

Original Research Article

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Pre-sowing Seed Treatments with Botanicals, Magnetic and Electric on Seedling Characters of Pearl Millet (*Pennisetum glaucum* L.)

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ABSTRACT

Keywords

Curry leaf extract, Neem leaf extract, Coconut water, Magnetic field, Electric field, Seed priming, Pearl millet seed

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The effect on given experiment was carried out to investigate the “Pre-sowing seed treatments with Botanicals, Magnetic and Electric on seedling characters of Pearl millet (*Pennisetum glaucum* L.)” in the post graduate experiment laboratory of seed science at Department of Genetics and Plant Breeding, SHUATS, Prayagraj (UP). The different seed priming techniques on germination and seedling characters of pearl millet an experiment was conducted in 2019-2020, the experiment based on complete randomized design (CRD). Seed were primed with three different method (T₀- control (unprimed), T₁- curry leaf extract(3%) for 8 hours, T₂- neem leaf extract(3%) for 8 hours, T₃- coconut water(3%) for 8 hours, T₄- magnetic field(100 gauss) for 30 minutes, T₅- magnetic field(150 gauss) for 30 minutes, T₆- magnetic field(200 gauss) for 30 minutes, T₇- electric field(100 mA) for 1 minute, T₈- electric field(150 mA) for 1 minute, T₉- electric field(200 mA) for 1 minute). The results revealed that, all the priming treatments showed significance difference with control and the highest germination percent, speed of germination, germination energy (%), root length (cm), shoot length (cm), seedling length (cm), seedling fresh weight (gm), seedling dry weight (gm), vigour index I, vigour index II, test weight (gm), moisture content (%) and protein content (%) were observed in coconut water@ 3% compare to control. Among the treatments coconut water @ 3% was found to be the best priming treatment. The study helps to improve the quality of seeds with the help of seed priming treatments which are cost effective and eco-friendly sources.

Introduction

Pearl millet (*Pennisetum glaucum* L.) (2n=14) is a native of Sahel zone of West Africa, which was introduced to eastern Africa and Indian sub-continent. The common name of pearl millet worldwide includes Pearl, Bulrush, Cat tail or spiked millet (Gill, 1991) that belongs to botanical family

Poaceae. While, in India it is called as bajra, which is a low prices food grain crop. It is the sixth most important crop after wheat, rice, maize, barley and sorghum in terms of annual global production to the tune of 10.7 percent (Chaudhari *et al.*, 2018).

Pearl millet is the only cereal that reliably provides both grain and fodder on poor, sandy

soils under hot, dry conditions. It is remarkable that it produces nourishment from the poorest soils in the driest regions in the hottest climate. In the drier regions of Africa and Asia, the crop is a staple food grain.

In more favoured areas, however, pearl millet grain is fed to bullocks, milch animals and poultry. In India, pearl millet is grown on more than 7.48 million ha with a production of 9.21 million tonnes and 1231 kg ha⁻¹ productivity (IIMR, 2018).

The nutritive value of pearl millet grains includes fairly high percentage of carbohydrate (69.4 %), 12.1 percent protein, 4.3 to 5.0 percent fat and 2 to 7 percent mineral matter. It is also rich in vitamins, thiamine and riboflavin contents and imparts substantial energy to the body with easy digestibility (Pal *et al.*, 1996).

Pearl millet can be grown under areas of high temperature, low and uncertain rainfall and shallow or sandy soil with poor fertility and low water holding capacity. These are the major constraints to increasing pearl millet productivity. In order to increase the productivity pre-sowing seed treatment is one of the important objectives in pearl millet.

Pre-sowing seed treatments with water, plant growth regulators, agro-chemicals, fungicides etc. also have been reported to increase the seed quality in several crop species. Improved seed priming techniques are being used in many parts of the world to reduce the germination time, synchronize germination, improve germination rate and increase plant stand (Khan, 1992 and Lee and Kim, 2000).

