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How seeds are monitored in the gene bank

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Abstract

In the Natural Resources Gene Bank of Iran, the seeds of pasture and medicinal plants collected from different parts of the country are stored in the basic (-18 degrees) and active (4 degrees) cold storage after going through the stages of irrigation and measuring the moisture content, purity and determination of power germination. Keeping seeds in controlled conditions in terms of temperature and humidity increases their lifespan. But in the same conditions, after a period of 5-10 years, depending on the type of seed, the germination power of the seeds is lost and the deterioration of the seeds occurs. In order to prevent deterioration, it is necessary to remove the seeds from the gene bank every few years (5-10 years) and measure their seed vigour, so that if it is lost, the seeds are in the process of regeneration and after regeneration and production, new seeds replace lost seeds. This experiments were carried out in the seed laboratory of Natural Resources Gene Bank of Research Institute of Forests and Rangelands, continuously. By a standard germination test (ISTA, 2007), the amount of germination and percentage of seed germination is determined. In the case of genera and species whose dormancy breaking and priming methods have been determined, the selected method for seed breaking and seed priming is applied, and for other cases, the optimal method for dormancy breaking and priming is selected using different sources and tests. Seed priming is done by using different methods.

Keywords: Monitoring, Seed, Gene Bank

Introduction: In the Natural Resources Gene Bank of Iran, the seeds of pasture and medicinal plants collected from different parts of the country are stored in the basic (-18 degrees) and active (4 degrees) cold storage after going through the stages of irrigation and measuring the moisture content, purity and determination of power germination. Keeping seeds in controlled conditions in terms of temperature and humidity increases their lifespan. But in the same conditions, after a period of 5-10 years, depending on the type of seed, the germination power of the seeds is lost and the deterioration of the seeds occurs. In order to prevent deterioration, it is necessary to remove the seeds from the gene bank every few years (5-10 years) and measure their seed vigour, so that if it is lost, the seeds are in the process of regeneration and after regeneration and production, new seeds replace lost seeds. And in this way, the genetic reserves protection program should continue. FAO/IPGRI (2014) Gene bank standards, recommend the first monitoring for the seeds of the basic cold storage (-18 degrees) with a germination percentage above 90% after 10 years.

There are various methods to evaluate seed vigour. In recent years, new knowledge has been obtained from molecular biology, biotechnology, biophysics, seed and seedling imaging, which are known as minimally invasive methods (biological signals), that directly or indirectly evaluates the metabolic state of the seed (Yong-Bi et al., 2015). Seed vigour monitoring requires low-cost and high-precision methods, although non-invasive methods are fast and save time and accuracy, but they are not as accurate and simple as traditional methods, and biological methods require significant amounts of seeds to adapt and adjust signals, and this problem. For species that are at risk and have low seed quantity, it is more severe. Recently, a simple and fast non-invasive accurate method has been proposed, which includes the analysis of the pattern of seed coat tear (dehiscence) followed by the emergence of the embryo (Ling-Xiang et al., 2018).

Materials and methods: This experiments were carried out in the seed laboratory of Natural Resources Gene Bank of Research Institute of Forests and Rangelands, continuously. Chenopodiaceae, Cruciferae, Graminae, Labiatae, Compositae, Papilionaceae, Caryophyllaceae and Umbelliferae families have the highest number of seed samples in the gene bank. By a standard germination test (ISTA, 2007), the amount of germination and percentage of seed germination is determined. In the case of genera and species whose dormancy breaking and priming methods have been determined, the selected method for seed breaking and seed priming is applied, and for other cases, the optimal method for dormancy breaking and priming is selected using different sources and tests. Seed priming is done by using different methods. Among them, we can refer to priming with hormones, chemicals materials and physical methods (Soltani & Koucheki, 2008).

Treated seeds are grown in a petri dish on a filter paper and placed in a germinator. Counting of germinated seeds is continued every day until two consecutive counts show an increase in germination rate, generally 14 to 21 days. After the germination period, the characteristics of germination, the number of un-germinated seeds with healthy embryos, the number of un-germinated rotten seeds, the number of abnormal seedlings, the number of seedling losses, the size and weight of the seedling, the percentage of germination and the percentage of seed viability are recorded in the Natural Resources Gene Bank software (Fig.1). In case of drop in capacity and germination percentage, the seeds will be introduced for the regeneration process. The formulas provided by Abdul-baki & Anderson (1973) and Maguire (1962), used to calculate seed vigour and germination rate, respectively.

Results and Discussion: The numbers of accessions in each family have been shown in Table 1.

Table 1: The number of accessions in each family that have been monitored

Family	Accession	Vi≥50%	Vi≤50%
Gramineae	719	335	**384**
Papilionaceae	1008	615	**393**
Chenopodiaceae	661	253	**408**
Cruciferae	490	218	**272**
Umbelliferae	753	362	**391**
Compositae	733	547	**186**
Caryophyllaceae	68	65	**3**
Labiatae	1033	624	**409**
Total	5465	3019	**2446**

Fig. 1. Steps of isolation, treatment, sterilization and sowing of seeds to monitor germination

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