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# EFFECT OF SEED AGEING ON BIOCHEMICAL COMPOSITION OF RICE VARIETIES

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## ABSTRACT

In the field of seed science and technology, the accelerated ageing technique emerged as an immediate approach. We can find a quick estimate of the deteriorated Biochemical composition in seeds during storage by using this technique in the field of biochemistry. Keeping this in mind, the current study was conducted on five varieties of rice to evaluate their biochemical composition. The most severe deterioration in seeds was observed after 14 days of using the accelerated ageing test. The best results were obtained after three days and eighty percent RH. The lowest values were observed at 14 days, 45°C, and 100 percent RH.

**Keywords: Rice Varieties, Biochemical changes, seed deterioration, accelerated aging**

## INTRODUCTION

Seed deterioration, a natural process is expressed as the loss of quality, viability and vigor during ageing or adverse environmental conditions. It is an irreversible degenerative process that occurs during storage. The rate of deterioration is however, influenced by the

seed moisture content and the temperature of the storage, an increase in either leading to more rapid deterioration **[1].** Many physiological and biochemical manifestation of seed deterioration have been extensively reported **[2-6]** the most widely accepted single criterion of seed deterioration is reduced germinability however, many testes for measuring the loss in vigor have been developed based on the physiological effect of ageing **[5, 7-11]**. Among them the most important method is accelerated ageing which is done by subjecting seeds to elevated temperature & high relative humidity moisture content. It provides a simple and good method for studying sequence and relationship of process of deterioration over short periods.

The changes associated with ageing are many and depending on ageing conditions differences among cultivars **[2, 12]** or harvesting conditions **[13]**. A broad review of this aspects related to Rice seed quality with regards to accelerated ageing was also published by several researches **[14-17]**. Varietal differences in the longevity of rice seeds stored under ambient conditions have also been reported by **Krishnaswamy and Sheshu [18] and Ray *et al.* [14]**. It was therefore thought imperative to investigate the physiological and biochemical changes to understand the basis of seed deterioration. This would help not only in identifying reasons for improving storage life of seeds but also provide information that would enable incorporation of trait for better storability in the genetic background of the high yielding varieties thus, present investigation was aimed to investigate various physiological and biochemical changes during seed deterioration as a result of accelerated ageing as well as to find out superior variety under storage rice. This study of seed storage and deterioration is important as seed is the important part of our civilization. Seeds are used for many things such as planting purpose for the production of crops, preservation of genetic resources, used during plant breeding and to carryover the plant material from year to year. This is why primitive people started storing seed, so they did not need to gather food but could plant the seed to produce some of their food. Storage of seeds is a serious issue in agriculture. Ideal environmental conditions are too difficult to maintain during storage and the seed survival is highly influenced by external environment conditions long storage effect the nutritional value of grain as well as seeds. For this research all the varieties were subjected in accelerated ageing condition of

45° C temperature along with 80 and 100 % RH for 3, 7 and 14 days.

## MATERIALS AND METHODS

The experiments were conducted in CRD with three replications. Five important untreated varieties of rice were put in the desiccators containing water to provide humidity (100% and 80%) for seeds. After this, desiccators were sealed with grease and placed in hot air oven at 30 ± 1, 45±1 and 60 ± 1°C temperatures for 3, 7 and 14 days. After incubation seeds were analyzed for reducing sugar, soluble protein and its fractions, and amino acids.

**Table 1: Varieties of seed taken**

| Code no. | Species | Variety/genotype | Source |
|---|---|---|---|
| V1 | Rice (*Oryza sativa* (L.) | Mohini | State Government authorized Prayag Seed Agency Allahabad ( local market ) |
| V2 | | NDR-359 | |
| V3 | | Mansoori-mu-7029 | |
| V4 | | Pusa Basmati | |
| V5 | | Narendra-97 | |

**Determination of Amino acids-**

**Estimation of lysine -** Lysine content was estimated by the method of **con-con [19].** 50 mg of fine sample were extracted with 0.05N tetra sodium pyrophosphate HCl buffer of (pH 9.4) and treated with trinitrobenzene sulphuric acid (50mg/ml aqueous solution).calculation was done by standard curve.