Seed priming is a widely used technique to enhance seed performance, notably with respect to rate and uniformity of germination thereby enabling better crop establishment (Heydecker, 1978 and Bradford, 1986).

Materials and Methods

Seeds of Pearl millet of variety Parbhani Sampada, obtained from VNMAU, Parbhani (MH), India. Present investigation was carried out at Post-Graduate laboratory of Seed Science and Technology at the Department of Genetics and Plant Breeding, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (UP) during 2018-2020.

Procedure of preparation of leaf extracts

The powdered of separately shade dried leaves using electric grinder. Take three grams Powder and dissolved in 100 ml of distilled water to make 3 percent leaf extract solution. These solutions were kept at room temperature for 48 hours. After 48 hours the leaf extracts were filtered by two layer of muslin cloth to remove unwanted material and leaf debris. Seeds were soaked independently in leaf extracts at room temperature for eight hours. After soaking seeds were air dried (Prabha *et al.*, 2016).

Procedure for preparation of Coconut water

The tender coconut water is directly used as seed treatment 3ml of coconut water were added separately in 100 ml of water to get 3 percent solutions which were used for seed treatment. Pearl millet seeds were soaked in coconut water for 8 hrs and then seeds were air dried overnight (Amarnath *et al.*, 2015).

Procedure for magnetic field

To treat the seeds electromagnetic field generator "OMEGA EMU-10" with variable horizontal magnetic strength with a gap of 5cm between pole pieces was used. Magnetic field flows through the cylinders when we input the power supply. A DC power supply

230 AC (0-4 Amp) (10% AC 50HZ) with continuously variable output current was used for the electromagnet. A digital gauss meter OMEGA DGM-20 (230V AC +10% at 50HZ) was used to monitor the field strength produced in the pole gap of magnetic field generator. The metallic probe made of indium arsenide crystal and encapsulated to a non-magnetic sheet is used. This could measure in steps of the magnetic field (Dimitrios *et al.*, 2013)

Procedure for electric field

To expose the seeds to electric field, an electric field generator was fabricated by using metallic conductor. A battery of 24V DC was used as the power source for the electric field treatment to pearl millet seeds. A battery is connected with ammeter to measure electric current and ammeter is connected with rheostat to adjust the current supply.

A metallic conductor was connected between rheostat and battery. The seed are placed on a metallic conductor and electric current of 24V DC was passed at required intensities for one minute (Dalavaiet *al.*, 2018).

For seedling characters, the germination test was conducted using four replications of 100 seeds in each replication. The between paper method used as per procedure described by ISTA.

Speed of germination were determined by Maguire (1962), seedling dry weight and vigour index I and II were determined by Baki and Anderson (1973), lowry method was followed for protein analysis.

Details of methodology

Germination percentage

$$\text{Germination (\%)} = \frac{\text{Number of germinated seeds}}{\text{Total number of seed sown}} \times 100$$

Speed of germination

$$\text{Speed of germination} = \frac{G_1}{D_1} + \frac{G_2}{D_2} + \frac{G_3}{D_3} \dots \dots + \frac{G_n}{D_n}$$

Where, $G_1, G_2, G_3, \dots, G_n$ are the number of seeds germinated on $D_1, D_2, D_3, \dots, D_n$ day.

Germination energy (%)

$$\text{Germination energy (\%)} = \frac{\text{Germinated seeds after 4 day}}{\text{Total number of seeds sown}} \times 100$$

Measurement of shoot, root and total seedling length (cm)

The length of root, shoot and total seedling was measured in centimetre upto one decimal.

Fresh weight of seedling (gm)

10 seedlings from each replication were taken randomly. The fresh weight of seedlings was weighted on electronic balance.

