

Production Potential and Economics of Indian Mustard (*Brassica juncea*) Based Cropping Systems Under brackish Water Situations of semi-arid tract of Rajasthan, India

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ABSTRACT

A field experiment was conducted for two years at the research farm of National Research Centre on Rapeseed-Mustard; Bharatpur to compare the productivity and economics of five important mustard based cropping systems under rainfed conditions. Among the cropping systems the most remunerates crop sequence was pearl millet cluster bean grown for fodder in *kharif* and mustard in *rabi* season (Rs 11989 net profit) followed by sequence cluster-bean fodder in *kharif* and mustard in *rabi* season (Rs. 10687 net profit). Fallow-mustard crop sequence followed mainly be farmers of Rajasthan gave the lowest mustard equivalent (10.15 k/ha) yield and net return (Rs. 6000 =00).

Key words-Mustard, Productivity, Cropping systems and brackish water.

Introduction

India is major rapeseed-mustard growing country in the world contributing 28% area (7.06 m/ha) and 20.8% production (6.94 mt), which is second to China in its area and third in production among four major rapeseed mustard growing countries i.e. China, India, Canada and France. This crop, in India is mostly grown in the marginal soils where either irrigation facilities are not available or poor quality (brackish water) of irrigation water is there due to which, in most of the areas mustard is grown keeping land fallow in *Kharif* season, therefore production per unit area is low as compared to China, Canada and France. Thus keeping above situation in view this investigation was under taken during 1997-98 & 1998-99 to maximize and sustain the production per unit area under rainfed conditions of semi arid tract of Rajasthan at Bharatpur where irrigation water is brackish and mustard (*Brassica juncea*) is grown as rainfed on conserved rainwater with one supplemental irrigation of brackish water.

Materials and Methods

The investigation was carried out during 1997-98 and 1998-99 at Research farm of National Research Centre on Rapeseed-Mustard Bharatpur in a split plot design with four replications. The soil of the experiment was sandy loam with PH 8.0, medium in available nitrogen (0.6%OC), phosphorus (23.5 kg P₂O₅ ha⁻¹) and potash (230 kg K₂O ha⁻¹). Five mustard based crop sequences viz. pearl millet (*Pennisetum typhoid*) + cluster bean (fodder)-mustard, cluster bean (fodder)- mustard, green manuring-mustard, mustard straw @5t/ha-mustard and fallow-mustard (farmers practice) were taken in main pots and four levels of nitrogen (0,30,60 & 90 Kg N/ha) were taken in sub plots. The mustard variety RH-30 (suitable for rainfed situations) was sown at a distance of 30 cm on 16.10.97 and 13.10.98 after taking preceding *Kharif* crops. The *Kharif* fodder crops were grown with recommended package and practices (Table1). The *sesbania* crop was turned down in the field for green manuring at 50-55 DAS whereas pearl millet +Cluster bean and cluster bean fodder were harvested at 50 DAS.

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The full dose of phosphorus and half dose of nitrogen (as per treatment) were applied as basal in mustard crop and remaining half dose of nitrogen was applied 45 days after sowing (DAS) after first irrigation. Only one irrigation at 35 DAS was given to mustard crop with brackish water. The oil content in seeds was determined by NMR technique. The data obtained were statistically analyzed after regular transformations.

Table 1: varieties, seed rate, spacing and fertilizer doses applied to different crops.

Crop	Variety	Seed rate kg/ha	Row spacing /cm/	N kg/ha	P ₂ O ₅ kg/ha	K ₂ O
Pearl-Millet+ Cluster- bean	Wcc.75	5.00	30	60	30	-
	FS 277	12.50	30	-	-	-
Cluster bean	FS 277	25.00	30	20	40	-
<i>Sesbania acculeata</i>	-	30.00	30	-	-	-
Crop residue mustard	Mustard straw @ 5t/ha	-	-	-	-	-
Mustard	RH-30	5.0	30	0.30, 60 & 90 kg/ha	40	

