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RESEARCH PAPER

Yield, nutrient uptake and quality of wheat (*Triticum aestivum* L.) as affected by fertility levels and biofertilizers and their residual effect on fodder maize (*Zea mays* L.) under Southern Rajasthan condition

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Abstract : A field experiment was conducted during the *Rabi* seasons of 2003-04 and 2004-05 at Udaipur, Rajasthan, to find out a suitable combination of chemical and organic nutritional sources for wheat (*Tritium aestivum* L.) grown with 9 fertility levels (100 % RDF, vermicompost 1.50 and 3.00 t ha^{-1}, vermicompost 1.50 and 3.00 t alongwith 50, 75 and 100 % RDF) in main plots and three biofertilizers (Control, *Azospirillum*, *Azospirillum* + PSB) in sub plots. Wheat crop under vermicompost 3.00 t ha^{-1} + 100 % RDF recorded significantly higher grain (4.96 t ha^{-1}), straw (6.46 t ha^{-1}) and biological (11.42 t ha^{-1}) yields, N, P, and K uptake and protein content over vermicompost 1.50 and 3.00 t ha^{-1}, respectively. This treatment also recorded the maximum green (25.43 t ha^{-1}) and dry fodder (8.40 t ha^{-1}) yield of residual fodder maize. Seed inoculation of *Azospirillum* + PSB recorded significantly higher grain (4.92 t ha^{-1}), straw (6.38 t ha^{-1}) and biological yield (11.30 tha^{-1}) over *Azospirillum* and control. *Azosirillum* + PSB also recorded significantly higher residual fodder maize (26.25 and 8.12 t ha^{-1} green as well as dry fodder yield) over control.

Key Words : Wheat, Fertility levels, Vermicompost, Nutrient uptake, Protein content, Fodder maize, Yield

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INTRODUCTION

Wheat (*Triticum aestivum* L.) being the second largest food crop of India , is grown over an area of around 27 mha with the total production of 76.80 mt in 2007-08 (Yojna. 2008). Wheat is responsible for the success story of 'green revolution' as its productivity increased many folds due to availability of inputs responsive high yielding varieties of the crop. Though there are several inputs which made it possible to raise the productivity of wheat but fertilizer is the main contributor and responsible for about 40 per cent of increased productivity of wheat. Plant nutrient management is one of the key component of intensive agriculture. The chemical fertilizers, no doubt, are the important source, which can meet the nutrient requirements but their unbalanced and continuous use lead to environmental pollution and deterioration of soil physico-chemical properties, furthermore, the availability of fertilizer at economic price is another problem for the country, under these circumstances one should not depend on single source of plant nutrients like chemical fertilizers. The need of the hour is to evolve an integrated plant nutrient supply system comprising balanced use of chemical fertilizer, organic manures and bio-fertilizers. An experiment was, therefore, planned to find out the effect of fertilizer levels, vermicompost and biofertilizer on productivity and quality of wheat and their residual effect on fodder maize.

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MATERIALS AND METHODS

The field experiment was conducted during consecutive *Rabi* seasons of 2003-04 and 2004-05 at the Instructional Farm, Rajasthan College of Agriculture, Udaipur. The soil of the experimental site was clay loam in texture having pH 8.4 and 8.2 and organic carbon (0.68 and 0.69 %), during *Rabi* 2003-04 and 2004-05, respectively. The available N, P_2O_5 and K_2O in soil were 289 and 278, 28.00 and 29.50 and 328 and 310 kg ha^{-1}, respectively. The experiment comprised of 27 treatment combinations, which consisted of nine fertilizer levels *viz.*, T_1 =RDF (recommended dose of fertilizers for wheat is 80 kg N and 35 kg P_2O_5 ha^{-1}), T_2 = vermicompost at 1.50 t ha^{-1}, T_3 = vermicompost at 3.00 t ha^{-1}, T_4= vermicompost at 1.50 t ha^{-1} + 50 % RDF, T_5= vermicompost at 1.50 t ha^{-1} + 75 % RDF, T_6= vermicompost at 1.50 t ha^{-1} + RDF, T_7=vermicompost at 3.00 t ha^{-1} + 50 % RDF, T_8=vermicompost at 3.00 t ha^{-1} + 75 % RDF and T_9=vermicompost at 3.00 t ha^{-1} + RDF) in main plots and three biofertilizers inoculation (control, *Azospirillum* and *Azospirillum* + PSB) in sub plots replicated thrice. Wheat variety Raj.3765 was sown on 26th and 25th November during 2003 and 2004, respectively. The crop was sown using seed rate 125 kg ha^{-1}at 22.50 cm apart row spacing. Crop received no rains during both the years of experimentation. Crop was harvested at physiological maturity. After harvesting of wheat, each experimental plot was prepared manually without disturbing original plan of layout. Maize (Ganga 2) was sown at 22.5 cm and at a depth of 5-6 cm after seed treatment with captan at 2 g kg^{-1} seed, using 30 kg seed ha^{-1}. Nitrogen was applied through urea at 80 kg N ha^{-1} in two equal splits first at sowing and second at second irrigation. Four irrigations were given to the crop. Harvesting of green fodder maize was done 65 days after sowing *i.e.* at tasselling stage of crop and fodder was weighed from individual plots separately.

