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PERFORMANCE OF LCO-FORTIFIED BIOFERTILIZER AND NANO NITROGEN IN PADDY (*ORYZA SATIVA* L.)

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ABSTRACT

Paddy is one of the major cereal crops grown under diverse agro-ecological conditions of Karnataka. Productivity of paddy is often limited due to poor nutrient use efficiency and imbalanced fertilizer management under field conditions. A field experiment was conducted at the University of Agricultural Sciences, GKVK, Bengaluru during *Kharif*-2022 to study the growth and yield performance of paddy as influenced by LCO-fortified biofertilizers and nano nitrogen. The experiment was laid out in a Randomized Complete Block Design with seven treatments replicated thrice. Treatments consisted of different combinations of lipo-chito oligosaccharide (LCO) fortified biofertilizer, nano urea, mycorrhizae, and different levels (100 and 75%) of recommended dose of fertilizers. Yield attributes varied significantly among treatments, and application of 100% RDF + LCO-fortified biofertilizer @ 10 kg ha^{-1} + foliar spray of nano urea @ 0.2% at 30 and 60 DAT (T_4) recorded higher number of productive tillers (589 m^{-2}), number of panicles (584 m^{-2}), panicle length (22.3 cm), grain weight (3.86 g panicle^{-1}), number of grains (176.7 panicle^{-1}) at harvest compared to only application of 100 % Rec. NPK as per PoP ($T_{1)}$. Higher grain yield (7056 kg ha^{-1}), straw yield (7556 kg ha^{-1}), and harvest index (0.48) were recorded with this treatment, while lower values (grain yield 5224 kg ha^{-1}, straw yield 6364 kg ha^{-1}, and harvest index 0.45) were obtained in T_1. Similarly, nutrient uptake of nitrogen, phosphorus, and potassium (95.99, 36.54, and 83.25 kg ha^{-1}, respectively), gross returns (Rs. 1,69,144 ha^{-1}), net returns (Rs. 1,12,447 ha^{-1}), and B:C ratio (2.98) were higher with 100% RDF + LCO-fortified biofertilizer + nano urea treatment compared to other treatments.

***Keywords* :** Paddy, LCO-fortified biofertilizer, Nano urea and Mycorrhizae.

Introduction

Rice [*Oryza sativa L.*] is one of the most important staple food crops worldwide, second only to wheat in terms of annual food consumption. It serves as the primary food source for over three billion people, and its demand is expected to rise with global population growth. Rice is cultivated globally over 162.06 million hectares with a production of 496.40 million tonnes. In India, rice contributes about 30% of daily caloric intake and provides carbohydrates, protein, vitamins, and essential minerals (Anon., 2021). India ranks as the second largest producer and consumer of rice, with an area of 46.28 million hectares, production of 129.47 million tonnes, and an average productivity of 2798 kg ha^{-1} (Anon., 2022a). In Karnataka, rice is grown over 13.85 lakh hectares, producing 43.18 lakh tonnes with an average productivity of 3089 kg ha^{-1} (Anon., 2022b). With the world population projected to reach 8.1 billion by 2025, an annual increase of 2-3% in rice production is necessary to maintain food security using available land and water resources.

Higher rice yields can be achieved through improved agronomic practices, including balanced fertilizer application, efficient weed management, and proper irrigation. Fertilizers, particularly nitrogen, play a critical role in vegetative growth, tillering, leaf area development, grain formation, and protein synthesis (Ladha *et al.*, 2005). However, excessive use of chemical fertilizers adversely affects the environment and soil health, highlighting the need for sustainable alternatives. Nanotechnology offers a promising approach by improving nutrient use efficiency and reducing environmental hazards. Nano-fertilizers, with particle sizes of 1-100 nm, have high surface area to mass ratios and unique physicochemical properties that enhance nutrient availability, improve plant metabolism, and allow controlled nutrient release, ultimately increasing fertilizer use efficiency (Giraldo *et al.*, 2014; De Rosa *et al.*, 2010; Biswas and Sharma, 2008).

