

## Productivity and economics of on-farm rainfed *rabi* crops in rice based cropping system under different moisture conservation practices

S. TRIPATHI, H.L. SONBOIR, N. PANDEY, MANISH KUMAR AND D. PANDEY

Department of Agronomy, Indira Gandhi Agricultural University, Raipur - 492 006, Chhattisgarh.

**Abstract:** On-farm field experiments were carried out in midland rainfed rice based cropping system during *rabi* seasons of 1999-00 and 2000-01 at village Khatti, district Mahasamund (C.G.) under National Agricultural Technology Project, RRPS-3 to explore the possibility of *rabi* crops (Safflower, Gram, Lentil, Lathyrus and Greengram) using moisture conservation practices (no mulch, soil and stubble mulch and rice straw mulch) in rainfed rice area. Among the crops, safflower produced significantly higher gram equivalent yield (13.50 q ha<sup>-1</sup>) and net profit (Rs. 10142 ha<sup>-1</sup>) than that of gram during 1999-00, while it was at par during 2000-01. Among the mulches, application of rice straw mulch recorded significantly higher grain yield (6.49 q ha<sup>-1</sup>) and net return (Rs. 10142 ha<sup>-1</sup>) and it was on par with that of soil and stubble mulch. Regarding interaction effect safflower with rice straw mulch gave significantly higher grain yield (12.29 q ha<sup>-1</sup>), which was at par with that of soil stubble mulch.

**Key words :** Safflower, Gram, Lathyrus, Lentil, Greengram, Mulch, Yield, Economics, On farm, Rainfed.

### Introduction

Chhattisgarh state is known as rice bowl and the *rabi* season is mostly fallow especially under rainfed condition and the cropping intensity is 125 per cent. In some areas, *Lathyrus* is sown during *rabi* season, which is exclusively under *utera* system (relay cropping) with very less productivity of 0.5 to 1.0 q ha<sup>-1</sup>. The delayed harvesting of rice and lack of technical know how for land preparation, seeding method and moisture conservation practices for growing *rabi* crops are very important cause for zero-fallow system in the region. Mulches have proved their efficiency in conserving residual soil moisture in rainfed situation in research farms (Prihar *et al.* 1981 and Datta *et al.* 2000). Therefore, a study was undertaken in farmer's field to explore the possibility of *rabi* crops using moisture conservation practices in rainfed rice area under National Agricultural Technology Project, RRPS-3.

### Materials and Methods

On farm experiments were conducted in midland rainfed rice based cropping system

during *rabi* seasons of the year 1999-2000 and 2000-2001 at farmer's field of village Khatti in Mahasamund district under National Agricultural Technology Project, RRPS-3, Indira Gandhi Agricultural University, Raipur. The soil was silty clay in texture, slightly acidic in reaction, normal in electrical conductivity (168 mSm<sup>-1</sup>), medium in organic carbon (0.68%), low in available nitrogen (224.2 kg N ha<sup>-1</sup>), medium in available phosphorus (12.4 kg P ha<sup>-1</sup>) and high in available potassium (310.4 kg K ha<sup>-1</sup>). During *kharif* seasons, 604.2 and 506.2 mm rainfall were received during 1999-00 and 2000-01. The amount of rainfall received during *rabi* crop seasons were very low in both the years (15.5 mm during 1999-00 and 13.3 mm during 2000-01). The experiment was laid out in split plot design with three replications. The main plot treatments were five crops *viz.* gram (JG-74), greengram (RUM-1), lathyrus (local), lentil (JLS-1) and safflower (JSF-1) and sub plot treatments were three moisture conservation practices *viz.* no mulch (M<sub>0</sub>), soil and stubble mulch (M<sub>1</sub>) and rice straw mulch (M<sub>2</sub>) @ 5 t ha<sup>-1</sup>. The mulches were applied at

Table 1. Grain yield (q ha<sup>-1</sup>) of different crops as influenced by mulch practices

Crops	Mulches								
	No mulch			Soil & stubble mulch			Rice straw mulch		
	99-00	00-01	Average	99-00	00-01	Average	99-00	00-01	Average
Gram	7.97	4.84	6.40	8.73	5.64	7.18	9.29	6.08	7.68
Greengram	2.34	1.47	1.90	2.61	2.04	2.32	2.73	2.32	2.52
Lathyrus	2.76	2.14	2.45	2.97	2.56	2.76	3.04	2.81	2.92
Lentil	2.90	2.45	2.67	3.45	3.12	3.28	3.59	3.21	3.40
Safflower	9.86	5.83	7.84	11.80	7.89	9.84	12.50	8.26	10.38

Table 2. Gram equivalent yield (q ha<sup>-1</sup>) of different crops as influenced by mulch practices

Crops	Mulches							
	No mulch		Soil & stubble mulch		Rice straw mulch		Average	
	99-00	00-01	99-00	00-01	99-00	00-01	99-00	00-01
Gram	7.97	4.84	8.73	5.64	9.29	6.08	8.66	5.52
Greengram	3.51	1.56	3.91	2.17	4.09	2.47	3.833	2.06
Lathyrus	1.82	0.99	1.95	1.19	2.00	1.31	1.92	1.16
Lentil	2.90	1.79	3.45	2.28	3.59	2.35	3.31	2.14
Safflower	10.64	4.66	12.74	6.31	13.50	6.60	12.29	5.85
Average	5.36	2.76	6.15	3.51	6.49	3.76	-	-
			99-00			00-01		
CD (P=0.05) Crops			0.80			0.71		
Mulches			0.62			0.52		
Crops x Mulches			1.37			1.24		

10 days after sowing. The crops were sown on 23.11.1999 and 17.11.2000 during the respective year with recommended package of practices of the location. The seed yield was converted in terms of gram equivalent to compare their yield on the basis of market price during the corresponding year.