RESULTS AND DISCUSSION

The experimental findings obtained from the present study have been discussed in following heads:

Effect on yield :

Over the seasons, fertility levels had significant influence on grain, straw and biological yield of wheat. The data presented in Table 1 reveal that application of vermicompost 3.00 t ha^{-1} + RDF produced maximum grain (4.96 tha^{-1}), straw (6.46 t ha^{-1}) and biological (11.42 t ha^{-1}) yield which was found significantly higher over vermicompost 1.50 t ond 3.00 t ha^{-1} alone. The magnitude of per cent increases with application of vermicompost 3.00 t ha^{-1} + RDF were of the order of 49.40 and 27.84, 45.17 and 26.42 and 46.98 and 27.03, respectively over alone application of vermicompost at 1.50 and 3.00 t ha^{1}.

Seed inoculation of *Azospirillum* + PSB and sole application of *Azospirillum* significantly recorded higher grain,

Table 1: Effect of fertility levels and biofertilizers on yields and protein content of wheat

Treatments	Yield (t ha^{-1}) Grain			Straw			Biological			Protein content (%)		
	2003 -04	2004 -05	Pooled	2003 -04	2004 -05	Pooled	2003 -04	2004 -05	Pooled	2003 -04	2004 -05	Pooled
Fertility levels												
RDF 100 %	4.52	4.64	4.58	6.11	6.26	6.18	10.63	10.90	10.76	11.05	11.17	11.11
Vermicompost 1.5 t ha^{-1}	3.25	3.40	3.32	4.34	4.56	4.45	7.59	7.95	7.77	8.58	8.68	8.63
Vermicompost 3.0 t ha^{-1}	3.81	3.40	3.88	5.02	5.19	5.11	8.83	9.15	8.99	8.61	8.69	8.65
Vermicompost 1.5 t ha^{-1} + 50 % RDF	3.92	4.06	3.99	5.17	5.32	5.25	9.09	9.39	9.24	8.85	8.98	8.92
Vermicompost 1.5 t ha^{-1} + 75 % RDF	4.86	5.01	4.94	6.29	6.43	6.36	11.16	11.43	11.30	10.82	10.91	10.87
Vermicompost 1.5 t ha^{-1} + 100 % RDF	4.88	5.02	4.95	6.38	6.49	6.44	11.26	11.52	11.39	10.97	11.02	11.00
Vermicompost 3.0 t ha^{-1} + 50 % RDF	4.28	4.41	4.35	5.59	5.75	5.67	9.87	10.16	10.02	9.64	9.67	9.66
Vermicompost 3.0 t ha^{-1} + 75 % RDF	4.83	5.02	4.96	6.35	6.44	6.40	11.24	11.46	11.35	10.81	10.91	10.86
Vermicompost 3.0 t ha^{-1} + 100 % RDF	4.90	5.03	4.96	6.39	6.52	6.46	11.29	11.55	11.42	11.03	11.15	11.09
CD (P=0.05)	0.48	0.43	0.31	0.66	0.72	0.47	0.72	0.77	0.51	0.518	0.600	0.393
Biofertilizers												
Control	3.92	4.06	3.99	5.16	5.33	5.25	9.09	9.39	9.24	9.30	9.38	9.34
Azospirillum	4.33	4.47	4.40	5.73	5.88	5.81	10.06	10.35	10.20	9.83	9.95	9.89
Azospirillum + PSB	4.85	4.99	4.92	6.32	6.44	6.38	11.17	11.43	11.30	10.70	10.77	10.74
CD (P=0.05)	0.21	0.216	0.15	0.27	0.29	0.19	0.36	0.39	0.26	0.252	0.246	0.201

