Indian J. Pl. Genet. Resources 7(2): 251-256, 1994; Special Issue
Short Communication

EFFECT OF ULTRA-DESSICATION ON SEED LONGEVITY IN PEARL MILLET

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Key words : Pearl millet, seed longevity, ultra-dessication

Seeds of the majority of crops and many other plant species show orthodox storage characteristics i.e., they can be dried to low moisture contents without causing decline in their viability. The longevity of such seeds increase with decrease in seed moisture content and storage temperature (Roberts, 1973). It has been shown that at a given temperature, there is a logarithmic relationship between the longevity of desiccation tolerant seeds and their moisture content (Ellis and Roberts, 1980; Ellis *et al.*, 1986). Ellis *et al.*, (1986) reported that the increase in seed longevity which resulted from reducing moisture content from 5 to 2 per cent in *Sesame* seed was about 40 folds. Reducing storage temperature from +20°C to –20°C also increased longevity by a factor of roughly 40. Considering these results, the usefulness of ultra-desiccation in the conservation of seed viability is being studied on a number of crops. The present study summarizes our results on pearl millet seeds.

The experimental material for the present study comprised of seed of pearl millet variety ICTP 8203 of varying moisture contents ranging from 3.5 per cent to 15 per cent. The seed lots with different moisture contents were prepared by either drying the seeds over regularly regenerated silica gel or by humidifying them over water in closed containers at 20°C. About 300 seeds each were placed in small (12 × 10 cm) labelled laminated aluminium foil pouches for various seed lots with different moisture contents. Two sets of seed lots representing all the moisture contents viz. 3.5, 6, 8, 10, 12 and 15 per cent were prepared to examine their viability under ambient temperature storage and artificial ageing environment (65° in oven).

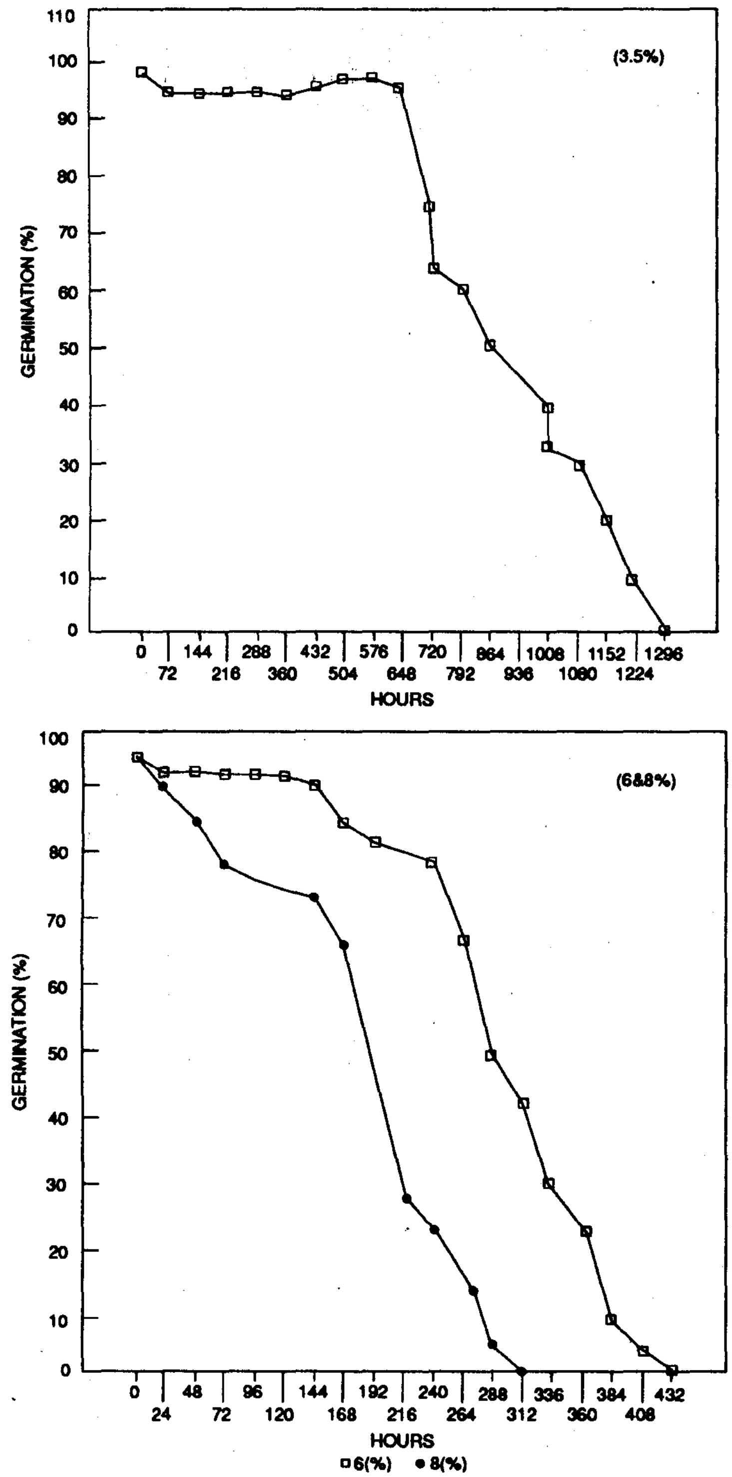
For artificial ageing, the seed packets with different moisture contents were kept in oven maintaining temperature of 65°C. One packet each of different moisture content was drawn regularly at fixed intervals. The seed packets stored under ambient storage condition were drawn at monthly interval for viability testing. The seeds with ultra low moisture content (3.5%) were humidified before their germination by placing them over a wiremesh in a closed disiccator having water in its bottom to avoid imbitional damage.

