

Effect of Seed priming with Organic-inputs on Fingermillet Seedling germination and vigour

ABSTRACT

A lab experiment was conducted at Department of Agronomy, Tamilnadu Agricultural University, Coimbatore, Tamilnadu. The research study revealed that effect of seed priming treatments with Vermiwash, Cowurine, Panchagavya, Beejamrutha, Jeevamrutha on seed germination and seedling vigour of fingermillet. The organic seed priming treatments had a substantial impact on the fingermillet seed quality. Seed priming with T4-cow urine 3% exhibited the highest germination% (91.67%), seedling length (9.27cm), root length(8.27cm), vigour index I (1011.23) and vigour index II (112.12) values. Shoot length(2.77cm), seedling fresh weight(4.01g), seedling dry weight(1.22g), root to shoot ratio (1.44) were recorded highest in T4-Cow urine 3% which was on par with T5-Panchagavya3% (2.70,3.98,1.21,1.42) T3- Vermiwash3% (2.67,3.97,1.19,1.40). This research helps to improve the quality of seedling with the help of organic bio-fertilizer treatments which are economical, non-toxic and ecofriendly.

Keywords: Beejamrutha, Cow urine, Fingermillet, Jeevamrutha, Panchagavya, Seed priming, Vermiwash

1.INTRODUCTION

Millets are one of the oldest food crops known to mankind. These are important food and fodder plants in semi-arid environments. Small millets are rich in dietary fibre, with low glycemic index and are valued for their preventive and curative health properties [1]. Millets are resilient crops that thrive in rainfed climates and on less fertile soils [2] and their importance is growing around the world. India is the largest producer of millets in the world, accounting for more than 40% of global consumption [3]. Fingermillet is one of the important millets commonly known as ragi and mandua in India. In various regions of India and Africa finger millet is staple food that supply rich number of calories and proteins to large segments of low-income group population. In India it is grown in 1.159 mha area, 2.0 mt, 1.7t/ha productivity [4]. Finger millet, ranks fourth in importance among millets after sorghum, pearl millet and foxtail millet in the world [5]. Karnataka is the major producer of finger millet in India, accounting for 58% of global production. Finger millet is a very easy crop to grow under severe conditions due to its hardiness, and it produces a high average yield. Of all the cereals and millets, finger millet has the highest amount of calcium (344 mg%) and potassium (408 mg%) and it has higher dietary fiber, minerals, and sulfur containing amino acids compared to white rice, the current major staple in India [6]. Because of its low sugar content and slow release of glucose or sugar in the body, finger millet is regarded an appropriate food for diabetics [7].

Due to various environmental challenges, the proportion of seed germination, emergence, and seedling vigour has been negatively impacted in recent years, resulting in low crop yields. Seed priming is a low-cost, high-impact hydration approach for increasing seed germination. Seeds go through a physiological process during priming, such as controlled hydration and drying, which improves the pre-germinative metabolic process and allows for faster germination [8]. The use of chemicals as seed priming treatments nowadays has an

impact on the seed and soil environment. As a result, the safest and most practical option is to prime seeds with organics, which is ecofriendly, cost-effective, readily available, and can be done on-farm. In semiarid tropics, organic seed priming gives resistance to high temperatures and little moisture. It improves germination and vigour as a result in increased crop productivity [9]. In light of the above, the current study, which looked at the effect of seed priming with organic bio-inputs on finger millet seed germination and seedling growth performance, was conducted.

2. MATERIALS AND METHODS

The experiment was conducted at Department of Agronomy, TNAU, Coimbatore during Summer 2022. in completely randomized design (CRD) with three replications. The seeds of finger millet variety CO-15 were used for the study. The experiment with seven treatments viz, T1: Control (Untreated), T2: Hydropriming, T3: Vermiwash 3%, T4: Cow urine 3%, T5: Panchagavya 3%, T6: Beejamrutha 3%, T7: Jeevamrutha 3%.