straw and biological yield over control during both the years of the study. On pooled basis, the corresponding increases were to the tune of 23.27 and 11.92, 21.66 and 9.90 and 22.37 and 10.77, respectively.

Effect on protein content in grain :

Protein content of wheat grain significantly influenced by fertilizer application during the both the years of experimentation (Table 1). On pooled basis, RDF recorded maximum (11.11 %) protein content, which was found at par with vermicompost 1.50 and 3.00 t ha^{-1} along with 75 % and RDF of chemical fertilizers and found significantly superior over rest of the treatments. Data further revealed that seed inoculation of *Azospirillum* and *Azospirillum* + PSB significantly recorded higher protein content over control and registering 5.89 and 14.99 per cent on pooled basis.

Effect on N, P and K uptake :

Application of vermicompost 3.00 t ha^{-1} + RDF brought about significantly higher NPK uptake by grain, straw and total NPK uptakeby wheat crop after harvest over vermicompost 1.50 and 3.00 t ha^{-1}. It was found to be at par with vermicompost 1.5 tha^{-1} alongwith 50 and 75 % RDF and vermicompost 3.00 t ha^{-1} + 75 % RDF. The corresponding increases were by 115.50, 109.25 and 114.12 in N uptake; 118.01, 111.91 and 116.22 in phosphorus uptake and 54.39, 49.64 and 50.57 in potassium uptake, respectively over vermicompost 1.50 t $ha^{-1}$by grain , straw and total uptake by the wheat crop on pooled basis. Seed inoculation of *Azospirillum* and dual inoculation of *Azospirillum* + PSB significantly recorded higher NPK uptake by grain, straw and total uptake over control. Application of *Azospirillum* + PSB significantly recorded 44.00, 42.20 and 43.61 per cent in nitrogen uptake; 43.62, 42.11 and 43.19 per cent in phosphorus uptake and 26.85, 24.91 and 25.30 per cent in potassium uptake by grain, straw and total uptake, respectively.

The positive response of vermicompost with chemical fertilizers *viz.*, nitrogen and phosphorus on yield could be ascribed to over all improvement in the crop growth due to better nutritional environment, enabling the plants to absorb more nutrients as is evident from the enhanced content and uptake of nutrients. An increase in uptake of plant nutrients empowered the plant to manufacture more quantity of photosynthates, accumulating them in reproductive parts. The nutrient uptake by crop is largely dependent on dry matter accumulation, nutrient concentration in plant and available nutrient status of the soil. The uptake in grain and straw and total uptake of NPK increased in the aforesaid treatments because of higher availability of these nutrients and higher biomass yield. Similar results have also been reported by Thakur *et al*. (1990), Verma *et al*. (2002), Jat *et al*. (2006) and Sarma *et al*. (2007).

Significant improvement in grain yield under dual inoculation could be ascribed to the fact that yield of crop is function of several yield components which are dependent on complementary interaction between vegetative and reproductive growth of crop. Further, in preceding paragraphs it has been well emphasized that dual inoculation played vital

Table 2 : Effect of fertility levels and biofertilizers on nitrogen, phosphorus and potassium uptake by grain, straw and total wheat (pooled of 2003-04 and 2004-05)

