

Original Research Article

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Seed Bio Priming for Enhancing Growth and Yield Attributes in Finger Millet Varieties (*Eleusine coracana* L. Garten.)

Soumya^{1*}, S.M. Prashant¹, Sangeeta I. Macha¹, Vijay Kumar Kurnalliker¹,
L.N. Yogeesh² and A. Ravikumar³

¹Department of Seed Science and Technology, ²Department of Genetics and Plant Breeding,
³Department of Sericulture, College of Agriculture, Raichur, University of Agricultural
Sciences, Raichur– 584 104, India

*Corresponding author

ABSTRACT

Seeds were bio primed with Hydropriming, biopriming with *Azospirillum brasilense* @ 20 %, *Pseudomonas fluorescens* @ 20 %, *Phosphobacteria* @ 20 %, *Trichoderma harzianum* @ 1 %, beejamrutha @ 50 %, vermiwash @ 2 %, cow urine @ 25 % and waste decomposer @ 20 % for two varieties GPU-67 and HR-13. The growth parameters differed significantly between the treatments. Seed bio primed with *Trichoderma harzianum* @ 1 % along with HR-13 recorded highest plant height (90.00 cm) and number of tillers per plant (6.76) at harvest, respectively. The yield parameters differed significantly between the treatments. Seed bio primed with *Trichoderma harzianum* @ 1 % along with HR-13 recorded highest finger length (8.10 cm), number of fingers per head (8.16), ear head weight (27.82 g), test weight (6.30 g), seed yield per hectare (2896.00 kg/ha) and fodder yield per hectare (9888.88 kg/ha).

Keywords

Priming, Yield,
Finger millet,
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Introduction

Finger millet (*Eleusine coracana* L. Garten.) commonly called as ragi in India. The generic name *Eleusine* is derived from the Greek goddess of cereals, “*Eleusine*” while the common name finger millet indicates “finger-like” branching of the panicle. It is native to Ethiopian highlands. Finger millet is an important staple food in the Eastern and

Central Africa as well as some parts of India as such, it may be one of the oldest indigenous domesticated tropical cereals in Africa. It ranks third in importance among millets in the country. It has dual importance as a source of food grain as well as straw. Straw is excellent as animal fodder with up to a total of 60 per cent digestible nutrients and is grown in an area of 1016 thousand hectare with an annual production of 1385 thousand

tones and with productivity of 1363 kg per ha (Anon., 2017).

It is a highly productive crop that can thrive under a variety of harsh environmental conditions, and is also organic by default. It can be grown on low fertility soils and is not dependent on the use of chemical fertilizers, hence, is a boon for the vast arid and semi-arid regions (Gull *et al.*, 2014). It is also known to be one of the most efficient utilizer of nitrogen (Gupta *et al.*, 2014). Finger millet seeds can resist storage pests, ensuring round the year food supply or even during a crop failure, that has earned it the popular name of 'famine crop' (Mgonja *et al.*, 2007). Ragi is considered to be an ideal food for diabetic individuals due to its low sugar content and slow release of glucose/sugar in the body its nutritional significance in providing minerals, calories and protein makes it an ideal model for nutrition.

The seed bio priming is an effective seed treatment to increase the rate, uniformity of emergence and crop establishment in most of the crops especially in advanced countries in last two decades. It integrates the biological and physiological aspects of enhancing growth, disease control and increase yield, which involves coating of seeds with biological agents and incubating the seeds under warm, moist conditions. Excessive and continues use of chemical fertilizers coupled with fungicide have damaged the production and productivity of different crops. Hence, present study was under taken to identify the best bio priming for finger millet crop.

Materials and Methods

A field experiment was conducted to study the effect of seed bio priming on growth and yield parameters in finger millet (*Eleusine coracana* L. Garten.) varieties during *kharif* 2019 at Agricultural Research Station, Hagari.