Dry weight of seedling (gm)

10 seedlings were dried in hot air oven at 103°C temperature for 1 hours. The dried seedlings were weighted on electronic balance.

$$\text{Seed vigour index-I} = \frac{\text{Germination (\%)} \times \text{Total seedling length}}{\text{Total seedling length}}$$

$$\text{Seed Vigour index-II} = \frac{\text{germination (\%)} \times \text{seedling dry weight}}{\text{seedling dry weight}}$$

Test weight (gm)

For recording test weight, 1000 seeds are taken and weighted on electrical balance.

Moisture content (%)

Moisture content of seed is calculated by hot air oven method, in this method, 5gm sample

taken in the sample pan and noted as W1. Then samples are kept in oven at 130⁰C for 1 hr. after withdrawing the sample pans from the oven then weight and noted as W2 and moisture percentage is calculated by formula,

$$\text{Moisture percentage} = \frac{W1-W2}{W1} \times 100$$

Protein analysis by lowry method

Results and Discussion

The effect of pre-sowing seed treatments on seeds of pearl millet. The data reveals that the significantly highest seed germination percentage was found in T₃ – coconut water (91.50%) followed by T₂ – (90.25%). while lowest seed germination percentage as compared to T₀ – (77.50%). Has been found, highest speed of germination was found in T₃ – coconut water (26.38) followed by T₂ – (26.17). while lowest speed of germination as compared to T₀ – (18.86), also significantly highest germination energy was found in T₃ – coconut water (65%) followed by T₂ – (63%). while lowest germination energy as compared to T₀ – (47%).

A performance of a seed treatments, the significantly highest root length was found in T₃ – coconut water (18.47 cm) followed by T₂ – (17.60 cm) while lowest root length as compared to T₀ – (11.80 cm). Has been found, significantly highest shoot length was found in T₃ – coconut water (9.32 cm) followed by T₂ – (8.72 cm). while lowest shoot length as compared to T₀ – (5.85 cm), also significantly highest seedling length was found in T₃ – coconut water (27.80 cm) followed by T₂ – (26.32 cm) while lowest seedling length as compared to T₀ – (17.65 cm).

The effect of pre-sowing seed treatment on seedling fresh weight of pearl millet, the data reveals that the significantly highest seedling fresh weight was found in T₃ – coconut water (0.89 gm) followed by T₂ – (0.87 gm) while lowest seedling fresh weight as compared to T₀ – (0.66 gm). Has been found significantly highest seedling dry weight was found in T₃ – coconut water (0.18 gm) followed by T₁ – (0.18 gm) while lowest seedling dry weight as compared to T₀ – (0.15gm).

Table.1 Treatment details

Symbols	Treatments	Concentration/ Intensity	Duration of exposure
T ₀	Control		
T ₁	Curry leaf extract	3%	8 hours
T ₂	Neem leaf extract	3%	8 hours
T ₃	Coconut water	3%	8 hours
T ₄	Magnetic field	100 gauss	30 minutes
T ₅	Magnetic field	150 gauss	30 minutes
T ₆	Magnetic field	200 gauss	30 minutes
T ₇	Electric treatment	100 mA	1 minute
T ₈	Electric treatment	150 mA	1 minute
T ₉	Electric treatment	200 mA	1 minute

Table.2.a Mean performance for seedling characters of pearl millet

S.No.	Treatments	Germination percentage	Speed of germination	Germination energy (%)	Root length (cm)	Shoot length (cm)	Seedling length (cm)
1	T ₀	77.50	18.86	47	11.8	5.85	17.65
2	T ₁	89.50	25.01	60	16.72	8.37	25.10
3	T ₂	90.25	26.17	63	17.60	8.72	26.32
4	T ₃	91.50	26.38	65	18.47	9.32	27.80
5	T ₄	86.00	22.61	49	14.55	8.05	22.60
6	T ₅	88.25	23.56	53	15.85	8.20	24.00
7	T ₆	82.00	21.77	52	12.60	6.52	19.12
8	T ₇	83.75	22.55	53	13.87	7.35	21.22
9	T ₈	86.50	25.38	56	15.57	7.92	23.50
10	T ₉	80.50	20.88	50	12.60	6.55	19.15
Grand Mean		85.57	23.11	54.52	14.96	7.68	22.65
C.D. (1%)		4.56	1.46	4.00	1.21	0.50	1.36
S.E.		1.65	0.53	1.45	0.44	0.18	0.49
C.V.		2.74	3.25	3.77	4.17	3.40	3.09