**Estimation of tryptophan-** the tryptophan content was estimated by **spies and chambe**r, **[20]**. 0.2g homogenized sample was treated with 10ml of 19N $H_2SO_4$ and kept for 12 hr in dark after that p- dimethyl amino benzaldehyde and sodium nitrite solution was added. Calculation was done by using standard curve.

**Estimation of methionine-** methionine content was estimated by the method of **Horn *et al* [21]**. 0.5g sample treated with 20 ml 6N HCl. After reflection of 20- 24 hr, 1 g activated charcoal were added and wash the filtrate with hot water. After that 0.1 ml sodium nitroprusside , 2 ml glycine solution and 4 ml metaphosphoric acid were added. The intensity of colour was measured on spectrophotometer at 450 nm.

**Estimation of proline-** Proline estimation was done by the method of **Chinard [22]**. Homogenize 0.5g of tissue with 10 ml of 3% aqueous sulphosallicyclic acid and filter it . Repeat the extraction and pool the filtrates. To 2ml of filtrate, add 2ml each of glacial acetic acid and ninhydrin and mix. Keep in boiling water bath for 1h and then terminate

reaction by placing on ice bath. Add 4ml of toluene, mix vigorously for 20-30sec. aspirate the toluene layer and warm to room temperature and measure the absorbance of red colour at 520nm against a reagent blank. Calculation was done by using a standard curve.

**Determination of reducing sugars-** reducing sugars were determined by **DNS method**. Samples were extracted with 80% ethanol. Glucose was used as a standard.

## RESULTS AND DISCUSSION

### Changes in Reducing sugar

In Rice reducing sugar content was analyzed maximum (0.15 g) at 30°c for 3 days where as at 60°c for 14 days enclosed least (0.02 g) during second year. Similar results were predicted in first year. There was a considerable temperature× varieties interaction for reducing sugar content maximum drop were observed at 60° C and 100% RH in PUSA BASMATI ( 0.04 and 0.03 g) and maximum value were observed in MOHINI ( 0.13 and 0.17g) at 30° C and 80% RH during first and second year respectively. Reducing sugar content were substantially higher in MOHINI (0.14, 0.12, 0.08g) for 3, 7 and 14 days at 80% RH in first year. Lowest value was found in PUSA BASMATI (0.09, 0.05 and 0.03 g) at 80 % RH for 3, 7 and 14 days during first year. Similar results have been analyzed in second year.

