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Effect of Bioagents on Fruit Quality and Soil Analysis in Ridge Gourd

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The present investigation entitled effect of bioagents on fruit quality and soil analysis in ridge gourd was carried out during *Kharif*, 2021 and Summer, 2022 at P.G block, College of Horticulture, Rajendranagar, SKLTSHU, Hyderabad. The experiment was carried out with 11 treatments in Randomized Block Design with three replications. The results reported that the T_1 (RDF + *Trichoderma viride* recorded highest in fruit quality, soil parameters and benefit-cost ratio in ridge gourd.

Keywords: Ridge gourd; arka prasan; Trichoderma; Pseudomonas; Bacillus.

1. INTRODUCTION

Ridge gourd (*Luffa acutangula*) is one of the most important warm season vegetable which is grown commercially in *Kharif* and Summer season propagated by seeds. It has high content of water and nutrients, protein, fat, carbohydrates, minerals and vitamins. In India, gourds are cultivated in an area of 4.52 lakh hectares with a production of 36.16 lakh MT (www.aps.dac.gov.in.) and in Telangana the crop is grown in an area of 14,087 hectares with a production of 2.82 lakhs MT and productivity of 20 MT (www.telanganahorticulture.nic.in.)

"Biocontrol agents are the living organisms, which can significantly lower the density of plant pathogens and have become very popular as an alternative to chemical pesticides for management of pests and diseases" [1].

"Genus *Trichoderma* can utilize a variety of nutrient sources and are able to effectively degrade some of them" [2]. Biofertilizer functions as a key player in sustainable agriculture by improving soil fertility, plant tolerance and crop productivity. Current soil management strategies are mainly dependent on inorganic chemical fertilizers, which caused a serious threat to human health and environment. Utilization of beneficial microbes as biofertilizers is of paramount importance in agricultural sector due to their potential in food safety and sustainable crop production.

2. MATERIALS AND METHODS

The present investigation was carried out during Kharif season (2021) and summer season (2022) at P.G block, College of Horticulture, SKLTSHU, Rajendranagar, Hyderabad. The experimental site is situated at a latitude of 17º.32' North, longitude of 78º.40' East and altitude of 542.3 m above mean sea level. The experiment was laid out in randomized block design with eleven treatments replicated three times. The entire experiment was executed on a creeping mesh. The pit size of 60 cm^2 were dug with a spacing of 1.5 × 1.0 m and were kept open for solarization for about 15 days. Good agricultural practices were followed during the entire crop period. The data recorded on fruit quality *i.e*. total soluble solids (ºBrix), ascorbic acid content (mg/g), reducing sugars (%), non- reducing sugars (%), total sugars (%), crude fibre content (%), pest percent of fruit damage=(Number of affected fruits/total number of fruits)× 100, leaf miner by counting per plant and downy mildew per cent incidence= (Number of plants infected/ Number of plants under observation) × 100 and in soil analysis pH using digital ELICO pH, EC using digital EC meter, organic carbon [3], Available nitrogen [4], available phosphorus [5], available potassium [3] were statistically analysed using Fisher's method of "Analysis of variance" (ANOVA) as outlined by Gomez and Gomez [6].

3. RESULTS AND DISCUSSION

3.1 Quality Parameters

The data pertaining to the fruit quality parameters *viz.,* TSS, ascorbic acid content, reducing sugars, non-reducing sugars, total sugars, chlorophyll content and crude fibre influenced by different bioagents was recorded (Tables 1 to 3).

3.1.1 TSS (ºBrix)

The data on the TSS (ºBrix) affected by the bioagents on quality in ridge gourd is presented in Table 1.

From the data it is clear that there was significant differences observed among the treatments with respect to TSS during *Kharif* season. Significantly maximum TSS (4.02) was recorded in T_1 followed by T_2 (3.78), while the minimum TSS (2.89) was recorded with T_{11} (control).

