

Effect of Various Bio Priming Seed Treatment on Seed Yield and Quality in Kodo Millet Cv. CO3

G. Sathiya Narayanan^{*1}, K. Agaligai² and M. Prakash³

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ABSTRACT

Kodo millet (*Paspalum scrobiculatum* L.) is also known as ditch millet. It is grown only in India, although the wild grass is a widespread tropical weed that is harvested as a wild cereal in West Africa. The species was domesticated in India some 3000 years ago. It is grown in India from Kerala and Tamil Nadu in the south, to Rajasthan and Uttar Pradesh in the north, and West Bengal in the east, as a food grain. Seeds are basic for crop production. No agricultural practice can improve a crop beyond the limits set by the seed. Quality seeds along with other improved package of practices play a vital role in improving productivity of crops under rainfed condition. Seed priming is a practice adopted to alleviate the moisture stress or making the plant resistant to moisture stress. With this background the present investigations were carried out at the Department of Genetics and Plant Breeding, Faculty of Agriculture, Annamalai University to study on the effect of various seed enhancement treatments on seed yield and quality in kodo millet cv. CO 3. The fresh seed of kodo millet cv. CO 3 were given with various organic seed enhancement treatments i.e., hardened with cow urine @ 3%, vermiwash @ 3%, panchagavya @ 3%, azospirillum @ 3%, goat urine @ 3%, rhizobium @ 3%. Then the treated seeds were evaluated for their seed qualities and productivity using untreated seeds as control. The vermiwash @ 3% hardened seeds registered significantly higher values for initial seed qualities and lower electrical conductivity. In field evaluation, vermiwash @ 3% hardened seeds recorded higher growth, physiological and yield parameters.

Key words: Kodo millet, Biological seed priming, Seed yield, Seed quality

Kodo millet is highly drought tolerant and therefore it can be grown in areas where rainfall is scanty and erratic. Kodo millet grain contains 8.3 per cent protein, 1.4 per cent fat, 65.6 per cent carbohydrates and 2.9 per cent ash with high fiber content and oxidant potential is much higher than any other millet and major cereals. In India, it is grown in Rajasthan, Uttar Pradesh, Tamil Nadu, West Bengal, Madhya Pradesh and Andhra Pradesh [1]. Seed is the most vital and crucial input for crop production. It is the cheapest input in crop production and key to agriculture progress. The importance of quality seeds has been recognized from the time immemorial. The Good seed in good soil yields abundantly. Seed priming is one of the enhancement technique is done with various botanical, chemical and biological to improve the physiological quality of seeds [2]. Biological seed priming treatments are expected to be one of the fastest growing seed treatment sectors in the near future, in part because they are easier to register at Environment Protection Agency (EPA). Inoculation of seeds with such biological agents in combination with priming (Biopriming) potentially able to promote rapid and more uniform seed germination and plants growth [3]. Primed seeds actually exhibit increased

germination rate, enhanced germination uniformity and enhanced speed of emergence and at times, greater total germination percentage [4]. With this background, the study was undertaken in kodo millet cv CO 3 to study the effect of various bio priming seed enhancement treatment on seed yield and quality.

MATERIALS AND METHODS

The present investigations were carried out at the Department of Genetics and Plant Breeding, Faculty of Agriculture, Annamalai University to study the effect of the pre sowing botanical seed treatment on seed yield and quality in kodo millet. Freshly harvested bulk seeds of kodo millet was CO 3 were graded and imposed with the following pre sowing seed treatments. The treatments are as: T₀- Control, T₁- Cow urine @ 3% hardening, T₂- Vermiwash @ 3% hardening, T₃- Panchagavya @ 3% hardening, T₄- Azospirillum @ 3% hardening, T₅- Goat urine @ 3% hardening, T₆- Rhizobium @ 3% hardening.

The seeds were soaked in above extracts at room temperature @ 1:1 ratio for 4 hrs and the seeds were shade dried and then sun dried brought back into original moisture content. The treatments were evaluated for seed quality parameters viz. speed of germination [5], germination (%), root length (cm), shoot length (cm), dry matter production (mg) as per the procedure of [6], seedling vigour index I, seedling vigour index II [7] and seed metabolic efficiency [8]. The above treated seeds were also evaluated for their field

*G. Sathiya Narayanan
sathiyaa2005@gmail.com

^{1,3}Department of Genetics and Plant Breeding, Faculty of Agriculture, Annamalai University, Annamalai Nagar - 608002, Tamil Nadu, India

performance. Field trial was conducted by adopting randomized block design (RBD) with three replications. The crop was raised with the spacing of 20×10 cm and recommended package of practices for kodo millet were followed. Ten plants were randomly selected in each of the treatment replication wise and the following observation was recorded i.e. plant height (cm), days to first flowering, days to 50 percent flowering, number of leaves per plant, dry matter production (g), number of tillers plant⁻¹, leaf area index (LAI), length of panicle (cm), number of panicles per plant, weight of grains per panicle (g), 1000 grain weight (g), harvest index, seed yield per plant (g) and seed yield per plot (g) were recorded. All the data were analyzed statistically with appropriate tools and expressed as mean values as per the method of [9].