The experiment was carried out in factorial completely randomized design (FRCBD). There were thirty six plots comprising of two varieties [GPU-67 and HR-13], nine treatments (T₀ - Hydro priming, T₁ - *Azospirillum brasilense* @ 20 %, T₂ - *Phosphobacteria* @ 20 %, T₃ - *Pseudomonas fluorescens* @ 20 %, T₄ - *Trichoderma harzianum* @ 1 %, T₅ - Beejamrutha @ 50 %, T₆ - Cow urine @ 25 %, T₇ - Vermiwash @ 2 %, T₈ - Waste decomposer @ 20 %) and interaction between varieties and varieties and treatments.

Results and Discussion

Growth parameters differed significantly due to different seed bio priming treatments. The finger millet seeds bio primed with *Trichoderma harzianum* @ 1 % recorded highest plant height (87.00 cm) and number of tillers per plant (6.45) at harvest, respectively. While in seeds bio primed with waste decomposer @ 20 % recorded lowest plant height (78.03 cm) and number of tillers per plant (4.90) at harvest.

Growth parameters were differed significantly in both the varieties. The variety HR-13 recorded highest plant height (83.07 cm) and number of tillers per plant (5.94) at harvest, respectively. While, in variety GPU-67 recorded lowest plant height (80.46 cm) and number of tillers per plant (5.30) at harvest. Interactions between varieties and seed bio priming treatments differed significantly for growth parameters. Highest plant height (90.00 cm) and number of tillers per plant (6.76) at harvest was recorded in treatment *Trichoderma harzianum* @ 1 % in variety HR-13. while, lowest plant height at harvest was noticed in treatment waste decomposer @ 20 % in variety HR-13 (78.00 cm). Lowest number of tillers per plant (4.73) at harvest, respectively was recorded in treatment waste decomposer @ 20 % in variety GPU-67.

Table.1 Influence of seed biopriming on plant height at harvest (cm), number of tillers per plant at harvest, number of fingers per head, finger length (cm) in finger millet varieties cv. GPU-67 and HR-13

Treatments	Plant height at harvest			Number of tillers per plant at harvest			Number of fingers per head			Finger length		
	GPU-67	HR-13	MEAN	GPU-67	HR-13	MEAN	GPU-67	HR-13	MEAN	GPU-67	HR-13	MEAN
T₀-Hydro priming	79.00	81.00	80.00	5.21	6.13	5.67	7.04	7.07	7.06	7.15	7.36	7.26
T₁-Azospirillum brasilense @ 20%	79.80	85.66	82.73	5.43	6.33	5.88	7.06	7.14	7.10	7.19	7.50	7.34
T₂-Phosphobacteria @ 20%	80.93	88.00	84.46	5.64	6.40	6.02	7.25	7.66	7.46	7.33	7.73	7.53
T₃-Pseudomonas fluorescens @ 20%	83.26	89.00	86.13	5.81	6.63	6.22	7.16	7.96	7.56	7.36	7.89	7.62
T₄-Trichoderma harzianum @ 1%	84.00	90.00	87.00	6.13	6.76	6.45	7.56	8.16	7.86	7.68	8.10	7.89
T₅-Beejamrutha @ 50%	80.30	78.83	79.56	5.2	5.70	5.45	7.04	7.09	7.06	7.00	7.23	7.11
T₆-Cow urine @ 25%	79.30	77.90	78.60	4.81	5.30	5.05	7.02	7.06	7.04	7.08	7.10	7.09
T₇-Vermiwash @ 2%	79.50	79.26	79.38	4.74	5.20	4.97	7.36	7.01	7.19	7.16	6.94	7.04
T₈-Waste decomposer @ 20%	78.06	78.00	78.03	4.73	5.06	4.90	7.00	6.90	6.95	7.11	6.93	7.02
MEAN	80.46	83.07		5.30	5.94		7.17	7.34		7.23	7.42	
	S.Em±	CD @ 5%		S.Em±	CD @ 5%		S.Em ±	CD @ 5%		S.Em±	CD @ 5%	
V	0.126	0.362		0.014	0.042		0.040	0.115		0.017	0.051	
T	0.271	0.771		0.030	0.089		0.090	0.245		0.042	0.109	
V x T	0.379	1.090		0.044	0.127		0.121	0.346		0.053	0.155	

