

International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2026): 5.29
IJABR 2026; SP-10(6): 26-31
www.biochemjournal.com
Received: 18-04-2026
Accepted: 20-05-2026

RJ Chaudhari
Pearl Millet Research Station,
Junagadh Agricultural
University, Jamnagar,
Gujarat, India

NN Chaudhari
Pearl Millet Research Station,
Junagadh Agricultural
University, Jamnagar,
Gujarat, India

PR Patel
Pearl Millet Research Station,
Junagadh Agricultural
University, Jamnagar,
Gujarat, India

GM Parmar
Pearl Millet Research Station,
Junagadh Agricultural
University, Jamnagar,
Gujarat, India

AC Detroja
Pearl Millet Research Station,
Junagadh Agricultural
University, Jamnagar,
Gujarat, India

KD Mungra
Pearl Millet Research Station,
Junagadh Agricultural
University, Jamnagar,
Gujarat, India

Corresponding Author:
RJ Chaudhari
Pearl Millet Research Station,
Junagadh Agricultural
University, Jamnagar,
Gujarat, India

Eco-friendly management of blast in pearl millet

RJ Chaudhari, NN Chaudhari, PR Patel, GM Parmar, AC Detroja and KD Mungra

DOI: <https://www.doi.org/10.33545/26174693.2026.v10.i6Sa.8547>

Abstract

A field experiment was conducted during *khari* 2023, 2024 and 2025 at Pearl Millet Research Station, Junagadh Agricultural University, Jamnagar, Gujarat, to study the eco-friendly management of blast disease in pearl millet. The experiment comprised different bio-agents and organic formulations for the management of blast under field conditions. The pooled results of three years revealed that all the treatments significantly reduced blast disease intensity over control. Among the treatments, *Trichoderma harzianum* recorded the lowest blast disease intensity at 45 DAS (10.24%), 60 DAS (15.84%) and 75 DAS (29.86%), and remained statistically at par with *Jivamrut* and *Pseudomonas fluorescens* at different crop stages. The significantly higher grain yield (2411 kg ha⁻¹) was obtained with *Trichoderma harzianum*, whereas the highest fodder yield (4883 kg ha⁻¹) was recorded with *Panchagavya*. Economic analysis indicated that the treatment *Trichoderma harzianum* produced the highest additional income (₹20,548 ha⁻¹), maximum net realization (₹19,373 ha⁻¹) and the highest incremental cost-benefit ratio (ICBR) of 1:17.49.

Keywords: Pearl millet, *Trichoderma harzianum*, blast, *Pseudomonas fluorescens*

Introduction

Pearl millet, scientifically known as *Pennisetum glaucum* L., and commonly referred to as bajra or bajri, belongs to the Poaceae family. It is an important cereal crop cultivated extensively for both human consumption and livestock feed and fodder. Being a C₄ plant, pearl millet possesses high photosynthetic efficiency and superior dry matter production capacity, which enable it to thrive under adverse agro-climatic conditions such as drought, low soil fertility, and high temperatures. Owing to its remarkable adaptability, it serves as a staple food crop for resource-poor and smallholder farmers across Asia and Africa. Globally, pearl millet contributes nearly half of the total millet production and ranks as the sixth most important cereal crop after maize, rice, wheat, barley, and sorghum.

In India, the major pearl millet growing states include Rajasthan, Maharashtra, Uttar Pradesh, Gujarat, and Haryana, which together contribute nearly 90 percent of the national production. In Gujarat, pearl millet is cultivated in 26 out of 33 districts during different seasons. During *khari* 2024-25, the crop occupied an area of 1.68 lakh hectares with a production of 3.10 lakh tonnes and an average productivity of 1844 kg ha⁻¹. In the summer season, it covered 3.22 lakh hectares with a production of 9.78 lakh tonnes and productivity of 3035 kg ha⁻¹, whereas in the coastal semi-rabi season, it occupied 0.070 lakh hectares with a production of 0.160 lakh tonnes and productivity of 2291 kg ha⁻¹. Overall, pearl millet covered 4.97 lakh hectares in Gujarat with a total production of 13.04 lakh tonnes and an average productivity of 2390 kg ha⁻¹ during 2023-24. Nutritionally, pearl millet grains contain approximately 11.60 percent protein, 5.00 percent fat, 67.00 percent carbohydrates, and 2.70 percent minerals (Gill, 1991) [3], making it an important source of nutrition in arid and semi-arid regions.