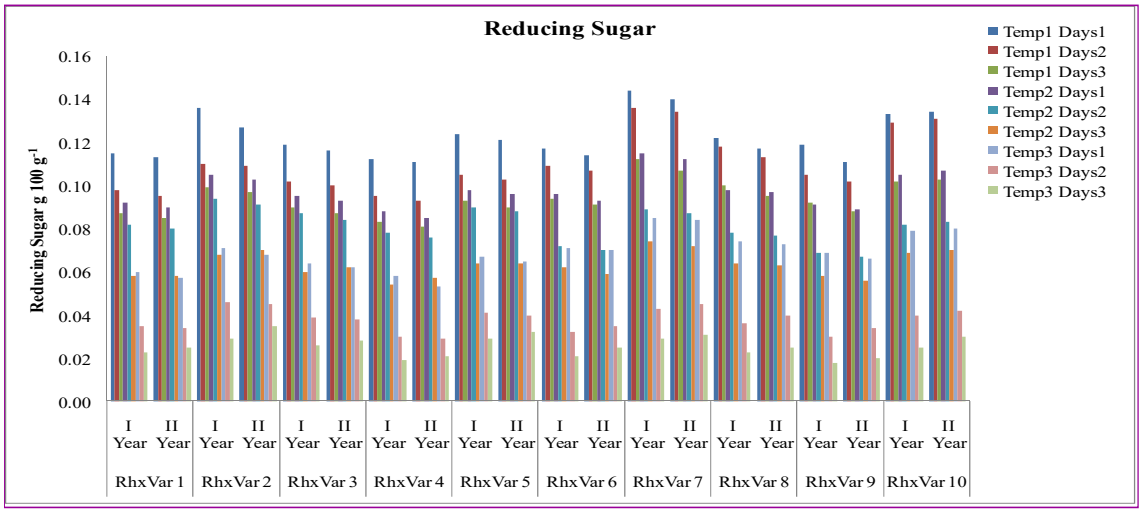


**Figure 1: Analysis of Reducing Sugar**

### Changes in Proline content

In Rice proline content was analyzed maximum (0.76 and 0.81g) at 60° C for 14 days where as at 30°c for 3 days enclosed least (0.27 and 0.29g) during first and second year. There was a considerable temperature× varieties interaction for proline content minimum fall were observed at 60° C and

80% RH in PUSA BASMATI ( 0.85 and 0.88 g) and minimum value were observed in NDR-359 (0.25 and 0.28) at 30° C and 100% RH during first and second year respectively. Proline content was substantially higher in PUSA BASMATI (0.59, 0.65, 0.74 g) for 3, 7 and 14 days at 80% RH in first year. Lowest values were found in NDR-359 (0.37, 0.43 and 0.52 g) at 100 % RH for 3, 7 and 14 days during first year. Similar results have been analyzed in second year.

