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## Physiological and biochemical traits associated with differential seed storability among sorghum (*Sorghum bicolor* (L.) Moench) Genotypes

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### Abstract

Seed longevity is a fundamental component of seed quality that determines the ability of seeds to maintain viability and physiological integrity during storage. Identification of sorghum genotypes with superior seed storability is essential for ensuring high-quality seed availability and enhancing the efficiency of seed production and conservation programmes. The present investigation evaluated the seed storability of sixteen sorghum (*Sorghum bicolor* (L.) Moench) genotypes under ambient storage conditions at the Department of Seed Science and Technology, University of Agricultural Sciences, GKVK, Bengaluru. Freshly harvested seeds were stored in cloth bags under ambient laboratory conditions and seed quality was assessed at two-month intervals up to nine months of storage. Seed moisture content, standard germination, seedling growth, seedling vigour indices, electrical conductivity of seed leachates and total dehydrogenase activity were recorded to monitor the progression of seed deterioration. Significant ( $P \leq 0.01$ ) differences were observed among genotypes, storage periods and their interactions for all evaluated parameters. Progressive seed ageing was characterized by an increase in seed moisture content and electrical conductivity, accompanied by a decline in total dehydrogenase activity, reflecting deterioration of membrane integrity and metabolic activity during storage. Considerable genotypic variation in storability was evident, with SSV 84 and DSV 6 consistently exhibiting lower moisture uptake, reduced membrane leakage and higher dehydrogenase activity throughout the storage period indicating superior seed longevity, whereas CSV 22 showed rapid deterioration with higher moisture accumulation, greater electrolyte leakage and reduced metabolic activity. These findings demonstrate substantial genetic variability for seed storability among sorghum genotypes and identify seed moisture content, electrical conductivity and total dehydrogenase activity as reliable physiological and biochemical indicators for assessing seed deterioration and predicting seed longevity. The superior genotypes identified in this study provide valuable genetic resources for breeding programmes aimed at improving seed storability and maintaining high seed quality during storage.

**Keywords:** *Sorghum bicolor*, electrical conductivity, total dehydrogenase activity, seed longevity

### Introduction

Sorghum (*Sorghum bicolor* (L.) Moench) is the fifth most important cereal crop globally and serves as a major source of food, feed and industrial raw material, particularly in semi-arid and arid regions where its inherent tolerance to drought and high temperatures makes it indispensable for sustainable agriculture. Besides its importance in ensuring food and nutritional security, sorghum contributes significantly to livestock production, biofuel industries and climate-resilient farming systems (Mathur *et al.*, 2017 and Arief *et al.*, 2024) <sup>[16, 3]</sup>. The success of these production systems largely depends on the availability of genetically pure, vigorous and physiologically sound seed capable of maintaining high quality during storage (Rajendra, 2023) <sup>[27]</sup>.

Seed longevity, often referred to as seed storability, is an important component of seed quality that determines the capacity of seeds to retain viability, vigour and physiological integrity during storage (Zhou *et al.*, 2020) <sup>[38]</sup>. The longevity of orthodox seeds is influenced by genetic constitution, seed developmental processes, initial seed quality, moisture status and storage environment. As seed ageing progresses, irreversible physiological and biochemical changes occur, resulting in membrane deterioration, impairment of metabolic processes and gradual loss

of seed viability (Solberg *et al.*, 2020) [33]. Also, it is hypothesized that the observed variation in seed longevity among diverse sorghum genotypes is fundamentally underpinned by intrinsic differences in metabolic stability, the efficacy of antioxidant defense mechanisms, and the maintenance of enzymatic activity under storage-induced stress (Yang *et al.*, 2025) [37]. Understanding the factors governing seed longevity has therefore become increasingly important for seed production, germplasm conservation and sustainable crop improvement programmes.

Considerable genotypic variation exists in seed storability among crop species, including sorghum, indicating that seed longevity is under substantial genetic control. Such variability provides opportunities for identifying superior genotypes possessing enhanced storage potential and for utilizing these traits in breeding programmes aimed at improving seed quality (Shi *et al.*, 2025) [31]. Previous investigations in sorghum have demonstrated significant differences among genotypes in their ability to retain viability during storage, emphasizing the importance of systematic evaluation of seed storability under practical storage conditions (Kannababu *et al.*, 2020) [11].