Despite its adaptability and nutritional significance, pearl millet production is constrained by several biotic stresses, among which blast disease caused by *Pyricularia grisea* is one of the most destructive. The disease has emerged as a serious threat to pearl millet cultivation in several parts of India, causing substantial losses in both grain and forage yield. The incidence of pearl millet blast on commercial hybrids has increased alarmingly in many states of the country (Thakur *et al.*, 2009) [20].

The pathogen is capable of infecting plants at all growth stages, from seedling to maturity, leading to severe reductions in grain yield and forage production (Lukose *et al.*, 2007) [8].

Management of blast disease has relied heavily on synthetic chemical fungicides. Although these chemicals provide rapid disease suppression, their continuous and indiscriminate use has resulted in environmental pollution, accumulation of toxic residues in food products, and development of fungicide-resistant pathogen strains. Therefore, there is an increasing need to develop eco-friendly and economically viable disease management strategies.

Among the alternative approaches, biological control using beneficial microorganisms has emerged as a promising and environmentally safe method for the management of fungal diseases. In this context, *Trichoderma harzianum* and *Pseudomonas fluorescens* have gained considerable attention because of their strong antagonistic activity against several plant pathogens and their additional role in promoting plant growth (Kashyap *et al.*, 2020) [5]. Species of *Trichoderma* suppress pathogens through various mechanisms such as mycoparasitism, production of hydrolytic enzymes, competition for nutrients and space, and secretion of antifungal metabolites (Rai *et al.*, 2016; Kashyap *et al.*, 2017) [13, 6]. Furthermore, they enhance plant growth by producing phytohormones including indole acetic acid, gibberellins, and cytokinins, thereby improving root colonization and nutrient uptake. Similarly, *Pseudomonas fluorescens*, an important plant growth-promoting rhizobacterium (PGPR), exhibits biocontrol activity through

the production of siderophores, antibiotics, and other secondary metabolites that inhibit pathogen growth and induce systemic resistance in plants (Srivastava *et al.*, 2013; Solanki *et al.*, 2014) [19, 18]. Therefore, the integration of biological agents offers a sustainable and eco-friendly approach for the effective management of pearl millet blast disease.

Materials and Methods

A field experiment was carried out at the Pearl Millet Research Station of Junagadh Agricultural University, Jamnagar, Gujarat, during the consecutive *khari* seasons of 2023, 2024 and 2025 to study the eco-friendly management of blast in pearl millet. The experiment was laid out in randomized block design with three replications at spacing of 60 × 10 cm with 4.0 × 3.0 m gross plot size. Standard agronomic practices of NPK-80 kg, 40kg, 0 kg were followed at the time of crop growth period. A variety dhanshakti was used in this experiment by imposing the following treatments: (Table 1). Foliar application of different bio agents were carried out for the management of pearl millet blast. The first spray was given just after appearance of the disease and second spray was given at an interval of 15 days. Ten plants were selected randomly from each plot for scoring the disease intensity. These plants were observed for disease intensity from upper, middle and lower leaves using disease rating scale of 0-9. Observations on disease intensity were recorded at 45, 60 and 75 DAS.