Biofertilizers provide an eco-friendly alternative to chemical fertilizers. Mycorrhizal inoculants enhance root branching, increase the absorption area for water and nutrients, and improve uptake of phosphorus and micronutrients such as zinc and copper (Lehmann *et al.*, 2014; Barman *et al.*, 2016; Ortas *et al.*, 2001). Lipo-chitooligosaccharides (LCOs), produced by rhizobacteria and some fungi, trigger symbiotic associations with plants, promoting nutrient acquisition, root growth, and overall development (Aamir *et al.*, 2020). Commercial bioformulations such as RhizoMyco, RhizoMyx, and RhizoPlex contain endo- and ecto-mycorrhizae along with growth-promoting substances that enhance plant growth and nutrient uptake. Despite their potential, limited research exists on the combined application of LCO-fortified biofertilizers with nano nitrogen in rice. Considering these factors, the present study was undertaken to evaluate the performance of LCO-fortified biofertilizers and nano nitrogen in paddy.

Materials and Methods

A field experiment entitled "Performance of LCO-fortified biofertilizers and nano nitrogen in paddy (*Oryza sativa* L.)" was conducted during Kharif-2022 at the Integrated Farming System (IFS) demo unit, Zonal Agricultural Research Station, University of Agricultural Sciences, Gandhi Krishi Vignana Kendra (GKVK), Bengaluru, Karnataka, located in the Eastern Dry Zone (Zone-V) at 13°08′ N latitude and 77°58′ E longitude, with an altitude of 930 m above mean sea level. The experimental field soil was red sandy loam, slightly acidic in reaction (pH 5.92) with an electrical conductivity of 0.28 dS m^{-1}, low in organic carbon (0.46%) and available nitrogen (263.5 kg ha^{-1}), high in available phosphorus (61.4 kg ha^{-1}), and medium in available potassium (225.4 kg ha^{-1}).

The experiment was laid out in a Randomized Complete Block Design (RCBD) with seven treatments and three replications using paddy hybrid KRH-4, transplanted at a spacing of 30 × 10 cm with a seed rate of 15 kg ha^{-1}. The treatments consisted of different combinations of recommended dose of fertilizers (RDF: 125:62.5:50 kg N:P_2O_5:K_2O ha^{-1}), LCO-fortified biofertilizer @ 10 kg ha^{-1}, mycorrhiza @ 10 kg ha^{-1}, and foliar application of nano urea @ 0.2% at 30 and 60 days after transplanting (DAT). The LCO-fortified biofertilizer used in the study contained *Bradyrhizobium* strains enriched with lipo-chito-oligosaccharides (LCOs) to promote root development, nutrient signaling, and physiological efficiency, while nano urea supplied nitrogen in nanoparticle form for rapid foliar absorption and improved nitrogen use efficiency. Farmyard manure @ 10 t ha^{-1} was applied uniformly before transplanting. Nitrogen was applied in two splits (50% basal and 50% at 30 DAT), while the full dose of phosphorus and potassium was applied basally. All recommended agronomic practices related to irrigation, weed management, and plant protection were followed uniformly for all treatments.

1. Yield attributes

Five plants were randomly selected and tagged in each plot for recording growth and yield parameters. Yield attributes such as number of productive tillers (m^{-2}), number of panicles (m^{-2}), panicle length (cm), number of grains per panicle, grain weight per panicle (g), and 1000-grain weight (g) were recorded at harvest following standard procedures.

2. Grain yield, straw yield and harvest index

Grain yield was recorded by harvesting the net plot area, threshing, cleaning, drying, and converting the yield to kg ha^{-1}. Straw yield was recorded after sun-drying the straw and expressed on a hectare basis. The harvest index (HI) was calculated as per Donald (1962) using the formula:

$$\text{Harvest index} = \frac{\text{Grain yield (kg ha}^{-1}\text{)}}{\text{Total biological yield (kg ha}^{-1}\text{)}}$$

3. Available nutrient status after harvest

Soil samples collected before sowing and after harvest from 0-20 cm depth were analysed for available nutrients. Available nitrogen was determined by the alkaline $KMnO_4$ method (Subbiah and Asija, 1956), available phosphorus by Bray's No.1 extractant and colorimetric method, and available potassium using neutral normal ammonium acetate followed by flame photometry (Jackson, 1973).