Treatments	Nutrient uptake (kg ha^{-1})								
	Nitrogen			Phosphorus			Potassium		
	Grain	Straw	Total	Grain	Straw	Total	Grain	Straw	Total
Fertility levels									
RDF 100 %	81.92	23.29	105.21	14.55	5.62	20.17	18.05	73.23	91.27
Vermicompost 1.5 t ha^{-1}	41.17	11.67	52.84	7.22	2.77	9.99	12.76	51.57	64.33
Vermicompost 3.0 t ha^{-1}	53.78	15.20	68.99	9.70	3.57	13.27	14.97	59.11	74.08
Vermicompost 1.5 t ha^{-1} + 50 % RDF	57.02	16.07	73.09	10.26	3.79	14.05	15.58	60.89	76.47
Vermicompost 1.5 t ha^{-1} + 75 % RDF	86.66	23.75	110.41	15.39	5.59	20.98	19.44	74.88	94.32
Vermicompost 1.5 t ha^{-1} + 100 % RDF	87.82	24.25	112.07	15.61	5.77	21.38	19.64	76.63	96.27
Vermicompost 3.0 t ha^{-1} + 50 % RDF	67.41	18.97	86.38	12.04	4.49	16.53	16.80	66.78	83.58
Vermicompost 3.0 t ha^{-1} + 75 % RDF	86.88	23.88	110.76	15.68	5.68	21.35	19.46	75.66	95.12
Vermicompost 3.0 t ha^{-1} + 100 % RDF	88.72	24.42	113.14	15.74	5.87	21.60	19.70	77.17	96.86
C.D. (P=0.05)	5.13	1.89	5.310	1.089	0.453	1.192	1.705	6.187	6.430
Biofertilizers									
Control	60.13	16.80	76.93	10.73	3.99	14.72	15.42	60.97	76.39
Azospirillum	70.40	19.82	90.22	12.59	4.72	17.31	17.15	68.17	85.32
Azospirillum + PSB	86.59	23.89	110.48	15.41	5.67	21.08	19.56	76.16	95.72
C.D. (P=0.05)	2.78	.810	2.970	0.527	0.189	0.585	0.781	2.655	2.886

role in improving three major aspects of yield determination *i.e.* formation of vegetative structure for higher photosynthesis, strong sink strength through development of reproductive structure and production of assimilates to fill economically important sink. The significant increase in straw yield under dual inoculation of *Azospirllum* + PSB seems to be due to their direct effect in improving biomass plant^{-1}, while indirect effect might be on account of increase in morphological parameters. Further, biological yield is a function of grain and straw yield. The profound influence of dual inoculation of biofertilizer on both these events have been mediated *via* higher photosynthetic efficiency and nutrients accumulation which ultimately led to production of higher biological yield. Sarma *et al.* (2007) also reported same findings.

Effect on yield and nutrient uptake by residual fodder maize:

Application of vermicompost at 3.00 t ha^{-1} +RDF being at par with vermicompost at 1.50 t ha^{-1} + 75 % RDF and RDF and vermicompost at 3.00 t ha^{-1} + 75 %RDF recorded significantly higher green and dry fodder, nitrogen and phosphorus uptake by residual fodder maize and by wheat + fodder maize system than remaining levels.

Significantly higher green and dry fodder yield, nitrogen and phosphorus uptake by residual maize and N and P uptake by wheat + fodder maize were recorded under seed treatment with *Azospirllum* + PSB (Table 3 and 4). On pooled basis, respective seed treatment with *Azospirllum* and *Azospirllum* + PSB resulted in 13.56 and 29.35, 8.56 and 19.89, 14.98 and 28.37, 17.58 and 38.73, 16.03 and 35.39 and 17.59 and 40.85 per cent higher green and dry fodder yield, nitrogen and phosphorus uptake by residual maize and N and P uptake by wheat + fodder maize over control.

Nitrogen and phosphorus balance sheet :

Balance sheet over the wheat- green fodder maize system (Table 5 and 6) revealed that all the applied treatments to wheat crop decreased negative balance of nitrogen and phosphorus after harvest of both the crops except application of vermicompost at 3.00 t ha^{-1} + RDF in nitrogen during 2005.

Data in Table 5 and 6 further revealed that after harvest of wheat – green fodder maize crop shows that seed treatment with *Azospirillum* + PSB reduced negative balance of nitrogen and phosphorus than control during both the years of study.

