Chapter V

Discussion

5. DISCUSSION

During seed storage, seed degradation is a normal, catabolic, permanent, and internal degenerative programed phenomenon. The seed quality, vigour, and viability in the process of ageing or adverse ecological conditions are translated as a loss. However, the deterioration rate of seed depends on the different types of seed species due to the seed moisture content and storage temperature, an increment or decline in one or the other leading to an expeditious or delayed deterioration process. The physical and chemical efficacy of seed degradation has recently been widely exposed (Kapoor, *et al*., 2010; Mahjabin, *et al*., 2015; Somasundaram, *et al*., 2017; Wang, *et al*., 2018; Fenollosa, *et al*., 2020). Numerous physiological and biochemical manipulative strategies have been invented by seed technologists to eradicate such climatic as well as biotic hazards that are conducive to earlier deterioration of stored seeds. There are a few reports that hydration-dehydration treatment, as well as chemical treatment of seeds of various natures, such as salts, phenols, vitamins, organic acids, antioxidants, essential oils, plant growth regulators, retardants, and so on, can significantly impact the viability status of the seeds (Bhattacharjee *et al*., 1984, 1993; Rai, 2000; Draganic and Lekic, 2012; Ojha, 2014; Lama, *et al*., 2016; Sasikala, *et al*., 2018; Palit, *et al*., 2019; Pati, 2020).

Degradation of seeds follows a convoluted contour that diversifies with the wide classes of desiccation tolerant, recalcitrant, and even seed species from various plant taxa. Reduced germinability is thus, like the difficult senescence processes of higher plants, the most widely-recognized criteria for the complex mechanism of seed deterioration. A number of studies have been carried out to evaluate loss of vigour based on ageing physiological consequences (Siddiqui, *et al*., 2011; Sarika, *et al*., 2013; Adeboye, *et al*., 2015; Shruthi, *et al*., 2018; Chan, *et al*., 2019; Nigam, *et al*., 2019; Laxmi, *et al*., 2021). One of the fundamental and important technologies of accelerated ageing is exposing seed to elevated temperatures and high relative humidity.It was recommended that a cold and accelerated ageing test be used to determine seed vigour, and that the results be compared to real field emergence (Nirja *et al*., 2018).

Owing to the lack of commercial seed substitutes, the majority of rice farmers have used a casual seed scheme for many years, relying on their self-conserved vulnerable and low-vigor rice seeds each year. This could decrease rice production overall, but a proper seed vigour test could avoid this problem and increase production by substituting high-vigor seeds. Because of the large quantities of rice seed required, seed production improves dramatically, but there is a chance of poor-quality seed remaining in the system. There must also be an effective quality management framework for rice seeds in order to guarantee seed quality, which includes seed vigour determination. Global warming has resulted in unfavourable climatic conditions, which can affect rice seed vigour and, as a result, reduce seed life in surrounding storage conditions. In all phases of rice production, such as seedlings, planting, flowering, harvesting, and so on, farmers are unable to anticipate ideal climatic conditions. Farmers can withstand the negative effects of climate change by using the most vigorous seeds. Planting rice seed varieties susceptible to ageing could withstand unfavourable conditions in the field, which would have a stable population of seedlings and plants.

The accelerated ageing test has been effectively utilised in anticipating the vigour and storage capability of various crop species under a wide range of storage conditions (Delouche and Baskin, 1973). The accelerated ageing test specified the vigour of Mungbean seeds at 42°C for 72 hours, corn at 45°C for 72 hours, soybeans at 42°C for 48 hours, and carrot, tomato, safflower, onion, gram, pea, sunflower, beetroot seeds, onion seeds, etc. as more efficient (Dutra, *et al*., 2004; Silva, *et al*., 2006; Pati, *et al*., 2011 & 2015; Vijay, *et al*., 2015; Patil, *et al*., 2018; Luciana, *et al*., 2019; Jangjoo, *et al*., 2020; Chaurasia, *et al*., 2021; Bhattacharjee, *et al*., 2021). Investigation into the accelerated ageing test for rice seed storability noticed accelerated ageing at 40°C and 100% RH for 1–15 days could anticipate rice longevity under storage conditions (Lee *et al*., 2018). Cold and accelerated ageing tests with implied field emergence could be applicable for rice seed vigour tests (Baek *et al*., 2018; Nirja *et al*., 2018). Studies have shown that artificial ageing tests are an effective technique to contemplate rice seed vigour rather than natural ageing (Kapoor, *et al*., 2011; Wang, *et al*., 2012; Bijanzadeh, *et al*., 2017; Henga, *et al*., 2019; Zhou, *et al*., 2020; Alahakoon, *et al*., 2021).

