Journal of Agroecology and Natural Resource Management
p-ISSN: 2394-0786, e-ISSN: 2394-0794, Volume 7, Issue 1; January-March, 2020, pp. 1-4

http://www.krishisanskriti.org/Publication.html

# Influence of Plant Growth Retardants on Storage Potential of Aromatic Rice Seeds in Accelerated ageing Condition in Darjeeling

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**Abstract—***The present study was carried out in five aromatic rice varieties of Darjeeling hill viz. KaloNunia, Mohan Bhog, Khemti, Masino Basmati and Musli for analyzing leaching of soluble carbohydrate and free amino acids during seed deterioration by subjected them to long term accelerated ageing treatment (95% relative humidity, RH) for 365 days (0, 90, 180, 270 and 360 days). Prolongation of ageing led to deterioration of both germinability and seed viability and increased leaching of soluble carbohydrate and free amino acids. These changes are directly proportional to seed germination and metabolism. However, some diminution of leaching was noted in the chemically pretreated seed lots with Ascorbic acid (ASA) with concentration of 250 and 500µg/ml, Succinic acid 2,2-dimethylhydrazide (SADH) with 150 and 300µg/ml, Sodium dikegulek (NaDK) with 1000 and 2000µg/ml compare to distilled water (Control) before accelerating ageing. The study concludes that accelerated ageing showed effect on seed quality of all the varieties of rice. All the test experiments performed concluded that the deleterious effect of seed leaching of soluble carbohydrate and free amino acid was substantially alleviated and ameliorated best by NaDK then followed by SADH and ASA respectively.*

**Keywords:** *Aromatic rice; Accelerated ageing; Ascorbic acid; Succinic acid 2,2-dimethylhydrazide Sodium dikegulac.*

## INTRODUCTION

Rice aroma is the most striking characteristics of high quality rice and has gained importance as a quality character. The demand of aromatic rice is increasing in both domestic and international markets (Sakthivel K *et. al*., 2009). Rice is the most important food crop and life for thousands of millions of people. By the year 2025, about 760 million tons of paddy needs to be produced to meet the increasing demand due to increase in world population, this requirement is 35 percent more than actual rice production (Duwayri *et. al*., 2000).

A good quality rice seeds are often free from diseases and possess high germ inability and vigor but obtaining high vigour seeds needs scientific managements and proper techniques for harvesting, processing, treatments and storage (Chhetri S, 2009). Seed vigour influences the productivity, quality and also the storability of seeds. Seed storage may influence seed viability and may reduce seed vigour, depending on the storage conditions and the length of storage period. The two most important factors that influence the life span of seeds are relative humidity and temperature and their effects are highly interdependent (Copeland and McDonald, 1995). Determination of seed storability and vigour in rice seeds seems to be more important recently and one of the most important is accelerated aging test which is a physiological stress test. The basis for this test is that higher vigour seeds tolerate the high temperature-high humidity treatment and thus retain their capability to produce normal seedlings.

Seed treatment is one of the important quality aspects of seeds. Treated seeds are protected from pests that attack seeds and seedlings and can improve seed quality and increase yields also (Powell, 2006). The possibility of prolonging the vigour and viability of stored seeds by chemical manipulative technique has been explored by a number of workers. To maintain seed viability, various methods have been suggested along the time (Aschermann-Koch *et. al*.,1992, Bhattacharjee *et.al*., 1984, 1993,1995, Rai A,.1999, Draganic and Lekic, 2012, Lama *et.al*., 2016)

Maintenance of vigour and viability of seeds is an important problem in agriculture and horticulture. The two environmental factors, i.e. temperature and relative humidity (RH), have profound influence on seed health under storage (Copeland and McDonald, 1995: Desai *et.al*., 1997). In recent years, some effective physical and chemical manipulative techniques have been developed by seed technologists to get rid of such climatic as well as biotic hazards which conducive to earlier deterioration of

stored seeds . There are some reports that hydration-dehydration treatment as well as treatment of seeds with chemicals of diverse nature (salts, phenols, organic acids, essential oils, plants growth regulators, bio products) can favourably influence the viability status of seeds (Chhetri *et.al.*, 1993; Bhattacharjee *et.al.,*1984, 1986, 1993, 1999, 2012 & Sasikala K *et.al*., 2018).