Seed deterioration is a complex and inevitable process characterized by progressive impairment of membrane structure, reduced enzymatic activity and disruption of cellular metabolism (Pallavi *et al.*, 2003) [21]. Among the numerous physiological and biochemical traits used to monitor seed ageing, seed moisture content, electrical conductivity of seed leachates and total dehydrogenase activity are considered reliable indicators of seed deterioration because they directly reflect moisture equilibrium, membrane integrity and metabolic activity, respectively. These parameters provide a sensitive assessment of seed physiological status and often detect deterioration before substantial losses in germination become evident (Vijay *et al.*, 2014) [36].

Seed moisture content plays a decisive role in regulating the rate of seed deterioration because even small changes in seed moisture accelerate respiratory metabolism, lipid peroxidation and oxidative damage during storage. Maintaining seed moisture within the optimum range is therefore essential for prolonging seed longevity and preserving physiological quality (Corbineau, 2024) [6]. Recent studies in sorghum have confirmed that seeds maintained at appropriate moisture levels exhibit reduced deterioration, lower electrolyte leakage, higher dehydrogenase activity and improved storage performance compared with seeds possessing higher or excessively low moisture content (Parihar *et al.*, 2014) [22].

Electrical conductivity has become one of the most widely accepted vigour tests for evaluating membrane integrity during seed ageing. Progressive deterioration of biological membranes increases the leakage of electrolytes from imbibed seeds, resulting in higher electrical conductivity values that are negatively associated with seed vigour and storage potential. Consequently, electrical conductivity provides a rapid and reliable assessment of seed deterioration and has been successfully employed in evaluating seed quality across several agricultural crops, including sorghum (Rodrigues *et al.*, 2020 and Sousa *et al.*, 2025) [28, 34].

Total dehydrogenase activity is another important biochemical indicator of seed viability because it reflects the respiratory metabolism of living tissues. Declining dehydrogenase activity during storage indicates reduced metabolic efficiency and loss of

cellular integrity, making it a sensitive marker for assessing seed ageing (Ahmed, 2017 and Rai, 2017) [2, 25]. The combined use of electrical conductivity and dehydrogenase activity offers a comprehensive evaluation of membrane stability and metabolic competence, thereby improving the accuracy of seed storability assessment (Singh *et al.* 2022) [32].

Although several studies have investigated seed storage behaviour in cereals, comprehensive information on genotypic variation in seed storability of sorghum using seed moisture content, electrical conductivity and total dehydrogenase activity as principal physiological and biochemical indicators remains limited. Most previous studies have primarily emphasized germination and seedling vigour, whereas comparatively less attention has been given to these sensitive indicators of seed deterioration under natural storage conditions. Addressing this knowledge gap will contribute to more reliable identification of superior sorghum genotypes with enhanced storage potential and facilitate the development of effective seed quality management strategies (Kannababu *et al.*, 2020; Rodrigues *et al.* 2020; Martins *et al.* 2023 and Mor *et al.* 2023) [11, 28, 14, 17].

Therefore, the present investigation was undertaken to evaluate differential seed storability among sixteen sorghum (*Sorghum bicolor* (L.) Moench) genotypes by monitoring changes in seed moisture content, electrical conductivity and total dehydrogenase activity during storage. The study also aimed to identify genotypes capable of maintaining superior physiological quality throughout the storage period and to establish reliable physiological and biochemical indicators for assessing seed longevity in sorghum.

## Materials and Methods

### Plant Material and Experimental Details

The field experiment was conducted during the 2019 *kharif* season at the All India Coordinated Research Project on Sorghum, Haradanahalli Farm, Chamarajanagara, Karnataka, India. Standard agronomic practices for sorghum cultivation were employed throughout the growth cycle. Subsequent to land preparation, sowing was performed under optimal soil moisture conditions following rainfall. The experimental design included sixteen sorghum (*Sorghum bicolor* (L.) Moench) genotypes, each planted in six-row plots (3 m length) with row-to-row and plant-to-plant spacings of 45 cm and 15 cm, respectively. Upon reaching physiological maturity, seeds were harvested, cleaned and dried to a safe moisture content. These samples were then packed in cloth bags and stored under ambient conditions at the Department of Seed Science and Technology, University of Agricultural Sciences, GKVK, Bengaluru, Karnataka, India, for further analysis of seed storability.