During the summer season, T_1 recorded maximum TSS (4.25) followed by T_2 (4.01), while the minimum TSS (3.04) was recorded with T_{11} (control).

The highest TSS content of the fruit was recorded in T_1 due to the application of NPK. TSS content increased with the nitrogen application which helped in vigorous vegetative growth and imparted deep green colour to the foliage and favoured photosynthetic activity of the plants. The greater accumulation of food material *i.e* carbohydrates in the fruit leading to increase in TSS content. Similar results have been reported by Tripathy et al*.* [7] in Onion, Diriba-Shiferaw et al*.* [8] in Garlic and Sharma [9] in Onion.

3.1.2 Ascorbic acid content (mg/100g)

The data presented in Table 1 shows that during the *Kharif* season, maximum ascorbic acid content (13.33) was observed with T_1 followed by T_2 recording the ascorbic acid content of 12.25. The minimum ascorbic acid content (8.27) was recorded with T_{11} (control).

During the summer season, maximum ascorbic acid content (13.65) was observed with T_1 and was at par with T_2 recording the ascorbic acid content of 13.39. The minimum ascorbic acid content (8.48) was recorded with T_{11} (control).

The highest ascorbic acid content was recorded in T_1 due to the availability of sufficient quantities of various nutrient sources resulting in production of more photosynthates, consequently synthesizing more vitamin ' C' content. Similar findings are comparable with Thriveni et al. [10] in Bitter gourd and Rathod et al. [11] in Ridge gourd.

3.1.3 Reducing sugars (%)

The data on the reducing sugars affected by the bioagents on quality in ridge gourd is presented in Table 2.

There was significant differences observed among the treatments with respect to reducing sugars during *Kharif* season. Maximum reducing sugars (4.54 %) were recorded in T_1 and was at par with T_2 (4.41 %), while minimum reducing sugars (2.98 %) were recorded in T_{11} (control).

During the summer season, T_1 recorded maximum reducing sugars (4.62%) and was at par with T_2 (4.57 %), while the minimum reducing sugars (3.07 %) were recorded with T_{11} (control).

Table 1. Effect of bioagents on TSS (º Brix) and ascorbic acid content (mg/100g) of Ridge gourd during *Kharif,* 2021 and Summer, 2022

Treatments	TSS (º Brix)		Ascorbic acid content (mg/100g)	
	Kharif 2021	Summer 2022	Kharif 2021	Summer 2022
T_1 : RDF + *Trichoderma viride* (5 kg/ha)	4.02	4.25	13.33	13.65
T_2 : RDF + *Pseudomonas fluorescens* (2.5 kg/ha)	3.78	4.01	12.25	13.39
T_3 : RDF + *Bacillus subtilis* (5 kg/ha)	3.66	3.89	12.61	12.97
T_4 : 75% RDF + *Trichoderma viride* (5 kg/ha)	3.70	3.85	10.18	10.55
T_5 : 75% RDF + *Pseudomonas fluorescens* (2.5 kg/ha)	3.68	3.72	9.26	10.32
T_6 : 75% RDF + *Bacillus subtilis* (5 kg/ha)	3.64	3.77	9.12	9.49
T_7 : 50% RDF +*Trichoderma viride* (5 kg/ha)	3.60	3.65	8.65	8.85
T_8 : 50% RDF + *Pseudomonas fluorescens* (2.5 kg/ha)	3.44	3.58	8.39	8.53
T_9 : 50% RDF + *Bacillus subtilis* (5 kg/ha)	3.57	3.65	8.55	9.98
T_{10} : RDF (100:100:50 NPK kg/ha)	3.52	4.00	10.34	10.81
T_{11} : control	2.89	3.04	8.27	8.48
SEm±	**0.06**	**0.06**	**0.16**	**0.16**
CD (P=0.05)	**0.16**	**0.17**	**0.46**	**0.48**

3.1.4 Non reducing sugars (%)

During *Kharif* and summer seasons, minimum non reducing sugars (1.69 and 1.74 %) were observed with T_1, while maximum (2.10 and 2.15 %) were recorded with T_{11} (control).

