

## Economic evaluation of groundnut (*Arachis hypogaea*)-based cropping systems in rainfed Alfisols

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### ABSTRACT

A field experiment was conducted on red sandy-loam soils during 1996-97 and 1997-98 at Regional Agricultural Research Station, Tirupati, to evaluate the yield and economics of different cropping systems in rainfed Alfisols. Significantly higher pod yield of groundnut (*Arachis hypogaea* L.) was obtained in single skip row with 100% population. Intercropping with pigeonpea or redgram [*Cajanus cajan* (L.) Millsp.] in 7:1 ratio significantly reduced the groundnut pod yields. But higher net returns of Rs 14,070 and Rs 3,331 were obtained with groundnut + redgram intercropping (7:1) in 1996-97 and 1997-98 in good and bad years respectively. Higher total yield advantage was also recorded with groundnut + redgram intercropping in 7:1 ratio. Groundnut + redgram (7:1) intercropping proved to be more remunerative than other cropping systems in rainfed Alfisols.

**Key words :** Groundnut, Skip-row, Intercropping, Net returns, Benefit : cost ratio

In southern agro-climatic zone of Andhra Pradesh, 78% of the area is under Alfisols with low moisture-retentive capacity. The erratic monsoon rains with long breaks result in low yield of groundnut; the ruling crop of drylands. The only means to stabilize and improve crop production in this area is to make better use of available natural resources. In the southern agro-climatic zone of Andhra Pradesh with the extended rainfall up to

December, which accounts for a total rainfall of 750-950 mm in 1 year, can support inter - or relay cropping systems. Intercropping and relay cropping in groundnut with different crops with varying levels of success at Tirupati has been well documented (Soundararajan *et al.*, 1990; Manorama, 1992). The performance of groundnut with intercrop and relay intercrops by altering crop geometry for efficient use of the natural resources is to be

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exploited. Hence it was felt necessary to take up this study to determine a better, efficient and remunerative cropping systems for drylands because of frequent failure of sole crop of rainfed groundnut.

### MATERIALS AND METHODS

The field experiment was conducted during rainy and winter seasons of 1996–98 at Regional Agricultural Research Station, Tirupati. The soil of the experimental field is sandy loam, neutral in reaction (pH 7.8) having 360, 20 and 195 kg/ha of available nitrogen, phosphorus and potash respectively.

The experiment was laid out in randomized block design, replicated thrice. The treatments comprised single row skipping of groundnut with 100% and 67% populations with and without inter-relay crops, viz. redgram and castor (*Ricinus communis* L.) compared with normal sowing of groundnut and groundnut + redgram intercropping in 7:1 ratio (Table 1). Groundnut variety 'TPT 1' was sown on 13 and 11 July and inter-relay crops were sown on 3 and 9 September during 1996 and 1997 respectively.

During 1996, an amount of 787.9 mm was received in 39 rainy days during the groundnut crop period (13 July 1996 to 23 October 1996) and an amount of 718.3 mm was received in 38 rainy days during the crop period of inter-relay crops (3 September 1996 to 18 February 1997). During 1997, an amount of 331.2 mm was received in 20 rainy days during the groundnut crop period (11 July 1997 to 1 November 1997). There were severe dry spells of 23 and 27 days during August and

October 1997.

### RESULTS AND DISCUSSION

Significantly higher pod yields of groundnut was obtained in single skip row of groundnut with 100% population over normal method of sowing. Intercropping of groundnut with redgram (7:1) significantly reduced the groundnut pod yield in both good or bad years (Table 1). There was a reduction in yield of groundnut when the population was reduced to 33% either in single skip or double skip, especially in drought year. Higher haulm yield was obtained with single skip row at 100% population than other treatments (Table 1).

Weather factors had profound influence on the yields of all crops in both the years. Practically there was no dry spell in the first year during the groundnut-growing period. However, the yields of inter-relay crops were not up to the expected levels because of the fact that the growth duration of these inter-relay crops was curtailed due to late season sowings. But during 1997, there were severe dry spells for about 23 and 27 days in the early stage and pod-filling stage, respectively. The serious drought hampered the pod yields of groundnut. The inter-relay crops have almost failed in 1997 due to severe drought followed by continuous wet weather in post-flowering season, thus promoting several pests and diseases and loss in population in spite of adopting best management practices.

Higher net returns were realized with groundnut + redgram intercropping in 7:1 ratio, followed by single skip with 100% population + redgram as inter-relay crop than those of over normal method of