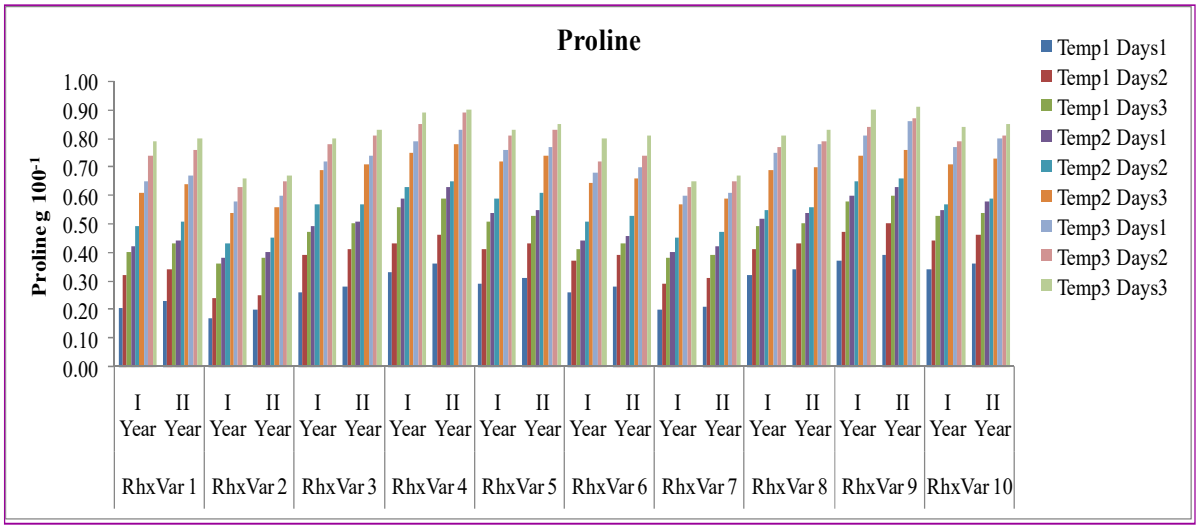


**Figure 2 Analysis of Proline**

**Changes in Methionine content**

In Rice methionine content was found to be maximum (0.50 and 0.56g) at 60°c for 14 days where as at 30°c for 3 days contained least (0.14 and 0.15g) during first and second year . There was a significant temperature× varieties interaction for methionine content maximum increase were observed at 60° C and 80% RH in MANSOORI-MU-7029 (0.54 and 0.57 g) and maximum decline were recorded in MOHINI (0.11 and 0.13g) at 30° C and 100% RH during first and second year respectively. methionine content was appreciably superior in MANSOORI-MU-7029 (0.26, 0.37, 0.45 g) and (0.28, 0.40, 0.45 g) for 3, 7 and 14 days at 80% RH and Lowest value were found in MOHINI (0.12, 0.17 and 0.22 g) and (0.13, 0.18 and 0.24 g) at 100 % RH for 3, 7 and 14 days during first and second year respectively.

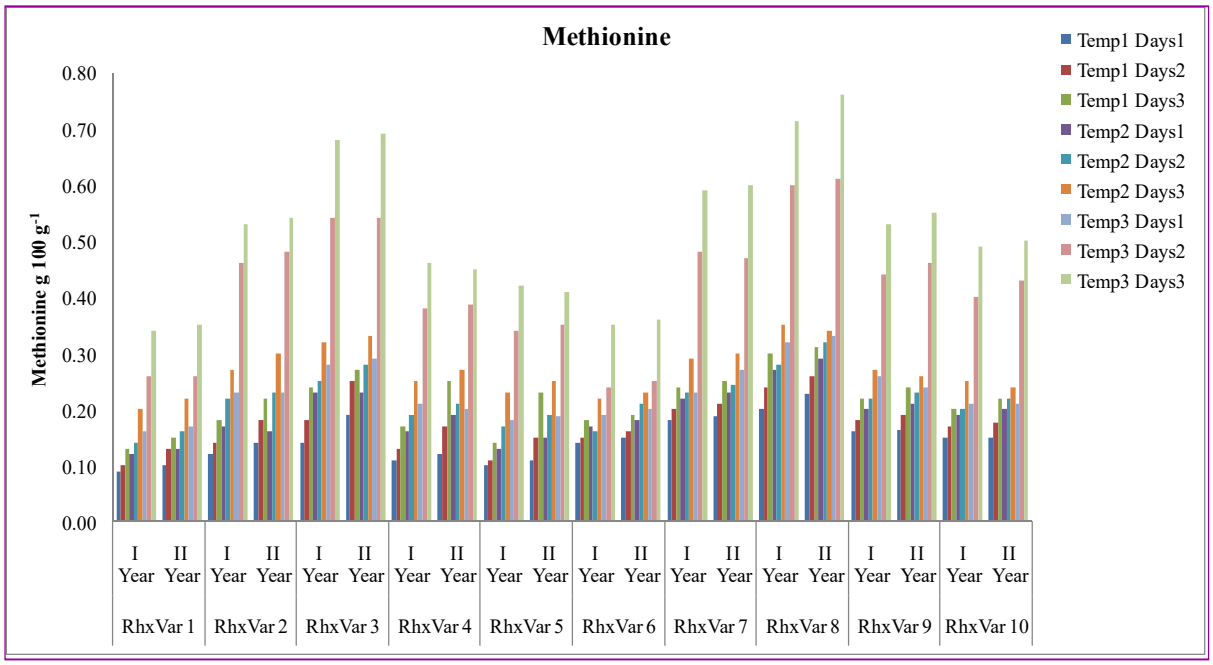


**Figure 3: Analysis of Methionine**

**Changes in Lysine content**

In Rice lysine content was analyzed maximum (0.40 g) at 60° C for 14 days where as at 30°c for 3 days enclosed least (0.28 g) during first year. Similar results were also reported in second year. There was a considerable temperature× varieties interaction for lysine content minimum reduction were observed at 60° C and 100% RH in PUSA BASMATI ( 0.45g) and minimum value were observed in NDR-359 (0.21g) at 30° C and 80% RH during first year and similar results were observed in second year. Lysine content was substantially higher in PUSA BASMATI (0.39, 0.41, 0.43 g) for 3, 7 and 14 days at 100% RH in first year. Lowest values were found in NDR 359 (0.22, 0.24 and 0.25 g) at 100 % RH for 3, 7 and 14 days during first year. Similar results have been analyzed in second year.

