J. Hortl. Sci.
Vol. 5 (1): 61-63, 2010

Long-term seed storage studies in radish (*Raphanus sativus* L.)

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ABSTRACT

Radish is an important root vegetable crop widely cultivated for its tender roots as well as for succulent foliage and immature pods which are used largely in salad and in culinary purposes and propagated through seeds. The information on storability as well as on extent of recovery of quality seeds upon conservation is inadequate. Seeds of radish *cv.* Pusa Reshmi were stored in moisture permeable, semi-impermeable and impermeable containers under different storage conditions for 25 years. Seed longevity was significantly improved from 2 to 25 years with controlled storage condition and it enabled to maintain high seed quality for 25 years. The percentage of seed germination was 88 in seeds stored in moisture impervious container at 5°C and –20°C storage. Seeds stored in moisture semi-impermeable containers also showed fairly high viability (79%) at 5°C storage, while seeds were succumbed to chilling injury when stored in moisture permeable containers. The extent of recovery of viable seeds was 89 per cent at 5°C and 88 per cent at –20°C after 25 years of storage. Seedlings from stored seeds were normal, healthy vigorous and free from morphological variations. Seed storage in radish in laminated aluminium foil pouches at 5°C was effective as well as cost effective in maintaining high viability (89%) for longer period (25 years) and useful in germplasm conservation avoiding thereby frequent growing of crop and genetic erosion.

Key words: Radish, seeds, storage, low temperature, viability, vigour, germination

INTRODUCTION

Radish (*Raphanus sativus* L.) is an important root vegetable crop in Europe and Asia. It is predominantly cultivated for tender roots, and also for succulent foliage and immature pods which are used in preparation of various vegetable dishes. Crop is propagated by seeds. Seed storage is widely practiced for preservation of genetic resources especially for medium to long term conservation and it is popular amongst conservationist in view of easy handling, economical and able to maintain genetic stability on conservation. Seeds are readily equipped to survive for a period that varies in different species. As a living entity it retains viability to a specific period and eventually it deteriorates and dies. The process of seed deterioration is rather irreversible and it cannot be eliminated totally. Further, decrease in seed viability during storage can neither be completely stopped nor eliminated. However the process of seed deterioration reduces under suitable storage conditions. Such information on an extent of recovery of viable seeds possible at different stages during long term conservation is lacking in radish. Improper handling of seeds during storage likely to affects the seed quality and storability. High storage temperature and high seed moisture during storage enhances the process of seed deterioration and affect the seed quality (Bass, 1980). Low seed moisture discourages the fungal growth (Christensen and Kaufman, 1965) thereby seeds remain viable for longer period (Minkov *et al*, 1974). Sowing of poor quality seeds affects the crop yield (Frohlich and Henkel, 1964). Seed longevity is an important component of germplasm collection and conservation. The present experiment was conducted with the view to know the seed longevity status on long term conservation and to ascertain the extent of recovery of viable seeds possible in a given period. Such information is lacking in radish and an experiment was conducted to determine optimal conditions for long term seed storage as well as to generate information on extent of recovery of germplasm possible in a given period.

MATERIAL AND METHODS

Radish *cv* Pusa Reshmi seeds were conserved under different storage conditions. Well dried seeds (6.5 % mc) were packed in moisture permeable (Kraft paper); semi-

impermeable (polyethylene, 0.3 ml) and impermeable (laminated aluminium foil pouches) containers and stored at ambient (16-35°C), low (5°C) and sub-zero (-20°C) temperatures for 25 years. Seeds were removed periodically and tested for viability and vigour. The seed viability was expressed in percentage of germination. Seeds were germinated in Clelands seed germinator at an alternate temperature of 20-30°C for 16 and 8 hr, respectively. Normal seedlings were used for evaluation purposes. Seedling growth parameters such as shoot length and root length were recorded on seven days old seedling. Dry weight was recorded on seedlings dried at 65°C for 48 hr. Vigour indices I and II were calculated by multiplying percentage of germination with seedling length and dry weight respectively (Abdul-Baki and Anderson, 1972). The data was statistically analysed for variance and means were compared by using protected least significant differences test at the 0.05 level.

