Vol.2 Issue-2, OCT 2021 (e-ISSN: 2582-8223)

JUST AGRICULTURE
multidisciplinary e-Newsletter

Maintaining Seed viability and Seed vigour: Important Aspects

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ARTICLE ID: 028

Abstract

Influences on viability and germination of seeds have been studied intensively for many years, particularly for the numerous commercially important agricultural, ornamental, and timber species. High germinating seed lots may differ substantially in field emergence when sown at the same time in the same field, and/or may differ in performance after storage in the same environment or transport to the same destination. Knowledge of the availability and abundance of viable seeds in tundra soils is important to an understanding of community processes in a stable or in a changing environment. This includes the actual recruitment from this seed bank into seedlings, juvenile and then adult population. Seed storage is very important to secure good quality seeds for planting programs whenever needed. Seed longevity, vigor and viability depend on genetic and physiological factors as well as storage conditions. The most important factors that influence storage are temperature, moisture, seed characteristics, micro-organism geographical location and storage structure. It is necessary to improve methods that increase potential seed longevity, vigor and viability in storage. Seed viability can be extended by cold or dry storage at seed moisture content below 5%.

Key words: Seed, Viability, Vigour, Storage, moisture

Introduction

The field emergence of high germinating seed lots can vary considerably when sowing at the same time in the same field, as well as their performance after storage or transportation to the same destination. An understanding of how communities function in a stable or changing environment depends on knowing the number and quality of viable seeds in tundra soils. This includes seedlings, juveniles and finally adult populations from this seed bank. The performance of seeds is greatly dependent on the storage conditions and genetic factors. Seed longevity, viability and vigour depend not only on the storage conditions but also on quality.

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It is important to note that temperature, moisture, seedcharacteristics, microorganism geographical location, and storage structure have significant influences on storage. Increasing the viability of seeds by storing them cold or dry with seed moisture less than 5% will increase their viability and lengthen their lifetime. Germination behaviour (i.e., the time and pattern of germination, as well as the lifespan of viable seed in the soil) is significant even in perennial plants since seedlings are more vulnerable to control approaches than mature plants and thus make better targets in any weed management scheme. Buried viable seed banks are a key part of seed plant biology, as they aid in the conservation and regeneration of plant communities and serve as predictors of plant response to changes in land use and climate (Thompson *et al.*, 1997).

Seed Viability

Seed viability refers to the embryo's capacity to germinate and is influenced by a variety of factors. Seed viability is affected by a number of factors, including the plant's ability to produce viable seeds, predator and disease damage, and environmental circumstances such as flooding or heat. The health and germination capacity of a seed are also affected by its age. Seeds are living embryos, and cells die and cannot be replenished over time. Both genetics and the environment can determine how long a seed remains viable. Some seeds can live for several years in ideal conditions, whereas others can only live for a season cycle. Seed viability is very important for sectors that rely on seeds. Seed viability is especially important in businesses that rely on germinating seeds, such as forestry and agriculture. Predicting seed viability is an important element of the planning process because it ensures that resources are spent appropriately. Seed viability can be predicted using two approaches. The first approach is based on a visual evaluation of seed quality, while the second method predicts viability based on the germination of a sample population of seeds.

Seed Vigour

The sum total of those features of the seed that determine the level of activity and performance of the seed in seed lot during germination and seedling emergence. Seed vigour loss is linked to a decrease in the ability of seeds to carry out all of the physiological tasks that allow them to operate in any seed lot. Physiological ageing (or degeneration) begins prior to harvest and continues throughout harvest, processing, and storage. Changes in cell membrane integrity, enzyme activity, and protein synthesis, for example, gradually impair performance capacities. These biochemical changes can happen swiftly (in a matter of days) or slowly (in years), depending on genetic, manufacturing, and environmental factors that are still unknown. The seed will eventually die as a result of this degradation (i.e. complete loss of germination). Seeds, on the other hand, lose their vigour before they lose their capacity to germinate. That's why seed lots with similar high germination rates might differ in physiological age (the level of degeneration) and, as a result, in seed vigour and hence performance. Seed lots of agricultural, horticultural, and silvicultural species have varying levels of seed vigour. (ISTA, 2009).