**Table 1:** Seed material (genotypes) used in the study

|         |             |            |                            |
|---------|-------------|------------|----------------------------|
| SPV 462 | 5. CSV 27   | 9. SSV 74  | 13. CSV 26                 |
| CSV 15  | 6. CSV 17   | 10. SSV 84 | 14. <i>Phule Suchitra</i>  |
| CSV 20  | 7. DSV 6    | 11. CSV 22 | 15. <i>Phule Revati</i>    |
| CSV 23  | 8. SPV 2366 | 12. CSV 29 | 16. <i>Gundlupet Local</i> |

Initial seed quality parameters (Table 2.) were recorded immediately after harvest (0 month) and subsequent observations were taken after 1, 3, 5, 7 and 9 months of storage to assess seed longevity and vigour retention.

| Genotypes              | Seed moisture (%) | Seed germination (%) | Seedling length (cm) | Seedling dry weight (mg) | Vigour index I | Vigour index II | Electrical conductivity ( $\mu\text{Scm}^{-1}$ ) | Total dehydrogenase activity (OD value) |
|------------------------|-------------------|----------------------|----------------------|--------------------------|----------------|-----------------|--------------------------------------------------|-----------------------------------------|
| SPV 462                | 10.09             | 91                   | 35.40                | 17.10                    | 3221           | 1556            | 130.00                                           | 0.978                                   |
| CSV 15                 | 10.00             | 92                   | 38.30                | 18.00                    | 3523           | 1656            | 130.10                                           | 0.948                                   |
| CSV 20                 | 10.08             | 85                   | 34.80                | 15.70                    | 2958           | 1335            | 134.00                                           | 0.924                                   |
| CSV 23                 | 10.05             | 91                   | 36.70                | 17.80                    | 3340           | 1620            | 137.00                                           | 0.960                                   |
| CSV 27                 | 10.45             | 89                   | 35.90                | 16.20                    | 3195           | 1442            | 145.00                                           | 0.945                                   |
| CSV 17                 | 10.10             | 88                   | 35.90                | 17.00                    | 3159           | 1496            | 158.00                                           | 0.935                                   |
| DSV 6                  | 10.05             | 92                   | 41.10                | 19.00                    | 3781           | 1558            | 125.00                                           | 0.987                                   |
| SPV 2366               | 10.20             | 90                   | 35.80                | 15.80                    | 3222           | 1422            | 152.00                                           | 0.948                                   |
| SSV 74                 | 10.00             | 86                   | 34.80                | 17.20                    | 2993           | 1479            | 128.12                                           | 0.902                                   |
| SSV 84                 | 10.05             | 95                   | 44.90                | 19.70                    | 4266           | 1872            | 120.12                                           | 0.998                                   |
| CSV 22                 | 10.44             | 80                   | 31.60                | 14.80                    | 2528           | 1184            | 202.01                                           | 0.844                                   |
| CSV 26                 | 10.58             | 84                   | 34.80                | 14.70                    | 2923           | 1235            | 151.02                                           | 0.888                                   |
| CSV 29                 | 10.40             | 83                   | 30.40                | 13.70                    | 2523           | 1137            | 160.00                                           | 0.897                                   |
| <i>Phule Suchitra</i>  | 10.80             | 84                   | 31.20                | 14.40                    | 2621           | 1210            | 200.25                                           | 0.842                                   |
| <i>Phule Revati</i>    | 10.71             | 83                   | 301.10               | 14.40                    | 2498           | 1195            | 175.55                                           | 0.860                                   |
| <i>Gundlupet Local</i> | 10.51             | 88                   | 35.60                | 15.60                    | 3132           | 1373            | 140.25                                           | 0.895                                   |

### Experimental design and statistical analysis

The experiment was conducted in a Completely Randomized Design (CRD). Data recorded for different seed quality parameters during storage were subjected to analysis of variance (ANOVA). The significance of differences among genotype means was tested using the critical difference (CD) at the 5 per cent probability level. Standard error of mean (SEm) and coefficient of variation (CV) were also computed wherever applicable.