Economics :

The highest net returns and B: C ratio were observed in vermicompost at 1.50 t ha^{-1} + 75% RDF in wheat and wheat + fodder maize during both the years as well as on pooled basis (Table 7). Seed inoculation with *Azospirillum* + PSB recorded maximum net returns and B:C ratio in wheat (Rs. 38374 ha^{-1} and 3.17) and wheat + fodder maize system (Rs.59020 ha^{-1} and

Table 3 : Effect of fertility levels and biofertilizers on residual fodder maize yield and nutrient uptake by fodder maize

Treatments	Fodder maize yield (q ha^{-1})						Uptake by fodder maize (kg ha^{-1})					
	Green			Dry			Nitrogen			Phosphorus		
	2003-04	2004-05	Pooled	2003-04	2004-05	Pooled	2003-04	2004-05	Pooled	2003-04	2004-05	Pooled
Fertility levels												
RDF 100 %	23.30	23.78	23.54	7.85	8.29	8.07	114.59	114.94	114.77	20.71	23.02	21.86
Vermicompost 1.5 t ha^{-1}	18.07	18.75	18.41	5.40	5.82	5.61	61.77	71.31	66.54	10.43	11.41	10.92
Vermicompost 3.0 t ha^{-1}	19.40	20.00	19.70	5.75	6.23	5.99	67.18	78.45	72.81	11.49	13.08	12.29
Vermicompost 1.5 t ha^{-1} + 50 % RDF	22.13	22.70	22.42	6.52	7.07	6.80	81.64	93.70	87.67	14.07	16.31	15.19
Vermicompost 1.5 t ha^{-1} + 75 % RDF	25.01	25.36	25.18	7.80	8.27	8.04	108.35	121.68	115.02	20.83	23.39	22.11
Vermicompost 1.5 t ha^{-1} + 100 % RDF	25.14	25.57	25.36	7.97	8.46	8.21	113.05	126.36	119.71	21.51	24.15	22.83
Vermicompost 3.0 t ha^{-1} + 50 % RDF	23.09	23.66	23.38	7.03	7.60	7.32	95.04	108.79	101.91	16.62	19.42	18.02
Vermicompost 3.0 t ha^{-1} + 75 % RDF	25.09	25.68	25.39	8.05	8.56	8.30	117.75	128.47	123.11	21.90	24.70	23.30
Vermicompost 3.0 t ha^{-1} + 100 % RDF	25.11	25.75	25.43	8.11	8.70	8.40	120.27	132.42	126.35	22.16	25.31	23.73
CD (P=0.05)	2.58	2.34	1.67	0.70	0.76	0.50	13.48	10.16	8.11	1.49	2.81	1.53
Biofertilizers												
Control	20.05	20.54	20.30	6.55	7.00	6.77	85.98	94.18	90.08	14.94	16.92	15.93
Azospirillum	22.75	23.34	23.05	7.05	7.66	7.35	97.14	110.01	103.58	17.45	20.00	18.73
Azospirillum + PSB	25.97	26.54	26.25	7.89	8.35	8.12	110.10	121.17	115.64	20.85	23.34	22.10
CD (P=0.05)	1.35	1.23	0.72	0.37	0.34	0.25	7.00	4.92	4.21	0.72	1.09	0.64

Table 4 : Effect of fertility levels and biofertilizers on uptake by fodder maize + wheat (kg ha^{-1})

Treatments	Nitrogen			Phosphorus		
	2003-04	2004-05	Pooled	2003-04	2004-05	Pooled
Fertility levels						
RDF 100 %	217.39	222.56	219.98	40.16	43.90	42.03
Vermicompost 1.5 t ha^{-1}	112.88	125.87	119.37	19.78	22.05	20.92
Vermicompost 3.0 t ha^{-1}	134.30	149.30	141.80	24.09	27.03	25.56
Vermicompost 1.5 t ha^{-1} + 50 % RDF	152.75	168.76	160.76	27.42	31.04	29.23
Vermicompost 1.5 t ha^{-1} + 75 % RDF	216.46	234.40	225.43	41.06	45.12	43.09
Vermicompost 1.5 t ha^{-1} + 100 % RDF	223.02	240.54	231.78	42.08	46.34	44.21
Vermicompost 3.0 t ha^{-1} + 50 % RDF	179.57	197.02	188.29	32.43	36.58	34.55
Vermicompost 3.0 t ha^{-1} + 75 % RDF	226.42	241.31	233.87	42.49	46.82	44.66
Vermicompost 3.0 t ha^{-1} + 100 % RDF	231.08	247.89	239.48	42.99	47.59	45.34
C.D. (P=0.05)	15.32	14.41	10.10	2.77	3.90	2.30
Biofertilizers						
Control	161.00	173.03	167.01	28.99	32.31	30.65
Azospirillum	185.14	202.44	193.79	34.02	38.05	36.04
Azospirillum – PSB	218.48	233.75	226.11	41.15	45.20	43.17
C.D. (P=0.05)	8.88	7.55	5.73	1.13	1.64	0.98