3.1.5 Total sugars (%)

The data on the total sugars affected by the bioagents on quality in ridge gourd is presented in Table 2.

There was significant differences observed among the treatments with respect to total sugars during *Kharif* season. Maximum total sugars (6.23%) were recorded in T_1 and was at par with T_2 (6.17%), while the minimum total sugars (5.08 %) was recorded with T_{11} (control).

During the summer season, T_1 recorded maximum total sugars (6.36 %) and was at par with T_2 (6.32 %), while the minimum total sugars (5.22 %) was recorded with T_{11} (control).

The sugar content was highest in T_1 due to application of nutrient which enhanced the carbon nitrogen ratio in the soil which might have increased the sugar content. Similar findings were also observed by Nayak et al. [12] in pointed gourd.

3.1.6 Chlorophyll content (DA meter reading)

The data presented in Table 3 revealed that during the *Kharif* season maximum chlorophyll content (1.49) was observed with T_1 followed by T_2 recording the chlorophyll content of 1.38. The minimum chlorophyll content (0.55) was recorded with T_{11} (control).

During the summer season, maximum chlorophyll content (1.57) was observed with T_1 followed by T_2 recording the chlorophyll content of 1.40. The minimum chlorophyll content (0.62) was recorded with T_{11} (control).

Application of NPK significantly increased the vigorous vegetative growth and imparted deep green colour to the foliage favouring photosynthetic activity of the plants. There was greater accumulation of food material due to increased photosynthetic activity. Similar results have also been reported by Tripathy et al. [7] in Onion.

Table 2. Effect of bioagents on reducing sugars (%), non-reducing sugars (%), total sugars (%) of Ridge gourd during the *Kharif*, 2021 and Summer, 2022

Treatments	Reducing sugars (%)		Non-reducing sugars (%)		Total sugars (%)	
	Kharif 2021	Summer 2022	Kharif 2021	Summer 2022	Kharif 2021	Summer 2022
T_1 : RDF + *Trichoderma viride* (5 kg/ha)	4.54	4.62	1.69	1.74	6.23	6.36
T_2 : RDF + *Pseudomonas fluorescens* (2.5 kg/ha)	4.41	4.57	1.83	1.81	6.17	6.32
T_3 : RDF + *Bacillus subtilis* (5 kg/ha)	3.67	3.58	1.88	1.90	5.55	5.48
T_4 : 75% RDF + *Trichoderma viride* (5 kg/ha)	3.89	3.56	1.76	1.75	5.72	5.37
T_5 : 75% RDF + *Pseudomonas fluorescens* (2.5 kg/ha)	3.24	3.43	1.94	1.91	5.18	5.34
T_6 : 75% RDF + *Bacillus subtilis* (5 kg/ha)	3.25	3.65	1.94	1.84	5.19	5.49
T_7 : 50% RDF +*Trichoderma viride* (5 kg/ha)	3.72	4.04	1.85	1.98	5.57	6.02
T_8 : 50% RDF + *Pseudomonas fluorescens* (2.5 kg/ha)	3.30	3.87	1.87	1.86	5.17	5.73
T_9 : 50% RDF + *Bacillus subtilis* (5 kg/ha)	3.38	3.44	1.96	1.97	5.34	5.41
T_{10} : RDF (100:100:50 NPK kg/ha)	3.42	3.58	1.84	1.88	5.26	5.46
T_{11} : control	2.98	3.07	2.10	2.15	5.08	5.22
SEm±	**0.06**	**0.06**	**0.03**	**0.03**	**0.08**	**0.09**
CD (P=0.05)	**0.17**	**0.18**	**0.08**	**0.08**	**0.25**	**0.26**

Table 3. Effect of bioagents on chlorophyll and crude fibre content of Ridge gourd during the *Kharif,* 2021 and Summer, 2022