Seed deterioration is a major problem in agricultural production. The climatic condition of Darjeeling hill is more acute due to high humidity. Keeping this problem in mind, an attempt was made to enhance the storage potential of rice seeds which undergo forced deterioration under adverse storage environment/ accelerated ageing. Thus the major, objective of this work was to test the efficacy of growth inhibitors ASA, SADH and NaDK on the alleviation of seed deterioration under storage.

**MATERIALS AND METHODS**

Aromatic rice Seed lots of 5 varieties KaloNunia, MohanBhog, Khemti, MasinoBasmati and Musli were collected from local farmers of Darjeeling, West Bengal, India. After collection, the seed lots were separated from husk and healthy, undamaged seeds were selected for experimental purposes. During the experimental period the environmental conditions of Darjeeling were as follows: Temperature: 6-22 degree Celsius, Relative humidity: 90-95+_ 2%.

This experiment was performed under artificially imposed environmental conditions called accelerated ageing for obtaining a relatively uniform and expeditious result. In case of long term accelerated ageing condition, starting from 0, 90, 180, 270 and 360-days, analyses were made at 90-days intervals up to 365days (1 year) after imposing ageing conditions and then experiments was terminated. After the surface sterilization with 0.1% mercuric chloride ($Hgcl_2$) for 90sec., all the 5 varieties of aromatic rice seeds KaloNunia, MohanBhog, Khemti, Masino Basmati and Musli were separately pre-soaked with aqueous solutions of Ascorbic acid (ASA) with concentration of 250 and 500µg/ml, Succinic acid 2, 2-dimethylhydrazide (SADH) with 150 and 300µg/ml, Sodium dikegulek (NaDK) with 1000 and 2000µg/ml or distilled water for 6 hours and then dried back to original weight of seeds. After 48 hours intervals such soaking dry treatments were repeated 3 times to make the total duration of pre-treatment of 18 hours. This mode of pre-treatment enabled maximum pre-treatment of the chemical while avoiding the commencement of germination. After complete pre-treatment of seed lots, the pre-treated seed lots (200g) each were put into separate cloth bags and thus stored in a desiccators in which an environment of 98.2% relative humidity was pre imposed by keeping 250 ml 5.96% sulphuric acid (vol/vol) within it. This experimental setup was kept allowing the seeds to experience forced ageing treatment and Sulphuric acid was changed periodically to restore the desired relative humidity within the dissector throughout the experimental period.

Free amino acid levels from the seed leachate of each treatment and each ageing period (0, 90, 180, 270, 360 days) were analysed after immersing 1g seed sample in distilled water for 16h. From the leachate stock, free amino acid level was quantified following the method of Moore and Stein (1948) modified by Bhattacharjee (1984). Sampling procedure of soluble carbohydrates from seed leachates was the same as done in case of leachable amino acids, and from the same leachate stock, soluble carbohydrate level was determined following the method of McCready *et.al.* (1950) with slight modification.

**RESULTS AND DISCUSSION**

In the long term accelerated ageing period, the high RH (relative humidity) treatment rapidly enhanced the rate of ageing, senescence of seeds and viability status was found to be low. Leaching of soluble carbohydrate and amino acids from the seed samples KaloNunia, Krishna Bhog, Khemti, Masino Basmati and Musli increased with advancement of ageing duration irrespective of treatment when data were recorded in 0, 90, 180, 270 and 360 days respectively. However, this increase was significantly reduced most in NaDK, then in SADH and lastly in ASA pretreated seed samples, regardless of the concentrations used, magnitude of the decline was less in all NaDK pre treated seed lots. The results are indicative of the fact that accelerated ageing caused to damage seed membrane which consequently resulted in the higher leakage of soluble carbohydrate and free amino acid in all control samples but in pre treating chemicals alleviated this deleterious effect to a considerable extent.