RESULTS AND DISCUSSION

Crop production by the use of sustainable methods in agriculture has become the order of the day as there is a growing concern to conserve the environment and make the earth last longer for posterity. Sustainable agriculture has become important in the present-day time owing to pollution and soil degradation. The use of organic manures and

fertilizer which are of biological origin is one of the practices in the farm of agriculture. Lots of scientists making efforts to find out manures and fertilizers that are eco-friendly and bio degradable. In cultivation of organically grown crops, chemical usage is excluded at all stages so organic agriculture broadly provides the dual benefits of soil quality improvement and chemical free organic food [10]. Seed treatment with organic products may promote plant growth or provide diseases control through a variety of mechanism, including supply of organic nutrient production of plant hormones, antibiotic or enzyme; induced systemic resistance; direct parasitism of plant pathogen or deleterious micro-organisms; or competition with pathogen for or nutrients [11].

In laboratory analysis vermiwash @ 3% hardened seeds recorded higher seed qualities viz. speed of germination, germination percentage, shoot length and root length. The above mentioned the treatments was recorded 20.81, 27.27, 48.97 and 20.43 percentage higher than control respectively with the above-mentioned characters and also for other seed qualities viz. dry matter production, vigour index I, vigour index II and seed metabolic efficiency. Thus, treatment also recorded 34.88, 58.12, 60, and 53.12 percentage higher than control respectively with the above-mentioned characters (Table 1).

Table 1 Effect of botanical seed enhancement treatment on initial seed qualities in kodo millet cv. CO 3

Treatment	Speed of germination	Germination percentage (%)	Shoot length (cm)	Root length (cm)	Dry matter production (mg seedlings ⁻¹⁰)	Vigour index I	Vigour index II	Seed metabolic efficiency
T ₀	9.85	66 (54.33)	4.90	9.30	0.042	951	2.90	0.690
T ₁	11.15	80 (63.47)	6.90	10.90	0.043	1,007	2.75	0.872
T ₂	11.10	67 (54.94)	7.10	11.10	0.051	1,349	3.97	0.998
T ₃	10.78	70 (56.79)	5.90	10.20	0.050	1,189	3.65	0.964
T ₄	11.30	83 (65.67)	7.30	11.20	0.049	1,269	3.24	0.991
T ₅	10.53	68 (55.55)	5.60	9.70	0.048	1221	3.55	1.073
T ₆	9.81	80 (63.45)	6.70	9.40	0.047	1,036	3.38	0.731
T ₇	9.83	74 (59.36)	6.40	9.20	0.053	1,416	4.24	0.843
T ₈	10.46	71 (57.42)	5.40	10.50	0.055	1518	4.56	1.080
T ₉	10.77	68 (56.16)	5.30	10.80	0.045	1,036	3.15	0.862
T ₁₀	10.59	72.7	6.15	10.23	0.059	1530	4.64	1.110
Mean	0.238	1.692	0.142	0.230	0.049	1234.38	3.64	0.906
SE(d)	0.499	3.555	0.299	0.484	0.001	26.859	0.255	0.020
C.D (P = 0.05)	9.85	66 (54.33)	4.90	9.30	0.002	56.061	0.531	0.041

Figures in parenthesis are arcsin transformation values

Nutrients and growth promoting substances present in the vermiwash showed its potentiality in seed germination and seedling vigour [12]. The enhanced seed quality such as root growth parameters can be attributed to the presence of humic acid in vermicompost and vermiwash. Humic acids have been known to enhance root growth [13] and nutrient uptake by increasing the root cell membrane permeability [14]. The better growth with vermicompost may be attributed to presence of unique mesophylic bacteria, fungi and worm secretions in vermicompost. This signifies that vermicompost is not all about nutritional enrichment but involvement of richer microbial, enzymatic activity of soil and plant growth regulators [15]. Increase in shoot length with vermiwash treated plants may be due to increased availability of more exchange of nutrients in the soil by application of vermiwash [16]. Increase in dehydrogenase activity and protein content supports the fact that the application of vermiwash influences growth by increasing the mitotic index. These observations can be correlated with the earlier studies of [17] reported stimulating influence of vermiwash on seed quality in

Solenum melogena. Similar results were reported by [18] in rice, [19] in ragi.

The above hardened seeds were also evaluated under field condition, the growth parameters and yield parameters were observed it revealed that that the vermiwash @ 3% hardening higher values for the growth parameters such as viz. plant height, number of tillers per plant, no of leaves per plant, dry matter production, leaf area index and panicle length which were 17.35, 24.65, 55.84, 58.34 and 43.31 percentage higher than the control respectively with above mentioned characters (Table 2). It recorded early days to first flowering and days to 50% flowering parameters which was 49.23 and 52.73 respectively when compared control and other treatments.

