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Productivity, profitability and sustainability of Indian mustard (*Brassica juncea*) raised after different rainy-season crops

A.K. TRIPATHI AND K.S. RATHI

Department of Agronomy, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh 208 002

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ABSTRACT

A field investigation was carried out during 1994–96 at Kanpur, to judge the productivity, profitability and sustainability of Indian mustard [*Brassica juncea* (L.) Czernj. & Cosson] raised after different rainy-season crops. Indian mustard yield maximized in green-manured plot with *Sesbania* (32.73 q/ha). The seed yield of Indian mustard decreased (25.86 q/ha) under fodder pearl millet [*Pennisetum glaucum* (L.) R.Br. emend. Stuntz]–Indian mustard sequential cropping. Computation of economics revealed that maize (*Zea mays* L.)–Indian mustard sequential cropping recorded the highest Indian mustard-seed equivalent (42.79 q/ha), more net return (Rs 22.57 thousand/ha) with highest land-use efficiency (61.92%). Blackgram (*Phaseolus mungo* L.)–Indian mustard remained next in order.

Key words : Indian mustard, Productivity, Profitability, Cropping systems

Development of improved production technology with suitable crop sequences for different agro-climatic zones plays a vital role in getting maximum monetary return without impairing the fertility of soil. Therefore, it becomes imperative to work out proper crop sequence for different situation. The Indian mustard-based crop sequences play a significant role in crop production in general and improving the economic condition of the farmers of central plain zone of Uttar Pradesh in particular. But its profitability and sustainability are not encouraging due to many reasons. However, an introduction of cereals or pulses in the system was found more beneficial than Indian mustard succeeding after fallow (Kanwar *et al.*, 1983). Hence to develop economically viable, technically feasible, sustainable and need-based crop sequences for Central Plains Zone of Uttar Pradesh, the present experiment was conducted.

MATERIALS AND METHODS

A field experiment was conducted during 1994–95 and 1995–96 at Kanpur, on sandy-loam soil, having 7.7 pH, 0.49% organic carbon, 13 kg/ha available phosphorus and 164 kg/ha available potassium. The experiment was conducted in split-plot design replicated 3 times, keeping 7 crop sequences in main plots and 4 nitrogen levels in subplots. The crop sequence treatments were fallow–Indian mustard, *sesbania* (green–manure)–Indian mustard, maize (grain)– Indian mustard, sorghum [*Sorghum bicolor* (L.) Moench] (fodder)–Indian mustard, pearl millet (fodder)–Indian mustard, blackgram (grain)–Indian mustard and cowpea [*Vigna unguiculata* (L.) Walp.] (fodder)–Indian mustard.

The varieties of the components crops of the sequences were 'Varuna' of mustard, 'Azad Uttam' of maize , 'T 22' of sorghum, 'WCC 75' of pearl millet, 'Pant U 35' of blackgram, 'T 2' of crowpea and 'Local' of *sesbania*. All the crops were grown as per the recommended package of practices. The rainy-season crops were sown during the first fortnight of July during both years. *Sesbania cannabina* as green-manure crop was grown in the rainy season and incorporated into soil 7 weeks after sowing. The succeeding crop of Indian mustard was sown after pre-sowing irrigation to ensure good germination. Indian mustard was sown during the third week of October during both the years. The cropping systems were evaluated in terms of Indian mustard seed-equivalent, economic returns and land-use efficiency. Economic returns (Rs/ha) and cost of cultivation (Rs/ha) for individual crop in sequence were calculated on the basis of prevailing market rates of inputs and selling prices of produce. Net return value in terms of Rs/ha/day was obtained by net monetary return of sequence divided by total duration of crops in that sequence (Tomar and Tiwari, 1990). Indian mustard-seed equivalent and land-utilization efficiency were computed as:

$$\text{Indian mustard seed equivalent (q/ha)} = \frac{\text{Yield of the produce (q/ha)} \times \text{price of the produce (Rs/q)}}{\text{Price of Indian mustard (Rs/q)}}$$

$$\text{Land-utilization efficiency (\%)} = \frac{\text{Total duration of crop sequence}}{365} \times 100$$

RESULTS AND DISCUSSION

Crop productivity

The productivity of different cropping systems under study was evaluated after converting the yield of rainy-season crops into Indian mustard seed equivalent. The seed yield of Indian mustard was significantly higher in *Sesbania* green-manured plot than that received under maize–Indian mustard and blackgram–Indian mustard cropping system (Table 1). The yield of Indian mustard could be depressed to a minimum level when grown in pearl millet–Indian mustard sequence. Our findings confirm those of Sharma *et al.* (1992) and Singh *et al.* (1994). The poor yield of Indian mustard after pearl millet could be attributed to the exhaustive and teletoxic nature of preceding crop. Giri and Saran (1986) also reported adverse effect of pearl millet on mustard yield.

