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Short communication

Evaluation of potato-based crop sequences for crop diversification in Malwa region of Madhya Pradesh

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ABSTRACT

A study was conducted to evaluate different crop sequences under limited-period irrigation conditions at farmers' fields in four villages of Malwa region of Madhya Pradesh during 2007-08. Six crop sequences, *viz*., Soybean-Garlic, Soybean-Onion, Soybean-Wheat, Soybean-Potato, Green gram-Radish-Potato and Green gram-Potato-Wheat were compared. Results revealed that crop sequence had remarkable influence on various competition indices. Highest potato equivalent yield (506.25q/ha) was recorded in green-gram- radish-potato crop sequence, followed by soybean-garlic, green-gram-potato-wheat and soybean-potato crop sequences. Land Utilization Index (LUI) was highest in green-gram-potato-wheat crop sequence and minimum in soybean-garlic and soybean-potato (both at 0.64) crop sequences. Green-gram-radish-potato crop sequence attained highest production efficiency (200.89kg/ha per day). Highest cost of input, output and net returns were obtained in greengram-radish-potato crop sequence whereas, Cost: Benefit ratio was maximum under soybean-onion crop sequence, followed by soybean-wheat and green-gram-radish-potato sequence.

Key words: Limited irrigation, crop diversification, crop sequence, potato

India faces the challenge of a burgeoning population and increasing demand for food, fibre and fuel. Crop intensification is a well-recognized solution for increasing productivity in a system (Gangwar and Katyal, 2001). Food of the future, potato holds a potential for higher quantity and quality produce per unit area besides spanning over a short duration of 60-80 days (Rawal *et al*, 2003). Malwa region of Madhya Pradesh, particularly Mandsaur and Neemuch districts, experience acute water scarcity during summer every year. The region largely grows soybean in *kharif*, and wheat, gram, garlic and onion in the *rabi* season. Generally, two crops are taken a year which not only limits productivity of a system, but also its land-utilization efficiency. Hence, a need is felt for crop intensification and diversification to make farming sustainable and economically viable. Therefore, the present study was planned to evaluate different crop sequences in the Malwa region of Madhya Pradesh.

A study was conducted to evaluate different crop sequences under limited period of irrigation at farmers' fields in four villages of Malwa (Mandsaur-Neemuch) region, Madhya Pradesh, during 2007-08. Six crop sequences, viz., Soybean (JS-71-05)-Garlic (G-1), Soybean (JS-335)-Onion (Agrifound Light Red), Soybean (JS-335)-Wheat (WH-147), Soybean (JS-335)-Potato (Kufri. Jyoti), Green gram (JM-721)-Radish (Japanese White)-Potato (Kufri. Laukar), Green gram (JM-721)-Potato (Kufri. Jyoti)-Wheat (Lok-1) were compared in randomized block design with four replications. Varieties were selected on the basis of their suitability to fit into the crop sequence and their adaptability in the region, and, acceptance among farmers. Standard package of practices was followed to raise the crops. Potato crop in the Green gram–Potato–Wheat crop sequence was harvested on 18th December, without allowing maturing and curing after dehaulming in the field so that wheat crop could be sown by 25th December. Yield of various crops was recorded and converted into potato equivalents on the basis of price (Govindakrishnan *et al*, 1990). Land Utilization Index (LUI) was calculated by dividing the total number of days different crops of a sequence remained in the field in a period

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Table 1. Effect of cropping sequence on various competition indices

Crop sequence	Yield (q/ha)			Potato Equivalent Yield (q/ha)	Land Utilization Index (LUI)	Production efficiency (kg/ha/day)
	1st crop	2nd crop	3rd crop			
Soybean - Garlic	21.3	95.3	-	397.31	0.64	170.52
Soybean - Onion	23.5	312.6	-	356.66	0.68	142.10
Soybean - Wheat	24.6	48.8	-	119.33	0.70	46.80
Soybean - Potato	24.1	275.5	-	368.69	0.64	156.89
Green gram - Radish-Potato	15.2	133.4	263.5	506.25	0.69	200.89
Green gram - Potato -Wheat	14.8	248.7	33.5	372.95	0.78	130.85
SEm ±				15.05		
CD *(P=0.05)*				45.34		

Table 2. Cost of input, output and net returns under different cropping sequences

Crop sequence	Input (Rs./ha) cost				Output (Rs./ha)				Total Net Return (Rs/ha)	*C:B ratio
	1st crop	2nd crop	3rd crop	Total	1st crop	2ndcrop	3rdcrop	Total		
Soybean - Garlic	7950	73500	-	81450	31950	285900	-	317850	236400	1 : 3.90
Soybean - Onion	7950	41530	-	49480	35250	250080	-	285330	235850	1 : 5.77
Soybean - Wheat	7950	12650	-	20600	36900	58560	-	95460	74260	1 : 4.50
Soybean - Potato	7950	55310	-	63260	36150	258800	-	294950	193290	1 : 3.06
Green-gram- Radish - Potato	4560	31950	55310	91820	52800	121400	230800	405000	313180	1 : 4.41
Green-gram - Potato -Wheat	4560	55310	12650	72520	51200	202160	45000	298360	225840	1 : 4.11

