International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(6): 1766-1768
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Received: 18-09-2019
Accepted: 22-10-2019

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Influence of seed priming with organic bio-fertilizers and botanicals on seed quality of foxtail millet

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Abstract
A laboratory experiment was carried out at Seed Quality and Research Laboratory, Seed Unit, National Seed Project (Crops), University of Agricultural Sciences, Dharwad during *kharif* -2018 to study the influence of seed priming with organic bio-fertilizers and botanicals on seed quality of foxtail millet. Seed quality of foxtail millet was significantly influenced by organic seed priming treatments. Seed priming with Cow urine at 3% (T_3) was found to be significant compared to control (T_9). However, Cow urine at 3% (T_3) was on par with Panchagavya at 3% (T_5), Jeevamrutha (T_7) and Vermiwash at 3% (T_4) for all seed quality parameters. Hence, either of the treatments can be used for enhancing seed quality in foxtail millet.

Keywords: Cow urine, vermiwash, panchagavya, Beejamrutha, Jeevamrutha, seed priming, foxtail millet

Introduction
Among the millets, foxtail millet (*Setaria italica* L.) is a dry land crop belonging to the family of Graminaceae. It mainly constitutes protein (11.7%), fat (3.9%), ash (3.0%), crude fiber (7.0%), carbohydrates (60.9 g), few major micronutrients like Ca (31.0 mg), Fe (2.80 mg) and amino acids like niacin (3.20 mg), thiamin (0.59 mg) and riboflavin (0.11 mg) (Ahmed *et al*., 2013) [2]. They are especially rich in iron, calcium and zinc, and have other dietary qualities that can help stave off anemia, celiac disease, and diabetes (Iswariya *et al*., 2019) [15]. Millets are the significant food and fodder plants in semi-arid areas and are gaining more importance in the globe. India is the world's biggest producer of millets and accounts for more than 40 per cent of the worldwide consumption. Millet farming is the keystone of rainfed farming that provides a livelihood for nearly 50 per cent of the total rural workers and supports 60 per cent of the Indian cattle population. In India, foxtail millet cultivated over an area of 0.619 m.ha with the production of 0.442 mt and productivity of 714 kg per hectare. The area is mostly concentrated in Madhya Pradesh, Andhra Pradesh, Gujarat, Tamil Nadu, Maharashtra and Karnataka. In Karnataka, it is widely grown in Haveri, Dharwad and Belagavi districts of Northern Transitional Zone of Karnataka (Zone-8). It occupies an area of 0.028 m.ha producing 0.01mt with average productivity of 357 kg/ ha (Anon., 2017) [5].

With due climate change, the existence of unpredictable rainfall, most of the times farm saved grains are used as seeds, while the changing environment conditions also affect the crop establishment and leading to crop failure. Seed priming is one of the key solution to overcome these problems and is very simple to adopt and being a low cost technology too, especially for dry land farmers. In the era of synthetic world the usage of chemicals as seed priming treatment is affecting the seed and soil ecosystem. Hence, the safe and practical approach is the priming of seeds with organics which is eco friendly, economical, easily available and can be done on-farm. Organic seed priming provides resistant to high temperature and low moisture especially in semiarid tropics. It encourages quicker germination, greater seedling vigour resulting in increased crop productivity especially in advanced countries it integrates the biological and physiological aspects of enhancing growth, disease control and increase in yield (Iswariya *et al.,* 2019) [15]. Keeping in view of the above facts, the present investigation i.e the influence of seed priming with organic bio-fertilizers and botanicals on seed quality of foxtail millet was carried out.

Materials and Methods

The laboratory experiment was conducted at Seed Quality and Research Laboratory of Seed Unit, National Seed Project (Crops), University of Agricultural Sciences, Dharwad during *kharif* 2017 in completely randomized design with four replications. The seeds of foxtail millet variety DHft-109-3 were treated with nine priming treatments *viz.*, T_1: Custard apple leaf extract at 3%, T_2: Neem leaf extract at 3%, T_3: Cow urine at 3%, T_4: Vermiwash at 3%, T_5: Panchagavya at 3%, T_6: Beejamrutha at 3%, T_7: Jeevamrutha at 3%, T_8: Hydropriming and T_9: Control (Untreated).