**Changes in Tryptophan content**

In Rice Tryptophan content was found to be maximum (0.38 and 0.35g) at 60°c for 14 days where as at 30°c for 3 days contained least (0.25 and 0.27g) during first and second year. There was a significant temperature× varieties interaction for tryptophan content maximum increase were observed at 60° C and 100% RH in PUSA BASMATI ( 0.36 and 0.32 g) and maximum decline were recorded in NDR-359 (0.20 and 0.22g) at 30° C and 100% RH during first and second year respectively. Tryptophan content was appreciably superior in PUSA-BASMATI

(0.29, 0.30, 0.31 g) and (0.31, 0.31, 0.33 g) for 3, 7 and 14 days at 100% RH and Lowest value were found in NDR-359 (0.20, 0.21 and 0.22 g) and (0.22, 0.22 and 0.23 g) at 100 % RH for 3, 7 and 14 days during first and second year respectively.

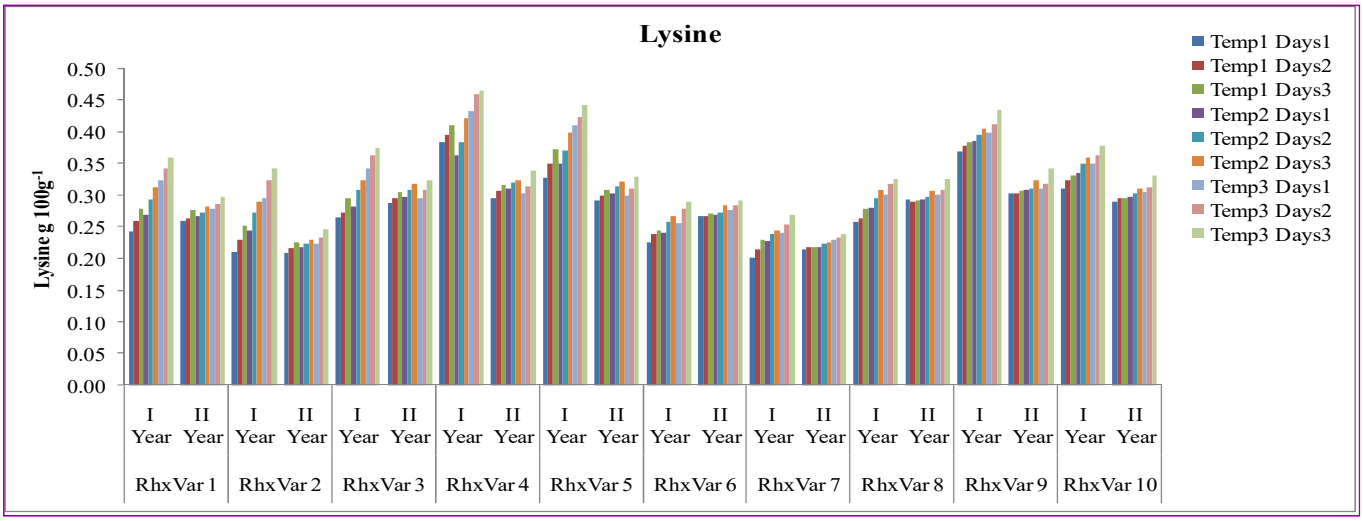


**Figure 4: Analysis of Lysine**

The quality of proteins of Rice is poor because it is deficient in the essential amino acids, lysine and tryptophan. Since these two amino acids are highly correlated. Tryptophan is usually used as a single variable for evaluating the nutritional quality of the grain protein. It has been previously reported that the decrease in zein resulted in the increased grain lysine and tryptophan content. The tryptophan content was negatively correlated to the content of globulin and α-zein concentrations. The notable absence of tryptophan and lysine in zein accounts for its negative dietary nitrogen balance. The need to improve the nutritional value of grains, both for animal feed and human consumption, resulted in development of quality protein, with increased levels of tryptophan and lysine. Since these two amino acids are highly correlated, tryptophan is usually used as a single parameter for evaluating the nutritional quality of the grain protein. Reduction in reducing sugar content is due to the inhibition of photosynthesis[**14**] reported differences in soluble carbohydrate content in two cultivars of Rice which are subjected to different ageing condition A.