The germination tests were carried out on each seed packet drawn from oven or ambient storage. 24 hrs after their draw, the tests were carried out following the procedure prescribed by the International Seed Testing Association (ISTA, 1985 a) using 50 seeds replicated four times on moist filter papers in petriplates. The germination counts were taken after 7 days and number of normal, abnormal seedlings and dead seeds were recorded according to criterion of normal germination (ISTA 1985 a,b.)

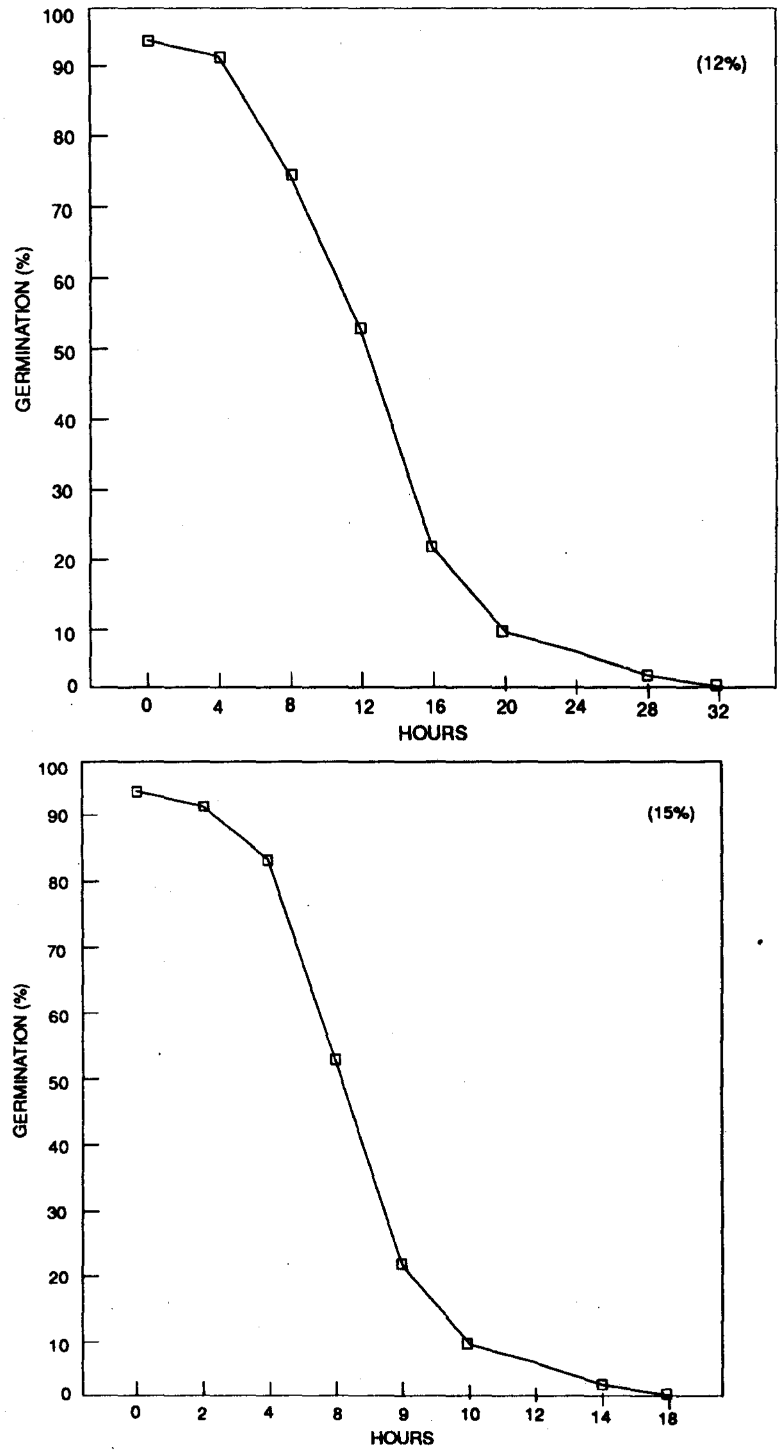
Storage of dry seeds in cooler environment is considered to be the safest and most reliable method of conserving genetic resources of seed propagated plant species. There are various technical standards which have been specified for long term storage of seeds of base collections of germplasm for their genetic conservation (Cromarty *et al.*, 1982). These standards require the seeds to be stored at –20°C in hermetically sealed containers at a seed moisture content of 5 ± 2 per cent (fresh weight basis). However, the maintenance of sub- zero storage temperatures especially in tropical countries indeed proves very expensive and difficult. Thus, there is a great need to look for other alternative methods aiming at the reduction in the cost of seed conservation of the germplasm.