Different seed priming treatments *viz.*, Custard apple leaf extract, Neem leaf extract, Cow urine, Vermiwash, Panchagavya, Beejamrutha, Jeevamrutha, were added to distilled water to obtain the desired per cent of treatment solution concentrations and seeds were soaked for six hours. However, no treatment was imposed for control. Further the seeds where dried under shade to bring back to its safer (original moisture content) and were subjected for seed quality testing. Seed germination percentage was worked out as per the procedure given by ISTA, (Anon., 2014) [11], shoot length, root length, seedling dry weight by Evans and Bhatt (1977) [12], 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 worked out as per the formula given by Abdul-Baki and Anderson (1973) [1]. The data of the laboratory experiment were analyzed statistically by the procedure prescribed by Gomez and Gomez (2010) [13].

Results and discussion

Seed priming treatments had profound influence on seed quality parameters of foxtail millet. Among the seed priming treatments cow urine at 3% (T_3), recorded significantly higher seed germination (88.7%) compared to control (81.3%). However, cow urine at 3% (T_3) was on par with Panchagavya at 3% (T_5) (88.3%), Jeevamrutha at 3% (T_7) (88.0%) and Vermiwash at 3% (T_4) (88.0%). It was followed by seed priming treatments *viz.*, Beejamrutha at 3% (T_6) (87.7%), Custard apple leaf extract at 3% (T_1) (86.7%), Neem leaf extract at 3% (T_2) (85.0%) and Hydropriming (T_8) (84.3%) (Table 1).

Table 1: Influence of seed priming with organic bio-fertilizers and botanicals on seed quality of foxtail millet

Treatments	Germination (%)	Shoot length (cm)	Root length (cm)	Total seedling length (cm)	Seedling vigour index-I	Seedling vigour index-II	Seedling dry weight (mg)
T_1: Custard apple leaf extract at 3%	86.7 *(68.5)	9.7	8.6	18.3	1585	220	2.54
T_2: Neem leaf extract at 3%	85.0 (67.1)	9.6	8.3	18.0	1527	212	2.49
T_3: Cow urine at 3%	88.7 (70.3)	11.3	9.9	21.3	1888	262	2.95
T_4: Vermiwash at 3%	88.0 (69.7)	11.0	9.7	20.8	1826	253	2.88
T_5: Panchagavya at 3%	88.3 (69.9)	11.1	9.9	21.0	1856	257	2.92
T_6: Beejamrutha at 3%	87.7 (69.4)	10.7	9.1	19.8	1736	241	2.75
T_7: Jeevamrutha at 3%	88.0 (69.7)	11.1	9.8	20.9	1839	255	2.90
T_8: Hydropriming	84.3 (66.6)	9.5	6.6	16.1	1357	188	2.23
T_9: Control	81.3 (64.3)	9.4	5.2	14.6	1186	165	2.02
Mean	86.4 (68.3)	10.4	8.6	19.0	1644	228	2.63
S. Em. ±	0.923	0.263	0.442	0.435	37.77	5.24	0.06
C. D. @ 1%	2.742	0.781	1.312	1.294	112.24	15.56	0.17

