

Economics of bio, organic and inorganic sources of nutrient in rice (*Oryza sativa*)–wheat (*Triticum aestivum*) cropping system

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A field experiment was conducted during 1987–88 and 1988–89 on farmers' field to evaluate the economic feasibility of different sources of nutrient in rice (*Oryza sativa* L.)–wheat (*Triticum aestivum*) cropping system at Bilaspur campus of the IGKV.

The experimental soil was neutral in reaction (pH 6.8), low in available nitrogen (233 kg/ha) and phosphorus (8.8 kg/ha) and rich in available potassium (418 kg/ha). Thirteen treatment combinations of blue green alga (BGA), farmyard manure (FYM) and chemical fertilizers (Table 1) were laid out in randomized block design with 4 replications. Seedlings of 'IR, 36' rice, @ 2–3 were transplanted at the age of 26 days in the last week of July during both the years at a spacing of 20 cm x 10 cm. The FYM contained 0.6% N, 0.2% P₂O₅ and 0.5% K₂O on dry-weight basis was incorporated 10 days before transplanting in respective plots @ 5 tonnes/ha. Full amount of P and K was given during transplanting in different treatments. Nitrogen was applied in 3 equal splits, viz. at transplanting, tillering and panicle-initiation stages. Mixed culture of BGA was applied @ 10 kg crust/ha, 7 days after transplanting in respective plots. 'Sonalika' wheat was sown

in the second week of December @ 100 kg seed/ha at a row spacing of 20 cm without disturbing the lay out in no fertilizer. All other recommended agronomic practices were followed. Economic analysis was done after taking the market values for grain and straw of rice and wheat. Cost incurred and net profit obtained were used to calculate benefit : cost ratio.

The higher net return of Rs. 935–1,388/ha in BGA and Rs 692–1,059/ha in FYM was obtained compared with the control (Table 1). The lower cost of applied BGA (Rs 50/ha) and FYM (Rs 230/ha) and significantly higher yield of rice than in the control (Rathore *et al.* 1995) contributed towards higher net profit from these inputs (Table 2). Increased net returns were obtained with increasing fertilizer levels in BGA- and FYM-treated plots because of increase in the crop yields which more than compensate the cost of fertilizer. The maximum net return was obtained from FYMF5, followed by BGAF5, BGAF4, FYMF4 and BGAF3 treatments during 1987–88, whereas the same was recorded in BGAF4 followed by BGAF5, BGAF3, BGAF4, and FYMF5 treatments during 1988–89. On an average the treatments of BGAF4, BGAF5,

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Table 1. Net returns (Rs/ha) in rice and wheat alone and in cropping sequence as affected by treatment applied to rice

Treatment	Net return (Rs/ha)								
	Rice			Wheat			Rice-wheat sequence		
	1987-88	1988-89	Mean	1987-88	1988-89	Mean	1987-88	1988-89	Mean
Control	2,117	4,945	3,081	1,288	1,793	1,541	3,405	5,838	4,622
BGA	3,052	5,433	4,242	1,697	2,479	2,083	4,749	7,912	6,331
FYM	2,809	5,104	3,957	1,648	2,371	2,010	4,457	7,475	5,966
BGA F1	3,906	7,688	5,797	1,929	2,838	2,384	5,835	10,526	8,181
FYM F1	3,837	6,831	5,334	1,914	3,048	2,481	5,755	9,879	7,817
BGA F2	4,877	8,103	6,490	2,211	3,316	2,764	7,088	11,419	9,254
FYM F2	4,759	7,963	6,361	2,028	3,182	2,605	6,787	11,145	8,966
BGA F3	5,445	8,882	7,164	2,186	3,198	2,692	7,631	12,080	9,855
FYM F3	5,358	8,788	7,073	2,198	3,219	2,709	7,556	12,007	9,782
BGA F4	5,448	8,998	7,223	2,178	3,020	2,599	7,626	12,018	9,822
FYM F4	5,446	8,836	7,141	2,263	3,255	2,759	7,709	12,091	9,900
BGA F5	5,449	8,907	7,178	2,121	2,956	2,539	7,240	11,863	9,552
FYM F5	5,454	8,800	7,127	2,291	3,276	2,784	7,745	12,076	9,910