Studies in Seed Bank

Seed banks have solely recently been integrated into demographic models of plant populations. This can be in all probability as results of seed bank information (e.g. seed survival and germination rates) are often harder to gather than data from adult plants. Furthermore, gamete banks are terribly totally different in composition, duration, and useful importance. Thompson and Grime (1979) classified seed banks into four types, distinctive between transient and chronic seed banks. They outlined transient seed banks as those while not viable seeds that existed for over a year and persistent seed banks as those with viable seeds that persisted for extended periods of time. In theoretical studies, the possible contributions of transitory and permanent seed banks to population long-term survival and viability have been considered (Cohen, 1966, 1967). Buried viable seed banks are a key part of seed plant biology, as they aid in the conservation and regeneration of plant communities and serve as predictors of plant response to changes in land use and climate (Thompson *et al.*, 1997). The species makeup of the seed bank gives an indication of the type of community that can emerge, depending on environmental changes at the sites (Richtner & Stronberg, 2005). Ground vegetation restoration can take place in a variety of ways: Planting of the missing herbaceous species, natural colonization from surrounding native woods, and natural colonization by the seed bank are all possibilities. The first option is far too costly to be generally adopted. Similarly, soil colonization from a neighboring forest can be sluggish and impossible if there is no native forest in the area under consideration. Seed banks could play a significant role in this instance (Augusto et al., 2001) since they would be a primary source of vegetation regeneration in areas where disturbance is common (Richtner & Stronberg, 2005).

Seed Bank Viability

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The importance of seed banks in sustaining populations of habitat-forming seagrasses and other submerged aquatic vegetation species is growing (McMillan, 1991; Harwell and Orth, 2002). In terrestrial plant communities, the usefulness of viable seed banks as "buffers" against variability and disturbance has been intensively studied, and it is widely acknowledged as an important approach in post-stress regeneration of habitat-forming vegetation (Middleton, 1991; Kalamees and Zobel, 2002). In hydrologically changeable habitats such as seasonal floodplains, marshes, and wetlands, seed recruitment is also crucial in defining vegetation composition (Leck and Brock, 2000; Bissels *et al.*, 2005 ;). In situ germination during the spring and summer contributed to the decline in viable seeds buried at non-deep conditions. The appearance of dead seedlings upon seed recovery revealed this. With seeds buried in deep condition, some in situ germination occurred, but the percentage was substantially lower. Seed deterioration was the main cause of the decline in viable seed of deeply buried red rice and commercial Rice Seeds.

Effect of Storage on Viability and Vigour

In agriculture, the highest seed yield was reached under normal nutrition and climatic circumstances (Shaban, 2013 a,b; Beyranvand *et al*, 2013 and Kiani *et al*, 2013). Seed quality and, ultimately, seed yield after cultivation was altered by storage conditions. Seed lots' storage potential is determined by the level of deterioration (vigour status) at the time of storage. If the storage environment is stressed in any way (e.g., temperature or relative humidity variations in unmanaged storage), high vigour seed lots will be able to tolerate the stress and will lose quality at a slower rate than lower vigour seed lots. The vigour level of the seed lot determines performance after storage, even under controlled storage circumstances (low temperature and low seed moisture content) (ISTA, 2009). Because various physiological and biochemical processes and products are regulated during dry storage, the use of hermetically sealed containers, desiccants, and low temperatures increases storability. Seeds that have been exposed to high temperatures and humidity for several days have been acknowledged as an accurate indicator of seed viability and storability (Delouche and Baskin, 1973).

