
Review on: Effect of Seed Storage Period and Storage Environment on Seed Quality

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Abstract: Seed quality deterioration is inevitable process. Since seed is a vital input in agriculture which determines not just the production but also the productivity, it is crucial to maintain the seed quality as well as seed vigor during the storage. Storage is a basic practice in the control of the physiological quality of the seed and is a method through which the viability of the seeds can be preserved and their vigor kept at a reasonable level during the time between planting and harvesting. Many researches on seed storage period have been investigated that seeds can be stored for short period is found in least deterioration. In contrast changes associated with seed deterioration are depletion in food reserve, increased enzyme activity, increased fat acidity and membrane permeability. As the catabolic changes continue with increasing age, the ability of the seed to germinate is reduced. Gradual decrease in the seed quality parameters were observed, as the storage period increase. It is estimated that good quality seeds of improved varieties alone can contribute about 18 to 20 per cent increase in crop yield keeping all the other inputs constant. Lastly using seeds as planting material which stored with in short period of time and in proper environment is very important.

Keywords: Seed Quality, Storage Period, Storage Environment

1. Introduction

1.1. Background of the Review

There are many factors that affect seed quality such as insects, temperature and all biotic and biotic factors [40]. Storage period of seed is most widely important factor, which affects seed quality. Seed moisture content goes up gradually during storage reducing seed quality depending on reduction in germination percentage. But at 15.5% moisture level invasion of rough rice by storage fungi and germination percentage reduction were proportional to increasing moisture content and the increasing length of storage. Rough rice was infected at moisture content of 13.4% to 13.8% within 413 days of storage causing reduction in germination percentage. Lack of availability of quality seeds led to a decline in production caused by the use of low-quality seeds and adaptation in the field is reduced [20]. Availability of quality seeds is related to seed storage. Good handling during storage period can minimize physical damage to the seed, especially seed quality during storage [17].

According to researchers the principal purpose of seed storage is to preserve storage temperature and moisture content on the vigor of economic crops from one season to another [12]. For instance: Storage Welsh onion seeds, after two years storage, the seed temperature and moisture content are the most important quality declined as storage temperature and seed moisture factors affecting seed longevity, with seed moisture content increased. The effects of storage period usually being more influential than temperature on viability and vigor of onion seeds were studied. Many investigators reported that a complete pattern of loss in viability in seed quality is largely dependent on long storage period, and it could be understood on the basis of seed moisture and temperature, relative humidity, storage temperature and concluded that adoption of length of storage, type of seed and seed quality [4].

However storage is a basic practice in the control of the physiological quality of the seed and it is a method through which the viability of the seeds can be preserved and their vigour kept at a reasonable level during the time between planting and harvesting [5]. A few scholars can be concluded

that amaranth seed can be stored safely for up to sixteen months with over 70% viability at a temperature range of 15.1 to 20.3°C and relative humidity of 26.9 to 50.7% [2]. A long-term storage of seeds, especially under unfavorable conditions, leads to loss of viability. The nature of this physiological damage is variable, e.g. short-term deterioration in the field is different from long term deterioration during storage, which in turn is different from mechanical damage [13].

Seed storage period may affect the viability of seeds, as the reduction in seed viability is directly proportional to the increase of time [9]. This is because it allows the ripening embryo storage period and further accumulation of food that lasts for storage before germinating, these activities led to an increase in the metabolic processes in the seed. As a result, the seed has decreased viability and cannot germinate optimally, because energy has been used in the metabolic process [6]. In addition to a storage period of seed, seed viability was also influenced by seed storage environments such as temperature and relative humidity [38]. The seeds stored at low temperature storage germinated higher than those stored at high temperatures storage in all storage period [22]. It is because the seeds are stored in high temperatures increase the respiration rate and enzyme activity resulting in the overhaul of food reserves before the seeds germinate, the seeds decreased vigor and physical quality of seed.