Table 5 : Effect of fertility levels and biofertilizers on available nitrogen (kg ha^{-1}) in soil after crop harvest

Treatments	Initial (A)		N added (B)		N uptake (C)		Expected nutrient D= (A+B)-C		Actual nutrient E		Apparent gain/loss F=(E-D)		Actual gain/loss G=(E-A)	
	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
Fertility levels														
RDF 100%	289.00	278.00	80.00	80.00	217.39	222.56	151.61	135.44	283.21	274.03	131.61	138.59	-5.79	-3.97
Vermicompost 1.5 t ha^{-1}	289.00	278.00	80.00	80.00	112.88	125.87	256.12	232.13	241.76	239.35	-14.36	7.22	-47.24	-38.65
Vermicompost 3.0 t ha^{-1}	289.00	278.00	80.00	80.00	134.30	149.30	234.70	208.70	248.32	236.42	13.61	27.72	-40.68	-41.58
Vermicompost 1.5 t ha^{-1} + 50 % RDF	289.00	278.00	80.00	80.00	152.75	168.76	216.25	189.24	252.37	253.58	36.12	64.34	-36.63	-24.42
Vermicompost 1.5 t ha^{-1} + 75 % RDF	289.00	278.00	80.00	80.00	216.46	234.40	152.54	123.60	282.85	273.80	130.31	150.20	-6.15	-4.20
Vermicompost 1.5 t ha^{-1} + RDF	289.00	278.00	80.00	80.00	223.02	240.54	145.98	117.46	284.80	276.70	138.82	159.24	-4.20	-1.30
Vermicompost 3.0 t ha^{-1} + 50 % RDF	289.00	278.00	80.00	80.00	179.57	197.02	189.43	160.98	282.13	271.40	92.69	110.42	-6.87	-6.60
Vermicompost 3.0 t ha^{-1} + 75 % RDF	289.00	278.00	80.00	80.00	226.42	241.31	142.58	116.69	283.10	274.31	140.53	157.62	-5.90	-3.69
Vermicompost 3.0 t ha^{-1} + RDF	289.00	278.00	80.00	80.00	231.08	247.89	137.92	110.11	286.38	278.89	148.46	168.78	-2.62	0.89
Biofertilizers														
Control	289.00	289.00	80.00	80.00	161.00	173.03	208.00	195.97	267.28	258.90	59.27	62.93	-21.72	-30.10
Azospirillum	289.00	289.00	80.00	80.00	185.14	202.44	183.86	166.56	273.54	266.58	89.68	100.03	-15.46	-22.42
Azospirillum + PSB	289.00	289.00	80.00	80.00	218.48	233.75	150.52	135.25	274.16	267.34	123.64	132.09	-14.84	-21.66

Table 6 : Effect of fertility levels and biofertilizers on available phosphorus (kg ha^{-1}) in soil after crop harvest