Vermiwash, Cowurine, Panchagavya, Beejamrutha, Jeevamrutha, seed priming treatments were mixed with distilled water to obtain the necessary percent of concentrated solution, and seeds were soaked for twelve hours. The seeds were dried under the shade to restore the moisture content to its original state. Data was collected on ten healthy seedlings chosen randomly in each treatment in each replication and different observations were measured up to 12 days old seedlings. All seedling parameters, including germination (%), seedling length (cm), shoot length (cm), root length (cm), fresh weight of seedling (g), dry weight of seedling (g), seedling vigour index I and seedling vigour index II were tested in both treated and untreated (control) seeds. ISTA's (Anon., 2014) protocol for calculating seed germination percentage was followed. Seedling vigour index I = Germination per cent \times [Root length (cm) + Shoot length (cm)] and Seedling vigour index II = Germination per cent \times Seedling dry weight (g) was calculated as per the formula given by Abdul-Baki and Anderson (1973) [10]. The various statistical techniques were used for calculation of data as suggested by Fisher and Yates [11].

3. RESULTS AND DISCUSSION

The results of this study were interpreted in terms of germination percentage, root length (cm), shoot length (cm), seedling length (cm), seedling fresh weight(g), seedling dry weight(g), moisture content (%), seed vigour index I & II. The results indicated that above seedling parameters are varied for different treatments (Table 1&2).

3.1. Germination percentage (%)

The data regarding germination percentage (%) was presented in Table 1 and fig.1. The germination percentage of finger millet ranged from 91.67 to 68.00 percent with mean value of 80. Maximum germination percentage (91.67%) was recorded with Cow urine 3%(T₄) followed by Panchagavya 3%(T₅) (85.67%) which had significantly on par results with T₃- Vermiwash 3% (84.33%). Minimum germination percentage (68%) was recorded by T₁ control. These results were presented in Fig.1. Results were similar to the observations of Ambika et al. [12] in coarse cereals. Amarnath et al. [13] also found similar results in sorghum, maximum increase in germination was occurred by coconut water priming which was on par with cowurine.

3.2. Root length (cm)

The data regarding root length(cm) is presented in Table.2. The root length of finger millet ranged from 8.27 to 5.90 cm with mean value of 6.84 cm. Maximum root length (8.27cm)

was observed with Cow urine 3%(T₄) followed by Panchagavya 3%(T₅) (7.10cm) which was on par with Vermiwash 3%(T₃) (6.97cm). Minimum root length was recorded by Control (T₁) (5.90cm).

3.3. Shoot length (cm)

The data regarding shoot length(cm) is presented in Table.2. The shoot length of finger millet ranged from 2.77 cm to 1.87 cm with mean value of 2.40 cm. Maximum shoot length (2.77 cm) was observed with Cow urine 3%(T₄) treatment followed by Panchagavya 3%(T₅) (2.70 cm), Vermiwash 3%(T₃) (2.67 cm) has on par results with cow urine 3%, Minimum shoot length (1.87 cm) was observed with Control (T₁). Similarly, Arvind kumar et al.[14] observed increased shoot length, seedling length, germination percentage with cow urine 3%.

3.4. Seedling length (cm)

The data regarding seedling length(cm) is presented in Table.1. The seedling length of finger millet ranged from 9.27 to 6.00 cm. Maximum seedling length (9.27 cm) was recorded with Cow urine 3% (T₄) followed by Panchagavya 3%(T₅) (8.67 cm). Minimum seedling length (6.00 cm) was recorded with Control (T₁). Results were similar to the observations of Vishwanath et al. [14] in Maize, Paddy, Ragi and Ambika et al. [13] in coarse cereals.

3.5. Seedling fresh weight (g)

The data regarding seedling fresh weight(g) is presented in Table.2. The fresh weight of finger millet seedlings ranged from 4.01 to 1.92g. Maximum fresh weight (4.01g) was recorded with Cow urine 3% (T₄) treatment followed by Panchagavya 3%(T₅) (3.98g) Vermiwash 3% (T₃) (3.97g) has significantly on par results with cow urine 3%. Minimum fresh weight (1.92g) was recorded by Control (T₁).

3.6. Seedling dry weight (g)

The data regarding seedling dry weight (g) is presented in Table.2. The dry weight of finger millet seedlings ranged from 1.22 to 0.40g. Maximum dry weight (1.22) was recorded with Cow urine 3% (T₄) treatment followed by Panchagavya 3%(T₅) (1.21g), Vermiwash 3% (T₃) (1.19g) has on par results with cow urine 3%. Minimum dry weight (0.40g) was recorded by Control (T₁) (0.40g). Results are similar with observations of Pavan Shinde et al. [3] in foxtail millet.