Treatments	Chlorophyll		Crude fibre content	
	Kharif 2021	Summer 2022	Kharif 2021	Summer 2022
T_1 : RDF + *Trichoderma viride* (5 kg/ha)	1.49	1.57	2.15	2.10
T_2 : RDF + *Pseudomonas fluorescens* (2.5 kg/ha)	1.38	1.40	2.24	2.21
T_3 : RDF + *Bacillus subtilis* (5 kg/ha)	1.23	1.28	2.47	2.43
T_4 : 75% RDF + *Trichoderma viride* (5 kg/ha)	1.20	1.25	2.59	2.55
T_5 : 75% RDF + *Pseudomonas fluorescens* (2.5 kg/ha)	1.17	1.14	2.56	2.50
T_6 : 75% RDF + *Bacillus subtilis* (5 kg/ha)	1.18	1.20	2.60	2.51
T_7 : 50% RDF +*Trichoderma viride* (5 kg/ha)	1.13	1.19	2.62	2.56
T_8 : 50% RDF + *Pseudomonas fluorescens* (2.5 kg/ha)	0.93	1.06	2.69	2.57
T_9 : 50% RDF + *Bacillus subtilis* (5 kg/ha)	1.15	1.17	2.74	2.70
T_{10} : RDF (100:100:50 NPK kg/ha)	1.29	1.24	2.53	2.46
T_{11} : control	0.55	0.62	2.86	2.79
SEm±	0.02	0.02	0.04	0.04
CD (P=0.05)	0.05	0.06	0.11	0.11

3.1.7 Crude fibre content (%)

The data presented in Table 3 revealed that during the *Kharif* season, minimum crude fibre (2.15) was observed with T_1 and was at par with T_2 recording the chlorophyll content of 2.24. The maximum crude fibre (2.86) was recorded with T_{11} (control).

During the summer season, minimum crude fibre (2.10) was observed with T_1 and was at par with T_2 recording the crude fibre of 2.21. The maximum crude fibre (2.79) was recorded with T_{11} (control).

The crude fiber content increased with the advancement of crop growth. The decrease in crude fibre content was due to the increase in succulence by the application of nitrogen, phosphorus, potassium increasing the thickness of the cell wall. Similar results were obtained by Prabu et al. [13] in okra. Mani and Ramanathan [14], Abusaleha [15] and Naidu et al. [16] in okra. Similar decrease in crude fibre content with increased of nitrogen was observed by Irene [17].

3.2 Pest and Disease Incidence

3.2.1 Pest incidence

There was no significant difference in incidence of fruitfly and leaf miner during *Kharif* and Summer season respectively.

3.2.2 Disease incidence

3.2.2.1 Downy mildew

The results presented in Table 5 revealed that shows less (24.18) percent of disease incidence and the highest incidence was observed in T_{11} control (55.10) during the *Kharif* season.

Roco and Perez (2001) reported that *Trichoderma* spp. have evolved numerous mechanisms such as competition for space and nutrient, mycoparasitism and production of inhibitory compounds, inactivation of the pathogen enzymes and induced resistance to crops by attacking other fungi and reduce the plant diseases. Similar results were reported by Yadav et al. [18] in Onion, Shilpa et al. [19] in Cabbage and Yogita et al. [20] in Ridge gourd.

3.3 Soil Analysis

3.3.1 pH

It is clear from Table 6 that pH did not vary significantly with different treatments during *Kharif* and Summer season respectively.

3.3.2 EC (dS/m)

The data presented in Table 6 there was no significant difference observed between the treatments during *Kharif* and Summer season respectively.