Analysis of the present investigation was performed with the five different varieties of aromatic rice seeds (MohanBhog, Khemti, MasinoBasmati, Musli, and Kalonunia) with the view to assessing their viability status under an unfavourable storage environment by analysing some putative and reliable biochemical parameters. In the current exploration, accentuation was laid on prolongation of seed viability under storage by utilising pre-treating chemicals Ascorbic acid, SADH and Na-dikegulac of definite concentrations, which is by all accounts promising in such manner in a couple of recent investigations (Chhetri, *et al*., 1992; Rai, *et al*., 1995; Maity, *et al*., 2000; Bhattacharjee, *et al*., 2006; Ojha, 2013; Lama, *et al*., 2016; Moori, *et al*., 2017; Bhattacharjee, *et al*., 2018; Pati, *et al*., 2019; Tamang, *et al*., 2020; Kanp, *et al*., 2021). The prospect of NaDK, ASA and then SADH respectively as beneficial chemical pre-treatment for maintaining vigour and the viability of seeds have been explored based on the various knowledge available and findings obtained until now during this study.

According to findings in this experiment, under long-term accelerated ageing starting from 0-, 90-, 180-, 270-, and 360-days, seed vigour decreased as ageing time increased, indicating a negative relationship. Seed vigour was drastically impaired with an increase in days of treatment. The data showed that a high relative humidity treatment increased the forced ageing process and this increase of leaky substances reduced the levels of protein, carbohydrate, amino acids as well as enzyme activities, which was considerably checked by seed pretreatment with NaDK, ASA, and SADH, respectively **(Figs 1, 2 & 3)**. However, a significant alleviation of the injurious effect was noted best in seeds that underwent pretreatment with NaDK, then in ASA and then in SADH, respectively.

The findings show that seed degradation and seed membrane damage occur as a result of accelerated ageing. Seed degradation occurs through a series of processes starting with biochemical event chains, mostly impaired liver and biosynthetic reactions, and resulting in the loss of several seed output characteristics, a decreased rate of germination, decreased field outbreaks, a rise in the number of seedlings that are unhealthy, and, ultimately, the death of seeds. Some of the most serious deterioration-causing physiological and biochemical activities are membrane degradation, changes in the cell's chemical components, decreased metabolic activity, free radical disruption, chromosome aberrations, and degradation of functional structures. reduced field emergence, a rise in irregular seedlings, and eventually seed death. Membrane degradation, enzyme changes, changes in cell chemical constituents, decreased metabolic activity, free radical disruption, chromosome aberrations, and degradation of functional structures are just a few of the significant physiological and biochemical events that occur as a result of deterioration. Seed deterioration is associated with chromosome aberrations and DNA injuries; impairment of RNA and protein syntheses; altered enzymes; nutrient stores; and membrane integrity depletion (Wang *et al*., 2012; Pati *et al*., 2014; Mahjabin *et al*., 2015; Chauhan *et al*., 2019; Ebone *et al*., 2019).

Work on the decline in germinability and viability has backed up the idea that reduction in integrity and the lesion incidence of the membrane may play a significant role in seed deterioration. Cellular constituents undergo permanent chemical and structural changes as a consequence of viability failure. Reduced membrane fluidity, altered DNA folding, protein elasticity loss, and increased cellular matrix brittleness are all structural changes associated with oxidation. Molecule oxidation results in small, readily diffused molecules with reagent carbonyl or nitrogen groups, or adducts that encourage cross-linkage or consequent breakdown of advanced glycation products between proteins, carbohydrates, and nucleic acids across cells. Phospholipids and phosphatidyl choline levels drop as seed germination decreases, causing membrane integrity to deteriorate (Walters *et al*., 2010). In an accelerated ageing environment of seed germination drops, the depletion of membrane integrity of phospholipids and phosphatidyl choline occurs. According to some studies, the ability of seeds to quickly reorganise their membrane for efficient germination is because of the desiccated rehydration of their tissues. Many studies have suggested that the membrane state of the germinating embryo is a significant degradation factor (Kibinza *et al*., 2006; Kapoor *et al*., 2011; Pati *et al*., 2019; Ebone *et al*., 2020).

