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Evaluation of Different Pre-sowing Seed Treatment for Improving Growth, Yield and Yield Attributes of Finger Millet (*Eleusine coracana (L.) Gaertn*)

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A B S T R A C T

The experiment was conducted in experimental field, Department of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.) during *Kharif* season 2019, in order to standardize the suitable pre-sowing seed treatment of Finger millet. Differentpre-sowing seed treatments including control were evaluated by screening 12 hour viz., T_0 – Control, T_1 – DH_2O, T_2 – Manitol @ 2%, T_3 – Manitol @ 4%, T_4 – KCl @ 2%, T_5 – KCl @ 4%, T_6 – KNO_3 @ 2%, T_7 – KNO_3 @ 4%, T_8 – $CaCl_2$ @ 2%, T_9 – $CaCl_2$ @ 4%, T_{10} – Parthenium leaf extract @ 5%, T_{11} – Neem leaf extract @ 5%, T_{12} – Tulasi leaf extract @ 5%. It was found that all the pre-sowing seed treatments including with control shows significant difference and lowest taken days to 50% flowering by T_7 – KNO_3 @ 4% and number of fingers per panicle, biological yield, harvest index were observed high in T_5- KCl @ 4% in field experiment. These study helps to improve the growth, yield and yield attributes by the help of Pre-sowing seed treatment which is simple method, economic and no requirement for expensive equipment, non-toxic and eco-friendly.

Introduction

Millets are some of the oldest one cultivated crops and important component in dry land agriculture. Millets refers to a group of annual grasses mainly found in the arid and semi-arid regions of the world. Small millets represent a diverse group of small seeded annual cereal grasses used for food, feed and forage purpose. These crops can face wide range of temperatures, moisture-regimes and input conditions and are capable to supply food and feed to millions of dry-land farmers, particularly in the developing world (Kaur *et al.*, 2012). Finger millet, ranks fourth in importance among millets after sorghum, pearl millet and foxtail millet in the world (Upadhyaya *et al.*, 2007), Finger Millet

(*Eleusine coracana* (L.) Gaertn) is an allopolyploid with chromosome number 2*n* = 4*x* =36 and evolved from a cross between two diploid species. Finger millet, being a hardy crop, is known to be least affected by biotic and abiotic stresses (Dwivedi *et al.*, 2012), it can thrive under a variety of harsh environmental conditions, varieties of factors viz., poor soil fertility, diseases and insect-pests attack (Bouis, 2000). It is rich in calcium (0.34%), Dietary fiber (18%), Phytates (0.48%), protein (6%–13%) minerals (2.5%–3.5%), and phenolics (0.3%–3%). The rapid and uniform field emergences are known to be the two essential pre-requisites to increase yield, quality, and ultimately to gain profit in crop.

Among the seed quality enhancement techniques, Seed priming is a pre-sowing strategy for influencing seedling development by modulating pre germination metabolic activity prior to emergence of the radicle and generally enhances rapid, uniform emergence and plant performance to achieve better growth and yield (McDonald, 2000). Hydro priming is a controlled hydration by soaking seeds in solution of low water potential followed by re-drying that allows per germination metabolic activities to proceed. Osmopriming include alternate wetting and drying, pre germination and controlled hydration by means of an osmoticum such as poly ethylene glycol PEG, Manitol. Halo-priming is one of the very important seed treatment technique apply with salt solution like as KCl, $CaCl_2$, NaCl, $CaCl_2$ and KNO_3 solution concentration. Organic-primingin which organic plant extract such as Neem leaf extract, Tulasi leaf extract is used. In the view of this, the present investigation was taken up to evaluate pre-sowing seed treatment for improving growth and Yield attributes in Finger millet. The seed bio-priming is an effective seed treatment to increase the rate, rapid emergence, uniformity of emergence and crop establishment in most of the crops (Rawat *et al.*, 2011). It integrates the biological and physiological aspects of enhancing growth, disease control and increase in yield, which involves coating the seed with biological agents and incubating the seed under warm, moist conditions.

Materials and Methods

The Research work was carried out at experimental field of Seed science and Technology, Department of Genetics and Plant Breeding, Sam Higginbottom Institute of Agriculture, Technology and Science, Naini Agriculture Institute, Prayagraj (U.P), during *Kharif* season 2019 to evaluate Seeds of finger millet(VR708) were obtained from Directorate of Research, SHUATS, Prayagraj, UP.