1.2. Objective of the Review

To review the effects of seed storage period and storage environment on seed quality.

2. Review of Literatures and Discussions

2.1. Definitions of the Terms

Seed: It is defined as a complex biological structure consisting of a plant in miniature and food reserves protected by covering coats. A miniature plant possessing a remarkable capacity to ensure that the new individual starts life in the right place at the right time [24].

Seed quality: Seed quality is judged by different end users such as farmers and industries. For instance, farmers expect to obtain high quality seeds that are able to germinate and produce normal seedlings under field conditions [21].

Seed storage: may be defined as the preservation of viable seeds from the time of collection until they are required for sowing [18]. Seeds are considered to be in storage from the moment they reach physiological maturity until germination [32].

2.2. Effect of Seed Storage Period and Storage Environment on Seed Quality

Farmers in the developing world still store their produce including seed under the ambient environment in longer period of time this has been observed to affect seed quality in general and germination in particular [28]. Decrease of seed quality is due to longer seeds storage period increases

connected with bio-chemical changes in physiology of seed such as due to auto oxidation of lipids and the increase of the content of free fatty acids these leads to a quick deterioration [31]. According to report, final germination percentage, germination index percentage, energy of germination percentage and emergence rate percentage were decreased as storage periods were increased [37]. The results revealed that before storage treatments significantly exceeded the other storage periods in final germination percentage, germination index percentage, energy of germination percentage and emergence rate percentage followed by that storage after 3 months. While, after 12 months from storage recorded lowest final germination percentage, germination index percentage, energy of germination percentage and emergence rate percentage. It could be concluded that increasing storage periods from 3, 6, 9 and 12 months decreased final germination percentage by 3.11, 9.91, 18.87 and 25.80%, respectively compared with final germination percentage of pre storage treatment. Increasing storage periods from 6, 9 and 12 months decreased germination index percentage by 6.51, 15.34 and 26.40%, respectively, compared with germination index percentage after 3 months. Increasing storage periods from 3, 6, 9 and 12 months decreased energy of germination percentage by 11.06, 15.63, 38.38 and 48.47%, respectively compared with energy of germination percentage of pre storage treatment. Increasing storage periods from 3, 6, 9 and 12 months decreased emergence rate percentage by 5.73, 11.51, 24.44 and 33.42%, respectively compared with emergence rate percentage of pre storage treatment.

Result worked on soybean; one of the major constraints to the production of soybean in the tropics is the rapid loss of seed viability and vigour during storage under ambient conditions [27]. The loss of germination is much more acute under tropical conditions [36]. Because Seed viability is the ability of the embryo to germinate and it is affected by a number of factors including temperature, light, oxygen, and water and species type. Germinability which is determined by germination percentage is the proportion of seeds that germinate from seeds subjected to the right conditions for growth while the germination rate is the speed with which the seeds germinate and is affected by seed viability, dormancy and environmental effects that impact on the seed and seedling [44]. Seed deterioration is also associated with storage duration according to report of [35]. Changes associated with seed deterioration are depletion in food reserve, increased enzyme activity, increased fat acidity and membrane permeability. As the catabolic changes continue with increasing age, the ability of the seed to germinate is reduced. Furthermore shrinking and breaking of seeds during storage are some of the physical changes that occurred in soybean seed in storage [26].

As seed quality deteriorates during storage, vigour declines before loss in standard germination [30]. Moreover, reported that farmers in the developing world still store their produce including seed under the ambient environment [15]. Some researchers concluded that, storage under ambient conditions has been observed to affect seed quality in general and

germination in particular [11]. Storage is improved under ambient conditions if seeds are well-packaged [23]. Irrespective of initial seed quality, unfavourable storage conditions, particularly temperature and relative humidity, contribute to accelerating seed deterioration in storage [14]. Germination and seedling vigour are severely affected if seed is stored at high relative humidity and deterioration is much faster if the storage temperature is also high [10].