The supporting references presented on membrane integrity and chemical pretreatment of seeds; thus, significantly less leaching of soluble carbohydrates and amino acids from the used chemical-pretreated seeds is suggestive of the fact that NaDK, SADH, and then ASA, respectively, rendered the seeds tolerant against storage deterioration in an unfavourable environment by retaining the integrity of the seed membrane. As seen in this study, forced ageing-induced membrane damage may be a factor in their rapid deterioration during storage. The supportive references to membrane integrity and chemical pretreatment of seeds, and substantially less leaching of soluble carbohydrates and amino acids of the chemically-treated seeds used, show that NaDK, SADH, and ASA have been tolerant to storage deterioration by preserving seed integrity in an unfavourable environment. Changes in a variety of biochemical parameters examined here, which are considered reliable indices of seed vigour, help the efficacy of NaDK, SADH, and ASA in maintaining the health of five aromatic rice seeds during the accelerated ageing time. The levels of protein **(Table 1.7)**, RNA **(Table 2.11)**, and insoluble carbohydrates **(Table 2.10)** steadily decreased in control samples during rapid ageing, with ageing length correlated with a proportional change in metabolism within seed kernels, but this pattern was significantly delayed by the pre-treating chemicals. Again, with the increase of accelerated ageing, a drastic reduction of protein and insoluble carbohydrates was noted. Here also, the pre-treating chemical efficiently relieved the deleterious effect of forced ageing treatment. Among the chemicals used, Na-dikegulac arrested the alarming rise in internal soluble carbohydrate level compared to the other chemicals used, ASA and SADH, as observed in experiments.

Seed degradation under storage is accelerated or postponed, determining the life period of a given seed species, resulting in a loss of vigour, viability, and subsequent decay of seeds, eventually leading to seed death. Despite the fact that both treated and control samples of aromatic rice seeds deteriorated, the catabolic processes inside the treated seeds remained somewhat subdued, making them more resistant to unfavourable storage conditions. According to studies, certain essential cellular components are lost during seed maturation. During the course of seed deterioration, there has been a reported increase in soluble compounds, amino acids, and nucleic acids. As a consequence, the findings obtained are consistent with the observations made (Anderson and Gupta, 1986; Bhattachharjee, 2005; Kim, *et al*., 2006; Kapoor, *et al*., 2011; Ojha, *et al*., 2012; Pati, *et al*., 2015 & 2019).

The analyses of control samples showed that both dehydrogenase activity and the percent of TTC-stained seeds were sharply decreasing and that an increase in ageing trials revealed sudden decreases in enzyme activity and seed species TTC stainability. The preprocessing chemical partly prevents the adverse impact and effectively alleviates the adverse effects of accelerated ageing substantially. The function of dehydrogenase is usually used as a valid seed reliable index (Patil *et al*., 2015; Pati *et al*., 2018; Chauhan *et al*., 2019). There are also reports that as seeds age, they lose vigour, which is evaluated by counting the percentage of TTC-stained seeds and/or by observing the pattern of TTC-staining that appears as As a seed-age, they often lose their vigour, which is assessed by counting TTC-stained seed percentages and/or by observing the TTC-stained pattern that is seen as deep red or erratic red patches on the seeds depending on their viable condition (Halder, 1981) **(Fig. 24)**. In this study, despite the accelerated ageing process, chemical seeds pretreated caused a mitigation of the deleterious consequences of ageing and kept the plants more vigorous than controls and influenced metabolically.

The detailed work was performed with the pretreated five varieties of aromatic rice seeds that experienced accelerated ageing for 0-, 90-, 180-, 270-, and 360-days in this inquiry. The test chemicals NaDK, SADH, and ASA each have a storage enhancement property, as evidenced by the cessation of seed germination loss and field emergence. It has been found that in control samples under accelerating ageing, percentage germination and field emergence **(Table 1.6)** have been adversely affected, but the inhibitor effects have been somewhat reversed in pretreatment chemical products. The assessment of low seed vigour is seen as a significant observable criterion for decreased germination and a slower rate of germination. Seedling establishment is affected by reduced vigour as treatment duration increases (Rai, 2000; Kanp *et al*., 2009; Dey *et al*., 2012; Pati *et al*., 2015; Mangena *et al*., 2019).There have also been reports of chemical improvements in seed germination and metabolism, and this finding conforms to the observations recorded. Accelerated ageing has detrimental effects on the germination of seed and seed development in chemicals like NADK, SADH, and ASA. The seeds seem to be hardening under unfavourable storage conditions.