Table 4. Effect of bioagents on pest incidence of ridge gourd during the *Kharif,* 2021 and Summer, 2022

Treatments	Mean Per cent fruit damage by fruit fly		Mean number of leaf mines per plant	
	Kharif 2021	Summer 2022	Kharif 2021	Summer 2022
T_1 : RDF + *Trichoderma viride* (5 kg/ha)	38.60	24.90	4.26	4.15
T_2 : RDF + *Pseudomonas fluorescens* (2.5 kg/ha)	38.23	24.25	4.35	4.28
T_3 : RDF + *Bacillus subtilis* (5 kg/ha)	39.36	25.58	4.44	4.49
T_4 : 75% RDF + *Trichoderma viride* (5 kg/ha)	38.58	25.18	4.46	4.24
T_5 : 75% RDF + *Pseudomonas fluorescens* (2.5 kg/ha)	39.90	27.59	4.65	4.58
T_6 : 75% RDF + *Bacillus subtilis* (5 kg/ha)	41.60	29.25	4.55	4.45
T_7 : 50% RDF +*Trichoderma viride* (5 kg/ha)	41.54	27.32	4.67	4.35
T_8 : 50% RDF + *Pseudomonas fluorescens* (2.5 kg/ha)	40.78	28.64	4.59	4.62
T_9 : 50% RDF + *Bacillus subtilis* (5 kg/ha)	43.85	29.58	4.54	4.59
T_{10} : RDF -100% NPK	40.52	25.24	4.75	4.37
T_{11} : control	43.90	30.07	4.98	4.79
SEm±	**0.57**	**0.39**	**0.07**	**0.07**
CD (P=0.05)	**NS**	**NS**	**NS**	**NS**

Table 5. Effect of bioagents on disease incidence of ridge gourd during the *Kharif,* 2021

	Mean of Downy Mildew % Incidence
	Kharif 2021
T_1 : RDF + *Trichoderma viride* (5 kg/ha)	24.18
T_2 : RDF + *Pseudomonas fluorescens* (2.5 kg/ha)	25.27
T_3 : RDF + *Bacillus subtilis* (5 kg/ha)	26.46
T_4 : 75% RDF + *Trichoderma viride* (5 kg/ha)	25.10
T_5 : 75% RDF + *Pseudomonas fluorescens* (2.5 kg/ha)	26.78
T_6 : 75% RDF + *Bacillus subtilis* (5 kg/ha)	27.36
T_7 : 50% RDF +*Trichoderma viride* (5 kg/ha)	26.26
T_8 : 50% RDF + *Pseudomonas fluorescens* (2.5 kg/ha)	30.69
T_9 : 50% RDF + *Bacillus subtilis* (5 kg/ha)	31.61
T_{10} : RDF -100% NPK	48.25
T_{11} : control	55.10
SEm±	**0.40**
CD (P=0.05)	**1.17**

3.3.3 Organic carbon (%)

It is clear from Table 6 that organic carbon did not vary significantly with different treatments during *Kharif* and Summer season respectively.

3.3.4 Available nitrogen (kg/ha)

The data of available nitrogen in the soil after harvest as influenced by the effect of bioagents are presented in Table 7.

The data indicated that among the treatments evaluated, maximum available nitrogen content in the soil (269.53 and 268.64) was observed with T_1 which was on par with T_2 (268.32 and 265.44) and T_3 (266.78 and 263.05), while the minimum nitrogen content in the soil was recorded with T_{11} (control) (211.66 and 215.04) during the *Kharif* and Summer season respectively.

3.3.5 Available phosphorus (kg/ha)

The data on available phosphorus in the soil after harvest as influenced by the effect of bioagents are presented in Table 7.