### Seed quality evaluation

Seed quality was assessed at each storage interval using standard seed testing procedures. The parameters evaluated included seed moisture content, standard germination, root length, shoot length, seedling length, seedling dry weight, seedling vigour index-I, seedling vigour index-II, electrical conductivity of seed leachates and total dehydrogenase activity. Among these, seed moisture content, electrical conductivity and total dehydrogenase activity were considered the principal physiological and biochemical indicators for assessing seed storability.

### Seed moisture (%)

Moisture percentage was determined by grinding the seeds in grinding mill and the sieved flour by using gravimetric method subjected to high constant temperature oven method as per the ISTA (ISTA, 2019) [10]. Randomly five grams of sorghum seeds from individual genotypes were drawn and conducted in two replications. Allowed to dry in aluminium boxes in the oven at  $130 \pm 2^\circ\text{C}$  for one hour. The aluminium boxes with seed material were cooled in desiccators over silica gel for 30 minutes and seed moisture content was calculated from the weighed samples and expressed in percentage on dry weight basis by using formula,

$$\text{Moisture content (\%)} = \frac{W_2 - W_3}{W_2 - W_1} \times 100$$

Where,

$W_1$ : The weight of the container with its lid

$W_2$ : The weight of the container with its lid and seeds before drying

$W_3$ : The weight of the container with lid and seeds after drying

### Electrical conductivity ( $\mu\text{S cm}^{-1}$ )

Twenty-five seeds were selected randomly from three replications from each treatment in a beaker. The selected seeds were soaked

in 25 ml of distilled water for 24 hours at  $25 \pm 1^\circ\text{C}$ . The electrical conductivity (EC) of seed leachate was measured from the steeped water of soaked seeds in digital conductivity meter (Model: Systronic conductivity meter 306). The actual EC of electrolyte was obtained after subtracting the EC of distilled water from the seed leachate and expressed in  $\mu\text{S cm}^{-1}$  (ISTA, 2019) [10].

### Total dehydrogenase activity (OD value)

Total dehydrogenase activity of the seeds was determined by method described by Perl *et al.* (1978) [24] with some modifications. The total dehydrogenase activity was estimated from the seeds which were used in EC test. Imbibed seeds were sliced longitudinally without damaging the embryo and then soaked in 0.2 per cent tetrazolium solution at  $30 \pm 1^\circ\text{C}$  for a period of 24 h. Then they were washed thoroughly with distilled water. The red colour (formazan) was extracted from the stained embryos by soaking in 5 ml of 2-methoxyethanol for 24 hours in an airtight screw capped vial. The extract was decanted and the colour intensity was measured with the help of spectrophotometer (Model: Systronics UV-VIS spectrophotometer 117) at  $A_{480}$ . The dehydrogenase activity was expressed in terms of optical density at  $A_{480}$ .

### Results and Discussion

The present investigation revealed substantial variation among sorghum genotypes in their ability to maintain viability and vigour during ambient storage. Germination percentage, seedling growth parameters, seedling dry weight and vigour indices declined progressively with storage duration in all genotypes. However, the magnitude of deterioration differed significantly among genotypes, indicating the existence of considerable genetic variability for seed longevity and storability (Kannababu *et al.*, 2016) [11].

The decline in seed quality parameters observed during storage may be attributed to the natural ageing process, which is associated with membrane deterioration, lipid peroxidation, oxidative stress and impairment of enzymatic systems involved in reserve mobilization. These physiological and biochemical changes ultimately reduce seed viability and seedling growth potential, resulting in lower germination, shorter seedlings and reduced vigour indices.

### Seed moisture (%)

In this study, the seeds of all sixteen genotypes were stored at safe seed moisture content which was taken at initial month (10%) and

the remaining data recorded at bimonthly intervals. All the genotypes showed non-significant difference with respect to seed moisture during the first and third month of storage (Table 3.). But the same genotypes reported significant difference at fifth, seventh and ninth months of storage.