Damages to membranes, nucleic acids, and proteins are related with some of the negative impacts of ageing (Fujikura and Karssen, 1995). Standardization of seed conditioning, packaging, and storage conditions could ensure that onion seeds are planted in good condition at the time of sowing. Confounding environmental and biological factors determine the rate of seed degradation. Seed degradation is accelerated by high storage temperatures and high seed moisture content (McDonald, 1999). Seed moisture content and temperature have different effects on seed lifetime depending on species and seed structural and biochemical composition. On the basis of seed moisture and storage temperature, a complete pattern of viability loss could be deduced (Ellis *et al.*, 1982). Under sub-tropical Indian circumstances, drastic variations, as well as high humidity and temperatures, exacerbate the loss of germination in stored onion seeds. At the worldwide level, genetic degradation of material kept in gene banks is seen as a serious issue (FAO, 1997). As a result, it is strongly advised that the key mechanisms producing genetic erosion in ex situ collections be monitored in order to prevent the loss of genetic diversity. Low quality of the original material, over drying of seed prior to storage, increase in temperature or moisture content of seed during preservation, lack of regeneration, losses of germplasm during multiplication, physiological changes in seed during storage, and no detectable loss of germination due to a lack of viability monitoring are some of these factors (FAO, 1997). In general, a moisture content of 37 percent and a storage temperature below 8 degrees Celsius would allow for long-term seed preservation (FAO/IPGRI, 1994). However, even if seed is stored in controlled circumstances, viability may suffer as a result of degradation.

Testing Seed Vigour

The standard germination test is a seed quality indicator that can be used to forecast field emergence if soil conditions are close to optimal (Duurant And Gummerson, 1990). However, the conditions under which the seed is discovered during examination frequently differ from those in the field. Seed viability affects germination in the field. Seed viability, also known as seed vigour, is a set of qualities that determines the activity and behavior of commercially viable seed germination seed lots in various environmental conditions. In addition to the foregoing, the seed vigour determines the seed's longevity with no negative consequences (ISTA, 2009). Various vigour tests are utilised to gain more specific information about the seed lot's quality (Miloevic And Cirovic, 1994). Testing seed viability using various seed vigour tests is important because vigour tests frequently produce findings that are more closely connected with the outcomes of field germination under adverse conditions than the results obtained by using a standard laboratory germination test (Johansen

And Wax, 1978). The vigour tests were divided into three categories by Mcdonald (1975): Seed parameters like as size and bulk are determined by physical examinations. These assays are low-cost, fast, and may be used on a large number of samples. They also have a favourable correlation with seed vigour. The accumulation of nutritive elements is the most important feature of seed growth, and it is also linked to vigour, or seed size and mass. Germination and growth characteristics are used in physiological examinations. These tests are divided into two categories. The first type occurs when germination takes place under favourable conditions (standard laboratory germination, and test of growth intensity). When a seed is subjected to unfavourable environmental conditions, the second type occurs (cold test, accelerated ageing test, and Hiltner test). Biochemical assays are regarded as indirect ways for determining the value of seeds. Tetrazolijum test, conductometric measures, enzyme activity, and respiration are examples of these.

Testing Seed Viability

Regular physiological, biochemical, and more recently molecular examinations of seed material should provide insight into the quality, and provide a firm basis for improving breeding programmes and enhancing control systems in the seed production process (Miloevic *at al.*, 2007). One of the secondary duties in the production of a grain crop is seed viability testing (germination). Nonetheless, it necessitates close scrutiny. Without knowing the germination potential of the seed to be planted, an educated calculation of the number of seeds required to provide an acceptable population of plants at the start of the planting cycle will be impossible. The percentage of seeds that germinate in a sample collected from seeds that will be planted is an important test, but it isn't enough. Another aspect to consider in this activity is the plant's vitality. The ability for the plantlets to establish and grow well is referred to as vigour. Seed physiology as evaluated by an emergence test is insufficient to predict seed storage potential (Stumpf *et al.*, 1997). Cho and Sanders used tetrazolium dye to test the viability of embryos from undamaged seeds (2009). To summarise, entire seeds were steeped in water overnight to weaken the seed coverings, which were then gently removed with a scalpel under a dissection microscope. Embryos were immersed in the dye solution (5 percent, w/v) in the dark for a minimum of 24 hours after the seed coats were removed. Non-viable embryos were left white, whereas healthy embryos were coloured red. Seeds with a V-shaped opening were separated from those with pieces identifiable by an attached pedicel.

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