Tropical Agricultural Research Vol. 6 1994

Effect of Packaging Material on the Storability of Chillie (*Capsicum annum* L.) Seed Stored in Sri Lanka

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ABSTRACT. *Extracted chillie seed from ripe, desiccated dry pods of cultivar MI 2 of known germination (81.0%), was dried to 9.7%, 5.9% moisture contents, and packed in three different packaging materials: aluminium foil, 500 gauge polythene and woven polypropylene sacks. The seeds were stored at ambient conditions in Pelwehera (30°C, 80% RH), Rahangala (23°C, 79% RH) and in a cold room (20°C 65% RH) in Gannoruwa. Seed germination, field emergence, and seed moisture content of the stored seed were tested at the inception and at 3 month intervals during the 12 month study period.*

Chillie seed with a low initial moisture content (5.9%) maintained germinability better than seeds with a high moisture content (9.7%) in all locations. Triple laminated aluminium foil was a better packaging material. Polysack packaging displayed free moisture movement from the early stages of the study, in all the locations. Polythene (500 gauge) was better than polysack and similar to aluminum foil when storing low moisture (5.9%) chillie seed for 12 months, at all the locations except in Pelwehera. A cold room condition was the best to store chillie seed without losing its viability below 75% for a period of one year. It could be recommended that these dried, extracted chillie seed from ripe dry pods of cultivar MI 2 packed in aluminium foil or in polythene (500 gauge) be stored in a cold room (20°C, 65% RH) for a long term (12 months).

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INTRODUCTION

Chillie which is grown for its fruit is considered an important crop because of its high consumption by Sri Lankans in the form of green or ripe dried chillies. Chillie is one of the most valuable cash crops in Sri Lanka. At present, the Department of Agriculture (DOA) produces only 4000-5000 kgs out of the 35000 kgs of annual national requirement of chillie seed.

Generally, the DOA purchases chillie pods and packs in jute or polysacks which are highly permeable to moisture (De Silva, 1987). These stocks are stored under ambient conditions (Table 1) at the Pelwehera Government Farm Stores, till the next planting season. The seeds are extracted and packeted just before they are issued for planting.

It was observed that chillie pods with 10% moisture content stored under 75-80% RH, 30°C, absorb moisture and come to an equilibrium moisture content of 15% within two weeks (De Silva, 1986). Preliminary trials done by the Seed Testing Laboratory, Peradeniya showed that the moisture content of seeds retained in well dried pods is 3% to 4% higher than that of extracted seed. Fungal infestation of seeds was also observed. Therefore, due to this chillie seed production process, viability and vigour of seeds declined rapidly within a few months.

The objective of this project was to investigate the influence of initial seed moisture content on the viability and vigour of chillie seed under different storage conditions.

MATERIALS AND METHODS

Seeds were extracted from ripe dry pods of a freshly harvested chillie crop. Half of the seed lot was dried to 5.9% moisture content and the other half used without dessication (moisture content: 9.7%). After initial quality testing (Table 2) 100 grams of seeds were packed in either 500 gauge polythene, triple laminated aluminium foil or in woven polysack packs according to the treatment combinations. To commence the study these were stored in Pelwehera (30°C, 80% RH), Rahangala (23°C, 79% RH) and in the cold room (20°C, 65% RH) of the Vegetable Seed Centre, Gannoruwa (Table 1). Treatment combinations were replicated four times, and assigned to a 2x3 factor factorial design using a randomized complete block design with four blocks replicated over three environmental conditions. Seed

samples (100 gram packs) were drawn once in three months and tested for germination, moisture content and field emergence, at the Seed Testing Laboratory, Mahailuppallama, according to the methods described by the International Seed Testing Association (ISTA) (Anonymous, 1986). The germination test was carried out under 20-30°C, on paper, for 400 seeds, in four replicates. Seedling evaluation was completed after 14 days. The field emergence test was carried out in the field. One hundred seeds from each sample were planted in sterilized soil. The final counting was taken after 14 days. The moisture contents of chillie seeds were determined by the air oven method in which 5 gram seed samples in two replicates were kept for 17 hours at 103°C.