The treatments were represented as, T_0 - Control, T_1 - Distilled water, T_2 - Mannitol @ 2%, T_3 - Mannitol @ 4%,T_4 - Potassium Chloride @ 2%, T_5 - Potassium Chloride @ 4%, T_6 - Potassium nitrate @ 2%, T_7 - Potassium nitrate @ 4%, T_8 - Calcium chloride @ 2%, T_9 - Calcium chloride @4%, T_{10} - Parthenium leaf extract @ 5%, T_{11} - Neem leaf extract @ 5%, T_{12} - Tulasi leaf extract @ 5%

The Seeds were divide into thirteen sub-samples each, one from thirteen were kept as control. Then the seeds are soaked in freshly prepared solutions i.e. Potassium Chloride @ 2% and 4%, Potassium nitrate @ 2% and 4%, Calcium chloride @ 2% and 4%, Mannitol@ 2% and 4%,Parthenium leaf extract @ 5%, Neem leaf extract @ 5%, Tulasi leaf extract @ 5% and distil water for 12hrs. The Soaked seeds were dried back to orginal moisture content at room temperature 25^{o}C for 24hrs.

To carryout the experiment the seeds were sown in thirteen plots each in three

replications with spacing of 22.5x10 cm using line sowing methods following Randomize Block Design.

Data collected of field emergence, it was expressed in percentage, Days to 50% flowering, Plant height of 60 and 90 days, it was expressed in centimeter, number of fingers per panicle, seed yield per plot expressed in grams, seed yield per plant expressed in grams, Biological yield and Harvesting index. The data recorded from field were analysed statistically following the method of analysis of variance (Fisher, 1948).

Prepration of solution

The solution of KCL (2%and 4%) was prepared by dissolving 2gm and 4gm of KCL in 100ml of distilled water, each in separate beakers. The solution of KNO_3 (2%and 4%) was prepared by dissolving 2gm and 4gm of KNO_3 in 100ml of distilled water, each in separate beakers. The solution of $CaCl_2$ (2%and 4%) was prepared by dissolving 2gm and 4gm of $CaCl_2$ in 100ml of distilled water, each in separate beakers. The solution of Mannitol (2%and 4%) was prepared by dissolving 2gm and 4gm of Mannitol in 100ml of distilled water each in separate beakers. The Neem leaf extract, Parthenium leaf extract, Tulasi leaf extract was prepared by drying of neem leaf and made into fine powder, 5gm of each powder is dissolved into 100ml of distilled water to make 5% solution

Results and Discussion

A field experiment was conducted to Evaluate different pre-sowing seed treatment for improving growth, yield and yield attributes in Finger millet (*Eleusine coracana* (L.) Gaertn). Mean performance of growth and yield characters of finger millet shown in Table I

The field emergence percentage ranged from 76.33% to 87.67%with mean value of 81.97%. Significantly maximum field emergence percentage (87.67%) was recorded by T_5 – KCl @ 4% and it was followed by T_7 – KNO_3 @ 4% (87.00%),T_9 – $CaCl_2$ @ 4% (86.33%)and T_2 – Mannitol @ 2% (85.00%). Minimum field emergence percentage was recorded by T_0 – Control (76.33%). Days to 50% flowering ranged from 56 to 70 days with mean value of 64. Significantly minimum taken days to 50% flowering (56) was recorded by T_7 – KNO_3 @ 4% and it was followed by T_5 – KCl @ 4% (58.00), T_2 – Mannitol @ 2% (60.00) and T_4 – KCl @ 2% (61.00).Maximum days to 50% flowering were recorded by T_0 – Control (70.00). Plant height at 60 DAS ranged from 41.07 cm to 52.95 cm with mean value of 46.18 cm. Significantly maximum plant heightat 60 DAS (52.95 cm) was recorded by T_2 – Mannitol @ 2% and it was followed by T_5 – KCl @ 4% (51.93 cm),T_7 – KNO_3 @ 4% (49.48 cm)and T_4 – KCl @ 2%(49.03 cm).Minimum plant height at 60 DAS was recorded by T_0 – Control (41.07 cm). Plant height at 90 DAS ranged from 82.50 cm to 98.33 cm with mean value of 89.60 cm. Significantly maximum plant height at 90 DAS (98.33 cm) was recorded by T_7 – KNO_3 @ 4% and it was followed by T_2 – Mannitol @ 2% (96.07 cm), T_5 – KCl @ 4% (94.30 cm) and T_4 – KCl @ 2% (92.43 cm). Minimum plant height at 90 DAS was recorded by T_0 – Control (82.50 cm). Number of fingers per panicle ranged from 4.80 to 7.47 with mean value of 5.53. Significantly maximum number of fingers per panicle (7.47) was recorded by T_5 – KCl @ 4% and it was followed by T_7 – KNO_3 @ 4% (6.47), T_2 – Mannitol @ 2% (6.13) and T_4 – KCl @ 2% (5.87). Minimum number of fingers per panicle was recorded by T_0 – Control (4.80). Seed yield per plant ranged from 4.44 gm to 7.90 gm with mean value of 6.27 gm. Significantly maximum seed yield per

