Biological Forum – An International Journal **14(3): 625-629(2022)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Effect of Accelerated Ageing on Moisture and Viability of Rice Genotypes

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(Received 17 May 2022, Accepted 19 July, 2022)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: The availability of high-quality seed at the time of planting is the most important factor in the success of any crop. This is because high-quality seed ensures not only proper emergence but also rapid establishment of seedlings in the field, which increases seed yield. Temperature and moisture content are two main factors that influence seed quality during storage. The use of stored seed for sowing results in low yield due to physiological and biochemical changes that occur during aging. Seed quality deterioration during aging is a natural occurrence. This is caused by changes in various physiological parameters such as change in moisture content, seedling length, and seed viability. Changes in these parameters have a negative impact on seed yield and related characteristics. Hence in this study different genotypes of rice (*Oryza sativa* L.) were subjected to accelerated ageing by traditionally and by using saturated salt (NaCl) for 24, 48 and 72 hours respectively, these artificially aged seeds were compared with unaged seeds. Accelerated ageing at both the conditions had significant effect on viability, length if seedling and moisture content of seeds. Viability and length of seedling was decreased with increase in time of ageing and completely lost in some genotypes at 72 hours of traditional accelerated ageing and the moisture was significantly increased in all the genotypes at both the accelerated ageing conditions. Finally, the results revealed that the accelerated ageing cause progressive decline in viability of seed.

Keywords: Accelerated ageing, genotypes, Moisture, Viability, Seedling.

INTRODUCTION

Rice (*Oryza sativa* L.) is the world's second most important cereal crop and a staple food for more than half of the world's population. It is grown in 118 countries worldwide, with Asia accounting for 146 million hectares of the world's rice producing (FAO, 2019). Asia accounts for nearly 90% of global rice production and Asia is home to nine of the top ten rice producing and consuming countries. With 42.5 million ha, India is the world's major (largest) rice-growing country (Surendran *et al*., 2021).

Rice cultivation in the country is carried out in a humid tropical and subtropical climate characterized by high temperature and relative humidity, resulting in changes in genetic integrity and faster deterioration of seeds. As the seed is the most important input in agriculture, it is essential to maintain the quality of seed for producing vigorous plants (Qun *et al*., 2007). Seed deterioration, an irreversible degenerative process that occurs during storage which reduces seed quality over time. On the other hand, the rate of deterioration is influenced by seed moisture content, which upon increasing causes faster deterioration (Ellis *et al*., 1992). Many physiological manifestations of seed deterioration have been extensively reported (McDonald, 1999; Jatoi *et al*., 2004; Kapoor *et al*., 2011). The most widely accepted criterion for seed deterioration is loss of seed viability and germinability. It takes at least three to four months to study the deteriorative changes that occur with age. As a result, an alternative approach known as accelerated ageing is used, which induces desired changes in rice in a shorter time span, resulting in properties similar to those of naturally aged rice (Gujral and Kumar 2003).

MATERIALS AND METHODS

Experimental Materials: The present study was carried out at the Indian Institute of Rice Research, Hyderabad and the Central Instrumentation Cell, PJTSAU, Hyderabad during 2021 in order to determine the effect of accelerated ageing on viability, moisture and seedling length in ten different rice genotypes, namely RNR-15459, RNR-21278, RNR-29325, RNR-28361, JGL-38168, JGL-38957, JGL-38071, JGL-18047, JGL 38237 and JGL-38917.

Accelerated ageing (AA): AA was traditionally performed with distilled water and a saturated salt solution (NaCl). The seeds were spread uniformly over a plastic net in a desiccator which contains 100 ml of distilled water. The main purpose of the plastic net is to avoid contact between the seeds and the distilled water. Saturated Salt Accelerated ageing (SSAA) is accomplished in the same way as described above by replacing distilled water with saturated salt solutions (Olivera *et al*., 2020). The seeds were collected after 24, 48 and 72 hour intervals respectively.