Scholars worked on different varieties of tef and reported that, germinating percentage of the seeds had declined when storage period elongates [42]. It is also noted the presence of variation in germination capacity among varieties when the storage period increases. The germination percentage falls in the range of 89% for Asgori variety stored for 31 months to 96% for Tsedey and Magna variety seeds stored for 7 months. Germination percentage was reduced by 1.6% as the storage period extended from 7 months to 19 months whereas further storage to 31 months had reduced germination of the seed by 3.7%. The result indicates all the varieties responded with a reduction in germination percentage when the seed storage period increased beyond 7 months. The germination capacity of Tsedey variety had deteriorated significantly when the storage period elongates to 31 months. Similarly Asgori variety had been significantly altered by seed storage period in higher degree. More over storage period had a negative influence on seed germination rate. After a year of storage, seed germination rates of all three genotypes declined significantly. After 12 months of storage, the average value of the tested parameter (89.03%) was statistically highly significantly lower than the other storage periods examined. However, on sunflower observed that no effect of storage period on seed germination and other seed quality parameters [16].

Researches worked on maize parental lines and reported that; significant variations were observed among and within parental lines for germination and emergence percentage as well seedling traits in different storage period [8]. Germination, emergence and fresh weight (shoot and root) were decreased as the seed stored longer duration. This finding demonstrated that seed germination, emergence rate and seedling establishment are decreased with increased in seed storage period [43, 7]. Reporters also added that seed germination declined significantly after one year storage [40]. Moreover; Suggested on boro Rice Variety BRRI dhan47 and reported that; Seed germination and seedling growth parameters were decrease with increase in storage period which might be the cause of attaining dormancy of seed due to increase in storage period [40].

Investigator reported that gradual decrease in the seed quality parameters were observed, germination percentage, speed of germination, seedling length, seedling dry weight and seedling vigor index decreased with the increase in Storage period [31]. The results showed germination percentage, speed of germination, seedling length, seedling dry weight and seedling vigor index were in the decreasing trend as storage periods increased. Results revealed that before storage treatments significantly exceeded the other storage periods

germination percentage, speed of germination, seedling length, seedling dry weight and seedling vigor index followed by after 150 days. While, after 250 days from storage recorded lowest germination percentage, speed of germination, seedling length, seedling dry weight and seedling vigor index.

Researchers reported that Tef seeds stored for 7 months had produced longest and vigorous seedlings than seeds stored for 31 months [42]. The result also showed that storing tef seeds beyond 7 months, particularly for 31 months reduce the seedling length by 6.64%. The reduction in seedling length could be attributed due to the depletion of the nutrients in the endosperm because of seed ageing. The current research ad further found that seedling length in tef was influenced by the inherent characteristics of varieties. On the other hand Dukem and Magna variety had significantly longest seedling length while Tsedey had the shortest. Accordingly, Vigour index I had been significantly affected by storage period. Seeds which were stored for 7 month exhibited statistically higher vigour index I from seeds stored for 19 and 31 months. On the other hand, 19 and 31 months stored seeds did not vary statistically. Storing the seed beyond 7 months to 19 months reduce vigour index I by 3.72%. Further extending storage period to 31 months had an effect of reducing vigour index I by 6.39%.

Reports stated that the increasing storage period from 0 to 18 months led to an increase in the value of electrical conductivity of a wheat seed 16.03 to 52.02 $\mu\text{S}\cdot\text{cm}$ [19]. During storage has suffered deterioration as indicated by electrolyte leakage that increases the value of electrical conductivity in soaking water. Moreover, increasing storage period also resulted in germination and dry weight decreased, at the end of the observation of the initial germination percentage decreased from 82.3% (0 months) to 53.6% (18 months), followed by the number of dead seeds [25]. The statement was in line with the increase in the percentage of dead seeds which from 25.31% (at 10 months) to 30.16% (at 12 months).

