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EFFECT ON YIELD AND ECONOMICS OF PADDY - LATHYRUS CROPPING SYSTEM AS INFLUENCED BY INTEGRATED NUTRIENT MANAGEMENT

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ABSTRACT

In Eastern Vidarbha region, mono-cropping of Paddy is followed. So it is necessary to increase the productivity of farmers in this region by growing another crop followed by paddy on residual moisture. Rice is major cereal crop of India which occupies on 45 million hectares area with 95 million tones production. Lathyrus is third important legume after chickpea and pigeon pea, predominantly grown in India. Lathyrus is rich in protein (28%) and minerals especially calcium, phosphorus and iron. During 2012-13, in Eastern Vidarbha region area under lathyrus cultivation is 42000 hector and average productivity is 2.17 q ha⁻¹. Paddy – lathyrus sequential cropping plays a significant role in total productivity of crops in Eastern Vidarbha. Hence, the experiment was conducted at College of Agriculture, Gadchiroli in split plot design with 4 main plot treatment to Paddy (N₁- 100 % RDN through chemical fertilizer, N₂- 75% RDN through chemical fertilizer + 25% N through Vermicompost, N₃ - 75% RDN through chemical fertilizer +25% N through Paddy straw compost, N₄ - 50% RDN through chemical fertilizer + 50 % RDN through (Vermicompost + Paddy straw compost), 3 subplot treatments to Lathyrus (F₁ - 0 % RDN through chemical fertilizer, F₂ - 50 % RDN through chemical fertilizer and F₃ - 100 % RDN through chemical fertilizer) with 3 replications during 2012-13. From the data of 2012-13 it is concluded that application of 75 % RDN through chemical fertilizer + 25% RDN through vermicompost to paddy crop recorded highest grain and straw yield of paddy (4408 and 5592 kg/ha respectively) and lathyrus (359 and 486 kg/ha respectively), gross monetary returns (Rs.71286 /ha) and paddy grain equivalent yield (5017 kg/ha) of system. However, highest net monetary returns (NMR) and B:C ratio (Rs. 42550/ha and 2.73 respectively) of system with application of 100 % RDN to paddy crop. Application of 100 % RDN to lathyrus recorded significantly highest grain (4379 kg/ha) and straw yield (5549 kg/ha) of paddy and highest seed (355 kg/ha) and straw yield (472 kg/ha) of lathyrus, paddy grain equivalent yield (4980 kg/ha), gross monetary returns (Rs. 70761/ha), net monetary returns (Rs. 38931/ha) and B:C ratio (2.30) of the system.

Keywords: *Paddy, Lathyrus, Inm*

INTRODUCTION

Rice is major cereal crop of India which occupies 11 % of Worlds crop area. In India area under rice crop has about 45 million hectares with 95 million tones production. The total area under paddy in the state is 15.13 lakh ha with an annual rice production of 41.71 lakh tonnes production. In Vidarbha, area under this crop is 7.95 lakh ha with production 16.81 lakh tones. Presently Lathyrus is third important legume after chickpea and pigeon pea, predominantly grown in India. *Lathyrus* is rich in protein (28%) and minerals especially calcium, phosphorus and iron. During 2012-13, in Eastern Vidarbha region area under *lathyrus* cultivation is 42000 hector and average productivity 2.17q ha⁻¹. In Eastern Vidarbha region, mono-cropping of Paddy is followed. So it is necessary to increase the productivity of farmers in this region by growing another crop followed by paddy on residual moisture. Hence Paddy – lathyrus sequential cropping plays a significant role in total productivity of crops in Eastern Vidarbha. An integrated nutrient management (INM) practices involving the input of vermicompost, farmyard manure (FYM) and crop residues viz. paddy straw and bio fertilizers are advocated to improve N use efficiency, soil organic carbon, crop productivity and soil health and plays vital role in sustaining both the soil health

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and crop production on long term basis without degrading the natural resources. Organic manure provides regulated supply of plant nutrients by slowly released resulted in increasing yield of rice and nitrogen use efficiency. Therefore, there is a need for systematic approach of nutrient management to the system as a whole to increase the fertilizer use efficiency and improve the fertility status of soil by accounting the residual effect of the applied fertilizers, vermicompost and succeeding crops.

Hence, the present experiment “Integrated nutrient management in Paddy – Lathyrus cropping system in Eastern Vidarbha region” was conducted at College of Agriculture, Gadchiroli.