Treatments	Initial (A)		P added (B)		P uptake (C)		Expected nutrient D− (A+B)-C		Actual nutrient E		Apparent gain/ loss F−(E-D)		Actualgain/ loss G−(E-A)	
	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
Fertility levels														
RDF 100%	28.00	29.50	17.20	17.20	40.16	43.90	5.04	2.80	25.02	26.26	19.97	23.46	-2.98	-3.24
Vermicompost 1.5 t ha^{-1}	28.00	29.50	17.20	17.20	19.78	22.05	25.42	24.65	18.03	23.20	-7.39	-1.45	-9.97	-6.30
Vermicompost 3.0 t ha^{-1}	28.00	29.50	17.20	17.20	24.09	27.03	21.11	19.67	21.40	24.84	0.29	5.17	-6.60	-4.66
Vermicompost 1.5 t ha^{-1} + 50 % RDF	28.00	29.50	17.20	17.20	27.42	31.04	17.78	15.66	22.27	25.42	4.50	9.77	-5.73	-4.08
Vermicompost 1.5 t ha^{-1} + 75 % RDF	28.00	29.50	17.20	17.20	41.06	45.12	4.14	1.58	24.30	26.80	20.16	25.22	-3.70	-2.70
Vermicompost 1.5 t ha^{-1} + RDF	28.00	29.50	17.20	17.20	42.08	46.34	3.12	0.36	25.16	26.94	22.05	26.59	-2.84	-2.56
Vermicompost 3.0 t ha^{-1} + 50 % RDF	28.00	29.50	17.20	17.20	32.43	36.68	12.77	10.02	24.35	25.42	11.57	15.40	-3.65	-4.08
Vermicompost 3.0 t ha^{-1} + 75 % RDF	28.00	29.50	17.20	17.20	42.49	46.82	2.71	-0.12	25.61	27.42	22.89	27.55	-2.39	-2.08
Vermicompost 3.0 t ha^{-1} + RDF	28.00	29.50	17.20	17.20	42.99	47.69	2.21	-0.99	26.08	28.28	23.86	29.27	-1.92	-1.22
Biofertilizers														
Control	28.00	29.50	17.20	17.20	28.99	32.31	16.21	14.39	22.85	25.44	6.64	11.06	-5.15	-4.06
Azospirillum	28.00	29.50	17.20	17.20	34.02	38.05	11.18	8.65	23.72	26.15	12.54	17.50	-4.28	-3.35
Azospirillum + PSB	28.00	29.50	17.20	17.20	41.15	45.20	4.05	1.50	24.17	26.61	20.12	25.10	-3.83	-2.89

Table 7: Effect of fertility levels and biofertilizers on economics of crops

Treatments	Net returns (Rs. ha^{-1})						Benefit-cost ratio					
	Wheat			Wheat+fodder maize			Wheat			Wheat+fodder maize		
	2003-04	2004-05	Pooled	2003-04	2004-05	Pooled	2003-04	2004-05	Pooled	2003-04	2004-05	Pooled
Fertility levels												
RDF 100%	34937	37044	35991	52923	55464	54194	3.15	3.25	3.20	3.76	3.86	3.81
Vermicompost 1.5 t ha^{-1}	22430	24528	23479	35709	38425	37067	2.12	2.26	2.19	2.63	2.77	2.70
Vermicompost 3.0 t ha^{-1}	27013	29187	28100	41490	44207	42848	2.32	2.45	2.39	2.84	2.97	2.90
Vermicompost 1.5 t ha^{-1} + 50 % RDF	28437	30554	29495	45371	48005	46688	2.50	2.62	2.56	3.16	3.28	3.22
Vermicompost 1.5 t ha^{-1} + 75 % RDF	37478	39799	38639	57003	59643	58323	3.19	3.30	3.25	3.87	3.97	3.92
Vermicompost 1.5 t ha^{-1} + RDF	37302	39640	38471	56944	59675	58310	3.07	3.19	3.13	3.77	3.87	3.82
Vermicompost 3.0 t ha^{-1} + 50 % RDF	30981	33115	32048	48781	51428	50104	2.50	2.61	2.55	3.17	3.28	3.22
Vermicompost 3.0 t ha^{-1} + 75 % RDF	36740	38870	37805	56342	59002	57672	2.87	2.97	2.92	3.57	3.67	3.62
Vermicompost 3.0 t ha^{-1} + RDF	36435	38696	37566	56056	58885	57471	2.76	2.87	2.82	3.47	3.58	3.52
CD (P=0.05)	3979	3731	2620	4676	4816	3225	0.345	0.307	0.221	0.318	0.322	0.217
Biofertilizers												
Control	27952	30032	28992	43019	45535	44277	2.36	2.47	2.42	2.90	3.01	2.95
Azospirillum	32071	34260	33166	49568	52289	50928	2.69	2.81	2.75	3.33	3.44	3.39
Azospirillum + PSB	37228	39519	38374	57619	60421	59020	3.11	3.22	3.17	3.86	3.97	3.91
CD (P=0.05)	1867	1979	1337	1931	1819	1304	0.156	0.161	0.110	0.130	0.119	0.087

3.91) which was found significantly higher over *Azospirillum* and control during both the years.

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