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Germination of Stored Winged Bean Seeds

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Abstract : The influence of two temperatures, room (29°C - 29.5°C) and low (14°C), and two types of containers, made of polythene or aluminium foil, on the germination of winged bean seeds stored upto 12 months was studied. Germination of seeds stored in polythene at both temperatures increased upto 2 months after storage (MAS) and thereafter declined upto 12 MAS. Viability of seeds stored in aluminium declined from the beginning, but the rate of decline was less than in the case of polythene.

There was no difference between the two temperature levels on viability, but the containers showed highly significant differences. Seeds stored in aluminium at room temperature were effective in maintaining viability and germination vigour. Seeds held in dry pods at room temperature for 12 MAS had comparable viability and better vigour than fresh seeds. The results suggest that simple and effective methods of storing winged bean seed in small farms of the tropical developing countries are possible.

1. Introduction

Prolongation of seed viability of winged bean (*Psophocarpus tetragonolobus* (L.) DC) is of practical significance in Sri Lanka where preliminary observations on a local strain (Accession 8) has shown that only a few flowers appear sporadically during long days and flowering is profuse during short days. These observations support previous reports on daylength sensitivity in winged bean.[5,6,7,8,10] Commercial cultivation in Sri Lanka therefore, is possible only during one season (October to January) for which seeds should be stored for 8 months from the previous harvest.

A long storage period could lead to loss of viability, demanding a high seed rate to get a uniform stand. No studies have been reported on the storability of winged bean seeds and the extent of viability losses during storage. This paper reports the results of a preliminary experiment conducted to study the influence of temperature and type of container on viability and vigour of seeds.

2. Materials and Methods

One-month old seeds of a local strain (Accession 8) having a moisture content of 10.1 % were stored in 17 cm^2 pouches of colourless polythene (gauge 150) or of aluminium foil under room temperature (29°C to 29.5°C) or low temperature (14°C). The room temperature treatment was the control in this experiment. Each treatment combination was replicated thrice and each replicate had 75 seeds. A completely randomized design was used.

Germination was tested at 2 months intervals for a period of 12 months after storage (MAS). Seeds were sown at a depth of 1.5 cm in aluminium trays (40 cm × 30 cm × 6 cm) containing sand. The medium was kept moist during the germination period. The cumulative germination percentage was recorded from the 7th day to the 27th day after sowing. The germination of a separate sample of seed held in undehisced dry pods at room temperature was also tested at 12 MAS.

3. Results

Although germination was recorded upto 27 days after sowing, it leveled off at 19 to 22 days in all treatments (Figure 1 to Figure 6). Maximum % of germination in fresh seeds used in the study was 67.9% (Table I). But the maximum germination of seeds stored in polythene at both temperatures was found to increase upto 2 MAS (Table 2a). Germination decreased in all treatments from 2 to 12 MAS (Table 2a). The decline was greater in seeds stored in polythene. However, in seeds stored in aluminium foil, decline was less.

TABLE 1. % germination of fresh seeds and seeds maintained in dry pods for 12 months. The figures in parenthesis indicate proportion of total germinated at 22 days.

Period of Storage	Days after Planting					
	7	10	13	16	19	22
0 MAS (fresh seeds)	5.3 (7.8)	19.1 (28.1)	26.6 (39.1)	46.2 (68.0)	67.0 (98.6)	67.9 (100.0)
12 MAS (seeds in dry pods)	32.4 (49.3)	49.3 (75.0)	59.5 (90.5)	64.4 (98.0)	65.7 (100.0)	65.7 (100.0)

At 12 MAS, seeds stored in aluminium at room and low temperatures had a higher germination compared to those stored in polythene (Table 2a.). This was also evident throughout the germination period from 7 to 22 days after sowing (Figure 6). However, at 8 MAS, seeds stored in aluminium at room temperature showed the highest germination percentage at all stages of counting (Figure 4).

TABLE 2a. Percentage germination of winged bean seeds at 2 months intervals at 22 days after sowing.