MATERIALS AND METHODS

The experiment was conducted at College of Agriculture, Gadchiroli during the year 2012-13. The soil was clay having pH 7.12, EC- 0.19 (dsm⁻¹), organic carbon 0.39%, available nitrogen, phosphorus and potassium are 229.30 kg ha⁻¹, 27.10kg ha⁻¹ and 298.70 kg ha⁻¹, respectively initially. The experiment was conducted in split plot design with 4 main plot treatment to Paddy (N₁- 100 % RDN(Recommended Dose of Nitrogen) through chemical fertilizer, N₂ - 75% RDN through chemical fertilizer + 25% N through Vermicompost, N₃ - 75% RDN through chemical fertilizer +25% N through Paddy straw compost, N₄ - 50% RDN through chemical fertilizer + 50 % RDN through (Vermicompost + Paddy straw compost), 3 subplot treatments to Lathyrus (F₁ - 0 % RDN through chemical fertilizer, F₂ - 50 % RDN through chemical fertilizer and F₃ - 100 % RDN through chemical fertilizer) with 3 replications during 2012-13. The paddy was sown by transplanting by Japanese method and Lathyrus by Utera cultivation. The variety of Paddy is Sindewahi-1 and Lathyrus is Ratan used for sowing. The experimental data was analysed with the help of analysis of variance (ANOVA) by using the statistical procedure with a three replications of four main factor and three sub factor to determine the statistically difference between treatments in split plot design. The average values were compared using the least significant difference (LSD) test at the 5% level. The experiment was conducted with the following objectives

1. To study the effect of different sources of nutrient on Rice-Lathyrus cropping system.
2. To workout the economics of Rice-Lathyrus cropping system

RESULTS AND DISCUSSION

Data shown in Table 1 indicates that the effect of nitrogen management and fertility levels on ancillary characters and yield of Paddy during the year 2012-13

Table 1: Ancillary characters and Yield of Paddy as influenced by different treatments during 2012-13

Treatments	Plant pop. (m ²)	Plant Height (Cm)	No. Of tillers hill ⁻¹	No. of effective tillers hill ⁻¹	Length of panicle (cm)	No. of grains panicle ⁻¹	Grain yield hill ⁻¹ (g)	Test wt. (g)	Grain yield (kg ha ⁻¹)	Straw yield (kg ha ⁻¹)
A) N Management										
N ₁	31.78	100.94	20.49	16.87	20.20	209.31	37.71	15.01	4148	5282
N ₂	32.00	103.44	21.31	18.20	21.19	214.71	39.76	15.53	4408	5592
N ₃	32.11	107.06	19.20	15.47	19.00	205.04	37.29	14.49	3941	5040
N ₄	31.44	101.93	18.84	14.96	17.38	202.69	36.84	14.27	3865	4949
SE(m) ±	0.34	1.55	0.30	0.29	0.28	1.52	0.59	0.26	74	87
CD at 5 %	NS	NS	1.05	1.02	0.98	5.27	2.03	0.89	256	303
B) Fertility levels										
F ₁	31.42	102.40	19.38	15.72	18.57	205.10	35.12	14.54	3790	4860
F ₂	32.00	103.60	19.75	16.32	19.41	208.43	38.03	14.83	4103	5238
F ₃	32.08	104.04	20.75	17.08	20.35	210.28	40.55	15.10	4379	5549
SE(m) ±	0.29	0.68	0.24	0.19	0.24	0.79	0.57	0.15	92	96
CD at 5 %	NS	NS	0.73	0.58	0.71	2.36	1.70	NS	275	289
C) Interaction										
SE(m) ±	0.58	1.37	0.48	0.38	0.47	1.57	1.13	0.30	183	193
CD at 5 %	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

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Effect of Nitrogen Management

Growth and yield contributing characters viz. number of effective tillers hill⁻¹, length of panicle, number of grains panicle⁻¹, grain yield hill⁻¹ and grain and straw yield ha⁻¹ of paddy were recorded significantly highest with application of 75 % RDN through chemical fertilizer + 25 % RDN through vermicompost to paddy crop (N₂) which were superior over rest of the treatments. However, treatment N₁ and N₃ were at par in respect of number of grains panicle⁻¹, grain and straw yield ha⁻¹. Number of tillers hill⁻¹ was recorded significantly highest with application of 75 % RDN through chemical fertilizer + 25 % RDN through vermicompost to paddy crop (N₂) which was superior over N₃ and N₄, but at par with N₂. Test weight was recorded significantly highest with N₂, but at par with N₁.

Effect of Fertility Levels

Application of 100% RDN through chemical fertilizers to lathyrus (F₃) recorded significantly highest no. of tillers, no. of effective tillers, length of panicle, grain yield hill⁻¹ and grain and straw yield of paddy which was significantly superior over F₂ (50% RDN to lathyrus) and F₁ (0% RDN to lathyrus). Highest number of grains panicle⁻¹ was recorded with application of 100% RDN through chemical fertilizer to lathyrus (F₃) which was significantly superior over F₁, but at par with F₂.

Effect of Interaction

Interaction effects were found to be non significant

Effect on Growth, Yield Attributes and yield of Lathyrus

Data shown in Table 2 indicates that the effect of nitrogen management and fertility levels on growth, yield attributes and yield of Lathyrus during the year 2012-13

Effect of Nitrogen Management

Highest no. of branches plant⁻¹ and no. of pods plant⁻¹ of Lathyrus were significantly recorded with application of 75 % RDN through chemical fertilizer + 25 % RDN through vermicompost to paddy crop (N₂) which was superior over rest of the treatments. However, treatments N₁, N₃ and N₄ were at par. Seed yield plant⁻¹ and straw yield ha⁻¹ of lathyrus were recorded significantly highest with application of 75 % RDN through chemical fertilizer + 25 % RDN through vermicompost to paddy crop (N₂) which was superior over rest of the treatments. Application of 75 % RDN through chemical fertilizer + 25 % RDN through vermicompost to paddy crop (N₂) recorded significantly highest seed yield ha⁻¹ of lathyrus which was superior over N₃ and N₄, but at par with N₁.