Per cent disease intensity (PDI) was calculated by using the following formula.

$$\text{Disease intensity (\%)} = \frac{\text{Sum of total rating}}{\text{Total number of leaves observed} \times \text{Maximum disease rating}} \times 100$$

Blast disease rating scale (0-9)

Scale	Description
0	No lesions
1	Small brown specks of pinhead size without sporulating center
2	Small roundish to slightly elongated, necrotic grey spots, about 1-2 mm in diameter with a distinct brown margin, lesions are mostly found on the lower leaves
3	Lesion type is the same as in scale 2, but significant number lesions are on the upper leaves
4	Typical sporulating blast lesions, 3 mm or longer, infecting less than 2% of the leaf area
5	Typical blast lesions infecting 2-10% of the leaf area
6	Blast lesions infecting 11-25% leaf area
7	Blast lesions infecting 26-50% leaf area
8	Blast lesions infecting 51-75% leaf area
9	More than 75% leaf area affected

Table 1: Treatments detail

Tr.	Treatments
T ₁	<i>Trichoderma harzianum</i> 1.0 WP 2 × 10 ⁶ cfu/g (0.005%)
T ₂	NSKE (5.0%)
T ₃	<i>Pseudomonas fluorescens</i> 1.15 WP 1 × 10 ⁸ cfu/g (0.006%)
T ₄	<i>Bacillus subtilis</i> 1.0 WP 1 × 10 ⁸ cfu/g (0.004%)
T ₅	Jivamrut (3%)
T ₆	Panchagavya (3%)
T ₇	Cow urine (3%)
T ₈	Cow milk + Jaggary (2.5:1)
T ₉	Control

Results and Discussion

The field experiment comprising nine treatments including an untreated control was conducted during *kharif* 2023, 2024, and 2025 to evaluate their efficacy against blast disease of pearl millet. The pooled results of three years presented in Table 2 to 4 revealed significant differences among the treatments in reducing blast disease intensity at different crop growth stages.

At 45 DAS (Table 2) the treatment *Trichoderma harzianum* recorded the lowest blast disease intensity (10.24%), which was significantly superior over the untreated control. However, it remained statistically at par with cow urine (12.47%), NSKE (12.50%), Panchgavya (12.97%), Jivamrut (13.27%), *Pseudomonas fluorescens* (13.77%) and *Bacillus subtilis* (14.25%). The untreated control recorded significantly higher disease intensity, indicating severe disease development in the absence of management practices.

Similarly, at 60 DAS (Table 3), *Trichoderma harzianum* again proved most effective by recording minimum blast disease intensity (15.84%) and it remained statistically at par with Jivamrut (17.31%). A similar trend was observed at 75 DAS (Table 3), where the lowest blast disease intensity (29.86%) was recorded under *Trichoderma harzianum*, which remained statistically at par with Jivamrut (31.08%) and *Pseudomonas fluorescens* (32.56%). In contrast, the untreated control registered the maximum blast disease intensity (54.36%).

The superior performance of *Trichoderma harzianum* against blast disease may be attributed to its strong antagonistic activity against the pathogen through mechanisms such as mycoparasitism, competition for nutrients and space, and production of antifungal metabolites. In addition, *Trichoderma* spp. are known to stimulate plant growth and improve physiological activities

by enhancing chlorophyll and pigment production, thereby increasing photosynthetic efficiency and helping plants tolerate disease stress (Ghorbanpour *et al.*, 2018) [2].

The reduction in blast disease intensity observed with *Pseudomonas fluorescens* might be due to induction of systemic resistance and production of antibiotics, siderophores, and other secondary metabolites that inhibit the growth and development of the pathogen. Similar findings were reported by Krishnamurthy *et al.* (1998) [7] and Bhaskar *et al.* (2021) [1], who observed substantial reduction in blast incidence with the application of *Pseudomonas fluorescens*. Similarly blast disease control was recorded from sprays of *P. fluorescens* in finger millet by Netam *et al.* (2016) [10]. Same result was found by Ramappa *et al.*, (2002) [14] obtained good control by two sprays of *P. fluorescens* against *Pyricularia grisea*. Sithther and Gananamanickan (1996) [17] reported the effectiveness of six strains of *Pseudomonas fluorescens* for their ability to inhibit the blast fungus. The application of bioagents in reducing the blast disease of finger was also reported by Senthil *et al.*, (2012) [15].