Table 1. Description of Locations (average for 30 years from 1958 to 1988).

Parameter	Pelwehera	Rahangala	Cold room
Climatic zone	Dry	Intermediate	-
Mean daily RH%	78	76	65
Mean daily Temp. °C	29	22	20
Mean annual RF mm	1358	1662	-
Altitude m	148	1258	-
Latitude	7°-8° N	6°-7° N	-

Table 2. Initial quality of the seed lots.

Parameter	High moisture seed	Low moisture seed
Germination %	81.0	81.0
Moisture content	9.7	5.9
Field emergence	69.0	72.0

RESULTS AND DISCUSSION

In Pelwehera, high moisture content seeds packed in all materials and low moisture content seeds packed in polysack, maintained their germinability at a level above 75%, only for the first three months (Table 3). The germination percentage of low moisture content seeds packed in polythene dropped to a 75% germination level in 9 months; whereas low moisture content seeds in aluminium packs maintained their germinability at a level above 75% throughout the study period (Table 3). This indicated the influence of initial seed moisture content (Table 2) and packaging on the seed viability during storage. In Rahangala, seeds packed in polysacks maintained a germination capacity above 75% for the first 6 months. The germination percentages of seeds packed in the other two materials were also over 75% for the rest of the study period (Table 3). These results demonstrated the importance of using moisture resistant packaging and a low storage temperature for seed storage.

Table 3. Mean seed germination percentages of chillie seed stored under different storage conditions for one year.

Treatment	3 Months			6 Months			9 Months			12 Months		
	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
T1	78	80	82	71	73	79	28	81	80	19	78	78
T2	78	77	82	68	84	81	44	81	80	13	77	79
T3	78	79	84	65	78	78	22	74	77	14	65	75
T4	86	76	85	81	83	80	75	81	80	56	78	81
T5	82	78	80	83	84	82	79	80	83	81	81	81
T6	78	74	83	70	81	77	27	74	75	16	70	77
MEAN	80	77	83	73	81	80	46	79	79	33	75	79
SE	1.7	1.7	2.3	2.3	2.8	1.3	2.9	2.1	2.4	2.9	2.1	1.4

L1 - Pelwehera
L2 - Rahangala
L3 - Cold room

T1 - High moist seed in Polythene
T2 - High moist seed in Aluminium
T3 - High moist seed in Polysack
T4 - Low moist seed in Polythene
T5 - Low moist seed in Aluminium
T6 - Low moist seed in Polysack

Under cold room conditions, seeds of all the forms of treatment did not lower their germination capacity below 75% throughout the one year period. Due to the low temperature and relative humidity (20°C, 65% RH) in the cold room, irrespective of initial seed moisture content, seeds in all the forms of treatment maintained a higher germinability, than the seeds in the other two locations (Table 3). Furthermore, it signifies that the high seed moisture content (9.7%) used in this trial was not undesirable for cold storage.

The mean moisture contents of seeds which had low moisture content at the beginning of storage in aluminium foil packs were the lowest in all locations (Table 4) owing to its low Moisture Vapour Transmission Rate (MVTR). This result proves the advantage of using aluminium foil packs over low density polythene, for safe seed storage.

The initial field emergence was 69% when the initial germination was 81% (Table 5). With time, seeds in all the forms of treatment in Pelwehera showed a rapid decline in field emergence, regardless of the packaging material (Table 5). This could be due to the high ambient temperature in Pelwehera during the study period. At 12 months, the field emergence of the high moisture content seed lot and the field emergence of low moisture seeds packed in polysacks were very low. In addition, seeds failed to germinate in the field.

Under high humidity and high temperature conditions seeds showed a tendency towards losing their vigour rapidly. This process could be accelerated by storing poor quality (high moisture) seed under high humidity and temperature conditions (Harrington, 1959; Justice and Bass, 1978). The low moisture seed lot maintained a higher germinability than the high moisture seed lot at all locations. Seeds packed in aluminium foil had a better field emergence after 12 months than the other two packages. The lowest field emergence values were shown by seeds packed in polysack (Table 5).