BGA, Blue green algae; BGAF1, blue green algae + 20 kg N + 15 Kg P₂O₅, 7.5 kg K₂O/ha; BGAF2, blue green algae + 40 kg N + 30 Kg P₂O₅, 15 kg K₂O/ha; BGAF3, blue green algae + 60 kg N + 37.5 Kg P₂O₅, 22.5 kg K₂O/ha; BGAF4, blue green algae + 80 kg N + 50 Kg P₂O₅, 30 kg K₂O/ha; BGAF5, blue green algae + 100 kg N + 62.5 Kg P₂O₅, 37.5 kg K₂O/ha; FYM, farmyard manure; FYMF1, farmyard manure + 20 kg N + 15 Kg P₂O₅, 7.5 kg K₂O/ha; FYMF2, farmyard manure + 40 kg N + 30 Kg P₂O₅, 15 kg K₂O/ha; FYMF3, farmyard manure + 60 kg N + 37.5 Kg P₂O₅, 22.5 kg K₂O/ha; FYMF4, farmyard manure + 80 kg N + 50 Kg P₂O₅, 30 kg K₂O/ha; FYMF5, farm-yard manure + 100 kg N + 62.5 Kg P₂O₅, 37.5 kg K₂O/ha

Table 2. Benefit : cost ratio and additional returns in rice and wheat in relation to various treatments applied to rice

Treatment	Benefit : cost ratio						Additional cost and returns over control*				
	Rice			Wheat			Rice		Wheat	Rice + wheat	
	Y ₁	Y ₂	Mean	Y ₁	Y ₂	Mean	Cost	Income	In- come	In- come	Increase (%) over control
Control	0.48	0.89	0.68	0.77	0.72						
BGA	0.70	1.18	0.94	0.86	1.06	0.96	49	1,162	517	1,679	36.3
FYM	0.61	1.07	0.84	0.84	1.01	0.92	234	875	439	1,315	28.5
BGA F1	0.86	1.61	1.23	0.98	1.18	1.08	231	2,716	767	3,483	75.4
FYM F1	0.81	1.38	1.09	0.98	1.31	1.14	416	2,253	912	3,165	68.5
BGA F2	1.03	1.63	1.33	1.18	1.42	1.3	413	3,409	1,238	4,647	100.5
FYM F2	0.97	1.55	1.26	1.07	1.34	1.2	598	3,280	1,029	4,309	93.2
BGA F3	1.11	1.73	1.42	1.15	1.34	1.24	595	4,083	1,109	5,192	112.3
FYM F3	1.05	1.65	1.35	1.16	1.38	1.27	780	3,992	1,168	5,160	111.6
BGA F4	1.08	1.69	1.38	1.12	1.26	1.19	777	4,142	999	5,141	111.2
FYM F4	1.04	1.60	1.32	1.21	1.39	1.30	962	4,060	1,227	5,287	114.4
BGA F5	1.04	1.61	1.32	1.12	1.16	1.14	959	4,097	868	4,965	107.4
FYM F5	1.00	1.54	1.27	1.23	1.41	1.32	1,144	4,046	1,265	5,311	114.9

Details of treatments are given in Table 2; Fixed cost (Rs/ha): rice, 4,388; wheat, 2,050; Mean data of 2 years; Y₁, 1987-88; Y₂, 1988-89

FYMF4, FYMF5, BGAF3 and FYMF3 had less differences in net returns (Rs 45–153/ha) amongst each other and are equally economical. The benefit : cost ratio was also higher in BGAF3 (1.42) and FYMF3 (1.35) treatments (Table 2). The beneficial effect of BGA and FYM to rice was also reported by Yushistier *et al.* (1987) and Sahu *et al.* (1982).

The residual effect of BGA and FYM on succeeding wheat was found economical and gave an extra income of Rs 439–517/ha than from the control. The residual effects of all the fertilizer dose with BGA and FYM did not have marked variation but the income was higher than from only BGA, FYM application and the control. The result confirms the findings of Venkataraman (1982) and Singh (1983). The benefit; cost ratio was higher in the residues of FYMF5 treatment, but all fertilizer residues did not have remarkable variations during both the years.

The extra net income of Rs 1,679/ha in BGA and Rs 1,315/ha in FYM over the control was obtained in rice–wheat cropping system. The highest net income of Rs 7,782/ha in 1987–88 and Rs 12,091/ha during 1988–89 from rice–wheat sequence was recorded in FYMF5 and FYMF4 in the respective years. The decreasing order of net profits were in FYMF4 and BGAF3 during 1987–88 and FYMF5 and FYMF3 in 1988–89. On an average, the net income obtained

from FYMF5, FYMF4, FYMF3, BGAF4 and BGAF3 did not show much differences amongst themselves. Hence it can be concluded that the residual effect of fertilizers with BGA of FYM did not contribute much to bring variations in economics of rice–wheat sequence may be due to less carry-over effect of applied fertilizers on yield of succeeding wheat. Fertilizer dose of 60 kg N + 37.5 kg P₂O₅ + 22.5 kg K₂O/ha with BGA or FYM was found most economical in rice–wheat cropping systems under the experimental conditions.

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