plant(7.90 gm) was recorded by T_5 – KCl @ 4% and it was followed by T_7 – KNO_3 @ 4% (7.24 gm),T_2 – Mannitol @ 2% (6.98 gm) and T_4 – KCl @ 2% (6.87 gm). Minimum seed yield per plant was recorded by T_0 – Control (4.44 gm). Seed yield per plot ranged from 63.60 gm to 142.32 gm with mean value of 95.94 gm. Significantly maximum seed yield per plot(142.32 gm) was recorded by T_5 – KCl @ 4% and it was followed by T_7 – KNO_3 @ 4% (111.00 gm),T_2 – Mannitol @ 2% (105.28 gm) and T_4 – KCl @ 2% (102.92 gm). Minimum seed yield per plot was recorded by T_0 – Control (63.60 gm). Biological yield ranged from 261.73 gm to 412.89 gm with mean value of 331.61 gm. Significantly maximum biological yield(412.89 gm) was recorded by T_5 – KCl @ 4% and it was followed by T_9 – CaCl2 @ 4% (377.51 gm),T_{11} – Neem leaf extract @ 5% (363.81 gm)and T_6 – KNO3 @ 2% (360.78 gm). Minimum biological yield was recorded by T_0 – Control (261.73 gm). Harvest index ranged from 24.35% to 34.56%with mean value of 28.80%. Significantly maximum harvest index (34.56%) was recorded by T_5 – KCl @ 4% and it was followed by T_7 – KNO_3 @ 4% (33.66%),T_2 – Mannitol @ 2% (32.79%) and T_4 – KCl @ 2% (30.65%). Minimum harvest index was recorded by T_0 – Control (24.35%).

Table.1 Mean performance of growth and yield characters of finger millet due to effect of pre-sowing seed treatment

S.No.	Treatments	Field Emergence Percentage	Days to 50% Flowering	Plant height at 60 DAS (cm)	Plant height at 90 DAS (cm)	Number of Fingers Per Panicle	Seed yield per plant (g)	Seed yield per plot (g)	Biological yield (g)	Harvest index
1	**T_0**	76.33	70.00	41.07	82.50	4.80	4.44	63.60	261.73	24.35
2	**T_1**	77.67	68.67	42.33	86.63	4.93	5.57	87.00	342.37	25.42
3	**T_2**	85.00	60.00	52.95	96.07	6.13	6.98	105.28	323.05	32.79
4	**T_3**	82.00	66.33	44.30	85.87	5.07	6.13	79.83	300.97	26.50
5	**T_4**	84.00	61.00	49.03	92.43	5.87	6.87	102.92	339.58	30.65
6	**T_5**	87.67	58.00	51.93	94.30	7.47	7.90	142.32	412.89	34.56
7	**T_6**	83.33	63.00	46.44	87.77	5.27	6.43	100.49	360.78	28.15
8	**T_7**	87.00	56.33	49.48	98.33	6.47	7.24	111.00	330.22	33.66
9	**T_8**	80.67	62.67	47.57	90.10	5.67	6.80	102.70	348.47	29.48
10	**T_9**	86.33	64.67	45.30	88.37	5.20	6.38	104.13	377.51	27.64
11	**T_{10}**	77.00	69.33	42.07	84.57	4.87	4.67	70.27	283.57	24.70
12	**T_{11}**	80.33	65.00	44.77	88.53	5.13	6.37	99.70	363.81	27.33
13	**T_{12}**	78.33	67.33	43.07	89.30	5.00	5.70	78.00	265.91	29.20
Grand Mean		**81.97**	**64.03**	**46.18**	**89.60**	**5.53**	**6.27**	**95.94**	**331.61**	**28.80**
C.D.(5%)		2.84	3.05	3.10	3.86	0.45	0.35	23.26	87.42	2.27
SE(m)		0.97	1.05	1.06	1.32	0.15	0.12	7.97	29.95	0.78
SE(d)		1.38	1.48	1.50	1.87	0.22	0.17	11.27	42.36	1.10
C.V.		2.06	2.83	3.98	2.56	4.79	3.33	14.39	15.64	4.68

In conclusions the pre-sowing seed treatment (priming) has been used to improve germination, reduce seedling emergence time, improve plant stand establishment and yield. It is the process of controlled hydration of seeds to a level that permits pre-germinative metabolic activity to proceed, but prevents actual emergence of the radicle. Improvement in priming is affected by some factors such as plant species, water potential form priming

factor, priming duration, temperature, vigour and seed primed storage condition. The beneficial effects of priming have been demonstrated for many field crops. It can enhance rates and percentage of germination and seedling emergence which ensure proper stand establishment under a wide range of environmental conditions.

On the basis of results obtained from the present experiment following conclusions are drawn.

Pre-sowing seed treatment increases the germ inability, significantly in field condition. Pre-sowing treatment with Potassium Chloride (4%) followed by Potassium Nitrate (4%), Mannitol (2%), Potassium Chloride (2%) and Calcium Chloride(2%) significantly increased the yield attributes of finger millet. Priming with KCl and KNO_3 showed maximum increase in germ inability of finger millet seeds and found to be lowest in control seeds. Priming of the finger millet seeds for 12 hrs, in which KCl (4%) give best result to enhanced germ inability, growth and yield attributes. These conclusions are based on the results of six months investigation.

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