Table.2.b Mean performance for seedling characters of pearl millet

S.No.	Treatments	Fresh wt. of seedling (gm)	Dry wt. of seedling (gm)	Seed vigour index I	Seed vigour index II	Test weight (gm)	Moisture content (%)	Protein content (%)
1	T ₀	0.66	0.15	1367.15	11.62	9.29	10.38	8.20
2	T ₁	0.84	0.18	2248.30	16.11	10.53	12.52	8.45
3	T ₂	0.87	0.17	2376.18	15.34	10.40	12.60	8.38
4	T ₃	0.89	0.18	2543.40	16.47	10.73	12.79	8.90
5	T ₄	0.72	0.17	1941.23	14.62	9.57	11.37	8.43
6	T ₅	0.74	0.16	2122.30	14.12	9.47	11.58	8.56
7	T ₆	0.73	0.16	1568.52	13.12	9.67	11.67	8.67
8	T ₇	0.70	0.16	1778.12	13.40	9.53	11.69	8.26
9	T ₈	0.74	0.16	2032.75	13.84	9.41	11.51	8.24
10	T ₉	0.72	0.15	1542.35	12.07	9.52	11.42	8.32
Grand Mean		0.76	0.16	1951.06	14.40	9.81	11.75	8.44
C.D. (1%)		0.03	0.01	145.19	1.74	0.41	0.36	0.14
S.E.		0.01	0.07	52.79	0.63	0.15	0.13	0.05
C.V.		2.55	6.00	3.82	6.24	2.20	1.58	0.90

Astatically significant variation in seed vigour index I of Pearl millet. It is evident from the table that maximum increase in seed vigour index I occurs by T₃ – coconut water (2543.40) followed by T₂– (2376.18). while lowest seed vigour index I as compared to T₀ – (1367.15), also seed vigour index II occurs by T₃ – coconut water (16.47) followed by T₂ – (16.11). while lowest seed vigour index II as compared to T₀– (11.62).

The significantly highest test weight was found in T₃ – coconut water (10.73 gm) followed by T₁– (10.53 gm). while lowest test weight as compared to T₀ – (9.29 gm), also significantly highest moisture content was found in T₃ – coconut water (12.79%) followed by T₂ – (12.60%). while lowest moisture content as compared to T₀ – (10.38%).

The effect of pre-sowing seed treatment on protein content of pearl millet. The data reveals that the significantly highest protein content was found in T₃ – coconut water (8.90%) followed by T₆ – (8.67%). while lowest protein content as compared to T₀ – (8.20%). Seed priming stimulates many of the metabolic processes (physiological and chemical) involved with the early phases of germination. Moreover, it has been noted that seedlings from primed seeds emerge faster, grow more vigorously, and perform better in adverse saline conditions (Cramer, 2002).

Seed vigour index length parameter depends on germination percentage, shoot length and root length. Result of the present study suggested that seed priming was effective tools for seed invigoration in sorghum. Similar findings were reported by (Amarnath *et al.*, 2015)

It is concluded that the present investigation of the different priming treatments showed significant effect on seedling parameters of

pearl millet. Priming with coconut water at 3% for 8 hrs. show the suitable results for seedling parameters *viz.*, seed germination percentage (91.50%), speed of germination (26.38), germination energy (65%), root length (18.47 cm), shoot length (9.32 cm), seedling length (27.8 cm), seedling fresh weight (0.89gm), seedling dry weight (0.18gm), seed vigour index I (2543.40), seed vigour index II (16.47), test weight (10.73 gm), moisture content (12.79%) and protein content (8.90%) statically compared with other treatments.

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