Increasing seed longevity by lowering seed moisture content to less than 4 per cent (called ultra-desiccation) may be advantageous. Roberts (1989) mentioned that whereas drying cereal seeds from 9 to 8 per cent moisture content doubles storage life, further decreases are progressively even mor ebeneficial; so that decreasing the moisture content from 5 to 4 per cent increases the storage life by a factor of 3.7 per cent. On the contrary the advantage of descreasing temperature operates according to a law of diminishing returns, so that decreasing the storage temperature from 25 to 20°C would approximately double the seed longevity, whereas decreasing temperature from 5°C to 0°C increased the longevity by a factor of 1.5. The present work was undertaken to examine the merit of ultra-desiccation in conservation of seed longevity with reduced cost and non dependence on sub-zero temeprature for storage of seeds.

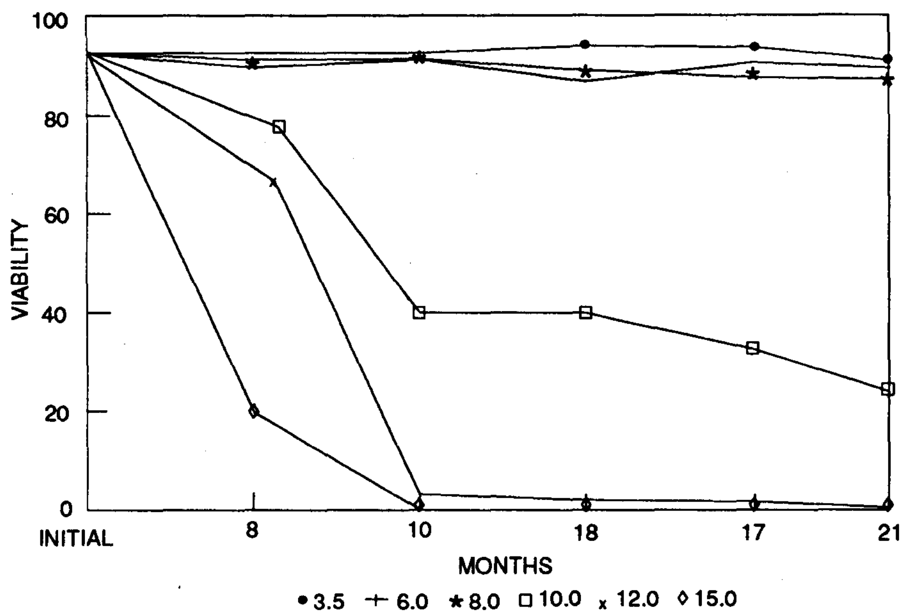
Under artificial ageing environment (Oven maintaining 65°C), seedw with 15 per cent and 12 per cent moisture content showed no germination after 14 and 28 hrs respectively. Seeds with 8 per cent moisture content were viable for 312 hrs (13 days) while those with 6 per cent moisture content remained



Graph 1a. Effect of high temperature (65°C) and moisture content on viability of pearl millet seeds



Graph 1b. Effect of high temperature (65°C) and moisture content on viability of pearl millet seeds



Graph 2. Storage of pearl millet seeds of different moistures at ambient temperature

viable upto 432 hrs (18 days). However, in the ultra-desicated seeds with 3.5 per cent moisture content the viability droppcd down to zero only after 1296 hrs (54 days) (Graph No. 1a, 1b and 2).

No significant decline in germination was observed for the pearl millet seed with the moisture content of 3.5 per cent stored at ambient temperature during 21 months of storage. For seeds with 6 per cent moisture content the viability dropped from 95 per cent to 92 per cent. In seeds having 8 per cent moisture, it further declined from 94 to 89 per cent, whereas the viability of 10 per cent moisture seeds reduced from 94 per cent to 22 per cent during the same period. No germination, however, could be recorded after 17 months in 12 per cent moisture seed lot and after a period of 10 months in case of 15 per cent moisture content.

The present study thus clearly indicates the merit of ultra-low seed moisture content in prolonging the viability fo the pearl millet seeds as observed in both the viability tests in artificial ageing environment as well as under ambient temperature storage.

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