Moisture content (%): It was determined by drying the sample in a hot air oven at 103°C for 17 hours (ISTA, 2013).

Viability (%): The viability of seeds is determined by using the traditional tetrazolium method (Moore, 1973).

Seedling length: Three replicates of ten seeds each were germinated using the paper towel method and after eight days of germination, five normal seedlings were chosen at random from each replicate and their length was measured.

RESULTS AND DISCUSSION

Parameters investigated during the study include seed viability, moisture, and seedling length. In the control group, initial seed viability ranged from 100 to 88 percent (unaged seeds). A significant decrease in viability was observed during bothTraditional Accelerated Ageing(TAA) and SSAA, with RNR 15459, RNR 29325, and JGL 38917 exhibiting negative behaviour with SSAA. In TAA, the maximum decline in viability was observed in RNR 15459 (95-24%), followed by JGL 38917 (89-22%) (Fig. 1), and the maximum decline in SSAA conditions was observed in JGL 38168 (100-63%), followed by JGL 38237 (99-87%) (Fig. 2). RNR 28361 was found to be the least affected in terms of viability during both ageing conditions. Similar decline in viability were observed in rice by Kapoor *et al*. (2011); Somasundaram and Bhaskaran (2017); Sasaki *et al*. (2015); in Niger seeds by Gordin *et al*. (2015); Jathropa by Suresh *et al*. (2019) and Tetrapleura by Sossou *et al.* (2019).

Moisture content increased in all rice genotypes under both ageing conditions. The percentage moisture increase was greater during TAA than during SSAA. The moisture content of the varieties ranged from 11 to 13% (unaged) across all genotypes. RNR 29325 had the greatest increase in moisture during TAA (11-29.8), followed by RNR 15459 (11-30.9 percent) (Fig. 3). There was a significant progressive increase in moisture with increase in duration of accelerated ageing in rice genotypes by Prakash *et al.* (2020); Bijanzadeh *et al.* (2017); Kavitha *et al.* (2017); Hussain *et al.* (2012) in maize and Kapoor *at al.*(2010) in chick pea. During SSAA the highest was observed in JGL 38957 at 72 hours of ageing treatment (Fig. 4) such differences were observed by Ellis and Hong (2007) in rice, Oliveira *et al.* (2020) in *Brachiaria brizantha*.

At both conditions, the accelerated ageing treatment resulted in a significant decrease in seedling length. The length decrease was greatest at TAA, and complete loss of germination was observed in RNR 15459, RNR 21278, JGL 38957, and JGL 38917 after 72 hours of TAA (Fig. 5). RNR 29325 had the greatest decrease in seedling length during 72 hours of SSAA, followed by JGL 18047 (Fig. 6). similar reduction pattern in seedling length in rice was reported by Garcia and Coelho (2021); Bijanzadeh *et al*. (2017); Govindaraj *et al*. (2017); Raja *et al*. (2019) in rice; Ghasemi *et al*. (2014) in wheat; Yagushi *et al*. (2014) in soy bean; and Vijayalakshmi *et al*. (2014) in tomato.

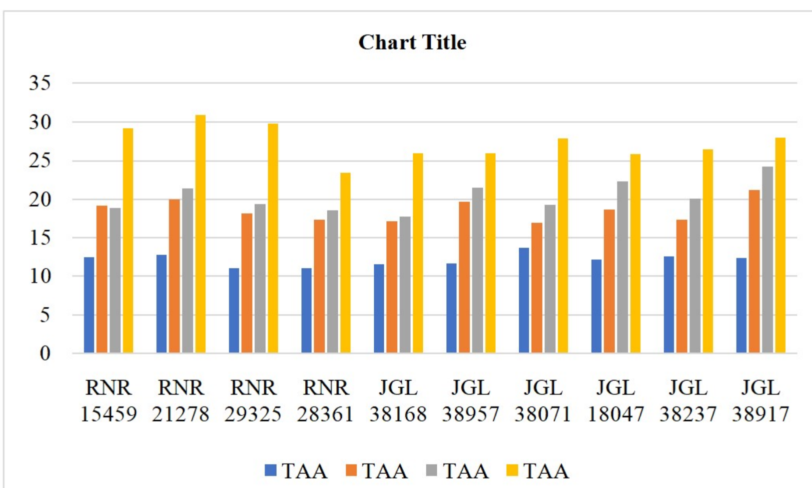

Fig. 1. Viability of rice genotypes under TAA conditions.