4. Total nutrient uptake

Plant samples (grain and straw) were dried, ground, and analysed for nitrogen, phosphorus, and potassium following Tandon (1993). Nutrient uptake was calculated using the formula:

$$\text{Nutrient uptake (kg ha}^{-1}) = \frac{\text{Nutrient content (\%)} \times \text{dry matter yield (kg ha}^{-1})}{100}$$

Total nutrient uptake (kg ha^{-1}) = Nutrient uptake by grain + Nutrient uptake by straw

5. Economics analysis

Economic analysis was performed based on prevailing market prices. Net returns and benefit-cost (B:C) ratio were calculated using the following formulas:

Net returns = Gross returns - Cost of cultivation

$$\text{B:C} = \frac{\text{Gross returns (Rs. ha}^{-1})}{\text{Total cost of cultivation (Rs. ha}^{-1})}$$

6. Statistical analysis

The data were subjected to analysis of variance (ANOVA) following Gomez and Gomez (1984). Treatment means were compared using the F-test at 5% level of significance, and critical difference (CD) values were calculated where treatment effects were significant.

Results and Discussion

Yield attributes of paddy

Yield parameters of paddy as influenced by LCO-fortified biofertilizer and nano nitrogen application are presented in Table 1-application of 100 % Rec. NPK + LCO-fortified biofertilizer @ 10 kg ha^{-1} with foliar spray of nano urea @ 0.2 % at 30 and 60 DAT (T_4) resulted in significantly higher number of productive tillers (589 m^{-2}), number of panicles (584 m^{-2}), panicle length (22.3 cm), grain weight per panicle (3.86 g), 1000-grain weight (20.6 g), number of grains per panicle (176.7). over other treatments (Tables 1) while the lowest values were observed in 100 % Rec. NPK as per PoP (T_1) with 491 productive tillers m^{-2}, 483 panicles m^{-2}, panicle length of 19.8 cm, grain weight of 3.10 g panicle^{-1}, 1000-grain weight of 18.9 g, 132.8 grains per panicle. Treatments with 75 % Rec. NPK + LCO-fortified biofertilizer @ 10 kg ha^{-1} with foliar spray of nano urea @ 0.2 % at 30 and 60 DAT (T_7) and 100 % Rec. NPK + LCO-fortified biofertilizer @ 10 kg ha^{-1} (T_3) were statistically on par with T_4 in most parameters, indicating that LCO-fortified biofertilizer and nano urea application effectively enhanced growth and yield components even at reduced NPK doses.

Table 1: Yield parameters of paddy as influenced by LCO-fortified biofertilizer and nano nitrogen management

Treatments	No. of productive tillers (m^{-2})	No. of panicles (m^{-2})	Panicle length (cm)	Grain weight (g panicle^{-1})	1000 grain weight (g)	Number of grains panicle^{-1}
T_1: 100 % Rec. NPK as per PoP	491	483	19.8	3.10	18.9	132.8
T_2: 100 % Rec. NPK + Mycorrhiza @ 10 kg ha^{-1}	506	500	20.8	3.42	19.3	148.7
T_3: 100 % Rec. NPK + LCO-fortified biofertilizer @ 10 kg ha^{-1}	543	537	21.2	3.71	19.9	163.2
T_4:100 % Rec. NPK + LCO-fortified biofertilizer @ 10 kg ha^{-1} + foliar spray of nano urea @ 0.2 % at 30 and 60 DAT	589	584	22.3	3.86	20.6	176.7
T_5: 75 % Rec. NPK + Mycorrhiza @ 10 kg ha^{-1}	497	492	20.7	3.17	19.1	143.9
T_6: 75 % Rec. NPK + LCO-fortified biofertilizer @ 10 kg ha^{-1}	513	509	21.1	3.57	19.4	157.7
T_7: 75 % Rec. NPK + LCO-fortified biofertilizer @ 10 kg ha^{-1} + foliar spray of nano urea @ 0.2 % at 30 and 60 DAT	557	551	21.3	3.78	20.1	168.6
F-test	*	*	*	*	**NS**	*
S.Em.±	**15.19**	**18.98**	**0.36**	**0.06**	**0.41**	**5.29**
CD at 5 %	**46.79**	**58.47**	**1.11**	**0.19**	**-**	**16.30**