The effectiveness of organic formulations such as Jivamrut, Panchgavya, cow urine, and NSKE may be associated with enhancement of beneficial microbial activity in the rhizosphere along with the presence of antifungal compounds that suppress pathogen development. These organic treatments possibly improved plant vigor and enhanced natural resistance against blast infection. The present investigation corroborates earlier reports suggesting that bioagents and organic formulations provide sustainable, eco-friendly, and effective management of blast disease under field conditions. Furthermore, Jambhulkar *et al.* (2018) [4] also reported that the combined use of biological agents enhances disease suppression and improves overall crop health.

Table 2: Blast disease intensity in various treatments of bioagents at 45 days after sowing

Treat.	Treatment	Blast intensity (45 DAS)			
		2023	2024	2025	Pooled
T ₁	<i>Trichoderma harzianum</i> 1.0 WP 2 × 10 ⁶ cfu/g (0.005%)	16.09 ^d (7.68)	19.46 ^d (11.09)	20.45 ^c (12.21)	18.66 ^c (10.24)
T ₂	NSKE (5.0%)	17.71 ^{bcd} (9.25)	23.44 ^{bcd} (15.82)	20.95 ^c (12.79)	20.70 ^{bc} (12.50)
T ₃	<i>Pseudomonas fluorescens</i> 1.15 WP 1 × 10 ⁸ cfu/g (0.006%)	19.77 ^{bc} (11.45)	24.91 ^{bc} (17.74)	20.66 ^c (12.45)	21.78 ^{bc} (13.77)
T ₄	<i>Bacillus subtilis</i> 1.0 WP 1 × 10 ⁸ cfu/g (0.004%)	18.32 ^{bcd} (9.88)	27.31 ^b (21.05)	20.92 ^c (12.45)	22.18 ^{bc} (14.25)
T ₅	Jivamrut (3%)	16.53 ^d (8.10)	27.03 ^b (20.66)	20.53 ^c (12.30)	21.37 ^{bc} (13.27)
T ₆	Panchagavya (3%)	16.96 ^{cd} (8.51)	21.99 ^{cd} (14.02)	24.37 ^{bc} (17.03)	21.11 ^{bc} (12.97)
T ₇	Cow urine (3%)	16.94 ^{cd} (8.49)	22.88 ^{cd} (15.12)	22.2 ^{bc} (14.28)	20.68 ^{bc} (12.47)
T ₈	Cow milk + Jaggary (2.5:1)	20.13 ^b (11.85)	24.6 ^{bc} (17.33)	25.91 ^b (19.09)	23.55 ^b (15.96)
T ₉	Control	23.22 ^a (15.54)	34.57 ^a (32.19)	35.01 ^a (32.92)	30.93 ^a (26.42)
	S. Em.±	0.91	1.19	1.38	1.28
	C. D. @ 5%	2.71	3.57	4.14	3.83
	C. V. %	8.52	8.21	10.20	9.12
Y	S. Em.±				0.39
	C. D. @ 5%				1.12
Y×T	S. Em.±				1.18
	C. D. @ 5%				3.35
Figures in parenthesis are retransformed arc sine values.					
Data were transformed (angular transformed) before analysis. Treatment means with letters(s) in common are at par as per DNMR at 5% level of significance.					

Table 3: Blast disease intensity in various treatments of bioagents at 60 DAS and 70 Days after sowing

