

Effect of Seed priming with organic-inputs on Finger millet seedling germination, seedling growth and vigour Finger millet

ABSTRACT

A lab experiment was conducted at Department of Agronomy, Tamilnadu Agricultural University, Coimbatore, Tamilnadu, India. The research study revealed that effect of seed priming treatments with Vermiwash, Cowurine, Panchagavya, Beejamrutha, Jeevamrutha on seed germination, seedling growth and seedling vigour of finger millet. The organic seed priming treatments had a substantial impact on the finger millet seed quality. Seed priming with T4-cow urine 3% exhibited the highest germination %- percentage (91.67%), seedling length (9.27cm), root length (8.27cm), vigour index I (1011.23) and vigour index II (112.12) values. The Sshoot length (2.77cm), seedling fresh weight (4.01g), seedling dry weight (1.22g), and root to shoot ratio (1.44) were recorded highest in T4-Cow urine 3% (T4) which was on par with T5-Panchagavya 3% (T5) (2.70cm, 3.98g, 1.21g, and 1.42, respectively) and T3- Vermiwash 3% (2.67cm, 3.97g, 1.19g, and 1.40, respectively). 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, Finger millet, 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 glycaemic index and are valued for their preventive and curative health properties [1]. Millets are resilient crops that thrive in rainfed climates and on in 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]. Finger millet 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 various regions of India and Africa. In India total production of finger millet is grown in 1.159 mha area, 2.0 mt, from an area of 1.159 mha, and productivity is 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

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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 the Department of Agronomy, TNAU, Coimbatore, India during Summer 2022. The study was arranged 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: priming with Vermiwash 3%, T4: priming with Cow-cow urine 3%, T5: priming with Panchagavya-panchagavya 3%, T6: priming with Beejamrutha 3%, and T7: priming with 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 air dried under the shade to restore the moisture content to its original state. Data was collected on ten 10 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 following the rules of ISTA (Anon., 2014). Seedling vigour index I = Germination per cent × [Root length (cm) + Shoot length (cm)] and Seedling vigour index II = Germination per cent × Seedling dry weight (g) as 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 (GP%) was presented in Table 1 and Fig.1. The germination percentage GP of finger millet ranged from 91.67 to 68.00 percent with mean value of 80. However, the maximum germination percentage GP (91.67%) was recorded with the priming of 3% Cow urine 3% (T₄) followed by Panchagavya 3% (T₅) (85.67%) which had significantly on par results with T₃-Vermiwash 3% (T₃)(84.33%). The minimum GP germination percentage (68%) was recorded by T₁ control. These results were presented in Fig.1. The results were similar to the observations of Ambika et al. [12] in coarse cereals. Amarnath et al. [13] also found similar results in sorghum, wherein the

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maximum increase in germination of GP_n 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. The M_{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). The M_{minimum} root length (5.90cm) was recorded by C_{control} (T₁)(5.90cm).

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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. Nonetheless, the M_{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 and cowurine 3%. While, the M_{minimum} shoot length (1.87 cm) was observed with Control (T₁). Similarly, Arvindkumaret al. [14] observed the 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. The M_{maximum} seedling length (9.27 cm) was recorded with Cow urine 3% (T₄) followed by Panchagavya 3%(T₅) (8.67 cm), and the M_{minimum} seedling length (6.00 cm) was recorded with C_{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. The M_{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 cowurine 3%. The M_{minimum} fresh weight(1.92g) was recorded by C_{control} (T₁).

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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 cowurine 3%. Minimum dry weight(0.40g) was recorded by Control (T₁) (0.40g). The R_{results are were} similar with observations of Pavan Shinde et al. [3] in foxtail millet.

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3.7. Root to shoot raio

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 cowurine 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 priming 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 priming 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	1.41
T ₂ :water	6.27	2.07	2.55	0.59	1.40
T ₃ :vermiwash 3%	6.97	2.67	3.97	1.19	1.44
T ₄ : cow urine 3%	8.27	2.77	4.01	1.22	1.44

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T ₅ :Panchagavy3%	7.10	2.70	3.98	1.21	1.42	Formatted: Line spacing: 1.5 lines
T ₆ :Beejamrutha3%	6.60	2.27	2.84	0.92	1.30	Formatted: Centered, Line spacing: 1.5 lines
T ₇ : jeevamrutha3%	6.77	2.50	3.19	1.01	1.35	Formatted: Line spacing: 1.5 lines
Mean	6.84	2.40	3.21	0.94	1.29	Formatted: Centered, Line spacing: 1.5 lines
S. Em. ±	0.06	0.05	0.03	0.02	0.02	Formatted: Line spacing: 1.5 lines
C.D (P=0.05)	0.19	0.15	0.08	0.07	0.07	Formatted: Centered, Line spacing: 1.5 lines