Leaching of soluble carbohydrate (Figure-2) from the accelerated ageing storage seeds showed positive result with the period of accelerated ageing. Data showed that the 0, 90, 180, 270 and 360 days respectively after ageing significantly increased leaching but during subsequent analyses the pre treating chemicals, regardless of its concentration, checked the higher leakage of sugars in all seed sample. Accumulation of amino acids in seed leachates (Figure-1) went on increasing in control seed samples of all the crop seeds with advancement of ageing duration. The same trend was apparent in case of chemical-pre treated seed samples but there the rate of increase was considerably slowed down at all concentrations. The higher concentration of NaDK was found effective in enhancement of enzyme activity in accelerated ageing duration.

Leakage of soluble carbohydrate and amino acids from the seeds is indicative of possible damage to seed membranes. There are numerous reports that the seed membranes are affected in deteriorating seeds leading to a progressive loss of viability. Biochemical parameters are increasingly used as indicators of seed vigour and viability. In this study, NaDK substantially alleviated the loss of sugars and amino acids followed by SADH and ASA respectively and hence the role for these chemicals in retaining membrane integrity and thereby decreasing loss of seed viability is the subject of much debate. Solute leaching was

associated with reduced vigour and germ inability activity of artificially aged seeds. A beneficial effect of NaDK on the maintenance of seed viability can also be postulated from these parameters, as the chemical was found to retard partially the rapid loss of vigour and enzyme activity.

Data showed that in long term accelerated ageing level of sugars and enzyme gradually declined in control samples with ageing duration and this declining trend was considerably slowed down by the pre treating chemicals. The above results, therefore, point out that although deterioration is a common phenomenon both in treated and in control seed samples, the leaching processes within the treated seeds remained somewhat subdued, thereby rendering them tolerant against unfavourable storage environments. That the pre treating chemicals are efficient in substantial alleviation of the damaging effect of accelerated ageing can be supported from the analyses. Data showed that progressively declined in long-term ageing experiment is generally used as a reliable index for the evaluation of seed viability.