Note: **Rec. NPK**- Recommended dose of nitrogen, phosphorus and potassium- 125: 62.5: 50 kg N: P_2O_5: K_2O ha^{-1} **PoP**- Package of practice **LCO**-Lipo-chito oligosaccharides **DAT**- Days after transplanting

The enhancement in yield attributes such as productive tillers (panicles m^{-2}), panicle length, number of grains per panicle, grain weight per panicle and 1000-grain weight can be attributed to the integrated application of LCO-fortified biofertilizer and nano nitrogen. LCO helped maintain higher chlorophyll content and delayed leaf senescence due to its cytokinin-like activity, resulting in improved photosynthetic efficiency, leaf area duration and assimilate availability (Minami *et al.*, 1996). Improved root growth and nitrogen uptake promoted better tiller initiation and survival, leading to higher productive panicles, as reported by Qiao *et al.* (2013). The hormonal regulation mediated by LCO (IAA and GA_3) reduced flower abortion and enhanced spikelet fertility, thereby increasing grains per panicle (Atti *et al.*, 2005; Chen *et al.*, 2007). Foliar application of nano urea ensured efficient nitrogen supply during reproductive stages, enhancing panicle elongation, grain filling and test weight through improved photosynthate translocation from source to sink (Jassim *et al.*, 2019; Abbas *et al.*, 2009). Similar improvements in grain weight per panicle and 1000-grain weight under combined conventional and nano nitrogen fertilization were also reported by Midde *et al.* (2022) and Sahu *et al.* (2022).

Grain yield, straw yield and harvest index of paddy

The data pertaining to grain yield, straw yield and harvest index as influenced by LCO-fortified biofertilizer and nano nitrogen are presented in Table 2 and Fig.1. Significantly higher grain yield (7056 kg ha^{-1}) and straw yield (7556 kg ha^{-1}) were recorded with application of 100 % Rec. NPK + LCO-fortified biofertilizer @ 10 kg ha^{-1} with foliar spray of nano urea @ 0.2 % at 30 and 60 DAT (T_4), which is on par with application of 75 % Rec. NPK + LCO-fortified biofertilizer @ 10 kg ha^{-1} with foliar spray of nano urea @ 0.2 % at 30 and 60 DAT (T_7) and 100 % Rec. NPK + LCO-fortified biofertilizer @ 10 kg ha^{-1} (T_3) (6616 and 7041 kg ha^{-1} respectively). The application of LCO-fortified biofertilizer and nano nitrogen on paddy harvest index was found non-significant. A slight increase in harvest index (0.49) was observed in treatment 100 % Rec. NPK + Mycorrhiza @ 10 kg ha^{-1}.

The increased grain yield, straw yield and harvest index observed with LCO-fortified biofertilizer and nano nitrogen application may be attributed to the cumulative improvement in yield attributes and enhanced physiological efficiency of the crop. Higher grain yield resulted from increased sink strength due to more productive tillers, longer panicles, higher grain number and improved grain filling, while sustained nitrogen availability promoted vegetative growth and dry matter accumulation, leading to higher straw yield (Midde *et al.*, 2022). Furthermore, delayed senescence induced by LCO facilitated efficient remobilization of assimilates from vegetative tissues to developing grains, improving partitioning efficiency and harvest index. Overall, the integrated use of LCO and nano nitrogen enhanced nutrient use efficiency, strengthened source-sink relationships and ensured sustainable improvement in both economic and biological yield of paddy (Benzon *et al.*, 2015; Sahu *et al.*, 2022).

