

## THE VIABILITY OF OKRA (*Hibiscus esculentus* L.) SEEDS UNDER DIFFERENT STORAGE CONDITIONS.

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### ABSTRACT

Commercial vegetable seed programmes demand information on storage of okra (*Hibiscus esculentus* L.) seeds for longer durations without a significant loss of viability. The present study was undertaken at the seed-testing laboratory, Peradeniya and the vegetable seed centre at Gannoruwa during the period 2000-2003 in order to study the behaviour of viability of okra seeds under different storage methods. Two varieties of okra, "MI-5" and "Haritha" that had been stored in a cold room for a period of two years in polypropylene (poly sack) were repacked in polythene and aluminium and stored at room temperature at Gannoruwa for a period of 28 months. At the end of four months, another set of polythene and aluminium packets were prepared using the same original seeds that were stored in the cold room and similarly stored for a period of 4 months at room temperature. This was repeated once every 4 months using the same original seeds stored in the cold room as a bulk. Results showed that the effect of packing method on the storability vary between storage methods indicating a significant interaction between the two factors. Storability of okra seeds could be extended by packing in aluminium when compared to polythene (guage 300) when stored for a period of six months or longer under room temperature. In this method, above 70% germinability could be maintained up to 11 months compared to 8 months with polythene packing. However, no significant effects of two packing methods were recorded when the bulk stored in the cold room was packed in aluminium or polythene of guage 300 and stored at room temperature only up to 4 months and viability of more than 70% could be maintained for a period of up to 15 months irrespective of the packing method and variety using this method of storage.

**KEYWORDS:** Okra seed, Packing method, Storage condition, Storage method.

### INTRODUCTION

Okra (*Hibiscus esculentus* L.) is a popular vegetable with a local and export demand. A total of about 7000ha of okra are cultivated in Sri Lanka during *yala* and *maha*, annually (Anon, 2002; 2003). The total seed required to cultivate this extent is about 30 mt., of which about 20% is supplied as certified seed and another 50% as quality assured seeds. The balance is farmer-saved seed. Okra seed has a long storability even under room temperature (Alhamdam *et al.*, 2004). However, decline of seed viability has been recorded when the seed is stored over two years in maintaining buffer stocks, even in cold-room temperatures (Anon, 2003). Storage condition is a prime factor that determines the storability of many seeds (Harrinton, 1963; Justice and Bass, 1978; Bass, 1980; Copeland and McDonald, 1995). Therefore, the present study was undertaken to identify the effect of different packing material and storage conditions on the storability of two varieties of

okra seeds that had been stored in a cold room for a period of two years from harvesting.

## MATERIALS AND METHODS

Certified seeds of okra varieties MI-5 and Haritha, harvested during March/April, 1998 at the government seed farm Kundasale, were used for this study. They were stored in a cold room (15°C temperature and 50-60% RH) as a bulk in polypropylene (poly-sack) bags after drying to about 10% moisture. At the end of a 24 month period, packets of 25g were prepared using aluminium and polythene of guage 300 and stored at room temperature at the seed-testing laboratory, Gannoruwa (S1). They were sampled at monthly intervals for a period of twenty-four months. Further sets were similarly prepared at four month intervals using the bulk of the seeds that were stored in the cold room once in every four months (S2). Each of these sets were also similarly sampled at monthly intervals for a period of four months. There were four replications for each treatment. Treatments were in three factor factorial combinations (variety x packing method x storage method) and arranged in a completely randomized design with four replications. Temperature and RH in the study location were monitored using thermo-hygrograph (Annexure 1). Percentage standard germination and seed moisture content were measured for all the samples at the seed-testing laboratory, Peradeniya, according to ISTA rules (ISTA rules, 1996). Data was statistically analysed using SAS computer package. Percentages were transformed using arcsine angular transformation, wherever necessary, to homogenize the variance.

## RESULTS AND DISCUSSION

Data on initial percentage standard germination and percentage seed moisture content for both varieties are given in Table 1.

Both cultivars had a very high percent germination and low seed moisture content at the beginning.

**Table 1. Initial germination (%) and seed moisture (%) of two varieties of okra.**

| <i>Variety</i> | <i>% Standard germination</i> | <i>% Seed moisture</i> |
|----------------|-------------------------------|------------------------|
| MI-5           | 96                            | 9.5                    |
| Haritha        | 98                            | 9.6                    |

### Standard germination

Seeds of both varieties that were packed with aluminium foil showed a higher storability compared to polythene packing when they were stored continuously under room temperature (S1), but when the bulk of the seed were

stored in the cold and released in quantities that are sufficient to store at room temperature only for a period of 4 months (S2), the difference was not significant, indicating a significant interaction effect between packing and storage methods (Figures 1, 2 & Table 2).