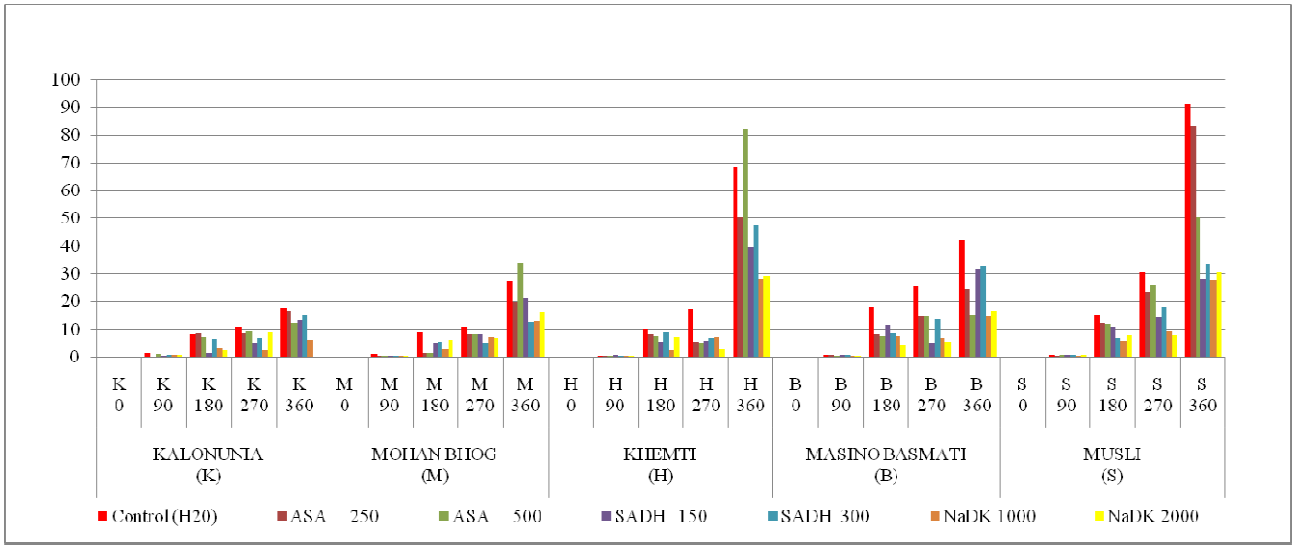


**Figure 1: Effect of long term accelerated ageing and seed pretreatment with aqueous solutions of Ascorbic acid (ASA) concentration of 250 and 500µg/ml, Succinic acid 2, 2-dimethylhydrazide (SADH) 150 and 300µg/ml, Sodium dikegulek (NaDK) 1000 and 2000µg/ml or distilled water (control) on leaching of free amino acids (mg/g fresh weight) contents in seeds of aromatic rice varieties : Kalo Nunia, Mohan Bhog, Khemti, Masino Basmati and Musli. Mature and healthy seeds were pretreated with the chemicals and distilled water for 18 hours. Data were recorded at an interval of 0-, 90-,180-, 270- and 360- days respectively.**

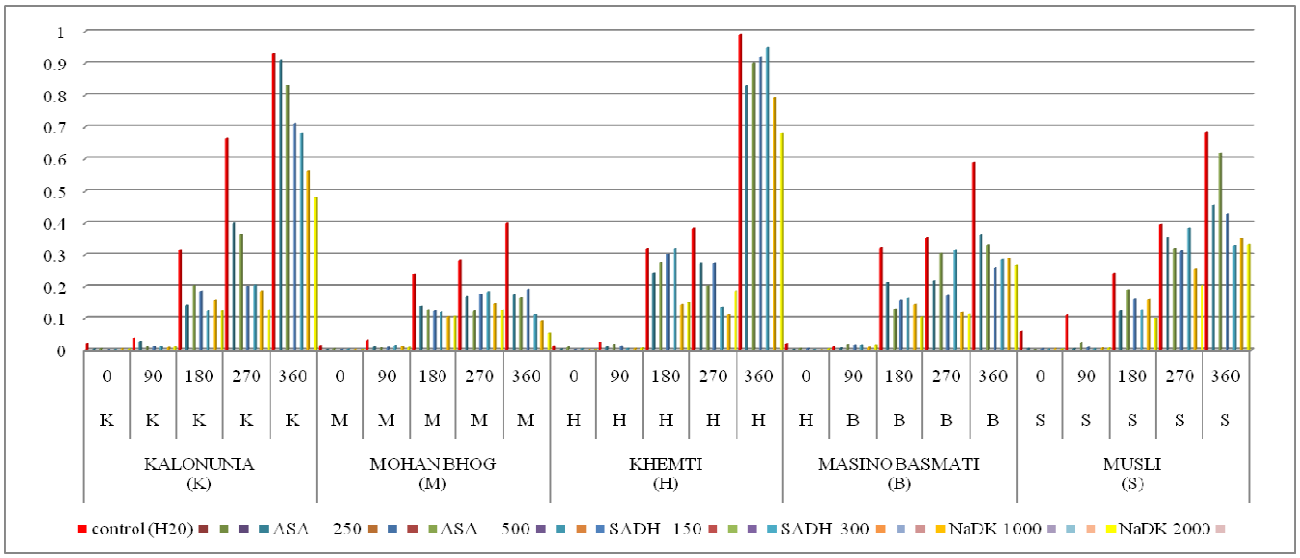


**Figure 2: Effect of long term accelerated ageing and seed pretreatment with aqueous solutions of Ascorbic acid (ASA) concentration of 250 and 500µg/ml, Succinic acid 2, 2-dimethylhydrazide (SADH) 150 and 300µg/ml, Sodium dikegulek (NaDK) 1000 and 2000µg/ml or distilled water (control) on leaching of soluble carbohydrate (mg/g fresh weight) contents in seeds of aromatic rice varieties : KaloNunia, MohanBhog, Khemti, MasinoBasmati and Musli. Mature and healthy seeds were pretreated with the chemicals and distilled water for 18 hours. Data were recorded at an interval of 0-, 90-,180-, 270- and 360- days respectively.**

Thus from a number of viability indices it can be concluded that NaDK may be used as abest seed potentiating (or hardening) agent among three chemicals used in experiment. Further work is in progress to establish its role in enhancing the storage potential of seeds.