Table 1. Seed or fodder yield and Indian mustard seed equivalent (q/ha) in Indian mustard-based cropping systems

Cropping system	1994–95		1995–96		Pooled mean	
	Rainy crop	Winter crop	Rainy crop	Winter crop	Rainy crop	Winter crop
			Seed or fodder yield (q/ha)			
Fallow–Indian mustard		27.90		31.83		29.86
Sesbania (GM)–Indian mustard	35.46*	30.94	37.10*	34.52	36.28*	32.73
Maize (G)–Indian mustard	38.54	28.54	34.22	32.83	36.38	30.69
Sorghum (F)–Indian mustard	454.17	25.37	408.79	28.37	431.48	26.87
Pearl millet (F)–Indian mustard	393.04	24.10	426.30	27.62	409.67	25.86
Blackgram (G)–Indian mustard	9.78	26.79	10.58	29.83	10.18	28.31
Cowpea (F)–Indian mustard	326.48	26.21	288.85	29.62	307.67	27.92
CD (P=0.05)		0.94		1.34		0.77
			Indian mustard seed equivalent (q/ha)			
Fallow–Indian mustard		27.90		31.83		29.86
Sesbania (GM)–Indian mustard	0.28	30.94	0.27	34.52	0.27	32.73
Maize (G)–Indian mustard	12.57	28.54	11.63	32.83	12.10	30.69
Sorghum(F)–Indian mustard	9.87	25.37	8.17	28.37	9.02	26.87
Pearl millet (F)–Indian mustard	6.84	24.10	6.82	27.62	6.83	25.86
Blackgram(G)–Indian mustard	13.39	26.79	13.75	29.83	13.57	28.31
Cowpea (F)–Indian mustard	8.53	26.21	6.93	29.62	7.72	27.92

GM, Green-manure; G, grain; F, fodder

*N kg/ha was computed on the basis of total green manure produced

Table 2. Indian mustard seed equivalent, cost of cultivation, returns and benefit : cost ratio as influenced by Indian mustard-based cropping systems

Cropping system	Mustard seed equivalent per year (q/ha)	Cost of sequence cultivation ($\times 10^3$ Rs/ha)	Mean net return ($\times 10^3$ Rs/ha/year)	Benefit : cost ratio	Net return (Rs/ha/day)	Land-use efficiency (%)	Net profit or loss over fallow-mustard (Rs/ha/year)
Fallow–Indian mustard	29.86	17.98	17.85	1.99	124	39.45 (144)	
Sesbania (GM)–Indian mustard	33.00	21.70	17.90	1.82	94	52.33 (191)	50
Maize (G)–Indian mustard	42.79	28.78	22.57	1.78	100	61.92 (226)	4,720
Sorghum(F)–Indian mustard	35.89	24.57	18.50	1.75	86	59.18 (216)	650
Pearl millet (F)–Indian mustard	32.69	24.44	14.79	1.60	72	56.16 (205)	(-)3,060
Blackgram (G)–Indian mustard	41.88	27.86	22.40	1.80	102	60.27 (220)	4,550
Cowpea (F)–Indian mustard	35.64	24.24	18.53	1.76	86	59.18 (216)	680
CD (P=0.05)	1.78		0.77	0.10			

Figures in parentheses are total duration of crops (days) in that sequence

In terms of Indian mustard seed equivalent, the productivity of maize–Indian mustard followed by blackgram–Indian mustard cropping system was at par and significantly higher than other cropping systems (Table 2.) Keeping fallow during the rainy season and raising Indian mustard thereafter proved meaningless by virtue of low yield potential in the system.

Land-use efficiency

Maize–Indian mustard sequence registered the highest land-use efficiency, followed by blackgram–Indian mustard, cowpea–Indian mustard and sorghum–Indian mustard systems, because these sequences occupied the field for longest duration (216–226 days). Fallow–Indian mustard system had the lowest land-utilization efficiency.

Economics analysis

Compution of economics revealed that maize–Indian mustard system fetched highest net return, followed by blackgram–Indian mustard system (Table 2). It was worth mentioning that monetary advantage (net profit/ha/year) in these system were also recorded Rs 4,720 and Rs 4,550/ha more than that received under fallow–Indian mustard system. Highest benefit : cost ratio was obtained from fallow–Indian mustard sequence. The lowest benefit : cost ratio was recorded with pearl millet–Indian mustard cropping system. Tomar and Tiwari (1990) also reported similar results.

Considering the production, net return and land-use efficiency, maize–Indian mustard and blackgram–Indian mustard cropping systems proved most promising and remunerative.

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