Sr. No.	Treatment	Blast intensity (60 DAS)				Blast intensity (75 DAS)			
		2023	2024	2025	Pooled	2023	2024	2025	Pooled
T ₁	<i>Trichoderma harzianum</i> 1.0 WP 2 × 10 ⁶ cfu/g (0.005%)	21.37 ^{bc} (13.28)	24.63 ^c (17.37)	24.36 ^d (17.01)	23.45 ^c (15.84)	30.08 ^b (25.13)	33.62 ^c (30.66)	35.67 ^c (34.00)	33.13 ^b (29.86)
T ₂	NSKE (5.0%)	21.22 ^{bc} (13.10)	29.11 ^{bc} (23.67)	28.59 ^{bcd} (22.90)	26.31 ^{bc} (19.64)	32.40 ^b (28.71)	38.31 ^{bc} (38.43)	38.78 ^{bc} (39.23)	36.50 ^b (35.38)
T ₃	<i>Pseudomonas fluorescens</i> 1.15 WP 1 × 10 ⁸ cfu/g (0.006%)	22.52 ^{bc} (14.67)	32.62 ^b (29.06)	26.18 ^{cd} (19.47)	27.11 ^{bc} (20.76)	32.43 ^b (28.76)	35.88 ^{bc} (34.36)	35.69 ^c (34.04)	34.67 ^b (32.36)
T ₄	<i>Bacillus subtilis</i> 1.0 WP 1 × 10 ⁸ cfu/g (0.004%)	22.88 ^{bc} (15.12)	33.87 ^b (31.05)	26.30 ^{cd} (19.63)	27.68 ^{bc} (21.58)	29.60 ^b (24.40)	38.53 ^{bc} (38.80)	39.64 ^{bc} (40.71)	35.92 ^b (34.42)
T ₅	Jivamrut (3%)	18.75 ^c (10.33)	29.60 ^{bc} (24.40)	25.41 ^{cd} (18.41)	24.59 ^c (17.31)	28.83 ^b (23.25)	36.73 ^{bc} (35.76)	36.09 ^c (34.70)	33.88 ^b (31.08)
T ₆	Panchagavya (3%)	22.55 ^{bc} (14.70)	26.30 ^c (19.63)	28.57 ^{bcd} (22.87)	25.80 ^{bc} (18.95)	33.15 ^b (29.90)	37.00 ^{bc} (36.22)	38.14 ^{bc} (38.15)	36.10 ^b (34.71)
T ₇	Cow urine (3%)	23.48 ^b (15.87)	28.43 ^{bc} (22.66)	30.31 ^{bc} (25.47)	27.41 ^{bc} (21.19)	31.79 ^b (27.76)	38.99 ^{bc} (39.59)	39.64 ^{bc} (40.71)	36.81 ^b (35.90)
T ₈	Cow milk + Jaggary (2.5:1)	24.29 ^b (16.92)	32.93 ^b (29.55)	32.51 ^b (28.88)	29.91 ^b (24.86)	34.34 ^b (31.81)	40.95 ^b (42.95)	42.24 ^b (45.18)	39.17 ^b (39.90)
T ₉	Control	31.28 ^a (26.96)	41.59 ^a (44.06)	39.20 ^a (39.95)	37.36 ^a (36.82)	44.36 ^a (48.89)	49.72 ^a (58.20)	48.43 ^a (55.97)	47.50 ^a (54.36)
	S. Em.±	1.27	1.88	1.54	0.53	1.64	2.13	1.73	0.62
	C. D. @ 5%	3.80	5.64	4.61	1.50	4.91	6.38	5.20	1.75
	C. V.%	9.49	10.51	9.16	9.88	8.60	9.49	7.63	8.62
	Y								
	S. Em.±				0.91				1.07
	C. D. @ 5%				2.60				3.03
	Y×T								
	S. Em.±				1.58				1.85
	C. D. @ 5%				NS				NS

Treatment means with letters(s) in common are at par as per DNMR at 5% level of significance.

Yield and Economics

The three-year pooled results presented in Table 4 revealed significant influence of different treatments on grain yield of pearl millet. Among the treatments, *Trichoderma harzianum* recorded the highest grain yield (2411 kg ha⁻¹) and proved superior over the untreated control. However, it remained statistically at par with *Pseudomonas fluorescens* (2386 kg ha⁻¹), *Bacillus subtilis* (2345 kg ha⁻¹), Panchagavya (2307 kg ha⁻¹), and Jivamrut (2301 kg ha⁻¹). The minimum grain yield (1689 kg ha⁻¹) was recorded under the untreated control, indicating severe reduction in crop productivity due to blast disease infection in the absence of management practices.