Table 2: Grain yield, straw yield and harvest index of paddy as influenced by LCO-fortified biofertilizer and nano nitrogen management

Treatments	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Harvest index (HI)
T_1: 100 % Rec. NPK as per PoP	5032	5384	0.48
T_2: 100 % Rec. NPK + Mycorrhiza @ 10 kg ha^{-1}	5628	5886	0.49
T_3: 100 % Rec. NPK + LCO-fortified biofertilizer @ 10 kg ha^{-1}	6616	7041	0.48
T_4:100 % Rec. NPK + LCO-fortified biofertilizer @ 10 kg ha^{-1} + foliar spray of nano urea @ 0.2 % at 30 and 60 DAT	7056	7556	0.48
T_5: 75 % Rec. NPK + Mycorrhiza @ 10 kg ha^{-1}	5474	5710	0.48
T_6: 75 % Rec. NPK + LCO-fortified biofertilizer @ 10 kg ha^{-1}	5951	6710	0.47
T_7: 75 % Rec. NPK + LCO-fortified biofertilizer @ 10 kg ha^{-1} + foliar spray of nano urea @ 0.2 % at 30 and 60 DAT	6814	7273	0.48
F-test	*	*	-
S.Em.±	**211**	**273**	-
CD at 5 %	**651**	**841**	-

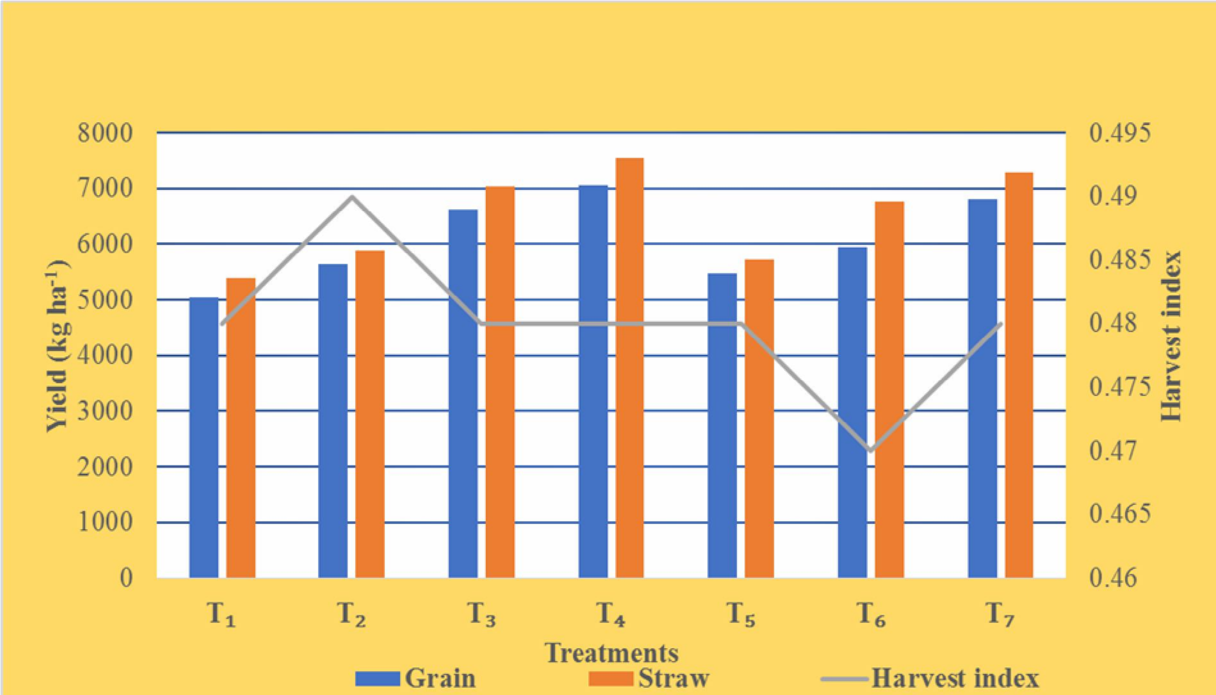

Fig. 1: Grain yield, straw yield and harvest index of rice as influenced by LCO- fortified biofertilizer and nano nitrogen management

