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Production potential, economics and soil fertility status of sunflower (*Helianthus annuus*)-based cropping sequences under scarce rainfall zone of Andhra Pradesh

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ABSTRACT

A field experiment was conducted for 5 years (1996–97 to 2000–2001) at Regional Agricultural Research Station, Nandyal, revealed that among different cropping sequences involving sunflower (*Helianthus annuus* L.) the sunflower-equivalent yield of groundnut (*Arachis hypogaea* L.)–sunflower was the highest (1,555 kg/ha) and was at par with setaria (*Setaria* sp.)–sunflower (1,545 kg/ha) and sunflower–sunflower (1,503 kg/ha). The net returns and benefit : cost ratio were the highest for setaria–sunflower followed by sunflower–sunflower sequence. The soil fertility status of rainfed cropping systems involving pulse crops was better than that involving non-pulse crops in the sequence.

Key words : Production potential, Economics, Land-use efficiency, Production efficiency, Soil fertility, Sunflower-based cropping system.

Sunflower is an important oilseed crop grown in India for edible oil although its average productivity is only 566 kg/ha (Damodaram and Hegde, 2000). By virtue of its short duration, low photo- and thermo-sensitivity and wider adaptability to different soil types, sunflower fits well into various multiple cropping systems. These features offer a potential scope to explore the system of cropping in sequence preceding to sunflower. Hence present investigation was conducted to assess the production potential and economic feasibility of different sunflower-based cropping systems and to find out the best sequence suitable for the region under rainfed conditions.

MATERIALS AND METHODS

The field experiment was conducted during 5 consecutive years from 1996–97 to 2000–2001 at Regional Agricultural Research Station, Nandyal, located in scarce rainfall zone of Andhra Pradesh. The soil was deep black, clayey (clay content > 40%), medium in available N (270 kg/ha), medium in available P (19.2 kg P_2O_5/ha) and high in available K (291 kg K_2O/ha), with soil pH 8.2. The experiment was conducted in randomized block design with 3 replications in a permanent layout at respective fixed locations. Six sunflower-based cropping sequences, viz. sunflower–sunflower, fallow–sunflower, greengram (*Phaseolus radiatus* L.)–sunflower, soybean [*Glycine max* (L.) Merr.]–sunflower, groundnut–sunflower and setaria–sunflower, were grown under rainfed condition with their recommended doses of fertilizers and spacings (Table 1).

Rainfall received from July to February during 1996–97, 1997–98, 1998–99, 1999–2000 and 2000–2001 was 1,042, 1,140, 1,063.8, 345.4 and 1,119.4 mm respectively. Final crop yields (main and by-products) were recorded and their total gross returns, production costs and net returns were calculated on the basis of prevailing market prices of the produce. For comparison between cropping sequences, the yield of all the crops were converted into sunflower-equivalent yield on price basis. Land-use efficiency values were calculated by dividing the total duration of crop sequences with 365 and expressed in percentage. Production efficiency values were calculated by dividing the total seed production/ha in a sequence with total duration of crops in that sequence (Tomar and Tiwari, 1990).

RESULTS AND DISCUSSION

Production potential and economics

The groundnut–sunflower cropping sequence recorded the highest sunflower-equivalent yield, followed by setaria–sunflower and sunflower–sunflower (Table 2). Monocrop of sunflower recorded the lowest seed yield and sunflower-equivalent yield of 675 kg/ha, which indicates that growing any of the crops preceding sunflower was found profitable than monocrop of sunflower. Higher sunflower seed-equivalent yield in groundnut sunflower and setaria sunflower cropping sequences may be attributed to higher tonnage and better price of these crops.

Table 1. Different crops, their varieties, spacing and recommended doses of fertilizers of sunflower-based cropping sequences

Crop	Variety	Fertilizer (kg/ha)			Spacing
		N*	P_2O_5	K_2O	
Sunflower	'APSH 11'	60	60	30	60 cm × 30 cm
Greengram	'ML 267'	20	50	40	30 cm × 10 cm
Soybean	'JS 335'	30	60	40	30 cm × 10 cm
Groundnut	'K 134'	20	40	50	30 cm × 10 cm
Setaria	'Narasimharaya'	20	50	0	30 cm × 10 cm

*Split application of N: Sunflower, 3 equal splits at sowing, 30-35 DAS and 50-60 DAS; groundnut, 2 equal splits at sowing and at 30 DAS; Setaria, 2 splits of 20 N at sowing and 10 N at 25 - 30 DAS

Table 2. Yield, other parameters, economics and soil fertility status under different sunflower-based cropping sequences (mean data of 5 years)

Cropping sequence	Yield (kg/ha)		Sunflower seed-equivalent yield	Duration (days)	Land-use efficiency (%)	Production efficiency (kg/ha/day)	Economics		Soil fertility status after 5 years of experimentation (kg/ha)		
	Rainy season	Winter season					Mean net returns (Rs/ha)	Mean benefit: cost ratio	N	P_2O_5	K_2O
Sunflower–sunflower	617	885	180	49.3	8.3	8.3	11,964	2.13	174	12.6	283
Fallow–sunflower		675	90	24.7	7.5	7.5	4,843	1.92	252	17.8	298
Greengram–sunflower	380	907	155	42.5	8.3	8.3	8,202	1.79	275	19.5	320
Soybean–sunflower	769	714	195	53.4	7.6	7.6	7,489	1.69	282	19.6	306
Groundnut–sunflower	554 (1,656)	733	195	53.4	7.6	7.6	9,766	1.72	289	18.9	315
Setaria–sunflower	1,183 (2,383)	991	210	57.5	10.4	10.4	13,716	2.45	243	16.7	296
CD (P=0.05)			186								

Figures in parentheses indicate haulm or straw yield

Market price of different commodities: Sunflower seed, Rs 15/kg; greengram seed, Rs 13/kg; soybean seed, Rs 10/kg; groundnut pods, Rs 13/kg; groundnut haulm, Rs 3/kg; setaria seed, Rs 4/kg; setaria straw, Rs 1.50/kg

However, the maximum net returns and benefit : cost ratio were realized from setaria–sunflower followed by sunflower–sunflower system (Table 2).

Land-use efficiency was the highest in setaria–sunflower cropping sequence because it occupied the land for longer period of 210 days (Table 2). Fallow–sunflower sequence showed the lowest land-use efficiency.

The production efficiency was also highest in setaria–sunflower cropping sequence because of higher tonnage of produce from this sequence (Table 2). Being a drought-resistant crop, setaria might have performed well under dry spell conditions, resulted in better yield and production efficiency.

Soil-fertility status

After 5 years of experimentation, it was observed that the sequences including cereal (setaria) and oilseed (sunflower) preceeding sunflower reduced the N and P status of the soil, whereas the sequences having pulses (greengram, soybean and groundnut) increased the overall fertility status of the soil in respect of N, P and K. Patil *et al.* (1995) and Thakur *et al.* (1998) also opined that inclusion of pulses in cropping systems resulted in better physico-chemical status of soil.

Thus, in Vertisols of scarce rainfall zone of Andhra Pradesh, setaria–sunflower cropping sequence was more remunerative as it gave higher crop yield with higher monetary returns under rainfed conditions.

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