**Table 1.** Pod and haulm yields of groundnut and yield of inter-relay crops (kg/ha) as influenced by cropping systems

Treatment	Pod yield of groundnut (kg/ha)		Haulm yield of groundnut (kg/ha)		Inter/inter/inter-relay crop yield (kg/ha)		Haulm/stalk yield of inter/relay crop (kg/ha)	
	1996-97	1997-98	1996-97	1997-98	1996-97	1997-98	1996-97	1997-98
T <sub>1</sub> , Normal method of sowing groundnut	1,713	651	2,805	720				
T <sub>2</sub> , Intercropping of groundnut + redgram in 7:1 ratio	1,442	401	2,620	585	1,050	928	1,500	904
T <sub>3</sub> , Single skipping of groundnut at 100% population	2,167	914	3,050	1,080				
T <sub>4</sub> , Single skipping of groundnut at 67% population	1,628	679	2,105	780				
T <sub>5</sub> , Double skipping of groundnut at 100% population	1,538	852	2,512	940				
T <sub>6</sub> , Double skipping of groundnut at 67% population	1,507	719	2,018	775				
T <sub>7</sub> , T <sub>3</sub> +Inter-relay crop of redgram	1,857	619	2,850	710	710	Crops failed	800	
T <sub>8</sub> , T <sub>3</sub> +Inter-relay crop of castor	1,937	710	2,750	810	220	Crops failed		
T <sub>9</sub> , T <sub>4</sub> +Inter-relay crop of redgram	1,614	509	2,050	660	600	Crops failed	850	
T <sub>10</sub> , T <sub>4</sub> +Inter-relay crop of castor	1,624	593	2,020	620	310	Crops failed		
T <sub>11</sub> , T <sub>5</sub> +Inter-relay crop of redgram	1,491	611	2,410	730	650	Crops failed		
T <sub>12</sub> , T <sub>5</sub> +Inter-relay crop of castor	1,487	741	2,440	865	350	Crops failed		
T <sub>13</sub> , T <sub>6</sub> +Inter-relay crop of redgram	1,555	485	2,050	515	610	Crops failed	800	
T <sub>14</sub> , T <sub>6</sub> +Inter-relay crop of castor	1,401	617	2,110	745	308	Crops failed		
CD (P = 0.05)	364	149	412	238		Crops failed		

**Table 2.** Economics of different cropping systems and total yield advantage in terms of groundnut pods (kg/ha) as influenced by plant population, crop geometry and cropping systems

Treatment	Gross returns (Rs/ha)		Net returns (Rs/ha)		Benefit : cost ratio		Groundnut pod equivalent (kg/ha)	
	1996-97	1997-98	1996-97	1997-98	1996-97	1997-98	1996-97	1997-98
T <sub>1</sub>	17,870	8,172	6,870	-1,829	0.62	-0.18	1,713	651
T <sub>2</sub>	28,070	16,331	14,070	3,331	1.0	+0.25	2,702	1514
T <sub>3</sub>	22,570	11,508	11,570	1,508	1.05	+0.15	2,167	914
T <sub>4</sub>	16,910	8,538	5,910	-1,462	0.53	-0.14	1,628	679
T <sub>5</sub>	15,130	10,694	5,130	694	0.46	+0.05	1,538	852
T <sub>6</sub>	15,670	9,016	4,670	-984	0.46	-0.09	1,507	719
T <sub>7</sub>	28,015	7,783	14,015	-4217	1.0	-0.35	2,698	619
T <sub>8</sub>	22,395	8,925	8,890	-2375	0.65	-0.22	2,157	710
T <sub>9</sub>	24,220	6,438	1,0210	-5,562	0.72	-0.46	2,334	509
T <sub>10</sub>	20,540	7,426	7,040	-4,074	0.52	-0.35	1,934	593
T <sub>11</sub>	23,670	8,427	4,670	-3573	0.33	-0.29	2,271	611
T <sub>12</sub>	19,090	9,325	5,570	-2,175	0.41	-0.18	1,837	741
T <sub>13</sub>	23,710	6,078	9,710	-5972	0.69	-0.49	2,287	485
T <sub>14</sub>	17,730	7,777	4,230	-3,223	0.31	-0.28	1,710	617

Details of treatments are given in Table 1

sowing groundnut during 1996 (Table 2). In the second year, which experienced severe drought, all the treatments including sole groundnut resulted in negative net returns (Table 2) except groundnut + redgram intercropping, single skip with 100% population and double skip 100%. Intercropping of groundnut + redgram (7:1) resulted in respectable net income at least after covering the cost of cultivation which itself has some reassurance to the farmers. The results of the 2 years study, i.e. extremely good and bad years, proved the definite advantage of intercropping system of groundnut + redgram in 7:1 ratio. Chikkanna *et al.* (1990) and Patel and Palmer (1988) also reported the economic advantage of groundnut + redgram intercropping in 7:1 ratio in dryland Alfisols.

Highest benefit : cost ratio was recorded with single skip with 100% population, followed by intercropping of groundnut + redgram in 7:1 ratio during 1996 (Table 2). In the second year, which was a drought year, all the treatments showed negative benefit : cost ratio, except groundnut + redgram (7:1) intercropping, single skip with 100% population and double skip with 100% population, emphasizing the necessity of the inclusion of redgram either as intercrop or as inter-relay crop in terms of economic returns. Similar results were also reported by Rafey and Verma (1988) and Soundararajan *et al.* (1990). During both the years, groundnut + redgram (7:1) intercropping resulted in the highest total advantage, giving 57% and 132% higher yields over normal method of sowing

respectively (Table 2). This can be attributed to the high yield of redgram as intercrop in addition to the high prices compared to all other systems. Similar yield advantage was also reported by Rao and Singh (1990).

Besides, with sole crop of groundnut, single skip with 100% population gave positive advantage in net returns in both the years. This simple agro-technique of crop geometry without involving any extra monetary input, conferred a good advantage in realizing better economic returns during drought years and normal years thus realizing this as a viable practice in areas where there is no extended rainfall.

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