3.7. Root to Shoot ratio

The data regarding root to shoot ratio is presented in Table.2. The root to shoot ratio of finger millet ranged from 1.44 to 1.00. Maximum root to shoot ratio (1.44) was recorded with Cow urine 3% (T₄) treatment followed by Panchagavya 3%(T₅) (1.42), Vermiwash 3% (T₃) (1.40) has on par results with cow urine 3%. Minimum root to shoot ratio (1.0) was recorded by Control (T₁).

3.8. Seedling vigour index I

The data regarding seedling vigour index I is presented in Table.1 and fig.2. The seedling vigour index I of finger millet seedlings ranged from 1011.23 to 528.07 with mean value of 746.60. Maximum vigour index I (1011.23) was observed with Cow urine 3%(T₄) followed by Panchagavya 3%(T₅) (839.43). Minimum vigour index I was observed with Control(T₁)

(528.07). The results are significantly similar with results of Vishwanath et al. [15] in Maize, Paddy and Ragi.

3.9. Seedling vigour index II

The data regarding seedling vigour index II is presented in Table.1 and fig.3. The seedling vigour index II of finger millet seedlings ranged from 112.12 to 27.19 with mean value of 76.94. Maximum vigour index I (112.12) was observed with Cow urine 3%(T₄) followed by Panchagavya 3%(T₅) (103.66) which was on par with Vermiwash 3%(T₃) (100.64). Minimum vigour index II was observed with Control (T₁) (27.19).

Table 1. Effect of treatments on seed germination and seedling vigour of finger millet

Treatments	Germination percentage (%)	Seedling length(cm)	Seedling vigour index I	Seedling vigour index II
T ₁ :Control	68.00	6.00	528.07	27.19
T ₂ :water	74.00	6.90	616.67	43.91
T ₃ :Vermiwash3%	84.33	8.37	812.37	100.64
T ₄ :Cow urine 3%	91.67	9.27	1011.23	112.12
T ₅ :Panchagavya 3%	85.67	8.67	839.43	103.66
T ₆ :Beejamrutha 3%	76.00	7.40	674.00	69.93
T ₇ :jeevamrutha 3%	80.33	7.87	744.43	81.17
Mean	80.00	7.78	746.60	76.94
S. Em. ±	0.70	0.07	7.82	1.97
C.D (P=0.05)	2.13	0.20	23.71	5.98

Table 2. Effect of treatments on morphological characters of finger millet seedlings

Treatments	Root length(cm)	Shoot length(cm)	Fresh weight (g)	Dry weight(g)	Root-shoot ratio
T ₁ :Control	5.90	1.87	1.92	0.40	1
T ₂ :water	6.27	2.07	2.55	0.59	1.11
T ₃ :vermiwash 3%	6.97	2.67	3.97	1.19	1.40
T ₄ : cow urine 3%	8.27	2.77	4.01	1.22	1.44
T ₅ :Panchagavy3%	7.10	2.70	3.98	1.21	1.42
T ₆ :Beejamrutha3%	6.60	2.27	2.84	0.92	1.30
T ₇ : jeevamrutha3%	6.77	2.50	3.19	1.01	1.35
Mean	6.84	2.40	3.21	0.94	1.29
S. Em. ±	0.06	0.05	0.03	0.02	0.02
C.D (P=0.05)	0.19	0.15	0.08	0.07	0.07