**Acknowledgements**

The authors are indebted to Dr. Alok Bhattarchjee, Professor of Botany, University of Burdwan for generous supply of sodium-dikegulek and to University Grants Commission, Government of India for financial assistance in the form of Rajiv Gandhi Ph.D. Fellowship.

**References**

[1] Ascherman-Koch, C., Hofmann, P., Steiner, A.M.,"*Presowing treatment for improving quality in cerealls. I. Gemination and vigor*". Seed Sci Technol 1992, pp 20: 435-440.

[2] Bhattacharjee, A., Chattopadhyay, A. and Rai, A.S. "*Potentiation of safflower seeds under artificial stress storage environment by chemical growth retardants*". Seed Science and Technology, 1999, pp 27, 707-719.

[3] Bhatttacharjee, A., Halder, S. and Gupta, K. "*Influence of dikegulac and growth hormones on senescence and sink strength of sunflower and their impact on crop yield"*. Burdwan university Journal of Science, 1984, pp1, 1-12.

[4] Chhetri, D. R., Rai, A. S. and Bhattacharjee, A. "*Chemical manipulation of seed longevity of four crop species in an unfavourable storage environment*". Seed Science and Technology, 1993, pp 21, 31-44.

[5] Copeland, L.O. and McDonald, M.B. "*Principle of Seed Science and Technology*". Chapman & Hall, New York 1995.

[6] Chhetri, S."*Identification of accelerated aging conditions for seed vigor test in rice* (*Oryza sativa* L.)". A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Science in Crop Production Technology Suranaree University of Technology, 2009

[7] Desai, B.B., Kotecha, P.M. and Salunkhe, D.K. "*Seed Handbook: Biology, Production, Processing and Storage*". Marcel Dekker Inc. New York 1997.

[8] Draganic, I. and Lekic, S**.** "*Seed priming with antioxidants improves sunflower seed germination and seedling growth under unfavorable germination conditions"*. Turk. J. Agric.2012, pp 36: 421-428.

[9] Duwayri, M., Tran, D.V. and Nguyen, V. N. *"Reflections on yield gaps in rice production: how to narrow the gaps*", 2000.

[10] Lama,P.C. and Tamang,D. "*Effect of sodium dikegulac on maintenance of viability of aromatic rice seeds under adverse storage condition*". Bioscience Guardian, 2016, Vol. 6 (1) pp 24.

[11] Lowry,O.H., Rosebrough N.J., Farr, A.L., Randall, R.J. *"Protein measurement with Folinphenol reagent*" .J.Biol.Chem. 1915, pp 193,265-275.

[12] McCready, R M ., Guggloz, J., Silviera, V., Ownes, H. S. *"Deterioration of starch and amylase in vegetables"*. Analyt. Chem.22, 1950, pp 1156-1158 .

[13] Moore,S., Stein, W. W. "*Photometric ninhydrin method for use in the chromatography of amino acid*". J .Biol. Chem.176, 1948, pp 367-388.

[14] Ojha, S., Pati,C. K. and Bhattacharjee, A. "*Seed invigouration and plant potentiation of two pulse crop cultivars under stressful storage Condition"*. J Botan. Soc. Bengal. 2013, pp 66(1): 63-67. 30.

[15] Pandey,P.H. "*Principals and Practices of Post Harvest Technology"*. 1998.

[16] Powell, A.A. "*Hand book of Seed Science and Technology"*. Food Products Press. New York. Seed Vigor and its Assessment. 2006, pp. 603-648.

[17] Rai, A. **"***An investigation into the problems of maintenance of seed vigour and viability under adverse climatic condition of Darjeeling hills*". Ph.D.Thesis. North Bengal University, West Bengal, India 2000.

[18] Sakthivel, K., Sundaram, R.M., Shobha, N., Balachandran, S.M., Neeraja, C.N. "*Genetic and molecular basis of fragrance in rice*". Biotechnology Advances 2009, vol. 27, Issue 4.