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Production potential and economics of different crop sequences

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ABSTRACT

An experiment was conducted on sandy-loam soils during the rainy and winter seasons from 1996–97 to 1998–99, to determine the impact of different cropping sequences on productivity, profitability and sustainability. Groundnut (*Arachis hypogaea* L.) – wheat (Triticum *aestivum* L. emend. Fiori & Paol.) system gave the highest wheat-equivalent yield (82.19 q/ha), net returns (Rs 31,912/ha) and benefit : cost ratio (2.28), followed by groundnut–Indian mustard [*Brassica juncea* (L.) Czernj. & Cosson], while predominant crop sequence of area maize (*Zea mays* L.) – wheat gave 54.93 q/ha wheat-equivalent yield only. Groundnut–wheat cropping sequence also proved most efficient in terms of land-use efficiency and production efficiency.

Key words : Cropping sequences, Production potential, Yield, Net returns, Economics

Since long conventional cropping system of maize–wheat is being followed in the most of the areas of Sub-humid southern plains and Aravalli hills zone of Rajasthan. The productivity of maize–wheat system has shown trend consistently declining in most of area and as such the income from this system is hardly sufficient for its continuance on sustainable basis. The exhaustive nature of cereal-based cropping sequence may be the reason for decrease in yields (Jadhav, 1989). Due to favourable influence of legumes on soil health, the legume and oilseed-based alternate cropping system may be economically viable and give sustained profitable production. Therefore, the present investigation was planned to evaluate economically viable, feasible and sustainable crop sequence for sub-humid southern plains and Aravalli hills zone of Rajasthan.

MATERIALS AND METHODS

The field study was conducted during 1996–97 to 1998–99 at Agriculture Research Station, Arjia, Bhilwara (24°20' N and 74°40' E, 432.6 m above mean sea-level). The soil was Inceptisol sandy loam in texture, low in organic carbon (0.38%), available N (196 kg/ha) and P (9.6 kg/ha),

but high in available K (182.4 kg/ha), with pH 7.9. The rainfall distribution was very erratic and total rainfall received during 1996–97, 1997–98 and 1998–99 (June to July) was 859.2, 634.0 and 493.2 mm respectively. Treatments comprised 9 cropping sequence systems, viz. 'Navjot' maize –'Raj. 3077', wheat maize–'Varuna' Indian mustard, maize–'Dahod Yellow' gram (*Cicer arietinum* L.), 'JL 24' groundnut – wheat, groundnut–Indian mustard, groundnut–gram, 'T 9' blackgram–wheat, blackgram–Indian mustard and blackgram–gram. Crops included in different sequences were raised with recommended agronomic practices. The treatments were tested in randomized block design with 4 replications. For comparison between crop sequences, the yield of all crops were converted into wheat equivalent on price basis (Yadav and Newaj, 1990). The data of 3 years were pooled. Land-use efficiency was calculated dividing the total duration of crop sequences by 365 and expressed in per cent. Production-efficiency values in terms of kg/ha/day was calculated dividing the production of the sequence by total duration of sequence and production efficiency in terms of Rs/ha/day was obtained by net return of sequence divided by total duration of sequence (Singh and Verma 1998). Sustainable-yield index was calculated as per Singh *et al.* (1990).

RESULTS AND DISCUSSION

Rainy-season crops

Maize gave the highest mean grain yield, followed by groundnut dry pod and blackgram (Table1).

Winter-season crops

Grain yield of wheat was higher when grown after groundnut and blackgram as compared to maize, presumably owing to beneficial effects of legumes on succeeding crop. De *et al.* (1983) and Tomar and Tiwari (1990) also reported similar findings. However, it was recorded that mustard yield was not influenced by preceding legume crops like groundnut or balckgram (Table 1).

Wheat-equivalent yield

The pooled data (Table 1) indicated that wheat-equivalent yield of groundnut–wheat sequence was significantly higher than rest of the sequences. The results over individual years also followed similar trend except 1998–99.

The highest land-use efficiency was recorded in groundnut–wheat cropping sequence, because this sequence occupied the field for longest duration (254 days). It was the lowest in blackgram–gram (209 days). Production efficiency in terms of Rs/ha/day was also highest in the groundnut–wheat sequence, followed by groundnut–mustard sequence, while production efficiency in terms of kg/ha/day was the highest in the maize–wheat sequence, followed by groundnut–wheat sequence (Table 2) in the present study.

Groundnut–Indian mustard crop sequence was found to be highly sustainable, giving 0.62 sustainability yield index, followed by groundnut–wheat (0.59), while maize–gram and blackgram–gram crop sequences were found to be sustainable giving a sustainable yield index of 0.32.