Table 2: Ancillary characters, grain and straw yield of Lathyrus as affected by different treatments during 2012-13

Treatments	Plant pop. m ⁻²	Plant height (cm)	No. of branches plant ⁻¹	No. of pods plant ⁻¹	Seed yield plant ⁻¹ (g)	Test wt. (g)	Seed yield (kg ha ⁻¹)	Straw yield (kg ha ⁻¹)
A) N management								
N1	44.67	24.84	3.80	7.42	1.14	75.33	337	446
N2	44.78	25.42	4.20	7.84	1.22	76.93	359	483
N3	46.56	23.90	3.56	7.27	1.07	74.68	297	393
N4	45.00	26.42	3.29	6.91	1.02	73.14	253	340
SE(m)	0.64	0.81	0.10	0.10	0.02	1.21	6	9
CD at 5 %	NS	NS	0.35	0.36	0.05	NS	22	32
B) Fertilizer levels								
F1	44.67	24.46	3.52	7.05	1.07	73.67	266	354
F2	45.33	25.40	3.72	7.32	1.12	74.78	314	420
F3	45.75	25.57	3.90	7.72	1.16	76.61	355	472
SE(m)	0.48	0.57	0.06	0.10	0.02	1.08	7	11
CD at 5 %	NS	NS	0.17	0.31	0.07	NS	20	32
C) Interaction								
SE(m)	0.96	1.14	0.12	0.21	0.05	2.17	13	21
CD at 5 %	NS	NS	NS	NS	NS	NS	NS	NS

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Effect of Fertility Levels

Application of 100% RDN through chemical fertilizers to lathyrus crop (F₃) recorded significantly highest no. of branches plant⁻¹ and seed and straw yield ha⁻¹ of lathyrus which were significantly superior over F₂ (50% RDN to lathyrus) and F₁ (0% RDN to lathyrus). Number of pods plant⁻¹ was significantly recorded maximum with application of 100% RDN to lathyrus crop (F₃) which was superior over F₂ and F₁. Application of 100% RDN to lathyrus crop (F₃) recorded significantly highest seed yield plant⁻¹, but at par with F₂ and F₁.

Effect of Interaction

Interaction effects were found to be non significant

Effect of Paddy- Lathyrus System on Paddy Grain Equivalent Yield and Economics

Data shown in Table 3 indicates that Paddy grain equivalent yield and economics of Paddy- Lathyrus system as affected by different treatments during 2012-13

Table 3: Paddy grain equivalent yield and economics of Paddy- Lathyrus system as affected by different treatments during 2012-13

Treatments	Paddy grain equivalent yield (kg ha ⁻¹)	GMR (Rs ha ⁻¹)	NMR (Rs ha ⁻¹)	B:C ratio
A) N management				
N1	4719	67068	42550	2.73
N2	5017	71286	37670	2.12
N3	4444	63201	33404	2.12
N4	4293	61105	22210	1.57
SE(m)	71	979	979	0.03
CD at 5%	245	3394	3394	0.10
B) Fertilizer levels				
F1	4240	60336	28754	1.97
F2	4634	65898	34192	2.15
F3	4980	70761	38931	2.30
SE(m)	95	1321	1321	0.04
CD at 5%	284	3959	3959	0.13
C) Interaction				
SE(m)	189	2641	2641	0.08
CD at 5%	NS	NS	NS	NS

Effect of Nitrogen Management

Paddy grain equivalent yield and Gross monetary returns (GMR) of Paddy-lathyrus system were significantly highest with application of 75 % RDN through chemical fertilizer + 25 % RDN through vermicompost to paddy crop (N₂) which was superior over rest treatments. Application of 100 % RDN through chemical fertilizer to paddy crop (N₁) recorded significantly maximum net monetary returns (NMR) and B:C ratio of the system which was superior over rest treatments.

Effect of Fertility Levels

Paddy grain equivalent yield, gross monetary returns, net monetary returns and B:C ratio of the system were recorded significantly highest with application of 100% RDN through chemical fertilizers to lathyrus crop (F₃) which was superior over F₂ and F₁.

Effect of Interaction

Interaction effects were found to be non significant

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Conclusions

From the data it is concluded that

- 1) Application of 75 % RDN through chemical fertilizer + 25% RDN through vermicompost to paddy crop recorded highest grain and straw yield of paddy and lathyrus, gross monetary returns (GMR) and paddy grain equivalent yield of system.
- 2) Application of 100 % RDN through chemical fertilizers to paddy crop recorded significantly highest net monetary returns (NMR) and B:C ratio of system.
- 3) Application of 100 % RDN through chemical fertilizers to lathyrus recorded significantly highest grain and straw yield of paddy and lathyrus, paddy grain equivalent yield, gross monetary returns (GMR), net monetary returns (NMR) and B:C ratio of the system.

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