The genotype *Phule Suchitra* recorded maximum seed moisture content (12.78%) after nine months of storage followed by *Phule Revati* (12.65%) and CSV 22 (12.24%). The genotypes CSV 22, *Phule Revati* and *Gundlupet Local* were on par with each other at fifth, seventh and ninth months after storage period. The genotype CSV 15 (10.02%) and DSV 6 (11.10%) recorded lowest seed moisture content amongst all the genotypes at initial stage and after nine months of storage period respectively.

Seed moisture content (SMC) is one of the critical factors that determine the viability of seeds in storage (Harrington and Douglas, 1970) [9]. The SMC of genotypes gradually increased with the advancement of storage period could be due to hygroscopic nature of seed enabling moisture absorption from the surrounding atmosphere. The observed decline in viability is intrinsically linked to the progressive depletion of membrane integrity and the accumulation of reactive oxygen species, which are exacerbated by reduced antioxidant enzyme activities (Sahoo and Patel, 2026) [30]. The container used in the present study was cloth bag. The atmospheric relative humidity and temperature of storage environment are very important factors which affects the SMC along with the packaging material in which seeds are stored. The differences in the moisture content could be attributed to the inherent variation in the chemical composition of each and individual genotype. The other probable reason for increase in SMC is metabolic release of water; fungal and insect infestation. Similar findings were also noted by Azadi and Younesi (2013) [5] in sorghum.

**Table 3:** Seed moisture content (%) of sorghum genotypes during storage

| Genotypes              | Period of storage in months |       |       |       |       |
|------------------------|-----------------------------|-------|-------|-------|-------|
|                        | 1                           | 3     | 5     | 7     | 9     |
| SPV 462                | 10.13                       | 10.23 | 10.59 | 10.83 | 11.33 |
| CSV 15                 | 10.02                       | 10.12 | 10.55 | 10.91 | 11.46 |
| CSV 20                 | 10.09                       | 10.41 | 10.70 | 11.18 | 11.65 |
| CSV 23                 | 10.04                       | 10.22 | 10.58 | 10.89 | 11.43 |
| CSV 27                 | 10.69                       | 10.87 | 10.80 | 11.18 | 11.62 |
| CSV 17                 | 10.15                       | 10.53 | 10.88 | 11.21 | 11.71 |
| DSV 6                  | 10.09                       | 10.10 | 10.32 | 10.60 | 11.10 |
| SPV 2366               | 10.23                       | 10.63 | 10.54 | 11.06 | 11.58 |
| SSV 74                 | 10.09                       | 10.56 | 10.72 | 11.23 | 11.77 |
| SSV 84                 | 10.05                       | 10.17 | 10.42 | 10.75 | 11.22 |
| CSV 22                 | 10.59                       | 10.95 | 11.45 | 11.81 | 12.24 |
| CSV 26                 | 10.66                       | 10.32 | 10.74 | 11.15 | 11.75 |
| CSV 29                 | 10.44                       | 10.84 | 11.08 | 11.33 | 11.84 |
| <i>Phule Suchitra</i>  | 10.90                       | 11.13 | 11.84 | 12.21 | 12.78 |
| <i>Phule Revati</i>    | 10.85                       | 11.09 | 12.12 | 12.33 | 12.65 |
| <i>Gundlupet Local</i> | 10.60                       | 10.89 | 11.18 | 11.45 | 11.93 |
| Mean                   | 10.35                       | 10.57 | 10.91 | 11.26 | 11.77 |
| SEm ±                  | 0.25                        | 0.23  | 0.24  | 0.23  | 0.17  |
| CD at 5%               | NS                          | NS    | 0.94  | 0.88  | 0.68  |
| CV (%)                 | 4.25                        | 3.70  | 3.87  | 3.50  | 2.57  |

### Electrical conductivity ( $\mu\text{S cm}^{-1}$ )

In this study, the electrical conductivity (EC) increased significantly as the storage period advanced (Table 4.) which might be due to increase in membrane permeability and decreased integrity of seed coat resulted in excess release of electrolytes. The lowest EC was observed in the genotype SSV 84 (120.77) in the initial and ninth month of storage (984.49), followed by DSV

6 (125.41 and 908) and SSV 74 (131.15 and 906.49). While, genotype CSV 22 (208.18) recorded highest EC during initial stage and genotype, *Phule Suchitra* (996.79) after nine months of storage period.