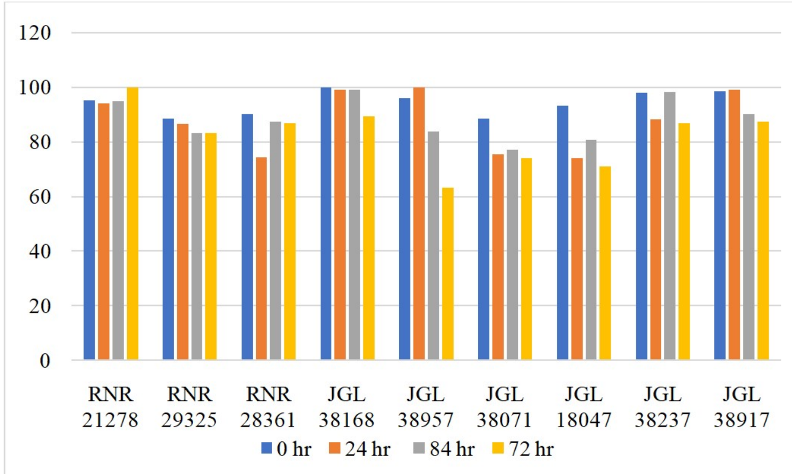

Fig. 2. Viability of rice genotypes under SSAA conditions.

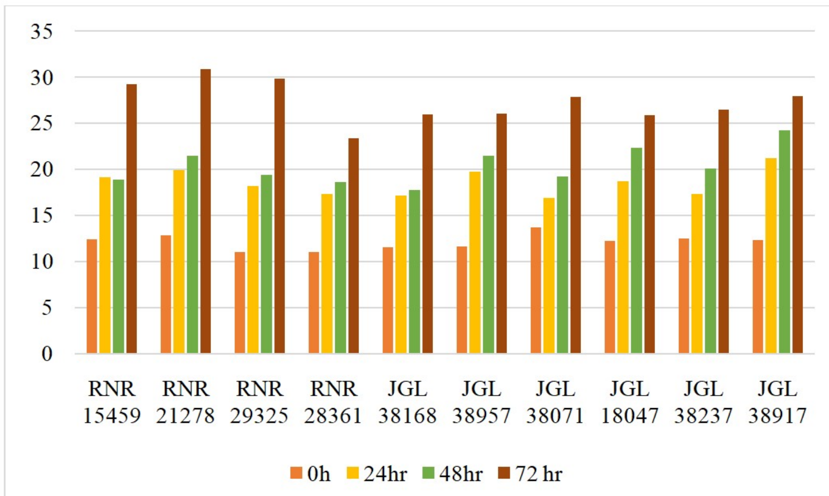

Fig. 3. Moisture content in rice genotypes under TAA.

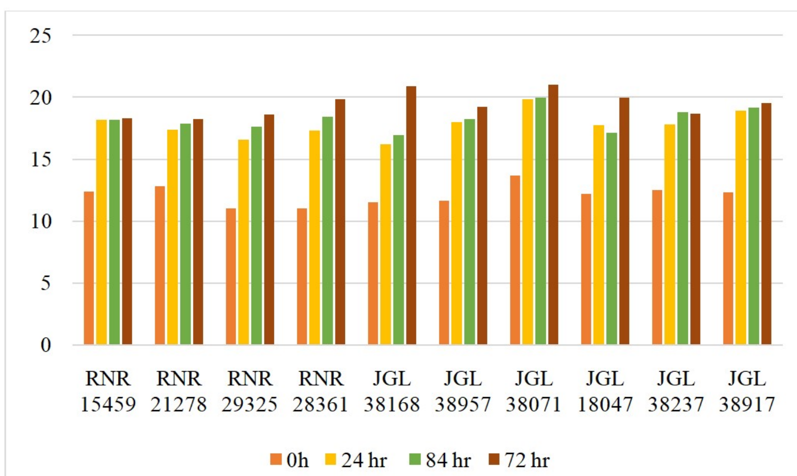

Fig. 4. Moisture content in rice genotypes under SSAA.

