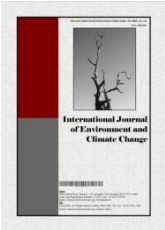

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Effect of Seed Priming with Organic-inputs on Seedling Germination, Seedling growth and Vigour of Fingermillet

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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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 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 percentage (91.67%),seedling length (9.27cm), root length(8.27cm), vigour index I (1011.23) and vigour index II (112.12) values. The shoot length(2.77cm), seedling fresh weight(4.01g), seedling dry weight(1.22g) and root to shoot ratio (1.44) were recorded highest in Cow urine 3% (T_4)which was on par with Panchagavya3%(T_5) (2.70cm,3.97g,1.21g,and1.42, respectively) and T3- Vermiwash3% (2.67cm,3.97g,1.19g,and1.40,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; fingermillet; jeevamrutha; panchagavya; seed priming; vermiwash.

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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 gycemic index and are valued for their preventive and curative health properties [1]. Millets are resilient crops that thrive in rainfed climates and 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]. Fingermillet is one of the important millets commonly known as ragi and mandua in India. 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 fingermillet is 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 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 fingermillet seed germination and seedling growth performance, was conducted.

2. MATERIALS AND METHODS

The experiment was conducted at the Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore during Febrauary, 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 urine 3%, T5: priming with 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. Those dried seeds were sown in 7 trays with 3 replications. Data was collected on 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. Seed germination percentage was calculated by following the rules of ISTA [10]. 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) was calculated as per the formula given by Abdul-Baki and Anderson [11]. By using LSD test we can analyse which treatment gives best performance. The data of the laboratory experiment were analyzed statistically by the procedure prescribed by Gomez and Gomez (2010) [12].

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 (Tables 1&2).

3.1 Germination Percentage (%)

The data which relate to germination percentage(GP) was presented in Table 1. The GP of fingermillet ranged from 91.67 to 68.00 with mean value of 80. However, the maximum GP (91.67%) was recorded with the priming of 3% cow urine (T_4) followed by Panchagavya 3%-(T_5) (85.67%) which had significantly on par results with Vermiwash 3%(T_3) (84.33%).The minimum GP (68%) was recorded by control (T_1). The results were similar to the observations of Ambika et al. [13] in coarse cereals. Amarnath et al. [14] also found similar results in sorghum, wherein the maximum increase of GP was occurred by coconut water priming which was on par with cowurine.

3.2 Root Length (cm)

The data which relate to root length is presented in Table 2. The maximum root length (8.27cm) was observed with priming of cow urine 3%(T_4) followed by Panchagavya 3%(T_5) (7.10cm) which was on par with Vermiwash 3%(T_3) (6.97cm).The minimum root length (5.90cm) was recorded by control (T_1).

3.3 Shoot Length (cm)

The data which relate to shoot length(cm) is presented in Table. 2. Nonetheless,the maximum shoot length (2.77 cm) was observed with priming of cow urine 3%(T_4) treatment followed by Panchagavya 3%(T_5) (2.70 cm) and Vermiwash 3%(T_3) (2.67 cm). While, the minimum shoot length (1.87 cm) was observed with control (T_1).Similarly, Arvind kumar et al. [15] observed the increased shoot length, seedling length, germination percentage with cow urine 3%.

Table 1. Effect of priming on seed germination and seedling vigour of fingermillet

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 priming on morphological characters of fingermillet 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

3.4 Seedling Length (cm)

The data which relate to seedling length(cm) is presented in Table. 1. The maximum seedling length (9.27 cm) was recorded with priming of cow urine 3% (T_4) followed by Panchagavya 3%(T_5) (8.67 cm),and the minimum seedling length (6.00 cm) was recorded with control (T_1). Results were similar to the observations of Vishwanath et al. [16] in Maize, Paddy, Ragi, and Ambika et al. [13] in coarse cereals.

3.5 Seedling Fresh Weight (g)

The data which relate to seedling fresh weight(g) is presented in Table. 2. The maximum fresh weight (4.01g) was recorded with priming of cow urine 3% (T_4) treatment followed by Panchagavya 3%(T_5) (3.98g) and Vermiwash 3% (T_3) (3.97g).The minimum fresh weight (1.92g) was recorded by control (T_1).

3.6 Seedling Dry Weight (g)

The data which relate to seedling dry weight (g) is presented in Table. 2. The maximum dry weight (1.22) was recorded with priming of cow urine 3% (T_4) treatment followed by Panchagavya 3%(T_5) (1.21g) and Vermiwash 3% (T_3) (1.19g).The minimum dry weight (0.40g) was recorded by control (T_1).The results were similar with observations of Pavan Shinde et al. [3] in foxtailmillet.

3.7 Root to Shoot Raio

The data which relate to root to shoot ratio is presented in Table. 2. The maximum root to shoot ratio (1.44) was recorded with priming of cow urine 3% (T_4) treatment followed by Panchagavya 3%(T_5) (1.42), and Vermiwash 3% (T_3) (1.40). The minimum root to shoot ratio (1.0) was recorded by control (T_1).

3.8 Seedling Vigour Index I

The data which relate to seedling vigour index I is presented in Table. 1. The maximum vigour index I (1011.23) was observed with priming of cow urine 3%(T_4) followed by Panchagavya 3%(T_5) (839.43). The minimum vigour index I (528.07) was observed with control(T_1). The results were significantly similar with results of Vishwanath et al. [16] in Maize, Paddy and Ragi.

3.9 Seedling Vigour Index II

The data which relate to seedling vigour index II is presented in Table. 1. The maximum vigour index II (112.12) was observed with priming of cow urine 3%(T_4) followed by Panchagavya 3%(T_5) (103.66) and Vermiwash 3%(T_3) (100.64). The minimum vigour index II (27.19) was observed with Control (T_1).

4. CONCLUSION

The present study revealed that there exists significant difference among seed priming treatments on the seed germination,seedling growth and vigour of fingermillet. It concluded that Cow urine 3% (T_4) exhibited the highest mean value for germination percentage, root length, seedling length, vigour index I, and vigour index II, followed by Panchagavya 3%(T_5), and Vermiwash 3% (T_3).

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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