RT (26.33^{0}C)	9.48	8.97	8.68	8.31	7.78
20^0 C	9.65	9.31	9.08	8.76	8.09
10 ^{0}C	9.86	9.62	9.47	9.10	8.83
S.E. ±	0.046	0.033	0.086	0.042	0.039
C.D. (P=0.05)	0.13	0.10	0.24	0.12	0.11

of Jatropha seeds was enhanced at 10°C may be ascribed to the slow rate of metabolic processes whereas, on the other hand at higher temperature the germinability of seeds is lost rapidly due to rapid metabolic activity and rapid loss of moisture content of seeds (Purohit *et al.*, 1982). Although low temperature is generally preferred in order to reduce ageing and prevent insect and fungal activity. The better germinative energy of seeds stored at 10°C may be ascribed to the slow rate of biological processes compared to 20°C and room temperature (26.33°C) (Gautam, *et al.,* 2005). The seeds stored at high temperature *i.e.* at ambient condition exhibited progressive deterioration and partially decrease in the speed of germination during seed storage. This may be due to decrease in moisture content during storage and hence invasion of fungi along with high respiratory activity in seed leading to degradation. The results are also in agreement with the findings of Gupta and Raturi (1975). The fluctuation in the mean moisture content with fluctuation of temperature during storage has been reported. Moisture content of seeds stored under high temperature reduced quickly to maintain equilibrium moisture content with surrounding. Low temperatures, apart from slowing down the rate of seed deterioration during storage, prevent excessive drying of seeds. The results are also in agreement with the findings of Gupta and Raturi (1975).

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