Table 6. Effect of bioagents in soil of ridge gourd plots during *Kharif,* 2021 and Summer, 2022

Treatments	PH		Electrical conductivity (dS/m)		Organic carbon (%)	
	Kharif 2021	Summer 2022	Kharif 2021	Summer 2022	Kharif 2021	Summer 2022
T_1 : RDF + *Trichoderma viride* (5 kg/ha)	7.11	7.13	0.297	0.299	0.58	0.59
T_2 : RDF + *Pseudomonas fluorescens* (2.5 kg/ha)	7.17	7.19	0.295	0.297	0.57	0.58
T_3 : RDF + *Bacillus subtilis* (5 kg/ha)	7.14	7.17	0.294	0.294	0.55	0.56
T_4 : 75% RDF + *Trichoderma viride* (5 kg/ha)	7.23	7.25	0.289	0.290	0.52	0.54
T_5 : 75% RDF + *Pseudomonas fluorescens* (2.5 kg/ha)	7.25	7.25	0.288	0.285	0.50	0.52
T_6 : 75% RDF + *Bacillus subtilis* (5 kg/ha)	7.26	7.31	0.287	0.288	0.51	0.53
T_7 : 50% RDF +*Trichoderma viride* (5 kg/ha)	7.17	7.22	0.285	0.282	0.49	0.49
T_8 : 50% RDF + *Pseudomonas fluorescens* (2.5 kg/ha)	7.28	7.29	0.281	0.280	0.47	0.48
T_9 : 50% RDF + *Bacillus subtilis* (5 kg/ha)	7.31	7.34	0.284	0.286	0.45	0.47
T_{10} : RDF (100:100:50 NPK kg/ha)	7.23	7.27	0.292	0.294	0.52	0.55
T_{11} : control	7.36	7.35	0.270	0.272	0.44	0.46
SEm±	**0.11**	**0.11**	**0.004**	**0.004**	**0.01**	**0.01**
CD (P=0.05)	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

The data indicated that maximum available phosphorus content in the soil (33.35 and 35.05) was observed with T_1 followed by T_2 (31.77 and 33.47), while the minimum phosphorus content in the soil was recorded with T_{11} (control) (23.31 and 23.52) during *Kharif* and Summer seasons respectively.

3.3.6 Available potassium (kg/ha)

The data on available potassium in the soil after harvest as influenced by the effect of bioagents are presented in Table 7.

The data indicated that maximum available potassium content in the soil (203.64 and 206.45) was observed with T_1 and was on par with T_2 (196.31 and 198.87) and T_3 (195.24 and 198.59), while the minimum potassium content in the soil was recorded with T_{11} (control) (149.17 and 154.90) during *Kharif* and Summer season respectively.

Owing to ready release of nutrients in available forms, N, P and K was higher with RDF treatment compared to other treatments. It may be due to added supply of nutrients and proliferous root system developed under balanced nutrient application resulting in better absorption of water and nutrients along with improved physical environment. Similar findings were reported by Sundar Raman et al [21] in gherkin.

3.4 Benefit Cost Ratio

The economics as influenced by the effect of bioagents has been calculated and presented in Table 8.

During *Kharif* season, T_1 recorded the highest gross returns (Rs. 3,615,00), net returns (Rs. 2,625,49.60) with benefit cost ratio of 2.65:1, whereas the T_{20} (control) recorded the lowest gross returns per hectare (Rs. 1,071,00), net returns per hectare (Rs. 16,845) with benefit cost ratio of 0.19:1.

Table 7. Effect of bioagents on soil of ridge gourd plots during *Kharif,* 2021 and Summer, 2022