Table.2 Influence of seed biopriming on ear head weight (g), test weight (g), seed yield per hectare (kg/ha), fodder yield per hectare (kg/ha) in finger millet varieties cv. GPU-67 and HR-13

Treatments	Ear head weight			Test weight			Seed yield per hectare			Fodder yield per hectare		
	GPU-67	HR-13	MEAN	GPU-67	HR-13	MEAN	GPU-67	HR-13	MEAN	GPU-67	HR-13	MEAN
T₀-Hydro priming	21.60	23.68	22.64	5.21	5.36	5.29	2414.17	2505.00	2459.58	8207.41	8259.25	8233.33
T₁-Azospirillum brasilense @ 20%	22.70	24.53	23.62	5.06	5.43	5.24	2504.33	2573.66	2539.00	8259.24	8333.32	8296.28
T₂-Phosphobacteria @ 20%	23.17	25.56	24.37	5.14	5.66	5.40	2544.00	2626.33	2585.17	8340.74	9296.27	8818.51
T₃-Pseudomonas fluorescens @ 20%	24.18	26.74	25.46	5.52	5.90	5.71	2586.93	2782.00	2684.47	8429.61	9355.55	8892.58
T₄-Trichoderma harzianum@ 1%	26.34	27.82	27.08	6.16	6.30	6.23	2662.53	2896.00	2779.27	9777.74	9888.88	9833.31
T₅-Beejamrutha @ 50%	20.70	22.09	21.39	5.17	5.23	5.20	2240.57	2457.13	2348.85	6962.95	8925.92	7944.44
T₆-Cow urine @ 25%	20.74	21.23	20.98	5.19	5.14	5.16	2303.17	2342.66	2322.92	7666.64	8074.07	7870.36
T₇-Vermiwash @ 2%	19.53	20.41	19.97	5.63	5.13	5.38	2216.27	2258.66	2237.47	7481.48	7925.92	7703.70
T₈-Waste decomposer @ 20%	18.17	19.40	18.78	4.90	5.08	4.99	2172.87	2242.46	2207.67	7888.86	7962.95	7925.91
MEAN	21.99	23.49		5.33	5.45		2404.98	2520.43		8112.74	8669.12	
	S.Em±	CD @ 5%		S.Em±	CD @ 5%		S.Em±	CD @ 5%		S.Em±	CD @ 5%	
V	0.048	0.140		0.0271	0.065		11.299	32.471		45.463	130.662	
T	0.101	0.297		0.051	0.132		23.970	68.880		96.441	277.177	
V x T	0.147	0.421		0.068	0.195		33.898	97.422		136.39	391.988	

Yield parameters differed significantly due to different seed bio-priming treatments. Finger millet seeds bio-primed with *Trichoderma harzianum* @ 1 % recorded highest finger length (7.89 cm), number of fingers per head (7.86), ear head weight (27.08 g), test weight (6.23 g), seed yield per hectare (2779.27 kg) and fodder yield per hectare (9833.31 kg). While, the lowest was recorded in seeds bio-primed with waste decomposer @ 20 % (7.02 cm, 6.95, 18.78 g, 4.99 g, 2207 kg and 7925 kg, respectively). All the yield parameters differed significantly in both the varieties. The variety HR-13 recorded highest number of fingers per head (7.34), finger length (7.42 cm), ear head weight (23.49 g), test weight (5.45 g), seed yield per hectare (2520.43 kg) and fodder yield per hectare (8669.12 kg). While, the lowest was recorded in variety GPU-67 (7.17, 7.23 cm, 21.99 g, 5.33 g, 2404.98 kg and 8112.74 kg, respectively).