Expenditure includes cost of all inputs used for raising the crop, e.g., seed, fertilizer, labour etc. prevailing at the time of study. For calculating economics under different crop sequences, grain/bulb/root/tuber yield was considered. Prevailing prices of soybean, garlic, onion, wheat, potato, green gram and radish were: Rs. 15, 30, 8, 12, 8, 40 and 10 per kilogram, respectively

*C:B = Cost:Benefit

spanning 365-days. Production efficiency was calculated by dividing Potato Equivalent Yield (PEY) by total number of days held by different crops of a sequence in the field. Economic analysis was carried out on the basis of cost of different inputs and produce prevalent in the region at the time of the experiment. Formulae used for calculation of Potato equivalent Yield (q/ha) and Production Efficiency (kg/day/ha) are given below:

$$\text{Potato Equivalent Yield (PEY) (q/ha)} = \frac{\text{Yield of the produce (q/ha) X Price of the produce (₹./q)}}{\text{Price of potato (₹./q)}}$$

$$\text{Production efficiency (kg/day/ha)} = \frac{\text{Potato Equivalent Yield}}{\text{Duration of the sequence (days)}}$$

Results revealed that crop sequences had a remarkable influence on various competition indices. Highest PEY (506.25q/ha) was recorded with green-gram–radish-potato crop sequence, followed by soybean-garlic, green-gram-potato-wheat and soybean-potato crop sequences. Soybean-wheat crop sequence yielded lowest (119.33q/ha) PEY. Higher yield of potato due to longer crop duration than in potato crop under green-gram-potato-wheat crop sequence, higher prices of green gram; and, inclusion of short duration radish crop all resulted in superior performance of green-gram-radish-potato crop sequence compared to other crop sequences. Similar positive effect of crop duration on tuber yield has also been reported by Praharaj *et al* (2001). Chatrath and Singh (2010) found delay in sowing to have a negative impact on wheat yield. Land Utilization Index (LUI) was highest in green-gram-potato-wheat crop sequence, and minimum with soybean-garlic and soybean-potato (both 0.64) crop sequences. Rest of the crop sequences showed LUI in the range of 0.68-0.70. Production efficiency of a cropping sequence can form a good criterion for selection, particularly under conditions of limited period irrigation. Data (Table 1) showed that green-gram-radish-potato crop sequence attained highest production efficiency (200.89 kg/ha/day), followed by soybean-garlic (170.52 kg/ha/day), soybean-potato (156.89 kg/ha/day) and soybean-onion (142.10 kg/ha/day). Soybean-wheat crop sequence showed lowest production efficiency. Data on cost of input and output (Table 2) showed that maximum expenditure was incurred on green-gram-radish-potato crop sequence, followed by soybean–garlic and, minimum under soybean-wheat crop sequence. Higher cost of seed and greater requirement of labour under these crop sequences could be a reason for the higher cost of inputs. Maximum output was realized under green-gram-radish-potato crop sequence, followed by soybean-garlic. Similarly, highest net return was

with green-gram-radish-potato crop sequence, followed by soybean–garlic crop sequence. Soybean–wheat crop sequence resulted in lowest net return. Cost:Benefit ratio showed maximum receipt per rupee invested under soybean-onion crop sequence, followed by soybean-wheat and green-gram-radish-potato crop sequences. It is important to note that, presently, soybean-garlic and soybean-onion are popular crop sequences in the region. These can beneficially replaced with green-gram-radish-potato and soybean-potato crop sequences, respectively for better returns.

REFERENCES

Chatrath, R. and Singh, S.K. 2010. Productivity improvement in rice-wheat cropping system. *Ind. Farming*, **60**:12-17

Gangwar, B. and Katyal, V. 2001. Productivity, stability and profitability of rice (*Oryza sativa*)- based crop sequences in West Bengal and Orissa. *Ind. J. Agron*., **46**:387-394

Govindakrishnan, P.M., Upadhyay, N.C., Grewal, J.S. and Premchand. 1990. An analysis of potato based crop sequences. *Ind. J. Agron*., **35**:40-43

Praharaj, C.S., Kumar, D., Sharma, R.C. and Paul Khurana, S.M. 2001. Potato-wheat-paddy: A new emerging alternative crop rotation for Indo-Gangetic plains. *J. Ind. Potato Assoc*., **28**:44-45

Rawal, S., Lal, S.S., Singh, B.P., Paul Khurana, S.M. and Kumar, P. 2003. Evaluation of potato, rice and wheat varieties for rice-potato-wheat system. *J. Ind. Potato Assoc*., **30**:95-96

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