Available nutrient status after harvest

Available nutrients in the soil after harvest as influenced by LCO-fortified biofertilizer and nano nitrogen management are presented in Table 3. Available nitrogen, phosphorus, and potassium in the soil were not significantly affected by the treatments. Higher residual soil nutrients were observed in 100% Rec. NPK as per PoP (T_1) with nitrogen, phosphorus, and potassium values of 209, 77, and 198kg ha^{-1}, respectively. Lower residual nutrients were recorded in 100% Rec. NPK + LCO-fortified biofertilizer @ 10kg ha^{-1} with foliar spray of nano urea @ 0.2% at 30 and 60 DAT (T_4), which recorded 177, 68, and 180kg ha^{-1} of nitrogen, phosphorus, and potassium, respectively. This reduction in residual soil nutrients might be due to enhanced uptake of nutrients by the paddy crop owing to improved growth and yield resulting from application of biofertilizer and foliar spray of nano urea. The increased utilization of soil P and K was also attributed to balanced nutrient supply and improved metabolic activity in the plant (Saha *et al.*, 2007; Bonkowski, 2004).

Table 3: Available nutrient status in soil after harvest of rice as influenced by LCO-fortified biofertilizer and nano nitrogen management

Treatments	Nitrogen (kg ha^{-1})	Phosphorus (kg ha^{-1})	Potassium (kg ha^{-1})
T_1: 100 % Rec. NPK as per PoP	209	77	198
T_2: 100 % Rec. NPK + Mycorrhiza @ 10 kg ha^{-1}	199	75	190
T_3: 100 % Rec. NPK + LCO-fortified biofertilizer @ 10 kg ha^{-1}	184	73	183
T_4:100 % Rec. NPK + LCO-fortified biofertilizer @ 10 kg ha^{-1} + foliar spray of nano urea @ 0.2 % at 30 and 60 DAT	177	68	180
T_5: 75 % Rec. NPK + Mycorrhiza @ 10 kg ha^{-1}	201	77	194
T_6: 75 % Rec. NPK + LCO-fortified biofertilizer @ 10 kg ha^{-1}	199	74	187
T_7: 75 % Rec. NPK + LCO-fortified biofertilizer @ 10 kg ha^{-1} + foliar spray of nano urea @ 0.2 % at 30 and 60 DAT	183	71	182
F-test	**NS**	**NS**	**NS**
S.Em.±	**11.84**	**2.59**	**6.02**
CD at 5 %	**-**	**-**	**-**

Total nutrient uptake

Total nutrient uptake (N, P, K) by paddy as influenced by the treatments is presented in Table 4. Total nitrogen, phosphorus, and potassium uptake by paddy were significantly influenced by LCO-fortified biofertilizer and nano nitrogen management. Significantly higher total nitrogen (95.99 kg ha^{-1}), phosphorus (36.54 kg ha^{-1}), and potassium (83.25 kg ha^{-1}) uptake was observed in 100% Rec. NPK + LCO-fortified biofertilizer @ 10kg ha^{-1} with foliar spray of nano urea @ 0.2% at 30 and 60 DAT (T_4). This was followed by 75% Rec. NPK + LCO-fortified biofertilizer @ 10kg ha^{-1} with foliar spray of nano urea @ 0.2% at 30 and 60 DAT (T_7) and 100% Rec. NPK + LCO-fortified biofertilizer @ 10kg ha^{-1} (T_3). Lower total uptake of nitrogen (60.76kg ha^{-1}), phosphorus (13.49kg ha^{-1}), and potassium (61.57kg ha^{-1}) was recorded in 100% Rec. NPK as per PoP (T_1). The higher nutrient uptake in treatments receiving biofertilizer and nano urea might be due to increased root growth, enhanced enzymatic activity, better metabolic efficiency, and improved translocation of nutrients from soil to plant tissues. These results indicate that combined use of LCO-fortified biofertilizer and nano nitrogen optimizes nutrient absorption and utilization in paddy, thereby improving crop productivity (Olaleye *et al.*, 2001; Sahrawat, 2000; Kumar *et al.*, 2021).