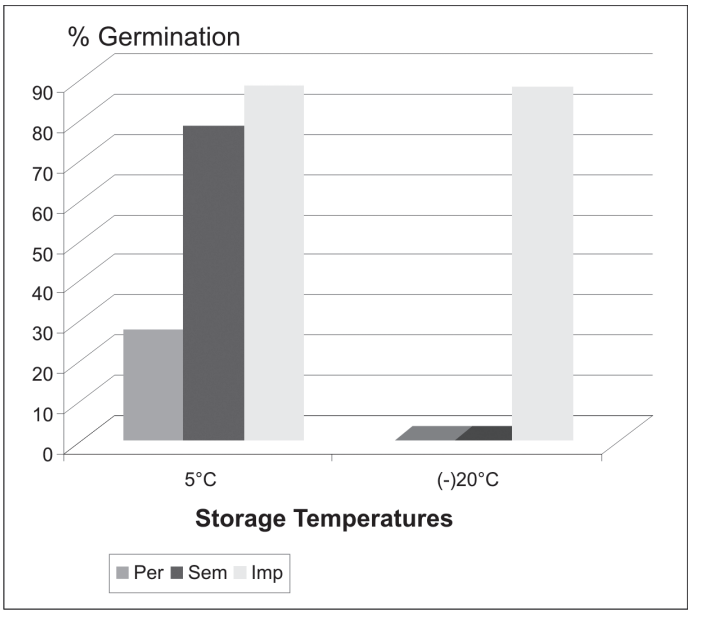

Fig 1. Seed viability after 25 years of storage in radish

RESULTS AND DISCUSSION

Radish seeds are small and have relatively good storage life under ambient conditions (Doijode, 2005). The initial seed viability (99%) was reduced to 88% after 25 years of storage under controlled storage conditions. The percentage of germination was 28 in moisture permeable; 79 in semi-impermeable and 89 in impermeable containers stored seeds at 5°C (Fig.1), whereas none of the seeds germinated when stored in moisture permeable and semi impermeable containers at –20°C storage. However, seeds showed high germination (88%) when stored in moisture impermeable container at –20°C. Seeds exhibit high longevity in moisture impermeable containers both at low (5°C) and sub-zero (-20°C) temperatures. Seeds stored in moisture semi-impermeable container at 5°C also showed higher storability. Villareal *et al* (1972) also reported that seed storage in polyethylene bags was effective especially under dry conditions. The loss of seed viability was greater in seeds stored in moisture permeable containers when exposed to chilling temperature as the moisture content was increased to 18.4%. The seedling vigour in terms of shoot length, root length, dry weight and vigour indices were also preserved with controlled storage conditions (Table 1). Seedlings raised from stored seeds were normal and did not show any morphological variations. High storage temperatures promote the seed deterioration and reduce the seed longevity (Fonseca *et al*, 1980). Further the process of seed deterioration was greater in moisture permeable containers due to higher humidity thereby affecting the seed quality (Bass and Clark, 1974). Harrington (1972) opined that seed deterioration was slower at cooler temperature. Apart from the seed viability, seed quality in terms of seedling vigour was also well preserved with low temperature storage. High seed quality at initial stages contributes greatly to the longer conservation, and on storage for higher production (Doijode, 2006). The results suggest that radish seeds conserved at low temperatures exhibit high viability and vigour. In this both moisture semi impermeable and impermeable containers are effective in maintaining high viability at low (5°C) and sub zero (-20°C) temperatures.

Table 1. Seedling characteristics of radish seeds after 25 years of storage

Storage Temperature (°C)	Storage containers	Vigour index II	Vigour index I	Vigour	Dry weight (mg)	Root length (cm)	Shoot length (cm)
5	Moist Per	4.6	5.8	3.8	4.0	319	106
	Moist Semi	5.2	6.3	4.4	11.3	908	348
	Moist Imp	5.3	6.2	4.5	12.7	1023	400
-20	Moist Per	—	—	—	—	—	—
	Moist Semi	—	—	—	—	—	—
	Moist Imp	13.0	13.8	4.8	12.6	2358	422
CD at 5%		0.57	1.83	NS	0.65	234	26

As simple and cost effective seed storage technique, radish seeds can be stored effectively as well as economically in laminated aluminium pouches at 5°C. The ideal seed storage method is the one which is readily accessible, inexpensive and capable of maintaining high genetic quality on long term storage. Seed germplasm can be kept in moisture semi impermeable containers at 5°C. The recovery of viable seeds was 89 per cent after 25 years of storage at 5°C, which is effective and economical and breeder can effectively conserve germplasm for longer period.

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(MS Received 3 July 2009, Revised 2 November 2009)