

Economic analysis of wheat (*Triticum aestivum*) and chickpea (*Cicer arietinum*)-based crop sequences

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ABSTRACT

A field experiment was conducted during 1988-89 to 1990-91 with different crop sequences, viz. soybean [*Glycine max* (L.) Merr.]—wheat (*Triticum aestivum* L. emend. Fiori & Paol.), soybean—chickpea (*Cicer arietinum* L.), groundnut (*Arachis hypogaea* L.)—wheat, groundnut—chickpea, sorghum [*Sorghum bicolor* (L.) Moench]—wheat and sorghum—chickpea, on farmers' fields. These were evaluated for their production potential, stability and economics. Wheat can successfully be grown after soybean, groundnut and sorghum. Groundnut—wheat, groundnut—chickpea and soybean—wheat gave significantly higher total yield of 6.41, 6.38 and 5.83 tonnes/ha respectively than sorghum—wheat (4.25 tonnes/ha), and higher significant net returns of Rs 14,429, Rs 13,345 and Rs 13,125/ha. The best crop sequences were found groundnut—wheat and groundnut—chickpea, followed by soybean—wheat for economic return.

Sorghum [*Sorghum bicolor* (L.) Moench]—chickpea (*Cicer arietinum* L.) is one of the popular crop sequences being followed in Satpura zone of Madhya Pradesh. But the net returns per unit area and time are not very encouraging in this crop sequence. In view of this it would be advantageous if a more profitable and viable sequence could be introduced under such a situation. The present study was therefore undertaken to select suitable wheat (*Triticum aestivum* L. emend. Fiori & Paol.)-and chickpea-based crop sequences to increase production potential and net returns per unit area and time.

MATERIALS AND METHODS

A field experiment was conducted on farmers' fields during 1988-91 at 4 locations (Chhindwara, Amarwara, Mohkhed and Chourai) with 6 crop

sequences, viz. soybean [*Glycine max* (L.) Merr.]—wheat, soybean—chickpea (*Cicer arietinum* L.), sorghum [*Sorghum bicolor* (L.) Moench]—wheat, sorghum—chickpea, groundnut (*Arachis hypogaea* L.)—wheat and groundnut—chickpea. The experiment was carried out in randomized block design. The soils were medium in fertility (N 260-340 kg/ha, P 12-15 kg/ha and K 600 kg/ha), with pH 7.2-7.6. The soils were loamy to loamy clay and silty loam in texture. The crops in rainy (*kharif*) and winter (*rabi*) trials were sown in last week of June and first week of November and harvested at maturity in first-third weeks of October and second-third weeks of March respectively. The varieties included were 'JS 2', 'CHS 5', 'Gangapuri', 'WH 147' and 'JG 315' of soybean, sorghum, groundnut, wheat and chickpea respectively. The fertilizers for different crop sequences

were applied on an average basis @ 89, 45 and 13.33 kg/ha respectively of N, P and K for soybean–wheat; 37 and 41.48 kg/ha of N and P for soybean–chickpea; 138, 35.37 and 33.33 kg/ha of N, P and K for sorghum–wheat; 94, 38.86 and 17.5 kg/ha of N, P and K for sorghum–chickpea; 96, 47.16 and 17.5 kg/ha of N, P and K for groundnut–wheat; and 54 and 58.95 kg/ha of N and P for groundnut–chickpea, as per crop requirements. Wheat was raised in semi-irrigated or irrigated conditions during the winter (*rabi*), whereas sorghum, soybean, groundnut during the rainy season and chickpea during the winter season were cultivated under rainfed situation. For comparison between crop sequences the yields of all other crops were converted into wheat equivalents on price basis (Verma and Modgal, 1983). The mean yields were computed based on the normal practices

followed for raising the crops and means of input and output. The total rains received during the crop season in 1988–89, 1989–90 and 1990–91 were 1,032, 1,026 and 1,220 mm respectively favoured the crop growth and resulted in good yield. Land-use efficiency was calculated taking total duration of crops (in individual cropping sequence) and dividing by 365.

RESULTS AND DISCUSSION

Wheat-based crop sequence gave significantly high wheat-equivalent yield (Table 1). This was due to higher productivity of wheat crop, which could successfully be grown after groundnut. Yield of wheat grown after groundnut was higher than that of soybean and sorghum. Singh and Venkateswarlu (1985) and Narwal and Malik (1987) reported beneficial effect of legumes on succeeding

Table 1. Yield, land-utilization efficiency and harvest index of wheat and chickpea-based crop sequences (mean data of 3 years)

Crop sequence		Land-utilization efficiency (%)	Harvest index (%)		Crop yield (tonnes/ha)		Wheat-equivalent yield (tonnes/ha)
Rainy season	Winter season		Rainy season	Winter season	Rainy season	Winter season	
Soybean–wheat		59.73	41.67	42.36	1.70 (3.09)	2.74	5.83
Soybean–chickpea		63.83	41.97	40.10	1.68 (3.05)	0.94 (1.94)	4.99
Sorghum–wheat		57.53	33.83	42.21	2.55 (1.63)	2.74	4.37
Sorghum–chickpea		67.12	31.37	42.94	2.64 (1.68)	1.24 (2.57)	4.25
Groundnut–wheat		63.01	41.67	42.07	1.38 (3.73)	2.68	6.41
Groundnut–Chickpea		67.12	41.63	43.36	1.37 (3.70)	1.29 (2.68)	6.38
CD (P = 0.05)							0.34

Figures in parentheses indicate wheat-equivalent yield (tonnes/ha)

Table 2. Economics of wheat- and chickpea-based crop sequences (mean data of 3 years)

Sequence		Net return (Rs/ha)		
Rainy season	Winter season	Rainy season	Winter season	Total
Soybean-wheat		7,040	6,305	13,345
Soybean-chickpea		6,856	4,051	10,907
Sorghum-wheat		4,882	5,768	10,650
Sorghum-chickpea		3,716	5,096	8,812
Groundnut-wheat		8,214	6,215	14,429
Groundnut-chickpea		8,125	5,000	13,125
CD (P = 0.05)				1,481

crop. Sorghum-chickpea sequence gave the lowest wheat-equivalent yield as well as harvest index (Table 1). Among the different crop sequences involving wheat, the highest significant wheat-equivalent yield was obtained with groundnut-wheat, followed by groundnut-chickpea and soybean-wheat. Sorghum recorded the lowest harvest index and soybean the highest. During the winter season chickpea showed highest harvest index when grown after groundnut and the lowest when grown after soybean. Sorghum-chickpea and groundnut-chickpea sequences showed nearly equal land-utilization efficiency of 67.12%, whereas sorghum-wheat the lowest (57.53%). Soybean-chickpea showed

63.83% land-utilization efficiency, followed by groundnut-wheat sequence.

Economics

Almost all crop sequences gave significantly higher net returns than sorghum-chickpea, being highest with groundnut-wheat sequence, followed by soybean-wheat sequence (Table 2). The lowest net return was achieved with sorghum-chickpea sequence. The higher net return from wheat-based sequences might be due to higher net return from wheat crop grown in these sequences. Thus wheat can successfully and profitably be grown after groundnut and soybean compared with that of sorghum. Among the cropping sequences, groundnut-wheat and soybean-wheat were the most paying crop sequences in the Satpura zone of Madhya Pradesh.

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