Pattern of seed longevity during storage of lentil (*Lens culinaris*) cultivars

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Lentil (*Lens culinaris* Medikus) is an important winter (*rabi*) season legume, globally grown in about 6.58 million hectares (ha) area with 7.6 million tonnes (mt) and 11.53 thousand metric tonnes (t) production and productivity (Parihar et al. 2018). In India, lentil is being cultivated in an area of about 1.5 million hectares with a production of around 1.6 million tonnes (mt) (Kumar and Gupta 2019). The average productivity of lentil in India is 847 kg/ha which is relatively low as compared to the average productivity of world (Sharma et al. 2018, PC report AICRP MullaRP 2019–20), which could be owing to scantiness of quality seed of improved varieties, use of farmers’ saved seed, poor crop management etc. Quality seed production and maintenance of its quality during storage till further utilization for sowing purpose is quintessential for sustaining lentil production. The duration of storage may vary from months to years, while the carryover seeds need to be stored for more than a year. In addition, the prevailing temperature, nature of the seeds, seed moisture content, the relative humidity during storage affects the seed longevity (Khalequzzaman et al. 2012). Likewise, if the seeds are to be conserved in a genebank, the storage period last for many years to reduce the cost of rejuvenation process. Therefore, it becomes very important to understand the exact period when the cultivar could be stored with minimum loss in viability. As per the Indian Minimum Seed Certification Standard (IMSCS), the minimum requirement of germination for a lentil seed lot is 75% (Trivedi and Gunasekaran 2013). Therefore, the present investigation was executed to assess the effect of the storage period on the viability of lentil cultivars.

The present study was carried out at ICAR-Indian Institute of Pulse Research (IIPR), Kanpur, Uttar Pradesh during the winter (*rabi*) seasons of 2017–20 to assess the effect of the storage period (under ambient conditions) on the viability of 36 lentil released cultivars. The seeds of 36 different varieties of lentil were produced at IIPR, Kanpur, Uttar Pradesh. After observing the initial viability percentage, the seeds of all the varieties were kept inside a cloth bag and stored at laboratory conditions. After 1 year (2016–17), 2 (2017–18), 3 (2018–19) and 4 (2019–20) years, the seeds from each of the varieties were tested for its viability. Viability was tested through germination test following top of the paper protocol. Briefly, 25 seeds of each cultivar in 4 replications were placed in petri plates lined with two wet filter paper. After placing the seeds, the petri plates were kept in germinator at 20°C for 10 days (ISTA 1999). On 11th day, the viability percentage was recorded on the basis of per cent normal seedlings developed.

In general, storing seeds for 3 years under ambient laboratory condition had no effect on viability of lentil varieties (Table 1), however, genotypic variability was observed. The viability percentage of fresh seed (before storage) of 36 lentil varieties varied between 71% (DPL 81) to 92% (HUL 57, VL 126, PL 5) with a mean value of 85%. All the varieties after first year of storage demonstrated a mean per cent viability of about 94%, and the value ranged between 74% (Ash, JL 3) to 100% (VL 4, LH 84-8). While, after 2 years of storage, the viability value fluctuated between 82% (PL 24) to 100% (LL 699), with a mean value of 94%. Likewise, after 3 years of storage, the viability value ranged between 68% (VL 507) to 100% (K 75, IPL 315), with a mean value of 93%. The low mean viability recorded in fresh seed (85%) as compared to one year stored seeds (94%) was owing to the presence of hard seeds in the freshly harvested seed and the value of which was not included in the germination value. After one year of storage, the percentage of hard seeds declined, and hence viability percentage increased. The occurrence of hard seeds in lentil has been reported (Ladizinsky 1985). Notably, the viability of seeds was drastically reduced when stored for 4 years with a mean value of 50%. The germination value oscillated between 0% (DPL 15, DPL 62) to 94% (WBL 77, KLS 216). Most interestingly, after 3 years of storage, all the varieties except VL 507 had viability more than 75% which is a minimum seed germination standard as per IMSCS. These findings demonstrate that all these varieties could be safely stored at ambient laboratory condition for 3
years. Conversely, after four years of storage, 27 varieties had viability of less than 75%, indicating unsuitability of these varieties to store beyond 3 years; while other nine varieties recorded viability of ≥75%, indicating appropriateness of storing them for 4 years. The varieties like NDL 1, VL 103, WBL 77 and KLS 218 recorded >90% viability even after 4 years of storage, indicating a possibility of storing them for few more years (Table 1). While, varieties like DPL 15, DPL 62, K 75 and PL 5 had 0–6% viability after 4 years of storage (Fig 1). Significant reduction in the germination of lentil seed is reported when stored at 75% relative humidity and 35ºC for 1, 2 and 3 months (Assefa and Srinivasan 2016). Considering the ability of these varieties to maintain seed germination after four years of storage the tested varieties were distributed in three categories, i.e. poor storer (17), medium storer (10) and good storer (9) varieties (Table 2). The good storer varieties could be stored for more than 4 years.

The process of seed deterioration, though, is reported to start as early as its development and maturation period (McDonald 2004), lentil fresh seeds usually records more than 90% seed germination (including hard seeds). Seed longevity is mainly influenced by the genotype and environment. Seed deterioration is an irreversible process, but the rate of its deterioration could be managed to a larger extent by making modifications in the storage condition (Lamichaney et al. 2019). Lamichaney et al. (2021) suggested that using of aged seeds could cause poor field emergence, along with non-uniform and delayed germination. During storage, per-oxidation of the lipids resulted into development and accumulation of reactive oxygen species (ROS) or free radicals which in turn negatively affects the viability and vigour of the seed (Corbínez et al. 2002). By scavenging the ROS, cell maintains its integrity and thus protects itself. The antioxidants like vitamin E, isoflavones and antioxidant enzymes like super oxide dismutase, catalase, peroxidase, glutathione reductase are known as ROS scavangers, which reduce the content of ROS and prolong seed longevity during storage.

**SUMMARY**

In the present study, the viability of 36 high yielding lentil cultivars were tested at an interval of 0 (before storage), 1, 2, 3 and 4 years of storage. In all the tested varieties, the
mean viability was 85, 94, 94, 93 and 50% when stored for 0, 1, 2, 3 and 4 years, respectively. Lentil being an orthodox seed can be stored well up to three years maintaining viability above the minimum requirement (75%) as per Indian Minimum Seed Certification Standards (IMSCS). Therefore, it is recommended to store the seeds of these varieties up to three years, except for VL 507, under ambient conditions. Notably, the seeds of nine varieties namely IPL 406, PL 639, Asha, PL 77-12, Ranjan, NDL 1, VL 103, WBL 77 and KLS 218 could be stored for more than 4 years. These varieties are identified with better storage ability and could be embraced as donors in lentil breeding program for developing cultivars with better storage efficiency

REFERENCES