Interactions between varieties and different seed bio-priming treatments differed significantly in yield parameters. Seeds bio-primed with *Trichoderma harzianum* @ 1 % coupled with variety HR-13 recorded highest finger length (8.10 cm), number of fingers per head (8.16), ear head weight (27.82 g), test weight (6.30 gm), seed yield per hectare (2896.00 kg) and fodder yield per hectare (9888 kg). While, the lowest ear head weight (18.17 g), test weight (4.90 g) and seed yield per hectare (2172.87 kg) was recorded in treatment waste decomposer @ 20 % coupled with variety GPU-67 and lowest finger length (6.93 cm) was noticed in treatment waste decomposer @ 20 % with variety HR-13. While, lowest fodder yield (6962.95 kg) was noticed in treatment beejamrutha @ 50 % with variety GPU-67.

The present study revealed that significant differences in plant height at all the growth stages of crops under study were due to bio-priming and similar results were given by

Janardan Yadav *et al.*, (2010) in cowpea who concluded that the increase in plant height might be due to the early emergence of the bio-primed seeds which makes the plant to compete well with the weeds and higher rate of accumulation of dry matter due to atmospheric nitrogen fixation and phosphorous solubilization. Priya *et al.*, (2018) seedling bio-priming with *T. harzianum* positively influences the growth promotion, nutrient uptake and nutrient use efficiency in rice plant under different soil conditions. Abdullahi *et al.*, (2014) reported significant difference for number of tillers per plant in pearl millet and Gangwar and Sinha (2014) in rice.

The increased rate of emergence could be correlated with early flowering and early maturity observed in the present study. Similar observations in advancement of flowering were also stated by Niranjana *et al.*, (2004) in pearl millet. Harris *et al.*, (1999) conducted a on farm trial in eastern India reported that primed seeds flowered earlier and matured earlier than control. Arif (2005) indicated that plants of primed seeds reached earlier at flowering and maturity as compared to plants of non-primed seeds in soybean. The present findings confirm the results of Zarei *et al.*, (2011) in chickpea, Similar significant findings for days to 50 per cent flowering have earlier reported by Anitha *et al.*, (2015) in soybean.

The increase in the number of fingers per head and finger length may be due to the synthesis of better carbohydrates transformation which resulted in better growth and length of panicle which ultimately results in increasing the yield. Same trend was also seen by Niranjana Raj *et al.*, (2004) in finger millet. (Patra and Haque, 2011) reported that productive tillers are very important because the final yield is mainly a function of the number of panicles bearing

tillers per unit area. Similar results were reported by (Rawat *et al.*, 2018) in barnyard millet.

Test weight is increased in *Trichoderma* treatment in our study which directly affects the seed yield and quality of seed lot. The response of bio priming on seed weight has been reported by Niranjana Raj *et al.*, (2004) in pearl millet. Similar results were previously reported by (Mishra *et al.*, 2014).

The increase in grain yield might be due to positive influence of bio-agent in initiation and growth of roots that in turn speed up and increased the uptake of essential elements and moisture from the soil. Similar results were also reported by (Kumar, 2013) and (Rawat *et al.*, 2018) in barnyard millet. Species of *Trichoderma* are considered as potent antagonists due to ability of production of antibiotics and cell wall degrading enzymes, competition for key nutrients, parasitism and stimulation of plant defense mechanism (Ushamini *et al.*, 2008) in turmeric plant. Reddy *et al.*, (2011) indicated that seed priming with *T. viridae* improved seed yield and quality of chickpea due to their growth promoting and biocontrol activities. This findings is in close conformity with the findings of (Hassan, 2014) also reported higher biological yield in wheat. (Rawat *et al.*, 2018), Khatso and Tiameren (2013) and Samanhudi (2014) has previously mentioned the maximum biological yield per plant in barnyard millet.

Increase in fodder yield in our experiment was due to fact that *Trichoderma* When inoculated with crop seeds they suppress the growth of many soil borne plant pathogenic microorganisms which help to alleviate stress, reduce incidence of plant diseases, promote good crop stand and qualitative yields. The results are in close agreement with Meena *et al.*, (2013) who observed the increased rice

straw yield for priming as compared to no soaking. Islam (2009) in rice stated the same results that *Trichoderma* increased grain and straw yield.

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