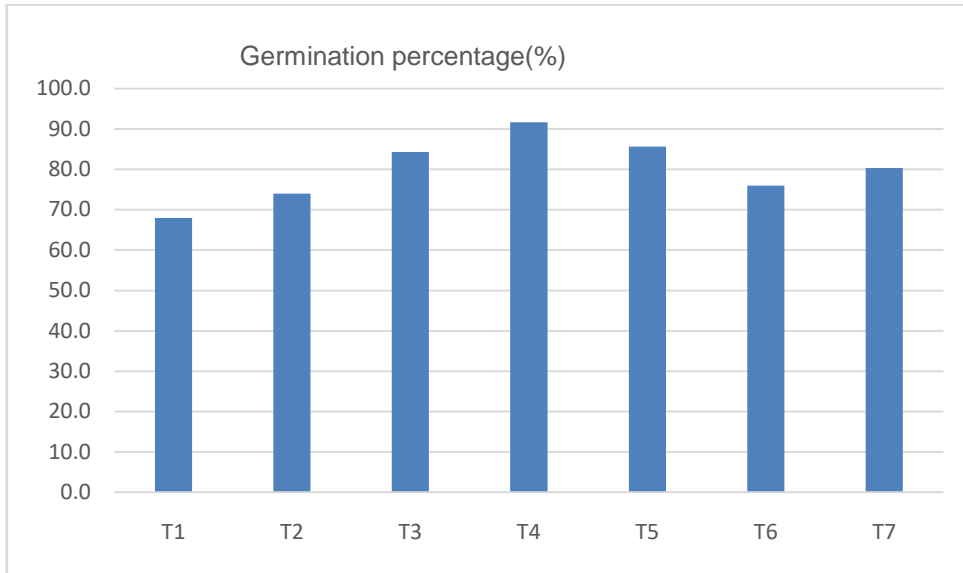


Fig. 1. Histogram presenting percentage of germination due to the effect of treatments

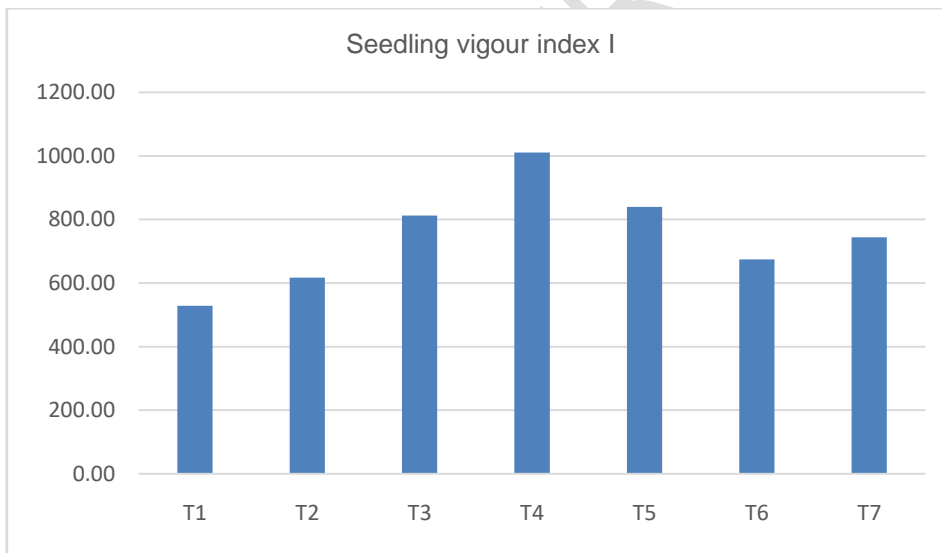


Fig. 2. Histogram representing seedling vigour index I due to the effect of treatments

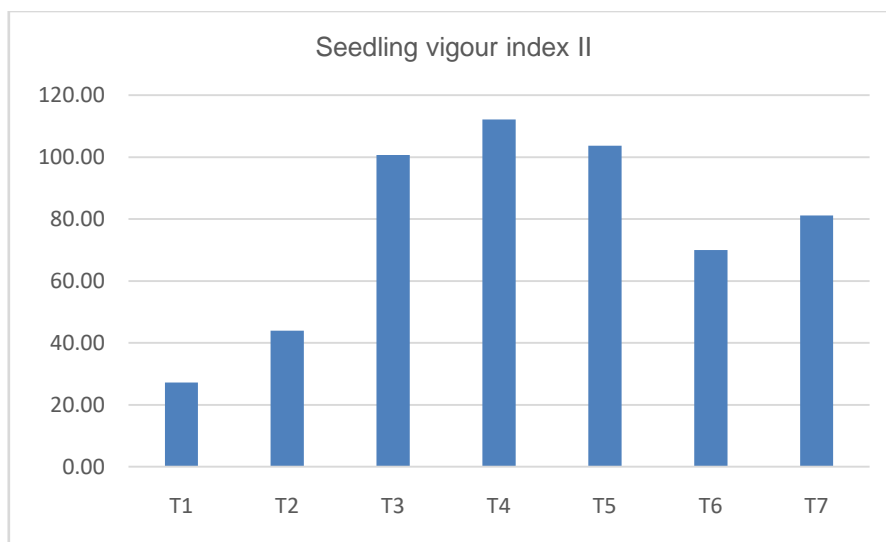


Fig.3. Histogram representing seedling vigour index II due to the effect of treatments.