The significant variation in EC may be due to the anatomical structure, membrane permeability and composition of seed coat. It was observed from the data that, seed leachate from sorghum seed increased during the entire storage period could be ascribed to the loss in viability or increased deterioration. The degree of deterioration is associated with concentration of the seed exudates which may be found in the steep solution (Timotiwi *et al.*, 2017) [35]. Seeds containing more moisture content might have led to more cellular membrane deterioration causing more leakage of solutes from the membrane (Paul and Ramaswamy, 1981 and Ngidi *et al.*, 2024) [23, 20]. Similar findings were also reported by Maruti *et al.* (2016) in paddy.

**Table 4:** Electric conductivity ( $\mu\text{Scm}^{-1}$ ) of seed leachates in sorghum genotypes during storage

| Genotypes              | Period of storage in months |        |        |        |        |
|------------------------|-----------------------------|--------|--------|--------|--------|
|                        | 1                           | 3      | 5      | 7      | 9      |
| SPV 462                | 132.18                      | 264.47 | 448.61 | 651.13 | 926.53 |
| CSV 15                 | 133.95                      | 260.65 | 436.66 | 635.30 | 911.18 |
| CSV 20                 | 134.19                      | 264.40 | 427.80 | 625.91 | 901.83 |
| CSV 23                 | 137.08                      | 269.82 | 445.93 | 641.98 | 918.99 |
| CSV 27                 | 146.51                      | 279.60 | 454.61 | 652.90 | 930.97 |
| CSV 17                 | 158.78                      | 295.65 | 471.91 | 670.72 | 950.28 |
| DSV 6                  | 125.41                      | 257.84 | 427.61 | 626.45 | 908.44 |
| SPV 2366               | 155.42                      | 289.35 | 464.61 | 662.40 | 955.07 |
| SSV 74                 | 131.15                      | 261.24 | 437.40 | 635.81 | 906.49 |
| SSV 84                 | 120.77                      | 250.92 | 418.97 | 617.22 | 894.49 |
| CSV 22                 | 208.18                      | 341.07 | 517.95 | 715.52 | 971.47 |
| CSV 26                 | 155.03                      | 286.76 | 462.83 | 662.19 | 936.24 |
| CSV 29                 | 166.77                      | 299.45 | 474.50 | 673.49 | 961.25 |
| <i>Phule Suchitra</i>  | 202.65                      | 334.63 | 512.88 | 711.38 | 996.79 |
| <i>Phule Revati</i>    | 180.50                      | 313.16 | 489.54 | 689.10 | 962.70 |
| <i>Gundlupet Local</i> | 149.47                      | 281.29 | 457.43 | 655.49 | 931.16 |
| Mean                   | 152.38                      | 284.39 | 459.33 | 657.94 | 935.24 |
| SEm ±                  | 2.86                        | 4.96   | 10.73  | 15.69  | 16.34  |
| CD at 5%               | 11.09                       | 19.19  | 41.56  | 60.77  | 63.28  |
| CV (%)                 | 3.25                        | 3.02   | 4.05   | 4.13   | 3.03   |

### Total dehydrogenase activity (OD at 480 nm 25 seeds<sup>-1</sup>)

The study of sixteen genotypes indicated that, significant decrease in the dehydrogenase enzyme activity with the advancement of the storage period (Table 5.). Among the genotypes, SSV 84 recorded highest enzyme activity in the entire storage period (0.993 and 0.353 at first and ninth month of storage period respectively) followed by, the genotype SPV 462 (0.967 and 0.315) and DSV 6 (0.964 and 0.326). Similarly, the minimum enzyme activity was observed in the genotype CSV 22 (0.822) during initial stage and *Phule Revati* (0.218) at the end of the storage period.