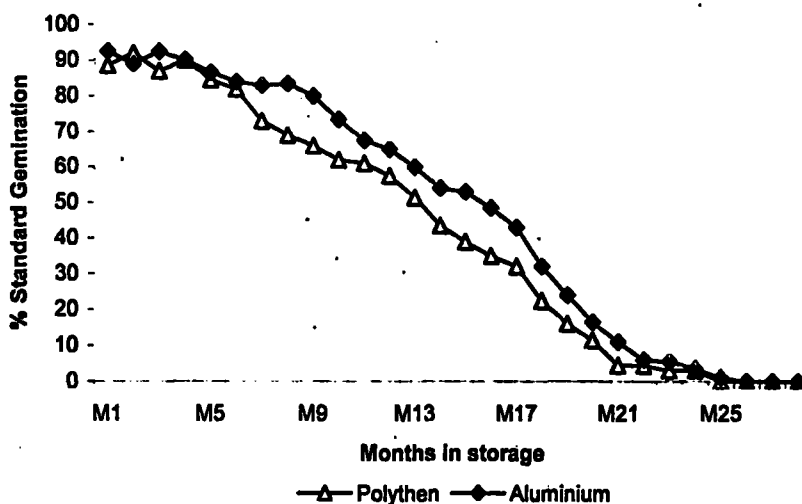


Figure 1. Effects of packing materials on germination of okra seeds under room temperature- S1 (SED<sub>(22,1)</sub>: - 5M - 3.2, 10M - 4, 15M - 4.2, 20M - 3.8).

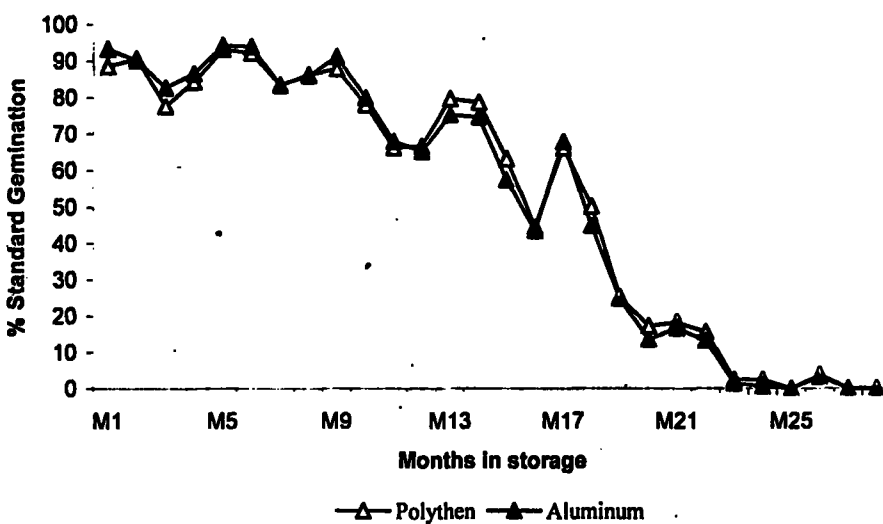


Figure 2. Effects of packing materials on germination of okra seeds under storage conditions of - S2 (M1, M5, M9, M13, M17, M21 and M25 are the months of starting of new sets) (SED<sub>(22,1)</sub>: - 5M - 3.4, 10M - 2.8, 15M - 3.7, 20M - 2.9).

**Table 2. Standard germination (%).**

| <i>Source of variation</i> | <i>5M</i> | <i>10M</i> | <i>15M</i> | <i>20M</i> |
|----------------------------|-----------|------------|------------|------------|
| Variety (V)                | ns        | ns         | ns         | ns         |
| Packing method (P)         | ns        | *          | **         | ns         |
| Store condition (S)        | ns        | **         | **         | ns         |
| VxP                        | ns        | ns         | ns         | ns         |
| VxS                        | ns        | ns         | ns         | ns         |
| PxS                        | ns        | *          | **         | ns         |
| VxPxS                      | ns        | ns         | ns         | ns         |

\*\* Significant at 1% probability level, ns=not significantly different, M=months in storage

In the treatment where seeds were stored continuously under room temperature after packing (S1), percentage germination dropped below 70% in 11 and 8 months in aluminium and polythene packing, respectively. Above 70% germinability was maintained up to 15 months in both the packing methods and varieties used, when the bulk of the seed were stored in a cold room and released in quantities that are sufficient to store in room temperature only for a period of 4 months (Figures 1, 2 & Table 2).

### Seed moisture content

There is an increasing trend in seed moisture content with storage period in all the treatments. However, the increase of seed moisture in seeds packed with aluminium was comparatively low with the increase of the storage period, even when they were stored continuously at room temperature. There were no significant differences in seed moisture between the two packing methods up to 4 months in continuous room temperature treatments and up to 12 months in the cold room + room temperature treatment, indicating a significant interaction between packing methods and storage conditions used (Tables 1, 3, 4 and 5).