The reduction of DNA and RNA **(Table 2.11 & 2.12)** levels, soluble carbohydrate **(Table 2.9)** and free amino acids (Table), subdued activities of dehydrogenase, amylase and catalase enzymes **(Table 1.8)**, enhanced activities of oxidase and protease enzymes (**Table 2.14)** in seed cotyledons and the relieving action and efficacy of chemicals NaDK, SADH, and ASA pretreatment are indicative of storage potentiaton property and quality property of these chemicals. The chemical induced alleviation of the deleterious ageing impacts on the overall development and metabolism of plants, which indicates the effectiveness of the pretreatment chemical. When seeds were chemically pretreated and tested for the potential of field emerging, higher protease levels **(Table 3.23)**, and activity of catalase **(Table 3.22)** and peroxidase enzymes **(Table 3.26)** compared to controls, the plants were also shown to have significantly better ability and performance.

The results from this research show that seed viability decreases with age under accelerated ageing conditions. The present study showed that prolonged ageing results in reduced seed viability, which causes stress, promotes denaturation of proteins, and causes the death of the seed. The catabolic processes in the pretreated seeds remained somewhat suppressed, making the seeds resistant to unfavourable conditions for storage. The depletion of certain essential cellular components caused by accelerated ageing is indicated by a reduction in nucleic acid, catalase, and peroxidase activities, which are commonly utilised as accurate indicators for assessing the viability of seed. Catalase and peroxidase are also considered possible scavenging enzymes that may effectively detoxify hazardous metabolites such as H2O2, thereby helping to relieve undesired cell-level toxicity (Bhattacharjee, 2005; Sharma, *et al.*, 2012; Pati, 2019; Dumanovic, *et al.*, 2021). As a result, higher catalase, protease, and superoxide dismutase activity, among other protective components, has been reported in the plant system. The findings of this study back up previous findings that rapid ageing causes a rise in protease activity as well as a decrease in anabolic enzyme activity.

Additional studies showed that storage time or the amount of time required to store seeds had a negative association with rice seed viability. The long-term aged seeds have reduced viability. The treatment of accelerated ageing results in the chemically treated seeds maintaining more vigorous seed and yielding better than the control plants. 360-day aged aromatic rice seeds reduced field performance as evidenced by decreases in plant height **(Table 3.28)**, stem circumference and inter-nodal elongation **(Table 3.29)**, yield attributes **(Table 3.27)** and biochemical parameters such as DNA **(Table 3.19)**, RNA **(Table 3.18)**, soluble **(Table 3.20)** and insoluble carbohydrate level **(Table 3.21)**, activities of catalase **(Table 3.22)**, protease **(Table 3.23)**, IAA-oxidasThe chemical induced reduction of the detrimental consequences of accelerated ageing on rice plants' overall development and metabolism suggests that pre-treatment chemicals used in plants may be retained. It is worth noting, however, that seeds that have been stored for a longer period of time may need more time to increase their percentage of germination because their rate of germination is normally slow. The data revealed that in plants raised from accelerated aged seed samples, the inception of germination to seedling emergence **(Fig. 9)**, tillering **(Fig. 13)**, elongation of stem **(Fig. 11)**, initiation of panicle to booting **(Fig. 14)**, flowering **(Fig. 16, 17 & 18)**, level of milk grain and the stage of dough grain **(Fig. 20 & 21)** were significantly delayed, with chemical pretreated samples partially alleviating the delaying action on the inception of the aforementioned developmental stages. Once more, decreased field results of plants have been linked with concomitant reductions of yield attributes, resulting in a plant's final seed yield **(Table 3.27)** impairment, produced from seeds of forced ageing. The yielding attributes, such as stem circumference diameter, internodal elongation (Table 27), seed weight, and seed number per panicle **(Table 3.29)**, The weight of 1000 seeds in pretreated seed samples has been shown to be slightly higher than in control samples. Chemically pretreated seeds have played a beneficial role in this regard, including the significant reduction of their negative effects on plant growth and yield. **(Table 3.27)**