Treatments	Months after Storage					
	2	4	6	8	10	12
Polythene, room temperature	79.5	78.6	32.8	21.7	20.4	16.7
Polythene, low temperature	88.4	84.8	47.5	38.6	32.4	30.6
Aluminium, room temperature	63.9	63.5	62.6	50.6	47.4	39.9
Aluminium, low temperature	63.5	53.3	48.4	47.5	45.3	44.8

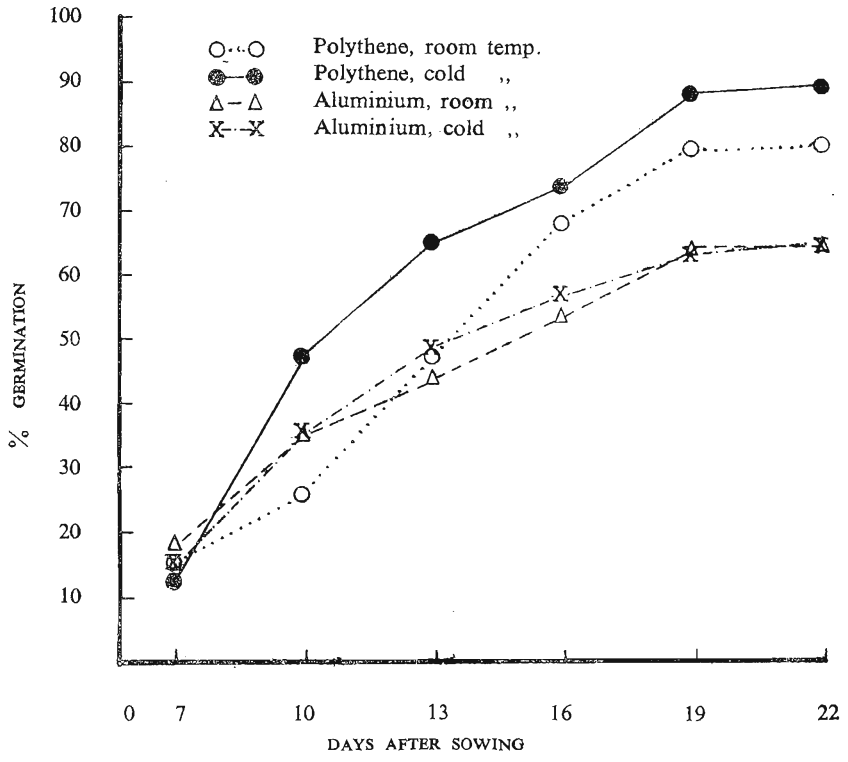

Figure 1

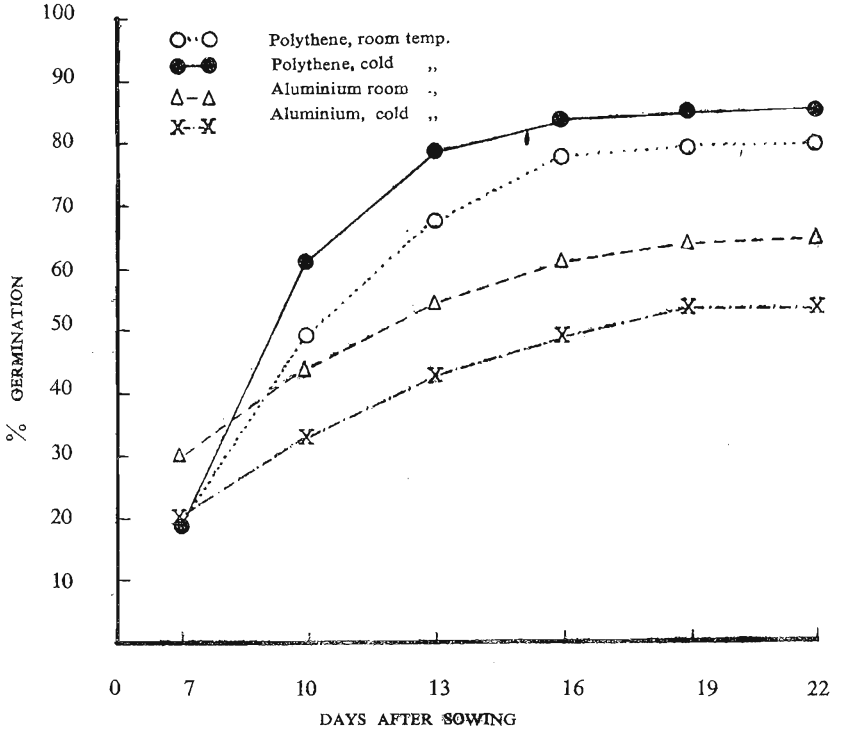

Figure 2

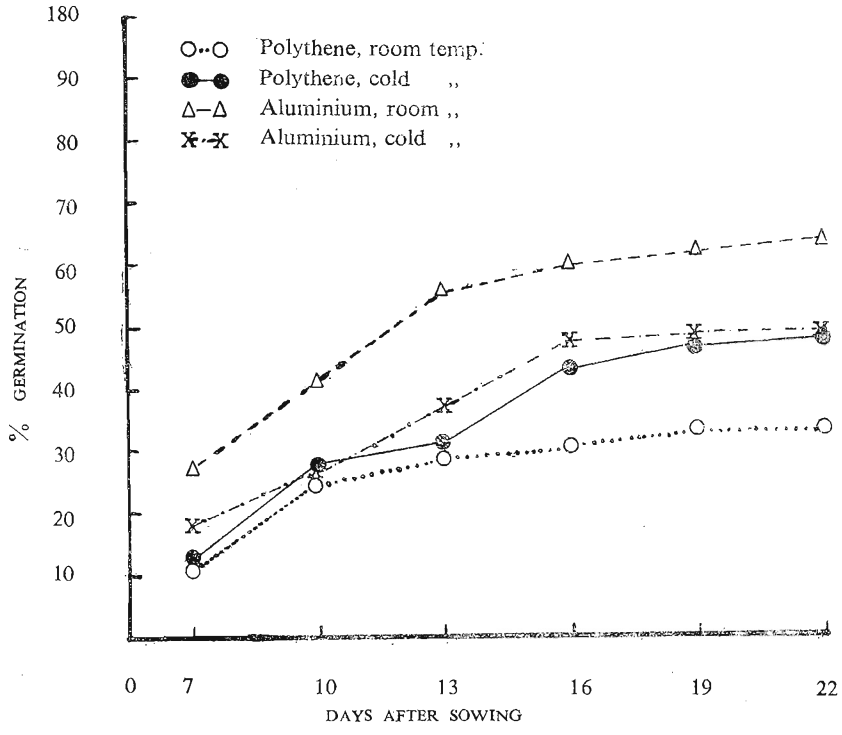

Figure 3

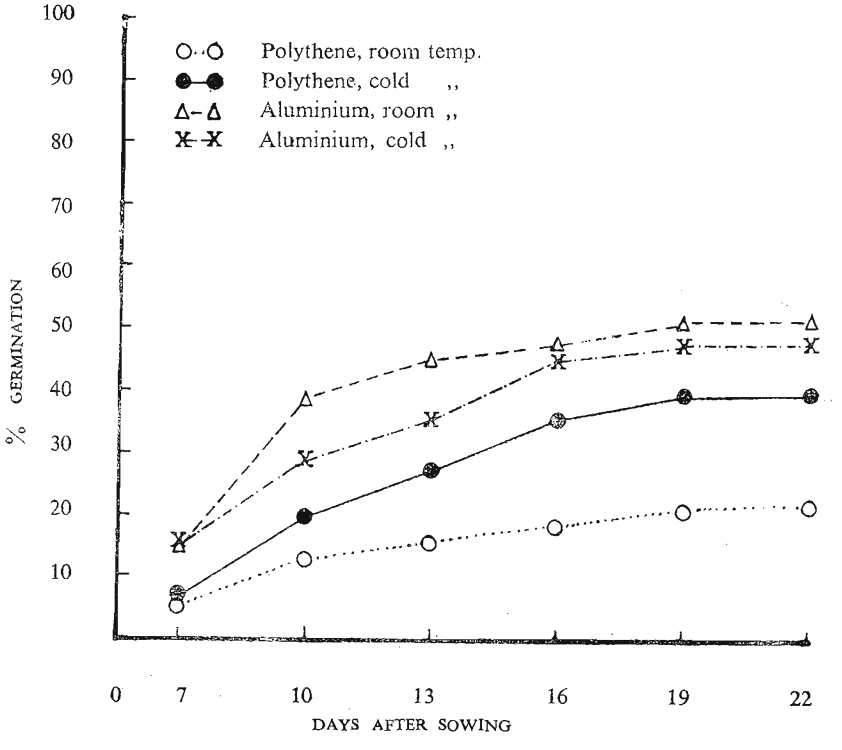