## Results and Discussion

### Seed yield

Among the crops, safflower produced significantly higher gram equivalent yield followed by gram. The seed yield of lentil and greengram was intermediate and comparable with each other (Table 1). Lathyrus produced significantly lowest gram equivalent yield among the crops. The seed yield of different crops was higher in mulch treatments as compared to no mulch treatment. Among the mulch treatments, significantly higher gram equivalent yield was

noticed with rice straw mulch, which was at par with that of soil and stubble mulch (Table 2). The seed yield was increased by 14.7% and 21% during 1999-00 and 27.1% and 36.2% during 2000-01 due to rice straw mulch and soil and stubble mulch, respectively, over control. The role of mulchs for moisture conservation and utilization by crops has been well documented. The more efficiency of mulch material during 2000-01 was due to better moisture conservation during the moisture stress period of the year.

The significant interaction effect for gram equivalent yield was not observed with crops to different mulch practices except safflower. The safflower with rice straw mulch produced (13.50 and 6.60 q ha<sup>-1</sup>) significantly higher gram equivalent yield, which was comparable to that of soil and stubble mulch (12.74 and 6.31 q ha<sup>-1</sup>). The increase in yield due to

Table 3. Economics of different crop as affected by mulch practices

Crops	Mulches	Cost of cultivation (Rs ha <sup>-1</sup> )		Net realisation (Rs. ha <sup>-1</sup> )			Profit per Rupee investment		
		99-00	00-01	99-00	00-01	Average	99-00	00-01	Average
Gram	M <sub>0</sub>	7262	7576	2786	1247	2016	0.38	0.16	0.27
	M <sub>1</sub>	8637	8816	2348	1112	1730	0.27	0.12	0.19
	M <sub>2</sub>	8487	9502	3202	1984	2593	0.32	0.20	0.26
Green gram	M <sub>0</sub>	6340	2575	-1797	-2478	-	-	-	-
	M <sub>1</sub>	7715	3553	-2617	-2875	-	-	-	-
	M <sub>2</sub>	7565	4035	-2235	-2243	-	-	-	-
Lathyrus	M <sub>0</sub>	6313	1757	-3829	-3104	-	-	-	-
	M <sub>1</sub>	7688	2076	-4923	-4160	-	-	-	-
	M <sub>2</sub>	7538	2265	-4802	-3821	-	-	-	-
Pigeon lentil	M <sub>0</sub>	6062	2905	-2340	-1964	-	-	-	-
	M <sub>1</sub>	7437	3687	-3025	-2557	-	-	-	-
	M <sub>2</sub>	7287	3793	-2695	-2301	-	-	-	-
Safflower	M <sub>0</sub>	5659	7360	7759	2723	5241	1.38	0.36	0.87
	M <sub>1</sub>	7034	9953	8977	3941	6459	1.27	0.39	0.83
	M <sub>2</sub>	6884	10397	10142	4535	7338	1.47	0.43	0.95

Application of mulches under rainfed condition was also reported by Sachan (1986), Sachan and Bhan (1986) and Upadhyay and Tiwari (1996).

#### Economic analysis

The economic analysis of different crops and application of mulches indicated that among the crops, only safflower and gram were found to be economical under this agro-climatic condition. The cultivation of safflower gave the net return of Rs.7759 to 10142 per hectare during 1999-2000 and Rs.2723 to 4535 per hectare during 2000-01 under different moisture conservation practices, while gram produced Rs.2786 to 3202 per hectare during 1999-00 and Rs.1112 to 1984 per hectare during 2000-01 when grown under residual soil moisture after the harvest of rice. Among the mulches, rice straw mulch was found more economical. Safflower and rice straw mulch also proved more profitable on per rupee investment basis (Table 3).

#### References

- Datta, R., Gogoi, P.K., Baroova, S.R. and Deka, N.C. (2000). Effect of sowing dates and mulching on *rabi* groundnut (*Arachis hypogea*) under rainfed condition. *Ann. Agric. Res.* 21: 557-558.
- Prihar, S.S., Sandhu, K.S., Singh, Y. and Singh, R. (1981). Effect of nitrogen rates on dry land wheat in relation to mulching previous crop or fallow. *Ferti. Res.* 2: 211-219.
- Sachan, S. (1986). Studies on the effect of mulch, row spacing and level of nitrogen on safflower in eroded soils under rainfed conditions. *Farm Sci. Journal*, 1: 78-81.
- Sachan, S.S. and Bhan, S.S. (1986). Effect of cropping system fertility levels and moisture conservation practices on the performance of mustard and safflower under dry land conditions. *Farm Sci. Journal*, 1: 70-76.
- Upadhyay, V.B. and Tiwari, J.P. (1996). Influence of nitrogen, seed rate and mulch on wheat (*Triticum aestivum*) varieties under late sown condition. *Indian J. Agron.* 41: 562-565.

(Received: November 2002; Revised: September 2003)