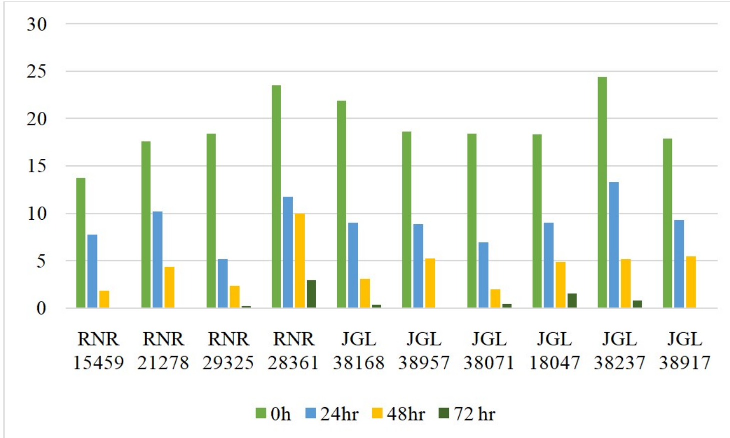

Fig. 5. Seedling length variation in rice genotypes under TAA.

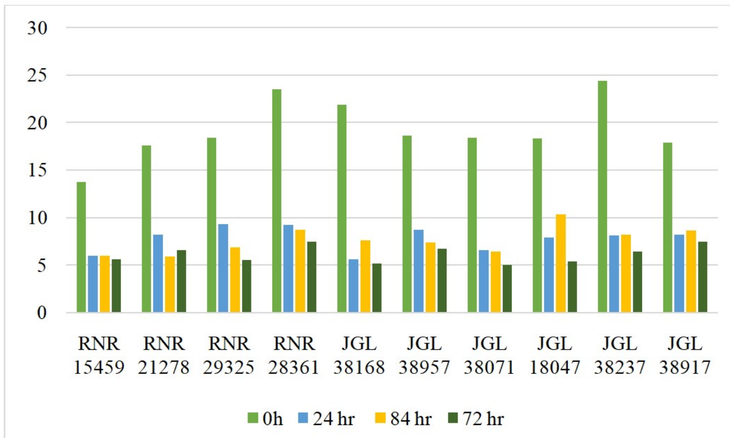

Fig. 6. Seedling length variation in rice genotypes under SSAA.

CONCLUSION

The study concluded that the viability, seedling length was decreased and increase in moisture was recorded as the duration of ageing prolonged among the varieties at both the AA conditions, Where as more effect was observed during TAA. Among the genotypes taken RNR 28361 showed maximum viability and seedling length at both the AA treatments**.**

The biological mechanism of seed deterioration during seed storage needs to be understood. The storage studies can be further extended to know the influence of storage conditions of different paddy varieties.

Acknowledgement. Authors are thankful to the Department of Plant Physiology and Biochemistry, ICAR-IIRR, Hyderabad for constant encouragement and support. Authors are also thankful to the Head of the department, Crop Physiology and other officials of PJTSAU for funding and providing necessary support during the study.

Conflict of Interest. None.

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How to cite this article: J. Poojitha, Ch. Aruna Kumari, D. Sanjeeva Rao, P. Raghuveer Rao and N. Siromani (2022). Effect of Accelerated Ageing on Moisture and viability of Rice Genotypes. *Biological Forum – An International Journal*, *14*(3): 625-629.