Table 4: Total nutrient uptake (N, P, K) by rice as influenced by LCO-fortified biofertilizer and nano nitrogen managemen

Treatments	Nitrogen (kg ha^{-1})	Phosphorus (kg ha^{-1})	Potassium (kg ha^{-1})
T_1: 100 % Rec. NPK as per PoP	60.76	13.49	61.57
T_2: 100 % Rec. NPK + Mycorrhiza @ 10 kg ha^{-1}	72.18	23.02	69.77
T_3: 100 % Rec. NPK + LCO-fortified biofertilizer @ 10 kg ha^{-1}	88.16	33.73	75.67
T_4:100 % Rec. NPK + LCO-fortified biofertilizer @ 10 kg ha^{-1} + foliar spray of nano urea @ 0.2 % at 30 and 60 DAT	95.99	36.54	83.25
T_5: 75 % Rec. NPK + Mycorrhiza @ 10 kg ha^{-1}	67.15	21.18	66.51
T_6: 75 % Rec. NPK + LCO-fortified biofertilizer @ 10 kg ha^{-1}	79.36	28.48	70.10
T_7: 75 % Rec. NPK + LCO-fortified biofertilizer @ 10 kg ha^{-1} + foliar spray of nano urea @ 0.2 % at 30 and 60 DAT	90.83	34.49	77.51
F-test	*	*	*
S.Em.±	**2.92**	**1.01**	**2.51**
CD at 5 %	**9.01**	**3.12**	**7.73**

Economics

Data pertaining to the economics of paddy as influenced by LCO-fortified biofertilizer and nano nitrogen management is presented in Table 5 and illustrated in Fig. 2. The economics of paddy cultivation varied with the application of different treatments. Maximum cost of cultivation (Rs. 56,697 ha^{-1}), gross returns (Rs. 1,69,144 ha^{-1}), net returns (Rs. 1,12,447 ha^{-1}), and benefit-cost (B:C) ratio (2.98) were recorded with the application of 100% Rec. NPK + LCO-fortified biofertilizer @ 10 kg ha^{-1} with foliar spray of nano urea @ 0.2% at 30 and 60 DAT (T4). This was followed by treatment 75% Rec. NPK + LCO-fortified biofertilizer @ 10kg ha^{-1} with foliar spray of nano urea @ 0.2% at 30 and 60 DAT (T7), which recorded a B:C ratio of 2.96, gross returns of Rs. 1,63,296 ha^{-1}, and net returns of Rs. 1,08,185 ha^{-1}.

Lower gross returns (Rs. 1,20,617 ha^{-1}), net returns (Rs. 67,339 ha^{-1}), and B:C ratio (2.26) were observed with 100% Rec. NPK as per PoP (T1). The enhanced gross and net returns in treatments receiving LCO-fortified biofertilizer and nano urea were attributed to higher paddy yield due to improved nutrient availability, better translocation of photosynthates, and increased grain and straw production. These results agree with Kumar *et al.* (2021), who reported improved crop productivity and profitability with foliar application of nano nitrogen and biofertilizers.

Table 5: Economics of rice as influenced by LCO-fortified biofertilizer and nano nitrogen management

Treatments	Cost of cultivation (Rs. ha^{-1})	Gross returns (Rs. ha^{-1})	Net returns (Rs. ha^{-1})	B:C
T_1: 100 % Rec. NPK as per POP	53277	120617	67339	2.26
T_2: 100 % Rec. NPK + Mycorrhiza @ 10 kg ha^{-1}	54477	134631	80154	2.47
T_3: 100 % Rec. NPK + LCO-fortified biofertilizer @ 10 kg ha^{-1}	55077	158509	103432	2.88
T_4:100 % Rec. NPK + LCO-fortified biofertilizer @ 10 kg ha^{-1} + foliar spray of nano urea @ 0.2 % at 30 and 60 DAT	56697	169144	112447	2.98
T_5: 75 % Rec. NPK + Mycorrhiza @ 10 kg ha^{-1}	52890	130517	77627	2.47
T_6: 75 % Rec. NPK + LCO-fortified biofertilizer @ 10 kg ha^{-1}	53490	143452	89962	2.68
T_7: 75 % Rec. NPK + LCO-fortified biofertilizer @ 10 kg ha^{-1} + foliar spray of nano urea @ 0.2 % at 30 and 60 DAT	55110	163296	108185	2.96