The dehydrogenase enzyme activity is good stable metabolic marker to estimate the degree of vigour in seeds and have positive association with vigour and viability of seeds (Halder and Gupta, 1982; Rudrapal and Basu, 1982) [8, 29]. The gradual decline in dehydrogenase activity may be due to reduction in vigour level of seed as the deterioration occurs rapidly over a period of time under uncontrolled condition and due to the inability of the seed tissues to reduce tetrazolium chloride to insoluble formazan (Raja, 2003 and Griffo, 2024) [26, 7]. In the same way decline in dehydrogenase activity may be related to age induced deterioration which is common phenomenon in any living entity and difference in genotypic response may be due to variation in

inherent genotypic composition to withstand the impact of ageing (Nagarajaiah, 2014; Khidrapure, 2015; Adetunji *et al.*, 2021 and Malviya & Gayen, 2025) <sup>[18, 12, 1, 13]</sup>.

**Table 5:** Dehydrogenase enzyme activity (OD value) in seeds of sorghum genotypes during storage

| Genotypes       | Period of storage in months |       |       |       |       |
|-----------------|-----------------------------|-------|-------|-------|-------|
|                 | 1                           | 3     | 5     | 7     | 9     |
| SPV 462         | 0.967                       | 0.808 | 0.644 | 0.489 | 0.315 |
| CSV 15          | 0.944                       | 0.799 | 0.634 | 0.481 | 0.310 |
| CSV 20          | 0.901                       | 0.750 | 0.587 | 0.432 | 0.265 |
| CSV 23          | 0.953                       | 0.796 | 0.633 | 0.477 | 0.307 |
| CSV 27          | 0.935                       | 0.780 | 0.615 | 0.461 | 0.293 |
| CSV 17          | 0.911                       | 0.757 | 0.591 | 0.433 | 0.264 |
| DSV 6           | 0.964                       | 0.823 | 0.659 | 0.499 | 0.326 |
| SPV 2366        | 0.924                       | 0.749 | 0.586 | 0.431 | 0.264 |
| SSV 74          | 0.892                       | 0.737 | 0.574 | 0.420 | 0.248 |
| SSV 84          | 0.993                       | 0.839 | 0.677 | 0.522 | 0.353 |
| CSV 22          | 0.822                       | 0.676 | 0.512 | 0.356 | 0.230 |
| CSV 26          | 0.851                       | 0.698 | 0.534 | 0.378 | 0.219 |
| CSV 29          | 0.872                       | 0.717 | 0.554 | 0.400 | 0.249 |
| Phule Suchitra  | 0.833                       | 0.681 | 0.517 | 0.361 | 0.228 |
| Phule Revati    | 0.862                       | 0.707 | 0.545 | 0.390 | 0.218 |
| Gundlupet Local | 0.909                       | 0.755 | 0.591 | 0.434 | 0.261 |
| Mean            | 0.908                       | 0.754 | 0.591 | 0.435 | 0.272 |
| SEm ±           | 0.02                        | 0.02  | 0.01  | 0.01  | 0.01  |
| CD at 5%        | 0.08                        | 0.06  | 0.05  | 0.03  | 0.02  |
| CV (%)          | 3.96                        | 3.70  | 3.96  | 3.09  | 3.53  |

## Conclusion

The present study revealed significant genotypic differences in seed storability among sorghum (*Sorghum bicolor* (L.) Moench) genotypes demonstrated that, seed longevity is strongly influenced by genotype and can be effectively characterized through physiological and biochemical quality attributes. Progressive seed deterioration during storage was consistently associated with increase in the seed moisture content and electrical conductivity, together with reduced total dehydrogenase activity which reflects the gradual loss of membrane integrity and metabolic competence. These three parameters proved to be robust, complementary and sensitive indicators for monitoring seed ageing and evaluating seed storability.

Among the evaluated genotypes, SSV 84 and DSV 6 exhibited superior storage performance by maintaining favourable physiological and biochemical characteristics throughout the storage period, whereas CSV 22 showed accelerated deterioration and comparatively poor storability. The pronounced variability observed among genotypes highlights the potential for exploiting genetic diversity to improve seed longevity through breeding and selection.

Collectively, the findings demonstrate that the integrated assessment of seed moisture content, electrical conductivity and total dehydrogenase activity provides a reliable framework for predicting seed longevity and identifying superior-storing sorghum genotypes. These insights have important implications for seed quality assurance, germplasm conservation and breeding programmes focused on improving seed storability, ultimately contributing to the availability of high-quality seed and the sustainability of sorghum production systems.

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