The increased grain yield observed under *Trichoderma harzianum* treatment may be attributed to effective suppression of blast disease along with enhanced plant growth and nutrient uptake. *Trichoderma* spp. are known to produce various growth-promoting substances and elicitors that stimulate root development, improve nutrient availability, and enhance physiological activities, ultimately leading to higher crop productivity (Ghorbanpour *et al.*, 2018) [2]. Similarly, *Pseudomonas fluorescens* and *Bacillus subtilis* might have improved grain yield through disease suppression and promotion of plant growth by producing beneficial metabolites and enhancing nutrient mobilization. The findings of the present investigation are in accordance with the results of Varshney and Chaube (1997) [21], who reported that application of *Pseudomonas fluorescens* and *Trichoderma harzianum* significantly increased growth and yield parameters in tomato. Likewise, Nezarat and Gholami (2009) [11] observed significant improvement in plant height, 100-seed weight, number of seeds per ear and seed yield in maize following application of beneficial microbial inoculants. Netam *et al.* (2016) [10] reported that significantly

higher grain yield found with three sprays of *P. fluorescens* in finger millet.

The fodder yield data presented in Table 4 also showed significant variation among different treatments. The maximum fodder yield (4883 kg ha⁻¹) was recorded with Panchagavya, which remained statistically at par with *Bacillus subtilis* (4873 kg ha⁻¹), cow urine (4854 kg ha⁻¹), *Trichoderma harzianum* (4819 kg ha⁻¹), *Pseudomonas fluorescens* (4808 kg ha⁻¹), and Jivamrut (4668 kg ha⁻¹). The untreated control recorded the lowest fodder yield (3570 kg ha⁻¹). Petro *et al.* (2020) [12] revealed that foliar spray of *Pseudomonas fluorescens* at 20 DAS and Trifloxystrob in + Tebuconazole at 35 DAS was found effective with least disease intensity of blast, higher grain and fodder yield.

Higher fodder yield under Panchagavya and bioagent treatments might be due to improved plant vigor, enhanced nutrient availability, and reduced disease severity, which collectively promoted better vegetative growth and biomass accumulation. Organic formulations such as Panchagavya and Jivamrut are known to enhance microbial activity in the soil and supply essential nutrients and growth-promoting substances, thereby improving crop growth and fodder production. The overall improvement in grain and fodder yield under biological and organic treatments suggests their potential as eco-friendly and sustainable approaches for blast disease management and productivity enhancement in pearl millet.

The highest additional income ₹20548 ha⁻¹, highest net realization of ₹ 19373 ha⁻¹ and maximum ICBR 1: 17.49 was obtained in the treatment *Trichoderma harzianum* followed by *Pseudomonas fluorescens*, Netam *et al.* (2016) [10] found that cost benefit ratio was also higher in three spray of *P. fluorescens*, three sprays of *Trichoderma harzianum* and at par with *Ediphenphos* in finger millet.

Table 5: Grain yield and fodder yield in various treatments of bioagents

Sr. No.	Treatment	Grain yield (kg/ha)				Fodder yield (kg/ha)			
		2023	2024	2025	Pooled	2023	2024	2025	Pooled
1.	T ₁ : <i>Trichoderma harzianum</i> 1.0 WP, 2×10^6 cfu/g	2758 ^{abc}	2430 ^a	2045 ^{bc}	2411 ^a	4376 ^{cd}	5280 ^a	4802 ^a	4819 ^a
2.	T ₂ : NSKE	2540 ^{bcd}	2008 ^{bcd}	1842 ^{cd}	2130 ^a	4222 ^{cd}	3989 ^{bc}	4132 ^{ab}	4115 ^{ab}
3.	T ₃ : <i>Pseudomonas fluorescens</i> 1.15 WP, 1×10^8 cfu/g	2428 ^{cd}	2411 ^{ab}	2320 ^{ab}	2386 ^a	4894 ^{abcd}	4677 ^{ab}	4853 ^a	4808 ^a
4.	T ₄ : <i>Bacillus subtilis</i> 1.0 WP, 1×10^8 cfu/g	2903 ^a	1977 ^{cd}	2155 ^{abc}	2345 ^a	6021 ^a	3989 ^{bc}	4608 ^a	4873 ^a
5.	T ₅ : Jivamrut	2377 ^d	2016 ^{bcd}	2508 ^a	2301 ^a	5048 ^{abcd}	4359 ^{abc}	4598 ^a	4668 ^a
6.	T ₆ : Panchagavya	2797 ^{ab}	1992 ^{cd}	2132 ^{abc}	2307 ^a	5640 ^{ab}	4161 ^{bc}	4848 ^a	4883 ^a
7.	T ₇ : Cow urine	2651 ^{abcd}	2329 ^{abc}	1862 ^{cd}	2281 ^a	5275 ^{abc}	4598 ^{ab}	4688 ^a	4854 ^a
8.	T ₈ : Cow milk + Jaggary (2.5:1)	2313 ^d	2010 ^{bcd}	1756 ^{cd}	2026 ^{ab}	4746 ^{bcd}	4217 ^{bc}	4430 ^a	4464 ^{ab}
9.	T ₉ : Control	1897 ^e	1744 ^d	1426 ^d	1689 ^b	3831 ^d	3444 ^c	3435 ^b	3570 ^b
	S. Em.±	104.01	122.88	129.40	39.75	364.66	306.08	267.17	105.06
	C. D. @ 5%	311.85	368.40	387.95	113.14	1093.28	917.66	801.01	299.04
	C. V. %	7.15	10.12	11.18	9.35	12.90	12.32	10.31	11.97
	Y								
	S. Em.±				125.66				181.98
	C. D. @ 5%				376.74				517.95
	Y×T								
	S. Em.±				119.24				315.19
	C. D. @ 5%				NS				NS