When seeds undergoing chemical treatment were developed, plant performance and plant potential were found to be much better and greater. A comparison of the aged seeds with control seeds was used for evaluating the seed vigour. The results showed that six days of accelerated ageing is equal to a natural storage period of nine months and holds germination above the minimum certification standards for Indian seeds (Mananthi *et al.*, 2015). It can be supported by the analysis that the pretreatment chemical has helped maintain seed storage capabilities and effectively reduce the harmful effects significantly. Adaptive plants' responses to environmental stresses show their high vigour and this extensive effort to modulate seed vigour by chemical processes and viability status to alleviate the specific problems and improve the metabolic status of seeds. Again, plants having higher levels of biochemical parameters in the chemical pretreated samples prove the invigorating action of the chemical. The results show that NaDK, ASA, and SADH chemical pretreated lots retained high vigour and developed more healthy seedlings, not only being more efficient in enhancing seed storage capacity but also in boosting seedling vigour than the control.

Pre-sowing seed treatment in water, mineral solutions such as $CaCl_2$, K_2SO_4, $ZnSO_4$, cobalt chloride/sulphate, KH_2O_4, $CuSO_4$, boric acid, growth regulators like manganese sulphate, ascorbic acid, kinetine, GA, benzyl adenine, and CCC, as well as products found singly or combined to fasten the process of germination; higher rate of germination and seedling vigour; enhanced resilience and crop yields. Seed treatment enhances a range of uses for seeds and seedlings to facilitate the quick and uniform germination and development of biotically, abiotically, and physiologically stressed plants. To some extent, biological agent effectiveness has improved and stabilised (Kim *et al.*, 2006; Krishnaveni *et al.*, 2010; Kar *et al.*, 2011; Mariappan *et al.*, 2013; Sharma *et al.*, 2015; Dominic *et al.*, 2016; Pati, 2020).

The accelerated ageing test has a positive association with field emergence and seed storage capacity. Under storage, seed health is closely associated with seed deterioration. Microorganisms, insects, pests, and fungal attacks are the major impediments to the safety of the grains, and, therefore, some precautionary measures are essential to safeguard the stored seeds. The storage fungus affects the parameters of seed quality and reduces the seed germination potential during storage. During seed storage, storage fungi affect seed quality parameters and reduce seed germination capacity. As regards the mechanism of used chemicals-induced maintenance of seed vigor, from this investigation it can be interpreted that chemicals help maintain the seed health of deteriorating seeds under adverse storage conditions by slowing down the metabolic process and by retaining membrane integrity. According to the investigation's findings, before planting in the field, rice must be preserved for a minimum of a year or longer. Seed vigour has long been recognised as a multifaceted trait influenced by a variety of influences, including genetic background, environmental factors during seed growth, and storage stages. When it comes to storing rice seeds, temperature and environmental factors are crucial. The factors investigated thus help to understand and monitor the degradation and infection of seed during storage. Overall, there was a significant variation in the interaction impact of the processing environment, seed age, and chemical treatments. It is likely that the three pre-treating growth retardant chemicals used might have rendered seeds less susceptible to fungal damage, thereby influencing the maintenance of seed vigour for a certain period of storage.

Drought, freezing, toxic metals, salinity, UV-B radiation, and pathogen infection cause cellular homeostasis to be disrupted resulting in increased ROS production in plants. ROS is frequently produced in plants as a result of various metabolic processes in various cell compartments or as a result of eventual leakage of the chloroplasts, mitochondria, and plasma membrane electron transport processes to O_2. ROS contains free radicals, including super-oxide anion (O_2•), radicals of hydroxyl (OH) and non-radical molecules such as peroxides of hydrogen (H_2O_2), single-oxygen ($1O_2$, etc.). All ROS are highly toxic to species at high concentrations.When the amount of ROS in a cell approaches defensive mechanisms, it is stated that there is an "oxidative stress". Enhanced cell development during environmental stress can harm cells by causing lipid peroxidation, protein oxidation, nucleic acid damage, enzyme inhibition, programmed cell death (PCD) activation, and ultimately cell death (Sharma et al., 2005).