Figure 4

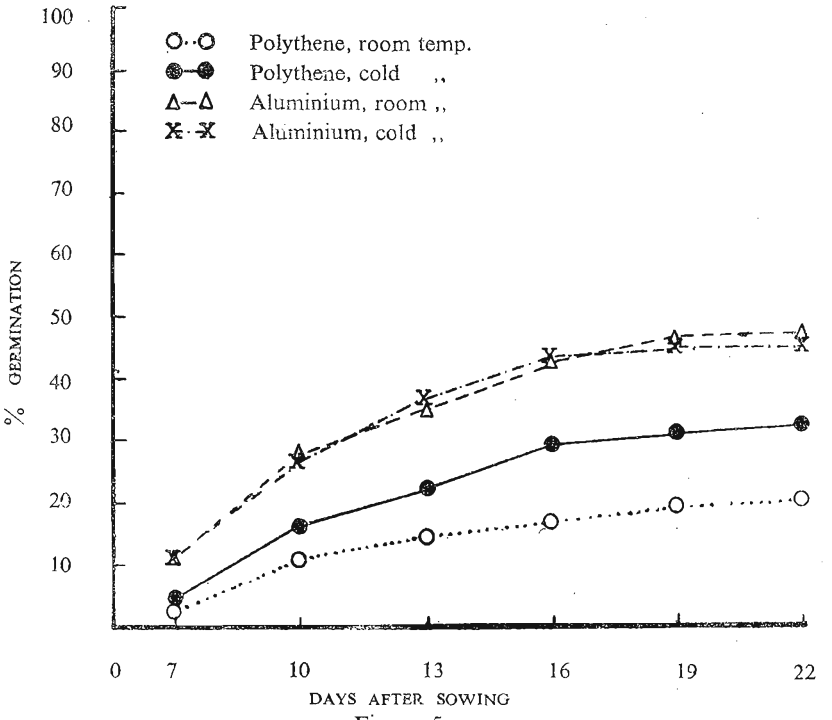

Figure 5

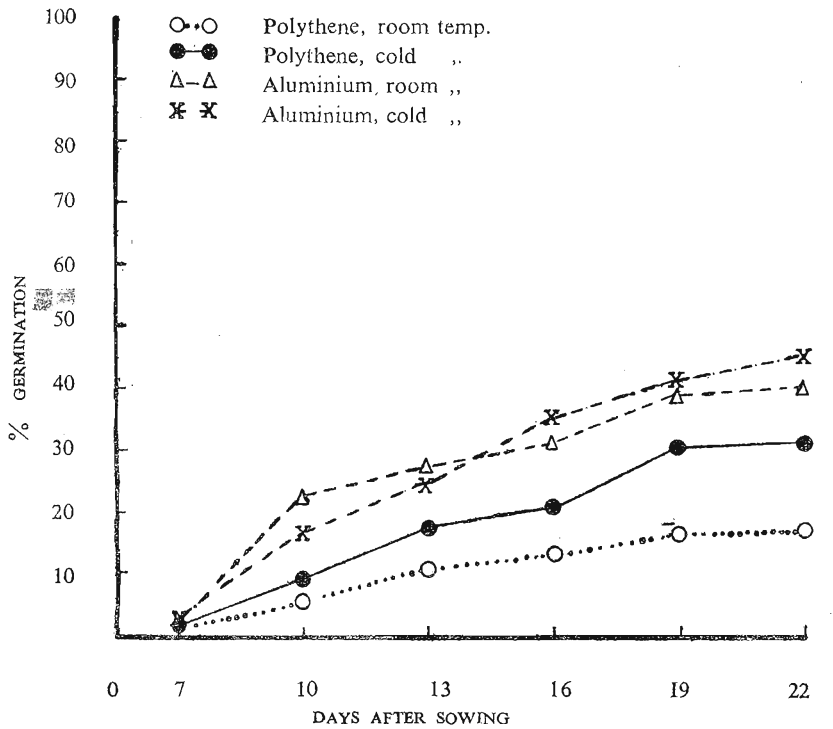

Figure 6

Figure 1—6 Percentage of germination of seeds stored at different treatments from 2 to 12 months at 2-months intervals.