Treatment means with letters(s) in common are at par as per DNMRT at 5% level of significance.

Table 6: Economics of various treatments for the management of pearl millet blast

No.	Treatment	Yield (kg ha ⁻¹)		Yield increase over control (kg ha ⁻¹)		Income		Additional income (₹)	Cost of treatment (fungicides, labour charge etc) (₹ ha ⁻¹)	Net realization	ICBR
		Grain	Fodder	Grain	Fodder	Grain	Fodder				
1	<i>T. harzianum</i> 1.0 WP	2411	4819	722	1249	18049	2499	20548	1175	19373	1: 17.49
2	NSKE	2130	4115	441	545	11029	1089	12118	8500	3618	1: 1.43
3	<i>P. fluorescens</i> 1.15 WP	2386	4808	697	1238	17427	2476	19903	2250	17653	1: 8.85
4	<i>Bacillus subtilis</i> 1.0 WP	2345	4873	656	1303	16395	2606	19001	1700	17301	1: 11.18
5	Jivamrut	2301	4668	612	1098	15289	2197	17485	1105	16380	1: 15.82
6	Panchagavya	2307	4883	618	1313	15456	2626	18082	5500	12582	1: 3.29
7	Cow urine	2281	4854	592	1284	14795	2568	17363	1450	16213	1: 11.97
8	Cowmilk + Jaggary (2.5:1)	2026	4464	337	894	8436	1789	10225	2600	7625	1: 3.93
9	Control	1689	3570	-	-	-	-	-	-	-	-

Conclusion

It can be concluded from the above results that the spraying of *Trichoderma harzianum* (50 g/10 l of water) or Jivamrut (300 ml/10 l of water) in pearl millet against blast disease were found effective to minimize blast intensity, higher grain and fodder yield and additional income also.