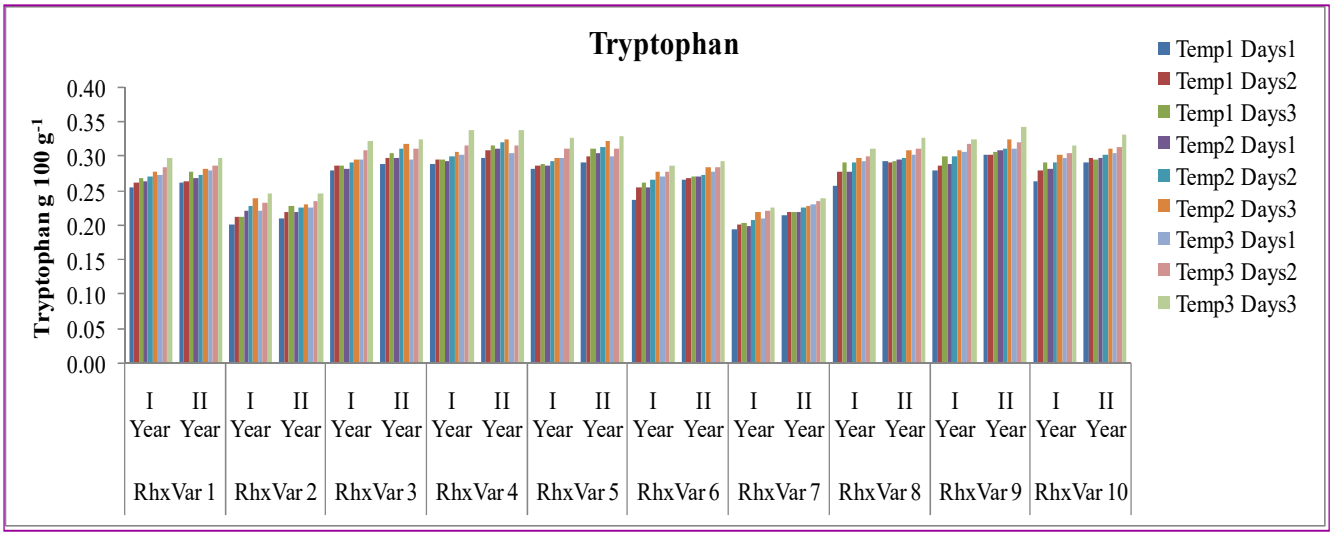


**Figure 5: Analysis of Tryptophan**

## CONCLUSION

Seed deterioration is a natural process marked by loss of quality, viability and vigor during ageing or adverse environmental conditions. It is an irreversible degenerative process that occurs during storage because ideal environmental conditions are too difficult to maintain during storage and the seed survival is highly influenced by external environment conditions. Longer time of storage effect the nutritional value of grain as well as seeds. For this research all the varieties were subjected in accelerated ageing condition of 45° C temperature along with 80% and 100 % RH for 3, 7 and 14 days.

The most severe deterioration in seeds was o bserved after 14 days of using the accelerated ageing test. The best results were obtained after three days and 80% RH. The lowest values were observed at 14 d ays, 45°C, and 80% RH. This result was shown because the amount of different amino acids (proline, lysine, tryptophan and methionine) increases as the temperature and humidity increases due to degradation in protein content. Also, with the increase in temperature and humidity the content of reducing sugar decreases.

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