Differences in storage temperatures had no significant effect on germination throughout the year except at 8 MAS (Table 2b). But types of containers had a very highly significant effect from 2 to 12 MAS at 22 days after sowing. Significant interactions were found between temperatures and containers (Table 2b).

TABLE 2b. Significance of influence of temperature, container and their interactions on germination at 22 days after sowing.

Treatments	Months after Storage					
	2	4	6	8	10	12
Temperature	NS	NS	NS	*	NS	NS
Container	***	***	***	***	***	***
Interaction	NS	**	***	***	*	NS

*, **, *** = Significant at P = 0.05, 0.1, 0.01 respectively
NS = Nonsignificant.

Germination % of seeds stored in pods at room temperature showed higher germination from 7th to 16th days after sowing and almost equal germination at 22 days, when compared with the performance of fresh seeds (Table I). The table also shows that 49.3% of the viable seeds held in pods germinated by the 7th day compared to 7.8% in fresh seeds and 90% germination was reached in them by 13 days. Likewise early germination was also evident in all storage treatments upto 6 MAS and for the seeds stored in aluminium foil upto 8 MAS (Figure 1 to Figure 4).

Since the critical storage period for an annual system of planting is 8 months in Sri Lanka, germination at 8 MAS was examined (Table 3). Seeds stored in aluminium at room temperature shows good early germination. By the 10th day, 77% had germinated and 3 days later germination increased to 88.5%. On both days germination was significantly higher than that of seeds stored in other treatments.

TABLE 3. Influence of temperature and container on proportion of germination 8 months after storage.

Treatments	Days after Planting					
	7	10	13	16	19	22
Polythene, room temperature	20.2	58.9	73.2	85.7	97.6	100.0
Polythene, low temperature	18.1	51.8	69.9	90.9	100.0	100.0
Aluminium, room temperature	29.2	77.0	88.5	93.8	100.0	100.0
Aluminium, low temperature	33.4	61.6	75.5	93.4	100.0	100.0
LSD(P = 0.05)	13.0	14.1	12.1	8.0	1.5	—

4. Discussion

The increase in germination % of seeds stored in polythene at room and low temperatures upto 2 months suggests that it may be due to a dormancy-breaking effect. This is comparable to the results of Singh and Gunasena,[11] who reported that % germination of 4 cultivars of soybean seeds increased with storage period up to 2 MAS. The decline in germination by 79% and 65% of seeds stored in polythene at room and low temperatures, respectively, could be due to their deterioration, probably to the increase of seed moisture%. In contrast, storage in aluminium was more suitable because the loss of viability was only 37% and 20% at the higher and lower temperatures, respectively. Harrington and Douglas[2] have identified polythene (700 gauge) and aluminium foil laminated packets as two of the moisture-proof containers when they are properly sealed. In our study, however, the polythene used was of 150 gauge which could have resulted in entry of moisture through the sealed polythene bags, and moisture being a factor that influences germination[1,3,12] the seeds stored in polythene could show lower germination as found in this study.

Seeds stored in polythene at low temperature always maintained a higher germination % than that stored at room temperature during the entire period of the study (Table 2a). This is comparable to other reports where storage at lower temperatures have given higher germination in beans[12] and soybeans.[9,11] In contrast, germination was higher in seeds stored at room temperature than under low temperature in aluminium up to 10 MAS (Table 2a) which suggests that in tropical-farming environments of developing countries the requirement of cold storage facilities which are not freely available could be by-passed in this crop until the next cropping-season.

The preliminary observations made in this study that seeds held in dry pods at room temperature had a comparable viability and early germination than fresh seeds suggests that keeping the seeds in pods in the farmers' homes would be an effective and cheap method of storage. This aspect needs further investigation.

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