4.CONCLUSION

The present study revealed that there exists significant difference among seed priming treatments attributing the seedling vigour of finger millet. It concluded that Cow urine 3% (T₄) exhibited higher mean value for germination percentage, root length, seedling length, vigour index I, vigour index II, it was followed by Panchagavya 3%(T₅), Vermiwash 3% (T₃).

REFERENCES

1. Varma V, Patel S. Value Added Products from Nutri-Cereals: Finger millet (*Eleusine coracana*). Emirate journal of food and agriculture.2013; 25(3): 169-176.
2. Stanly Joseph Michaelraj P, Shanmugam A. A study on millets-based cultivation and consumption in India. International Journal of Marketing, Financial Services & Management Research. 2013; 2(4):49-58.
3. Pavan Shinde, Ravi Hunje, Hilli JS, Harshavardhan J Hilli, Atish Rangoli, Kulsumbi et al. Influence of seed priming with organic biofertilizers and botanicals on seed quality of foxtail millet. International journal of chemical studies. 2019; 7(6): 1766-1768
4. Anonymous 2021. www.indiastat.com.
5. Upadhyaya HD, Gowda CLL, Reddy VG. Morphological diversity in finger millet germplasm introduced from Southern and Eastern Africa. Journal of Semi-Arid Tropical Agricultural Research. 2007; 3(1): 1-3.
6. Shobana S, Krishnaswamy K, Sudha V, Malleshi NG, Anjana RM, Palaniappan L, Mohan V. Finger millet (Ragi, *Eleusine coracana* L.): a review of its nutritional properties, processing, and plausible health benefits. Advances in Food and Nutrition Research. 2013; 69:1-39.
7. Soumya, Prashant SM, Sangeeta I Macha, Vijay Kumar Kurnalliker, Yogeesh LN, Ravikumar A. Influence of seed bio priming for enhancing seed quality in finger millet (*Eleusine coracana* L. Garten.). Journal of Pharmacognosy and Phytochemistry 2021; 10(1): 102-104.

8. Dawood MG. Stimulating plant tolerance against abiotic stress through seed priming. In: *Advances in Seed Priming*. Springer, Singapore. 2018;147-183.
9. Iswariya K, Sujatha, Subhashini R. Enhancement of seedling vigour through bio-priming for Barnyard Millet Var. MDU 1. *International Journal of Current Microbiology and Applied Sciences*. 2019; 8(4): 2254-2259.
10. Abdul-Baki AA, Anderson JD. Vigour determination in soybean seed by multiple criteria. *Crop Science*. 1973; 13:630-633.
11. Fisher RA, Yates F. *Statistical tabulation for Biological, Agricultural and Medicinal Research* Oliver and Boyd Endinburgh VI edition.1963.
12. Ambika S, Balakrishnan K, Sujatha K. Enhancing the seed germination and vigour in coarse cereals by bovine urines. *Journal of agroecology and natural resource management*. 2014; 1(2):40-43.
13. Amarnath BH, Chaurasia AK, Arvind Kumar. Effect of Priming with Botanicals and Animal Waste on Germination and Seedling Length of Sorghum (*Sorghum bicolor* L.) Seeds. *International Journal of Current Microbiology and Applied Sciences*. 2018; ISSN: 2319-7706 Special Issue-7 pp. 2917-2923.
14. Aravind Kumar, Amarnath BH, Chaurasia AK, Niranjana C, Vivekanada V, Singh AK. Effect of priming with botanicals and animal waste on germination and seedling vigour in sorghum (*Sorghum bicolor* L.) seeds. *Advances in Applied Science Research*.2015; 6(10):73-75.
15. Vishwanath K, Maruthi JB, Atheekur Rehaman HM, Prasannakumar MK. Influence of seed fortification on seed quality parameters of maize, paddy and ragi. *Journal of Eco-friendly Agriculture*.2015; 10(2): 131-134.