Vermiwash is liquid manure, extracted of vermicompost rich with more number of earthworms. Its seed hardening dramatically improves the growth and productivity of crop [20] has indicated that it is coelomic fluid extraction contains several enzyme, plant growth hormones like cytokinins, giberdine and vitamins along with micro and

macro nutrients. It improves plant growth in crop [21] have reported that nitrogen in the form of mucus, nitrogenous excretory substance; growth stimulating hormones and enzyme are found in vermiwash [22]. Vermiwash is believed to contain plant growth hormones, enzymes and vitamins from earthworm-associated microbes [23]. Vermiwash promotes plant growth by physical amelioration of substrate and

influencing nutrient uptake mechanism [24]. Edwards, reported in the microbial activity in vermicompost could result in production of significant quantity of plant growth regulators such as IAA, gibberellins, cytokinins, by microorganisms. Large amount of humic acid were produced during vermicomposting and these had been reported to have positive effects on plant growth [25].

Table 2 Effect of biological seed Enhancement treatment on initial growth parameters in kodo millet cv. CO 3

Treatment	Plant height (cm)	Days to first flowering	Days to 50 percent flowering	No of tillers per plant	No. of leaves per plant	Dry matter production (g)	Leaf area index	Panicle length (cm)
T ₀	57.72	61	65	40	13.25	2.98	0.98	8.38
T ₁	58.34	60	60	41	14.76	3.10	1.12	9.54
T ₂	67.74	49	52	50	20.65	4.10	2.85	12.01
T ₃	66.84	50	54	49	18.64	3.78	2.10	11.04
T ₄	59.68	50	59	41	17.46	3.65	1.67	8.66
T ₅	60.78	53	61	44	16.55	3.43	1.85	9.31
T ₆	68.23	56	57	45	15.26	3.10	0.99	10.65
Mean	67.04	54	59	44	16.65	3.45	1.65	9.94
SE(d)	2.41	2.10	2.27	0.89	0.34	0.07	0.09	0.43
C.D (P = 0.05)	1.20	1.04	1.13	1.76	0.70	0.14	0.04	0.21

Figures in parenthesis are arcsin transformation values

Table 2 Effect of biological seed Enhancement treatment on initial growth parameters in kodo millet cv. CO 3

Treatment	No of panicles per plant	Weight of grain per panicle (g)	1000 seed weight (g)	Harvest index	Seed yield per plant (g)	Seed yield per plot (g)	Seed yield per hectare (kg)
T ₀	3.23	0.51	3.30	30.33	1.64	163.48	0.168
T ₁	3.64	0.53	3.40	33.46	1.92	251.93	0.251
T ₂	4.71	0.60	4.40	36.10	2.82	260.30	0.260
T ₃	4.01	0.58	3.98	37.18	2.32	203.55	0.203
T ₄	3.78	0.56	3.33	35.74	2.11	185.41	0.185
T ₅	3.33	0.53	3.56	34.10	1.76	193.34	0.193
T ₆	3.78	0.52	3.67	35.10	1.96	223.89	0.223
Mean	3.78	0.54	3.66	34.57	2.07	211.7	0.211
SE(d)	0.08	0.02	0.07	0.65	0.049	4.500	0.006
C.D (P = 0.05)	0.16	0.01	0.14	1.30	0.107	9.914	0.013

Figures in parenthesis are arcsin transformation values

The seed hardened was also recorded the yield parameters such as no. of panicles per plant, weight of grains per panicle, 1000 seed weight, seed yield per plant and harvest index. It recorded 45.82, 15.38, 33.33, 47.61 and 19.02 percentage higher than control respectively with the above-mentioned characters (Table 3). Vermiwash is the source of minerals and plant growth hormones such as auxin and other plant growth regulators, including humic acids, and also because of its physicochemical structure, it has a positive effect on the photosynthetic system [26].

The vermiwash contain auxin like substance that modifies the effects of the plant auxins and enhanced plant growth. They enter the cells facilitating easy rapid utilization of nutrients. The vermiwash also contains enzymes and secretions of earthworms and would stimulate the growth and yield of crops [27]. Vermiwash contains several enzymes, plant growth hormones, vitamins along with micro and macronutrients which increases the resistance power of crops against various diseases and enhances the growth and productivity of crops [28]. The enhanced growth and yield may be due to the presence of growth regulatory substances such as IAA, GA, cytokinin, essential plant nutrients and

effective microorganisms [29]. Higher seed quality content and yield might be attributed to the presence of plant growth promoters like gibberellins, cytokinin, auxins and vitamins like vitamin D present in vermiwash [30]. The increase in various yield attribute due to vermiwashing may be attributed to the presence of water-soluble macro and micronutrients, growth promoting hormones, beneficial micro-organisms, etc. which might have also caused a buildup of germination-promoting metabolites, metabolic repair during imbibitions and osmotic regulations within the seed and increases its yield. It contains various enzymes of protease, amylase and phosphatase. These are beneficial for growth and development of plant and stimulate the yield and productivity of crops [30]. Similar results reported by [31] in bhendi.

CONCLUSIONS

Thus, the effect of the effect of various bio priming seed enhancement treatment on seed yield and quality in kodo millet cv. CO 3 revealed that vermiwash @ 3% hardened seeds recorded the higher seed yield and quality when compared to other treatments and control.

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