

Production and economics of rice (*Oryza sativa*)-based rainfed cropping systems

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ABSTRACT

A field experiment conducted during 1996-99 revealed that among the different rainfed cropping sequences, the rice-equivalent yield of 'Swarna' rice-'Annegiri' gram (*Cicer arietinum* L.) was the highest (74.9 q/ha) and was at par with rice-'Pusa 24' lathyrus (*Lathyrus sativus* L.) (73.4 q/ha) and safflower (*Carthamus tinctorius* L.) (70.9 q/ha). The production efficiency of lathyrus (9.3 kg/ha/day), safflower (7.8 kg/ha/day) and gram (7.5 kg/ha/day) was better than other winter crops. The net return and benefit : cost ratio were the highest for rice-gram (Rs 10,670/ha and 1.55 respectively) and was at par for rice-lathyrus sequence (Rs 10,070/ha and 1.52 respectively). The soil-fertility status of rainfed cropping systems involving pulse crops was better than that involving oilseed crops.

Key words : Rice-based cropping systems, Rainfed, Economics, Soil fertility

In western Orissa irrigation facility is quite meagre. Here rice-fallow is the predominantly followed cropping system under shallow lowland rice ecosystem. But the need of the time is to increase land-use efficiency and production efficiency of a land through utilization of residual soil moisture. In this ecosystem, growing of rice is the only option in rainy season. However, various low-duty winter crops are seen to have been adjusted after rice in sporadic patches by the farmers of this zone only to harvest a very poor yield. In the present investigation, an attempt was made to

evaluate the economic feasibility of different rice-based rainfed cropping systems and to find out the best sequence suitable for the region.

MATERIALS AND METHODS

A field experiment was conducted from 1996-97 to 1998-99 at Regional Research and Technology Transfer Station, Bhubaneswar, Orissa. The soil of the experimental plot was loamy clay with pH 7.2, available N 186 kg/ha, available P₂O₅ 9.2 kg/ha and available K₂O 289 kg/ha. The soil-moisture content at field capacity and

permanent wilting point were 32.2 and 13.8% respectively. The experiment was conducted in randomized block design with 3 replications.

Thirtyfive day-old-seedlings of high-yielding 'Swarna' rice was transplanted in third week of July at 15 cm × 15 cm spacing and was harvested in the second week of November during all the years of experiment.

After rice, the winter crops, viz. 'A 1' safflower, 'Seline 74-3' lentil (*Lens culinaris medikus*), 'Annegiri' gram, 'T 9' blackgram (*Phaseolus mungo* L.), 'Tarm 2' greengram (*Phaseolus radiatus* L.), 'Pusa 24' lathyrus and 'Laxmy 27' linseed (*Linum usitatissimum*), were sown in permanently laid out plots in fourth week of November. The rice crop was given a fertilizer dose of 80:40:40 kg N : P₂O₅ and K₂O/ha. The safflower and linseed crops were given 40:40:20 kg N : P₂O₅ : K₂O/ha, whereas lentil, gram, blackgram, greengram, and lathyrus 20:40:0 kg N : P₂O₅ : K₂O/ha. All other recommended package of practices were followed to raise

the crops successfully. The rainfall received during 1996-97, 1997-98 and 1998-99 was respectively 934.5, 976.2 and 983.0 mm in rainy season and 75.5, 75.4 and 20.2 mm in winter season.

The data of 3 years were pooled as the trend was identical and subjected to computation following standard statistical procedure. The economics was calculated on the basis of prevailing market prices. The land-use-efficiency and production efficiency was calculated as per normal procedure.

RESULTS AND DISCUSSION

Crop productivity and economics

The yield of safflower was the highest as the winter crop was followed by lathyrus and gram (Table 1). This might be owing to higher production potential of these winter crops in residual soil-moisture condition than other crops under study. Similar findings were also reported by Padhi (1993). However, the production efficiency of lathyrus was the maximum, followed by safflower and bengalgram. The root dry

Table 1. Land-use efficiency, productivity, production efficiency and economics of different crop sequence (mean) and final soil fertility status

Crop sequence	Land-use efficiency (%)	Grain yield (q/ha)		Rice-equivalent yield (q/ha)	Production efficiency of winter crop (kg/ha/day)	Net return (Rs/ha)	Benefit : cost ratio	Soil fertility status after 3 years of cycle (kg/ha)		
		Rainy season	Winter season					N	P ₂ O ₅	K ₂ O
Rice-safflower	75.6	45.4	10.2	70.9	7.8	7,880	1.38	174	8.6	290
Rice-linseed	66.8	46.2	6.8	63.2	6.9	5,100	1.25	180	8.9	292
Rice-lentil	68.2	45.6	5.6	62.4	5.4	5,670	1.29	204	9.8	300
Rice-gram	70.7	45.5	8.4	74.9	7.5	10,670	1.55	192	9.4	295
Rice-blackgram	65.8	46.1	4.5	46.4	4.8	7,760	1.41	205	9.7	297
Rice-greengram	64.1	46.0	5.2	69.4	5.9	8,960	1.48	211	9.9	298
Rice-lathyrus	67.1	45.8	9.2	73.4	9.3	10,070	1.52	198	9.2	306
CD (P = 0.05)		Ns		5.2	2.1	972	0.04			

weight of winter crops estimated 80 days after sowing was 85.4, 24.2, 21.8, 15.2, 14.8, 12.7 and 12.2 g/m², for safflower, gram, lathyrus, greengram, blackgram, linseed and lentil respectively. Safflower, gram and lathyrus having better horizontal and vertical root ramification might have helped in efficient utilization of moisture from different layers of soil profile in residual moisture condition and resulted in better yield and production efficiency. Mandal *et al.* (1994) also reported similar results. Among the different sequences, rice-gram gave the highest rice-equivalent yield and was statistically at par with rice-lathyrus and rice-safflower systems. However, the maximum net return and benefit : cost ratio were realized from rice gram followed by rice-lathyrus system (Table 1). Tomar and Tiwari (1990) found that inclusion of legumes in cropping systems invariably increase yield and net return.

Fertility status

After 3 years of experiment, it was observed that the sequences including oilseeds reduced the N and P status of soil,

whereas the sequences having pulses increased the overall fertility status of soil in respect of N, P and K. Patil *et al.* (1995) and Thakur *et al.* (1998) also opined that inclusion of pulses in cropping systems resulted in better physico-chemical status of soil.

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