Reporters reported that all varieties of sorghum were stored at storage room with temperature of 38°C and RH \pm 48% for 12 months yielded damage seed was higher than stored for 10 months, by 24.19%, 14.73% [29]. Seed vigor as shown by the percentage of total normal seedling stored at storage room with temperature of \pm 18°C and RH \pm 48% for 12 months was lower than stored at storage room for 10 months, by 59.50%, 78.00%, respectively. Also, the speed germination of seed after store 12 months was lower than it stored at storage room for 10 months, by 36.47%/day, 24.58%/day, respectively. Sorghum variety that has the best seedling was Super-1. It was indicated by root length and dry weight of normal seedlings. Research finding worked on storage of Boro rice variety BRRI dhan47 and Concluded that Seed germination and seedling growth parameters reduced with increasing storage duration due to dormancy of seed [40]. BRRI dhan47 showed the tendency to become dormant after storage. After six months of storage seed germination percentage and seedling growth parameters were almost zero. Seeds that deteriorated rapidly by increasing storage duration generally showed a marked decline in their ability to germinate [1].

Research done on perennial rye grass and concluded that seed and seedling traits were affected significantly under effects of storage temperature values of germination, germinability and length of plumule were increase with increase of storage while the length of radical were increase after the length of 18 months storage [32]. The percentage of dead seeds was highest in soybean seeds stored in the storage period of 60 days after the stored, which is the longest storage time of the study [3]. Researchers were found similar results to the current experiment on timothy grass seeds which were stored for one, two, three, four and 5 years under ambient storage condition [34]. They had observed that germination of timothy grass seed had sharply declined from 90-95% on the fresh harvest to 1% after 5 years. The magnitude of reduction in germination percentage was minimal in seeds stored from 1 year to 2 years; however, subsequent storage periods had severely reduced the germination percentage of timothy grass. Similarly reported that, a significant germination percentage reduction after storage of two varieties of perennial ryegrass for 9 months at different temperatures [33]. According to finding, germination percentage had reduced due to seed storage which had stayed above 9 months and seed germination was affected by storage time and the varietal characteristics in perennial ryegrass [40]. Seed should not be stored for extended periods when there is high temperature and relative humidity [41]. Storing seed beyond of optimum storage period might be resulted in reduces germination potential, seedling establishment and final seed production [38].

3. Conclusion and Recommendation

3.1. Conclusion

Seed and its quality among others are vital input in crop production. Crop response to other inputs largely depends on the quality of seed. It is estimated that good quality seeds of improved varieties alone can contribute about 18 to 20 per cent increase in crop yield keeping all the other inputs constant. Seed germination and vigour are important indicators of quality which are substantially reduced during storage. Seed aging and improper storage environment is recognized by some parameters like delay in germination and emergence, slow growth and increasing of susceptibility to environmental stresses in various periods of storage. Seed quality decreases under long storage conditions due to long seed storage period. It is the reason of declining in germination characteristics. Long seed storage period is manifested as reduction in germination percentage and those seeds that do germinate produce weak seedlings.

3.2. Recommendation

Storage is a basic practice in the control of the physiological quality of the seed and is a method through which the viability of the seeds can be preserved and their vigour kept at a reasonable level during the time between planting and harvesting. Seed deterioration starts immediately after a crop

has attained the physiological maturity stage. Thus, in order to prevent the quantitative and qualitative losses due to several biotic and abiotic factors during storage, several methods are being adopted such as seed treatment with suitable chemicals or plant products, as well as seed storage in safe environment. As due to the damage in cell membrane and other conditions changes in the seed system, for example, the protein and nucleic acid accumulation. Such degenerative changes result in complete disorganization of membranes and cell organelles and ultimately causing death of the seed and loss of viability. The most widely recognized and predictable ultra-structural changes in all the cell organelles were the loss in integrity of membranes, which constantly leads to increased seed deterioration particularly during storage. So that timely use of a seed than storing seeds longer period of time and controlling seed storage environment is very important.

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