Treatments	Nitrogen (kg/ha)		Phosphorous (kg/ha)		Potassium (kg/ha)	
	Kharif 2021	Summer 2022	Kharif 2021	Summer 2022	Kharif 2021	Summer 2022
T_1 : RDF + *Trichoderma viride* (5 kg/ha)	269.53	268.64	33.35	35.05	203.64	206.45
T_2 : RDF + *Pseudomonas fluorescens* (2.5 kg/ha)	268.32	265.44	31.77	33.47	196.31	198.87
T_3 : RDF + *Bacillus subtilis* (5 kg/ha)	266.78	263.05	31.23	32.51	195.24	198.59
T_4 : 75% RDF + *Trichoderma viride* (5 kg/ha)	259.02	257.01	30.42	31.82	193.18	197.04
T_5 : 75% RDF + *Pseudomonas fluorescens* (2.5 kg/ha)	256.86	257.03	30.01	31.48	190.11	190.39
T_6 : 75% RDF + *Bacillus subtilis* (5 kg/ha)	255.19	255.54	29.89	30.26	183.74	189.71
T_7 : 50% RDF +*Trichoderma viride* (5 kg/ha)	248.91	249.70	26.50	26.66	177.51	180.79
T_8 : 50% RDF + *Pseudomonas fluorescens* (2.5 kg/ha)	246.58	242.46	25.11	25.32	168.53	170.83
T_9 : 50% RDF + *Bacillus subtilis* (5 kg/ha)	245.44	244.95	24.74	26.35	163.46	169.58
T_{10} : RDF (100:100:50 NPK kg/ha)	260.73	260.12	30.52	31.63	194.96	193.62
T_{11} : control	231.66	235.04	23.31	23.52	149.17	154.90
SEm±	3.40	3.47	0.44	0.45	2.74	2.78
CD (P=0.05)	10.23	10.04	1.33	1.29	8.21	8.08

Table 8. Effect of bioagents on benefit: cost ratio of ridge gourd during *Kharif*, 2021 and Summer, 2022

Treatments	Cost of cultivation (Rs/ha)		Gross income (Rs/ha)		Net returns (Rs/ha)		B:C ratio	
	Kharif 2021	Summer 2022	Kharif 2021	Summer 2022	Kharif 2021	Summer 2022	Kharif 2021	Summer 2022
T_1 : RDF + *Trichoderma viride* (5 kg/ha)	98950.40	99500.40	361500	370650	262549.60	271149.60	2.65	2.73
T_2 : RDF + *Pseudomonas fluorescens* (2.5 kg/ha)	98950.40	99500.40	320250	324750	221299.60	225249.60	2.24	2.26
T_3 : RDF + *Bacillus subtilis* (5 kg/ha)	98970.40	99520.40	295050	300450	196079.60	200929.60	1.98	2.02
T_4 : 75% RDF + *Trichoderma viride* (5 kg/ha)	96801.60	97351.60	346200	351750	249398.40	254398.40	2.58	2.61
T_5 : 75% RDF + *Pseudomonas fluorescens* (2.5 kg/ha)	96801.60	97351.60	281400	288900	184598.40	191548.40	1.91	1.97
T_6 : 75% RDF + *Bacillus subtilis* (5 kg/ha)	96821.60	97371.60	268800	280500	171978.40	183128.40	1.78	1.88
T_7 : 50% RDF +*Trichoderma viride* (5 kg/ha)	94652.70	95202.70	313950	315900	219297.30	220697.30	2.32	2.32
T_8 : 50% RDF + *Pseudomonas fluorescens* (2.5 kg/ha)	94652.70	95202.70	253200	258750	158547.30	163547.30	1.68	1.72
T_9 : 50% RDF + *Bacillus subtilis* (5 kg/ha)	94672.70	95222.70	233850	237750	139177.30	142527.30	1.47	1.50
T_{10} : RDF (100:100:50 NPK kg/ha)	98850.40	99400.40	287400	293550	188549.60	194149.60	1.91	1.95
T_{11} : control	90255.00	90805.00	107100	125400	16845.00	34595.00	0.19	0.38

During the summer season, T_1 recorded the highest gross returns (Rs. 3,706,50), net returns (Rs. 2,711,49.60) with benefit cost ratio of 2.73:1, whereas the T_{20} (control) recorded the lowest gross returns per hectare (Rs. 1,254,00), net returns per hectare (Rs. 34,595) with benefit cost ratio of 0.38:1.

Similar results were also reported by Kavita et al. [22] in Ridge gourd [23,24].

4. CONCLUSION

From the study it may be concluded that RDF along with *Trichoderma viride* (5 kg/ha) was found to be most effective treatment combination for getting higher fruit quality, soil parameters and maximum net returns in ridge gourd.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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