Therefore, if chillie seeds are to be stored in Pelwehera, they should be dried to a moisture content of less than 6.0% and packed in aluminum foil to retain their quality.

Table 4. Mean seed moisture percentages of chillie seed stored under different storage conditions for one year.

Treatment	3 Months			6 Months			9 Months			12 Months		
	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
T1	9.5	9.8	9.6	10.6	9.7	9.3	9.7	9.8	9.3	9.6	10.0	9.3
T2	9.4	10.6	9.5	10.0	9.3	9.7	9.5	9.9	9.4	9.9	9.7	9.6
T3	10.6	12.3	8.4	10.5	10.9	8.9	9.7	9.1	8.6	9.8	8.3	9.0
T4	7.4	7.0	6.8	8.5	7.2	7.0	8.7	8.2	7.2	9.1	8.4	7.5
T5	5.9	5.9	5.8	6.2	5.9	6.2	5.8	6.1	5.9	6.4	7.1	6.7
T6	10.3	12.5	8.4	10.2	11.0	8.9	9.2	8.8	8.7	9.5	8.3	8.9
MEAN	8.8	9.6	8.0	9.3	9.0	8.3	8.7	8.6	8.1	9.0	8.6	8.5
SE	0.22	0.08	0.09	0.24	0.09	0.22	0.21	0.19	0.09	0.09	0.4	0.2

L1 - Pelwehera
L2 - Rahangala
L3 - Cold room

T1 - High moist seed in Polythene
T2 - High moist seed in Aluminium
T3 - High moist seed in polysack
T4 - Low moist seed in Polythene
T5 - Low moist seed in Aluminium
T6 - Low moist seed in Polysack

In Rahangala, after 3 months of storage, the mean field emergence was reduced from 69% to about 50%; whereas cold room stored seed maintained a mean field emergence above 60%. The field emergence of seeds stored in Pelwehera was below 40% (Table 5). During the study period, seeds stored under cold room conditions did not show any significant differences among packages or between moisture levels. Only the seeds stored in Pelwehera showed a statistical difference in moisture levels at nine months and among packages at 12 months.

Table 5. Mean field emergence percentages of chillie seed stored under different storage conditions for one year.

Treatment	3 Months			6 Months			9 Months			12 Months		
	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
T1	36	52	58	28	53	56	20	45	56	02	39	40
T2	40	48	64	31	61	65	15	38	54	00	40	45
T3	44	52	62	28	57	60	11	37	49	01	42	50
T4	33	53	62	51	58	64	48	53	55	27	40	52
T5	42	57	65	53	60	65	51	48	60	46	48	50
T6	38	48	62	43	57	55	16	27	57	02	46	33
MEAN	39	52	62	39	58	61	27	41	55	13	43	45
SE	4.0	3.5	3.9	3.0	3.1	3.4	2.9	2.6	3.7	1.9	2.4	4.3

L1 - Pelwehera T1 - High moist seed in Polythene T4 - Low moist seed in Polythene
L2 - Rahangala T2 - High moist seed in Aluminium T5 - Low moist seed in Aluminium
L3 - Cold room T3 - High moist seed in polysack T6 - Low moist seed in Polysack

CONCLUSIONS

The results obtained from this study lead to the following conclusions:

1. During storage, seeds with low initial moisture content had better storability than seeds with high initial moisture content.

2. Cold room conditions minimised loss of germinability and seed vigour.

3. Aluminium foil was the best packaging material for storing chillie seed under ambient conditions if initial moisture content is low.

Considering these facts, it is advisable to store well dried, high quality, cleaned seed in moisture resistant triple laminated aluminum foil packages or in 500 gauge polythene packages, under cold room conditions (20°C, 65% RH) to preserve viability and vigour. If conditioned storage facilities are not available, storing seed in aluminum foil or 500 gauge polythene packages in Rahangala can be recommended with adequate drying, preferably close to 6%.

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