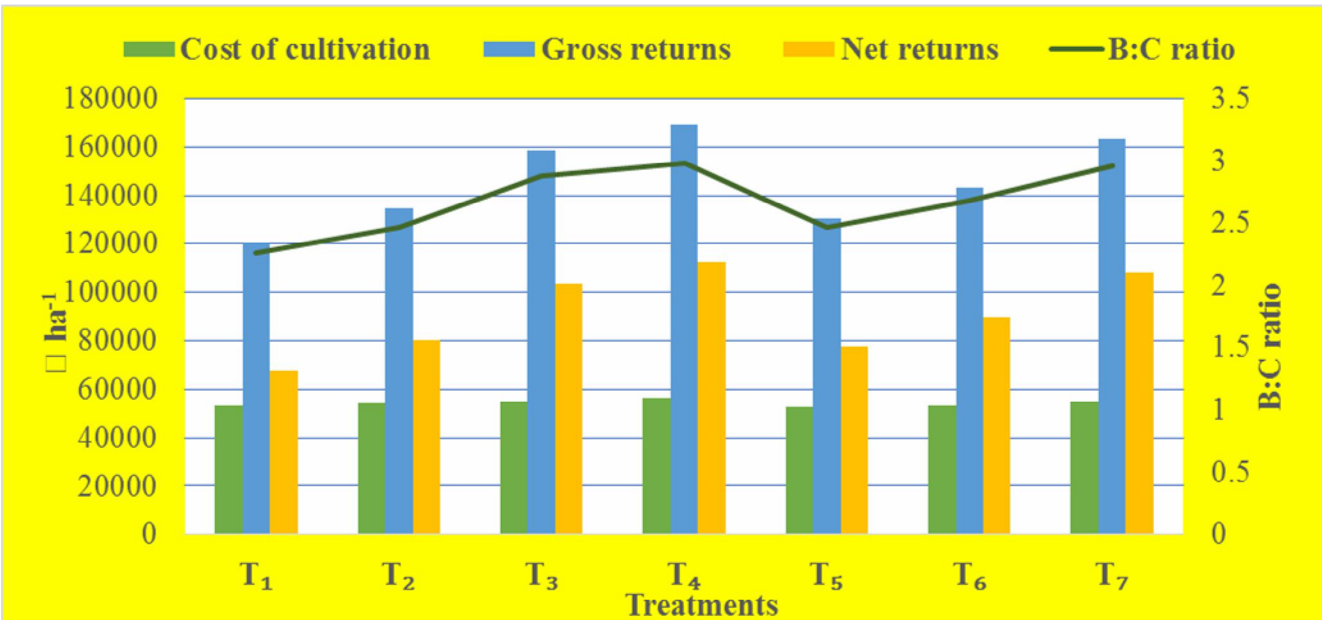

Fig. 2: Economics of rice as influenced by LCO-fortified biofertilizer and nano nitrogen management

Conclusion

The present study was carried out to understand the influence of LCO-fortified biofertilizer and nano nitrogen management on yield, nutrient uptake, and economics of paddy. From this study, it is concluded that among the different treatments, the application of 100% Rec. NPK + LCO-fortified biofertilizer @ 10kg ha^{-1} with foliar spray of nano urea @ 0.2% at 30 and 60 DAT resulted in significantly higher total nitrogen, phosphorus, and potassium uptake, higher available soil nutrient status, maximum gross and net returns, and the highest B:C ratio compared to other treatments. This indicates that combined use of LCO-fortified biofertilizer and foliar nano nitrogen enhances nutrient absorption, promotes better growth, and improves the profitability of paddy cultivation

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