**Table 3. Change of seed moisture content (%) of okra seeds stored continuously at room temperature.**

| <i>Months in Storage</i> | <i>% Seed moisture</i> |                  | <i>Significance</i> |
|--------------------------|------------------------|------------------|---------------------|
|                          | <i>Aluminium</i>       | <i>Polythene</i> |                     |
| 0                        | 10.2                   | 10.2             | ns                  |
| 4                        | 10.4                   | 11.5             | ns                  |
| 8                        | 10.7                   | 12.5             | *                   |
| 12                       | 11.4                   | 13.1             | **                  |
| 16                       | 11.7                   | 13.0             | **                  |
| 20                       | 12.2                   | 13.9             | *                   |
| 24                       | 13.6                   | 14.3             | ns                  |

Okra seeds of cultivar MI-5 and Haritha have maintained their viability up to 98 % for a period of 2 years in a cold room probably due to low temperature and low RH conditions in the cold room. Joao Abba and Lovata (1999) have also shown that the temperature of 25 °C and a RH of 65% as optimum conditions for storage of many seeds.

**Table 4. Change of seed moisture content of okra seeds stored in cold room + room temperature treatment.**

| Set Number | Month in Storage | % Seed moisture |           | Significance |
|------------|------------------|-----------------|-----------|--------------|
|            |                  | Aluminium       | Polythene |              |
| 1          | 0                | 10.2            | 10.2      | ns           |
|            | 4                | 10.5            | 10.9      | ns           |
| 2          | 0                | 10.3            | 10.3      | ns           |
|            | 4                | 11.1            | 11.3      | ns           |
| 3          | 0                | 10.8            | 10.8      | ns           |
|            | 4                | 12.1            | 12.6      | ns           |
| 4          | 0                | 11.1            | 11.1      | ns           |
|            | 4                | 12.7            | 13.7      | *            |
| 5          | 0                | 12.5            | 12.5      | ns           |
|            | 4                | 13.3            | 14.3      | *            |
| 6          | 0                | 12.8            | 12.8      | ns           |
|            | 4                | 14.0            | 14.5      | ns           |

**Table 5. Seed moisture content.**

| Source of variation   | 4M | 8M | 12M | 16M |
|-----------------------|----|----|-----|-----|
| Variety (V)           | ns | ns | ns  | ns  |
| Packing method (P)    | ns | *  | *   | ns  |
| Storage condition (S) | ns | ** | **  | ns  |
| VxP                   | ns | ns | ns  | ns  |
| VxS                   | ns | ns | ns  | ns  |
| PxS                   | ns | *  | **  | ns  |
| VxPxS                 | ns | ns | ns  | ns  |

\*\* Significant at 1% probability level, ns-not significantly different, M-months in storage

Increase in seed moisture content has been the major reason for declining viability of okra seeds after being taken out from the cold room. Paderes *et al.* (1997) have also observed a significant negative correlation between percent germination and seed moisture content. Absorption of moisture has been fast in polythene packing compared to aluminium when the storage environment becomes conducive. This could be the reason for showing a significant difference in seed moisture in polythene packing when they were stored continuously under room temperature, compared to cold room + room temperature method. Moisture availability in cold room environment must be low compared to open air at room temperature, resulting

in no difference in seed storability due to two packing methods tested in that treatment.

### CONCLUSIONS

The storage life of okra seed stored under cold room conditions for a long period (2 years) could be extended at ambient temperature by packing properly dried seed in a moisture resistant material such as aluminium (guage 300). Packing in polythene is also equally good if the bulk of the seed is kept in the cold room and released in quantities that are sufficient only for a short period ( $\leq 4$  months) to store under room temperature. This is more appropriate when releasing okra seed that had been stored in a cold room for a long period as buffer stocks.

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**Annexure 1. Monthly average temperature and RH data of the experimental location for the period of the experiment (2000-2003).**

| <i>Month</i> | <i>Temperature (°C)</i> |             | <i>% Relative humidity</i> |                |
|--------------|-------------------------|-------------|----------------------------|----------------|
|              | <i>Max.</i>             | <i>Min.</i> | <i>Evening</i>             | <i>Morning</i> |
| January      | 28                      | 18          | 60                         | 76             |
| February     | 30                      | 17          | 57                         | 73             |
| March        | 32                      | 20          | 75                         | 78             |
| April        | 29                      | 22          | 90                         | 85             |
| May          | 28                      | 21          | 86                         | 83             |
| June         | 30                      | 21          | 90                         | 88             |
| July         | 28                      | 21          | 80                         | 76             |
| August       | 29                      | 22          | 75                         | 71             |
| September    | 27                      | 23          | 78                         | 75             |
| October      | 28                      | 25          | 80                         | 75             |
| November     | 28                      | 27          | 78                         | 73             |
| December     | 27                      | 26          | 70                         | 68             |