* Figures in the parentheses are indicates arcsine-transformed values

The reasons for increased seed physiological parameters may be due to the fact that cow urine contains physiological active substances *viz*., growth regulators, nutrients (about 1.0 per cent nitrogen, traces of P_2O_5 and 1.0 per cent K_2O) (Kamalam and Rajappan, 1989) [17]. The beneficial influence on germination of seeds may be due to growth promoting substances in cow urine. Seed priming with organic liquids increase the free radical scavenging enzymes to improve seed viability and strength. Vishwanath *et al*. (2015) [10] suggested that seed priming decreased the resistance of the endosperm envelope to expansive growth allowing the turgor threshold for germination to be reached faster than in non-primed seeds thereby greater root and shoot length. Similarly Ambika *et al*. (2014) studied the effect of pre sowing seed treatments of coarse cereals with bovine urines and reported that cow urine at 5 per cent recorded significantly higher seed germination (94%), as compared to other treatments and control (82%). The results are in agreement with the research findings of Shakuntala *et al*. (2012) [8] and Vishwanath *et al*. (2015) [10] in paddy seeds; Sreenivasa and Naik, 2011 [7, 9] in wheat and soybean; and Amaranath *et al*. (2018) [3] in sorghum.

Among the seed priming treatments Cow urine at 3% (T_3), recorded significantly higher shoot length (11.3 cm), root length (9.9 cm) and total seedling length (21.3 cm) compared over Control (T_9) (9.4, 5.2 and 14.6 cm, respectively) and other treatments. However, Cow urine at 3% (T_3) was on par with Panchagavya at 3% (T_5) (11.1, 9.9 and 21.0 cm), Jeevamrutha at 3% (T_7) (11.1, 9.8 and 20.9 cm) and Vermiwash at 3% (T_4) (11.0, 9.7 and 20.8 cm). (Table 1).

Rapid germination of seeds due to priming ultimately could lead to the production of larger seedlings. The results presented confirm that primed seed exhibit early vigour and produce significantly taller root and shoot and thereby heavier seedlings due to enhanced activity of alpha-amalyse as reported by Harris *et al.* (1999) [14]. Neelima and Sreenivasa (2011) [7, 9] reported that, the presence of beneficial macro and essential micro nutrients, vitamins, essential amino acids, growth promoting substances like indole acetic acid (IAA), gibberlic acid (GA) and beneficial microorganisms in cowurine might be helpful in the initial seed germination phase and seedling growth.

Among the priming treatment, seed priming with cow urine at 3% (T_3) significantly influenced seedling vigour index-I (1888), seedling vigour index-II (262) and seedling dry weight (2.95 mg), compared to Control (T_9) (1186, 165 and 2.02 mg, respectively) and was onpar with Panchagavya at 3% (T_5) (1856, 257 and 2.92 mg, respectively), Jeevamrutha at 3% (T_7) (1839, 255 and 2.90 mg, respectively) and Vermiwash at 3% (T_4) (1826, 253 and 2.88 mg, respectively) (Table 1).

The enhancement in seedling vigour indices and seedling dry weight may be attributed due to the action of growth promoting substances such as GA, kinetin and microbes present in panchagavya which may be responsible for

enhanced microbial activity resulting in increased nitrogen content this intern responsible for increased seed germination and seedling length. Sreenivasa *et al.* (2011) [7, 9] who have also reported the presence of naturally occurring beneficial microorganisms predominantly bacteria, yeast, actinomycetes and certain fungi in organic liquid manures. Hence, these formulations would serve a long way in supplementing many of the biofertilizers and biocontrol agents used in crop production in the rural areas. Similarly, Arvind kumar *et al*. (2015) observed maximum seed germination (94.5%), root length (16.65 cm), shoot length (22.88 cm) and seedling length (39.53 cm) were recorded due seed priming with cow urine at 3 per cent as compared to control (76.5%, 10.68 cm, 17.48 cm, 28.16 cm, respectively) in sorghum. The results are in conformation with the findings of Shakuntala *et al*. (2012) [8] and Vishwanath *et al*. (2015) [10] in paddy seeds.

Conclusion

Seed quality of foxtail millet was significantly influenced by organic seed priming treatments. Seed priming with Cow urine at 3% (T_3) was found to be significant compared to control (T_9). However, Cow urine at 3% (T_3) was onpar with Panchagavya at 3% (T_5), Jeevamrutha (T_7) and Vermiwash at 3% (T_4) for all seed quality parameters. Hence, either of the treatments can be used for enhancing seed quality in foxtail millet.

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