Seed degradation is linked to free radical buildup formed as a result of the process of metabolism, which is involved in ageing and plant senescence. Plant cells' free radical activity is a natural component of their metabolism, which is based on electron transmission, oxidation/reduction reactions, and molecular oxygen reactions.Free radicals, on the other hand, can cause adverse reactions in the cell and their activity is strictly controlled. The antioxidant system (AOS) in plants has a multilevel, complex network designed to fight against damaging reactive oxygen species (ROS). The ability of cells of a plant to live at high H_2O_2 concentrations is proof that they have excellent antioxidative protection mechanisms. For stressed plant survival, it is especially important for the AOS to cooperate, participate, and improve the safety and regeneration of active reduced types of redox reactions (Shah *et al*., 2001; Sharma *et al*., 2007; Khunpon *et al*., 2018; Wang *et al*., 2019).Plants include antioxidants, detoxifying enzymes, and antioxidant compounds that scavenge ROS in order to ensure the seed longevity and removal of any free radicals "leaking" from usual metabolic processes. Free radical activity may be involved directly or indirectly in the hormonal regulation of plant senescence and seed growth and development. Abscisic acid, lipoxygenase, cytokinins, and calcium are plant hormones that have been linked to reactive oxygen species (ROS), which can attack cellular components in the absence of free radical scavengers (Rodriguez, *et al*., 1990; Sharma, *et al*., 2005; Kibinza, *et al.,* 2006; Pehlivan, *et al*., 2017).

The effectiveness of chemical pre-treatment with Na-dikegulac, SADH, and ASA on maintaining storage potential and vigour of seeds can be substantiated by the comprehensive work done, and the results of this investigation are thus in conformity with the reported observations in accordance with the findings reported. The used chemicals induced regulation of free radicals and consequent improvement of seed health under storage. In several electron transfer reactions, the participation of free radicals, mostly in the form of activated O_2 species such as superoxide (O_2) or H_2O_2, is normally regulated by adequate defensive mechanisms such as the actions of superoxide dismutase, catalase, and peroxidases (Sharma *et al*., 2012). Oxidative stress can rise to higher levels, leading to cellular damage and seed degradation during seed desiccation, germination, storage, and ageing. Of the possible biophysical and biochemical causes of seed deterioration, free-radical damage leading to a disruption of the functions of the cellular membrane (Narayanan *et al*., 2016) assumes significance. On the other hand (Gondwe *et al*., 2016; Steven *et al*., 2019) found that provision of a source of free electrons significantly extended seed viability. ROS (reactive oxygen species) play a role in various stages of seed biology development. ROS are recognised as molecules that participate in cellular signalling and regulate seed development. For example, ROS has also been discovered to play a part in gene expression during early embryogenesis, dormancy, and germination, thus suggesting that quenching of naturally produced free radicals would be of advantage in controlling seed senescence (David *et al*., 2006; Barreto *et al*., 2017). In pretreated seeds under accelerated ageing conditions (Das *et al*., 2014; Pehlivan, 2017), we observed higher activity of H_2O_2-scavenger enzymes, catalase and superoxide dismutase, which are part of the seed biology growth process at different stages. Thus, in the present study, it is quite possible that by promoting free radical enzyme activity that has made seeds tolerant of unfavourable storage, chemicals have helped to maintain essential cellular components and improve the defence mechanism.

According to the findings of this experiment, the seeds that were aged for a longer time had a decrease in viability. The viability of seeds under accelerated ageing decreases over a longer treatment period. When rice varieties were subjected to longer accelerated ageing, there was a negative association between the seed vigour and treatment time. From the present investigation, it is clear that the chemicals used at least partially alleviated the accelerated ageing-induced deleterious effects on seed germination behavior, seed metabolism, seedling growth, plant growth and metabolism at five developmental stages, as well as partially overcome them. There is little doubt that these chemicals can improve seed storage potential and maintain seed health under storage for a longer period of time, as evidenced by the current study's findings. Of the three chemicals used in this investigation, the promising effects of Na-DK on storage potential and viability extension of aromatic rice seeds in unfavourable storage conditions are obvious.

The future focus is on saving each grain that is produced, and the findings of this study will direct farmers and processors to ensure high-quality seeds on concerns about storage time and storage temperature. The extension of ageing has led to both germination and seed viability being reduced. The findings of the physiological results matched the biochemical parameters. Aging conditions have led to higher moisture content in all varieties. According to the findings, accelerated ageing had an impact on the seed quality of all rice varieties. The present study showed that the vigour of seeds from various varieties actually varies, which results in later changes in field performance. With regard to accelerated ageing, all of the research studies concluded that the variety Kalonunia is particularly susceptible, and Mohanbhog is the best variety, followed by MasinoBasmati, Musli, and Khemti varieties.