Results and discussion

Seed yield and mustard seed equivalent yield

During 1997-98 the yield of the mustard very low because during this year there was continuous foggy weather for more than one month during early growth stage which resulted severe infection of white-rust disease. This year proved to be the bad year for whole country due to which country's mustard production and productivity came down from 6.66 million tones and 1017 kg/ha (1996-97) to 4.7 million tones and 668 kg/ha respectively. Among different cropping systems maximum mustard seed yield was recorded in the plots preceded by green manuring (12.2.q/ha) followed by mustard grown after cluster bean (F) (11.85 q/ha). The higher yield of mustard grown after green manuring and cluster bean is due to residual effect of nitrogen fixation from the atmosphere (40 kg N/ha) by these leguminous crops in *Kharif* season. Sharma and Mitra (1988) reported beneficial effect of green manuring which corroborate our findings. Whereas maximum mustard seed equivalent yield was recorded in pearl millet + cluster bean-mustard crop sequence followed by cluster-bean -mustard crop sequence. The higher mustard seed equivalent yield in two treatments was because of *Kharif* fodder production while in other treatments there was no preceding crop production. The lowest-mustard seed equivalent yield was recorded in fallow-mustard crop sequence followed by crop residue-mustard sequence. Farmers of this tract usually grow mustard-keeping land fallow in *Kharif* season due to brackish water. But as per this study it is not useful to keep the land fallow. In *Kharif* season fodder crops pearl millet+cluster-bean or cluster bean can be safely grown which gives additional fodder yield without affecting the mustard seed yield.

Cost of cultivation and net return

The cost of cultivation (Table-3) was maximum in cluster-bean -mustard crop sequence followed by pearl millet + cluster bean-mustard, which was because of the cost of seed and fertilizer used in *Kharif* season. The lowest cost was in fallow-mustard crop sequence as no cost of seed or fertilizer etc was involved for *Kharif* crops but difference was not much as in fallow fields number of ploughings increased in *Kharif* season for controlling heavy weed infestation in the fields. The net return was highest in pearl millet + cluster bean (F) -mustard cropping sequence, which was due to higher production of fodder in *Kharif* season without much affecting succeeding mustard crop. This was closely followed by cluster bean (F)- mustard cropping sequence.

Though fodder yield of cluster bean was low but being a leguminous crop it fixes nitrogen (Approximately 40 kg N / ha.) from atmosphere, which increased succeeding mustard yield. The lowest net return was obtained in fallow-mustard cropping system. Thus it can be concluded from the present study that among the cropping sequences tried, pearl millet + cluster bean (fodder)--mustard cropping system is most profitable than fallow-mustard cropping system (commonly followed by the farmers due to brackish water).

Table 2: Green fodder and dry matter yield of kharif crops.

Crops	Green fodder yield q/ha			Dry matter yield q/ha		
	1997-98	1998-99	Average	1997-98	1998-99	Average
Pearl Millet + Cluster bean	496.2	327.0	411.6	80.6	62.7	71.65
Cluster bean	295.8	75.8	185.8	70.9	19.6	45.25

Table 3: Mustard seed yield and mustard equivalent seed yield in different mustard based cropping systems

Treatments	Seed yield of mustard (q/ha)			Mustard seed equivalent yield (q/ha)		
	1997-98	1998-99	Average	1997-98	1998-99	Average
Cropping systems						
Pearl. millet. + Cluster-bean-mustard	7.40	13.90	10.65	13.60	17.98	15.80
Cluster-bean-mustard	7.80	15.90	11.85	12.71	17.16	14.94
Crop residue-mustard	7.40	13.90	10.65	7.40	13.90	10.65
Green manuring-mustard	8.30	16.10	12.20	8.30	16.10	12.20
Fallow – Mustard	7.10	13.20	10.15	7.10	13.20	10.15
CD (P = 0.05)	NS	1.90	-	-	-	-

Table-4 Mustard seed equivalent yield cost of cultivation, net return and benefit/cost ratio of various cropping systems.

Cropping system	Mustard seed equivalent Yield (q/ha)	Return per year	Cost of cultivation	Net return	Cost benefit ratio
Pearl. millet. + Cluster-bean-mustard	15.79	18762	6973	11789	1.69
Cluster-bean-mustard	14.94	17902	7215	10687	1.48
Crop Residue-Mustard	10.65	12744	6492	6252	0.96
Green manuring-mustard	12.20	14640	6282	8358	1.33
Fallow-mustard	10.15	12192	6192	6000	0.97

Note:- Price of mustard grain, pearl millet + cluster-bean (fodder) and cluster-bean fodder were Rs. 1200.00, 15.00 and 20.00 (Rs. q⁻¹) respectively.

References: -

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