Table 1. Wheat-equivalent yield, mean yield and duration of crops in the cropping sequences (mean data of 3 years)

Cropping sequence	Wheat-equivalent yield (q/ha)				Mean crop yield (q/ha)			Mean duration (days)		
	1996–97	1997–98	1998–98	Mean	Rainy season	Winter season	Total	Rainy season	Winter season	Total
Maize–wheat	61.93	47.78	55.09	54.93	25.18	28.78	53.96	91	144	235
Maize–Indian mustard	47.16	46.11	58.56	50.61	24.58	11.47	36.05	91	127	218
Maize – gram	41.70	33.76	51.83	42.43	25.92	8.64	34.56	91	120	211
Groundnut–wheat	104.42	77.56	64.60	82.19	20.37	31.34	51.71	110	144	254
Groundnut–Indian mustard	84.70	73.56	65.69	74.65	19.85	11.57	31.42	110	127	237
Groundnut–gram	81.70	56.64	51.89	63.51	19.46	8.37	27.83	110	120	230
Blackgram–wheat	79.22	53.59	42.48	58.43	11.78	30.96	42.74	89	144	233
Blackgram–Indian mustard	57.80	54.53	40.54	50.96	11.22	11.25	22.47	89	127	216
Blackgram–gram	60.30	35.74	29.62	41.89	11.46	8.30	19.76	89	120	209
CD (P=0.05)	7.25	5.62	4.53	3.62						

Table 2. Economics and other parameters under different cropping sequences (mean data of 3 days)

Crop sequence	Net return (Rs/ha)	Benefit : ratio	Land-use efficiency (%)	Production efficiency (kg/ha/day)	(kg/ha/day)	Net profit or loss per ha over maize–wheat	Sustainable yield index
Maize–wheat	21,888	1.71	64.4	22.96	93.14		0.46
Maize–Indian mustard	20,224	1.78	59.7	16.54	92.77	–1,664	0.42
Maize–gram	16,030	1.32	57.8	16.38	75.97	–5,858	0.32
Groundnut–wheat	31,912	2.28	69.6	20.36	125.64	10,024	0.59
Groundnut–Indian mustard	28,433	2.28	64.9	13.26	119.97	6,545	0.62
Groundnut–gram	22,130	1.70	63.0	12.10	96.22	242	0.46
Blackgram–wheat	23,545	2.21	63.8	18.34	101.05	1,657	0.38
Blackgram-Indian mustard	19,664	2.17	59.2	10.40	91.04	–2,224	0.40
Blackgram–gram	14,364	1.46	57.3	9.45	68.73	–7,524	0.32

Economics

Economic analysis (Table 2) indicated that groundnut–wheat sequence gave the highest net return, followed by groundnut–Indian mustard. The results also revealed that higher benefit : cost ratio was obtained from groundnut–wheat and groundnut–Indian mustard cropping sequences. Groundnut–wheat, groundnut–Indian mustard, blackgram–wheat and groundnut–gram sequences gave higher net return of Rs 10,024, 6,545, 1,657 and 242/ha, respectively, over maize–wheat sequence which was dominant sequence in this region.

Thus, it was concluded that productivity, profitability and sustainable-yield index were higher under groundnut–wheat and groundnut–Indian mustard cropping sequences than maize–wheat sequence.

REFERENCES

De, R., Rao Yogeswara, Y. and Ali, W. 1983. Grain and fodder legumes as preceding crops affecting the yield and N economy of rice. *Journal of Agricultural Science, Cambridge*, **105** : 1–7.

Jadav, A.S. 1989. Nutrient balance with reference to fertilizer management under wheat-based cropping system. *Journal of Maharashtra Agricultural Universities* **14**(3) : 288–291.

Singh, N.B. and Verma, K.K. 1998. Production potential and economic analysis of rice (*Oryza sativa*)- based cropping system. *Indian Journal of Agronomy* **43**(2) : 199–203.

Singh, R.P., Das, S.K., Rao, U.M. Bhaskara and Reddy, M. Narayana. 1990. *Towards Sustainable Dryland Agricultural Practices*, pp 5–9. Central Research Institute For Dryland Agriculture, Hyderabad.

Tomar, S.S. and Tiwari, A.S. 1990. Production potential and economics of different crop sequences. *Indian Journal of Agronomy* **35** (1&2) : 30–35.

Yadav, D.S. and Newaj, R. 1990. Studies on increasing the utilization of natural resources through intensive cropping systems. *Indian Journal of Agronomy* **35** (1&2) : 50–55.