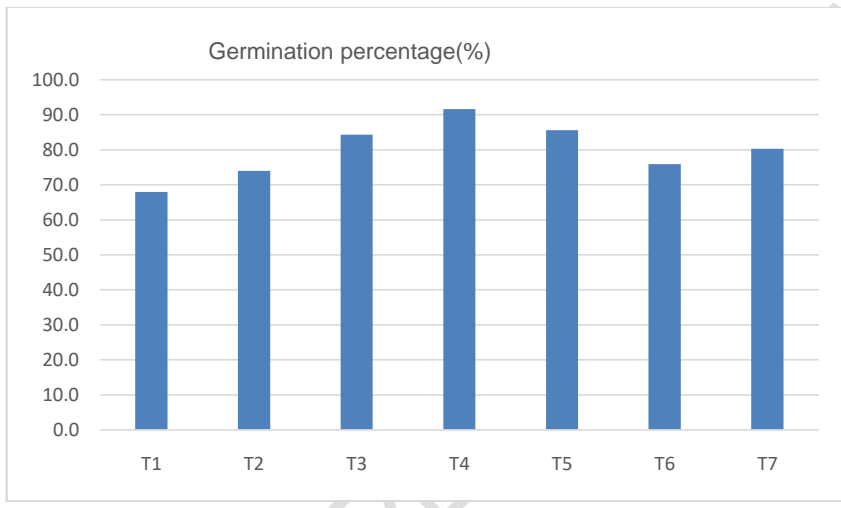


Fig. 1. Histogram presenting percentage of germination due to the effect of treatments

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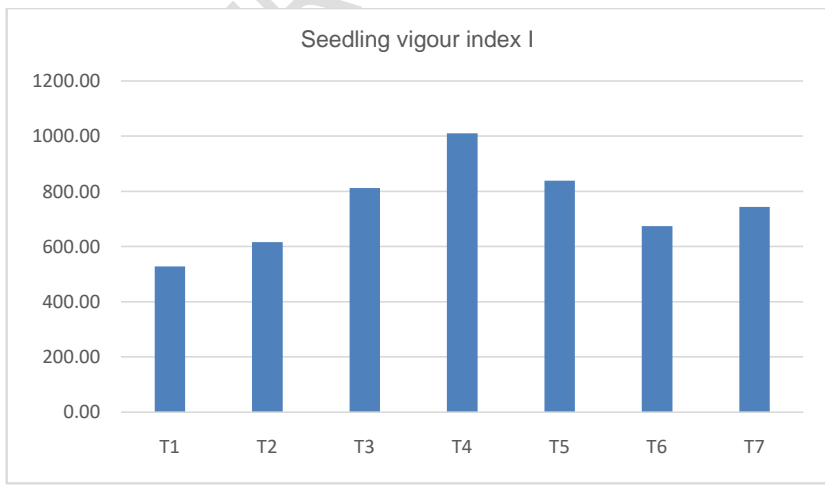


Fig. 2. Histogram representing seedling vigour index I due to the effect of treatments

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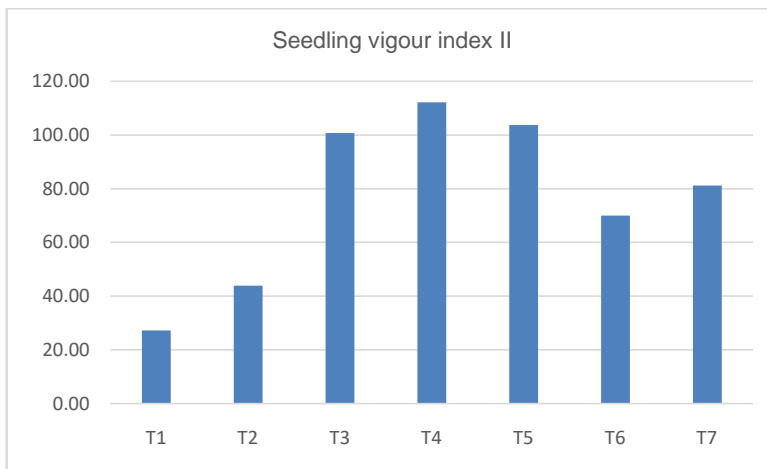


Fig.3. Histogram representing seedling vigour index II due to the effect of treatments.

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4.CONCLUSION

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

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