References

- Bhaskar B, Devi RSJ, Rajan CPD, Kumar SV, Sudhan PM, Harathi PN, *et al.* Evaluation of combination spray schedules of Tricyclazole and *Pseudomonas fluorescens* against blast disease of rice. *Oryza*. 2021;58(3):419-426.
- Ghorbanpour A, Salimi A, Ghanbary MAT, Pirdashti H, Dehestani A. The effect of *Trichoderma harzianum* in mitigating low temperature stress in tomato (*Solanum lycopersicum* L.) plants. *Sci Hortic*. 2018;230:134-141.
- Gill KS. Pearl millet and its improvement. New Delhi: Indian Council of Agricultural Research; 1991. p. 1-305.
- Jambhulkar PP, Sharma P, Manokaran R, Lakshman D. Assessing synergism of combined applications of *Trichoderma harzianum* and *Pseudomonas fluorescens* to control blast and bacterial leaf blight of rice. *Eur J Plant Pathol*. 2018;152(1):1-14.
- Kashyap PL, Solanki MK, Kushwaha P, Kumar S, Srivastava AK. Biocontrol potential of salt-tolerant *Trichoderma* and *Hypocrea* isolates for the management of tomato root rot under saline environment. *J Soil Sci Plant Nutr*. 2020;20(1):160-176.
- Kashyap PL, Rai P, Srivastava AK, Kumar S. *Trichoderma* for climate resilient agriculture. *World J Microbiol Biotechnol*. 2017;33(8):155.
- Krishnamurthy K, Gnanamanickam SS, Raju MRB. Biological control of rice blast by *Pseudomonas fluorescens* strain Pf7-14. *Biol Control*. 1998;13(3):158-165.
- Lukose CM, Kadvani DL, Dangaria CJ. Efficacy of fungicides in controlling blast disease of pearl millet. *Indian Phytopathol*. 2007;60(1):68-71.
- Mehta PR, Singh B, Mathur SC. A new leaf spot disease of bajra (*Pennisetum typhoides* Staph and Hubbard) caused by a species of *Pyricularia*. *Indian Phytopathol*. 1953;5:140-143.
- Netam RS, Kumar P, Yadav SC. Efficiency of biocontrol agents for the management of (*Pyricularia grisea*) blast disease of finger millet under field condition of Bastar, Chhattisgarh. *J Pure Appl Microbiol*. 2016;10(3):2421-2425.
- Nezarat S, Gholami A. Screening plant growth promoting rhizobacteria for improving seed germination and seedling growth of maize. *Pak J Biol Sci*. 2009;12:26-32.
- Patro TSSK, Georgia KE, Rajkumar S, Anuradha N, Sandhya Y, Triveni U. Management of pearl millet

- blast through fungicide and biocontrol agents. Int J Chem Stud. 2020;8(4):1357-1359.
13. Rai S, Kashyap PL, Kumar S, Srivastava AK, Ramteke PW. Identification, characterization and phylogenetic analysis of antifungal *Trichoderma* from tomato rhizosphere. SpringerPlus. 2016;5(1):1939.
 14. Ramappa HK, Ravishankar CR, Prakash P. Estimation of yield loss and management of blast disease in finger millet (ragi). Proc Asian Congr Mycol Plant Pathol. Mysore: University of Mysore; 2002. p. 195.
 15. Senthil R, Shanmugapackiam S, Raguchander T. Evaluation of biocontrol agents and fungicides for the management of blast disease of finger millet. J Mycol Plant Pathol. 2012;42(4):454-458.
 16. Singh PK, Singh AK, Singh HB, Dhakad BK. Biological control of rice blast disease with *Trichoderma harzianum* in direct seeded rice under medium low land rainfed conditions. Environ Ecol. 2012;30(3B):834-837.
 17. Sitther V, Gnanamanickam SS. Biological control of blast disease of finger millet (*Eleusine coracana* L.) and analysis of fertility of *Magnaporthe grisea*. Curr Sci. 1996;71:144-147.
 18. Solanki MK, Singh RK, Srivastava S, Kumar S, Kashyap PL, Srivastava AK, et al. Isolation and characterization of siderophore-producing antagonistic rhizobacteria against *Rhizoctonia solani*. J Basic Microbiol. 2014;54(6):585-597.
 19. Srivastava R, Tripathi BM, Singh RK, Srivastava P, Kumari P, Srivastava M, et al. Profiling of plant growth promoting bacteria associated with Jaunpuri Giant Raddish rhizosphere. Int J Agric Environ Biotechnol. 2013;6(2):187-196.
 20. Thakur RP, Sharma R, Rai KN, Gupta SK, Rao VP. Screening techniques and resistance sources for foliar blast in pearl millet. J SAT Agric Res. 2009;7:1-5.
 21. Varshney S, Chaube HS. Growth promotion by *Pseudomonas fluorescens*, *Trichoderma harzianum* and *Glomus* spp. In: International Conference on Integrated Plant Disease Management for Sustainable Agriculture; Nov 1997; New Delhi. p. 248.