

Groundnut — Mixed Cropping Experiment

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Introduction: Groundnut is one of the important commercial crops of the Madras State and it occupies nearly two million acres with an estimated production of one million tons of nuts in shell valued at nearly 33 crores of rupees. The area under groundnut has expanded phenomenally at the expense of other crops because of the ease of cultivation and the attractive monetary returns. Groundnut is grown pure and also extensively as a mixture with other cereals and pulses. The benefits of mixed cropping have been stressed by many agronomists. The practice is not new to the Indian ryot whose holding is small and a variety of crops is taken by resorting to judicious mixed cropping. However to get the best results out of mixed cropping subsidiary crops to be grown have to be chosen carefully to see that the components do not react adversely on each other.

Summary of previous work: Previous work done in this regard in the other States has been dealt at length in a previous paper on the subject by John, Seshadri and Shanker Rao (1943). At the Agricultural Research Station, Hagari (Andhra) Groundnut-*tenai* was found to be ecologically a sound mixture. At Guntur (Andhra) Cotton-groundnut mixture gave highest monetary return per unit area. Similar results were obtained at Dharwar (Bombay). Mehta (1942) reported that redgram and groundnut mixture was better than redgram sown pure. The same combination proved successful at the Agricultural Research Station, Siruguppa, (Andhra). Mixed cropping trials with cotton at the Agricultural Research Station, Koilpatti (Madras) have shown that groundnut, among the different mixed crops, has the least effect on cotton. Mixed cropping experiment was conducted at the Agricultural Research Station, Tindivanam (Madras) from 1939-'40 to 1948-'49. Results obtained in the first series of experiment from 1939-'40 to 1941-'42 have already been published and in this paper results obtained in the second series conducted from 1942-'43 to 1948-'49 are reported.

Materials and Methods: (a) *Treatments:* The experiment was conducted at the Agricultural Research Station, Tindivanam for

seven years (1942-'43 to 1948-'49) in two series. The main object of this experiment was to study the relative effects of the mixed cropping on the two main types grown in the country viz. spreading and the bunch.

I Series (Bunch Groundnut) (1942-'43 to 1945-'46)

Treatments	Strains	Spacings
1. Groundnut and Cotton	Groundnut TMV. 2	6" x 6"
2. Groundnut and Redgram	Cotton - Co. 4	3' x 9"
3. Groundnut and Castor	Cumbu - Local	3' x 6"
4. Groundnut and Cholam	Tenai - Local	3' x 6"
5. Groundnut and Tenai	Castor - TMV. 2	6' x 2'
6. Groundnut and Cumbu	Redgram - Local	6' x 9"
	Cholam - Local	6' x 6"

II Series (Bunch and spreading groundnuts)
(1946-'47 to 1948-'49)

Treatments	Spacings Groundnut	Other crops
1. Groundnut (TMV. 2) - Bunch pure	6" x 6"	
2. Groundnut (TMV. 2) - Castor (TMV. 3)	6" x 6"	6' x 2'
3. Groundnut (TMV. 2) - Redgram P. S. Strain	6" x 6"	6' x 9"
4. Groundnut (TMV. 2) - Cholam - Local	6" x 6"	6' x 6"
5. Groundnut (TMV. 2) - Cumbu - Local	6" x 6"	3' x 6"
6. Groundnut (TMV. 1) - Spreading pure	9" x 9"	
7. Groundnut (TMV. 1) - Castor - TMV. 3	9" x 9"	6' x 2'
8. Groundnut (TMV. 1) - Redgram P. S. Strain	9" x 9"	6' x 9"
9. Groundnut (TMV. 1) - Cholam - Local	9" x 9"	6' x 6"
10. Groundnut (TMV. 1) - Cumbu - Local	9" x 9"	3' x 6"
11. Castor pure (TMV. 3)		3' x 2'
12. Redgram pure - P. S. Strain		3' x 6"
13. Cholam pure - Local		1' x 6"
14. Cumbu pure - Local		1' x 6"

The randomised method of layout was adopted. The net plot size after rejecting requisite borders was 44' x 6' or 1/165 acre in the first series and 33' x 6' or 1/220 acre in the second series.

(b) *Cultivation details*: The fields were cultivated as are usually done for the groundnut crop. Town rubbish was applied at the rate of 10,000 lb. per acre and was incorporated into the soil. Sowings were done in the proper seasons. Two hoeings and weedings were given to all the plots, the first during the fourth week and the second a month later. The bunch groundnut was harvested by pulling the plants and stripping the pods and the spreading variety by digging with mammuty and stripping the pods. After the harvest of groundnut H. M. Guntake No. 2 was worked in between the rows of Castor, Redgram and cotton to remove weeds.

(c) *Season: First Series*: The first series of the experiment was conducted during the four years 1942-'43, 1943-'44, 1944-'45 and 1945-'46. The first season though started late, was a favourable one for the bunch crop. Good distribution of rainfall during the earlier part of the season proved ideal for the bunch groundnut and very good yields were obtained. The rapid development of the groundnut plants affected the growth of the subsidiary crops and the short duration cereals were the worst affected. The second season (1943-'44) was characterised by increased activity of the north-east monsoon, which favoured only the long duration subsidiary crops. The groundnut crop was an average one. During the third season (1944-'45) immediately after sowing there was a heavy downpour which affected the germination of all the six subsidiary crops grown mixed with groundnut. Excessive rains delayed harvest of the groundnut crop and as a result large percentage of nuts sprouted in the field. The yields were erratic and hence discarded. The fourth season (1945-'46) was a normal one and fairly good yields were obtained.

Second Series: In the first year 1946-'47, groundnut was sown by the middle of July. Rainfall received during the crop period was in excess of the requirements. The distribution was also not altogether satisfactory. The yield of bunch groundnut was below normal. In the second year, 1947-'48, season was adverse to the spreading groundnut as the north east monsoon was a near failure. The distribution of rain during south west monsoon period was uneven and unsatisfactory. The yield of bunch groundnut was below normal while that of spreading groundnut was poor. In the final year 1948-'49, the season was marked by partial failure of both the south west and the north-east monsoons. Prolonged drought prevailed in the initial stages which greatly affected the growth of the crop especially that of bunch groundnut. The north-east

monsoon also failed and rendered harvesting difficult. The initial setback greatly upset the results of the experiment, especially in case of bunch groundnut.

Results: (a) Yield: The yield of groundnut grown as a pure crop and as mixture crop was recorded for all the seasons. The field data were statistically analysed and the results are given in tables below, series wise.

TABLE I (a)
Mixed Cropping of Groundnut (1942 - '43 to 1945 - '46)
Groundnut Yield Data — (Average for three years)

Particulars	Groundnut Bunch-pure (Control) A	Groundnut and Cumbu B	Groundnut and Tenai C	Groundnut and Cotton D
Acre yield in lb.	1,450	1,242	1,275	1,370
Percentage on Control	100.5	85.7	87.9	94.5

Groundnut and Castor E	Groundnut and Redgram F	Groundnut and Cholam G	Stan- dard error	Whether significant or not (P=0.05)	Critical diffe- rence
1,336	1,180	1,105	37.1	Yes	105.0
92.1	81.4	76.2	2.6	Yes	7.2

Conclusion: A, D, E, C, B, F, G.

TABLE I (b)
Groundnut mixed cropping experiment (1946—47 to 1948—49)
Yield of Groundnut in lb.— (Average for 3 years)

Second Series:

Treatment	Bunch TVM. 2		Spreading TVM. 1	
	Acre yield in lb.	Percentage on control	Acre yield in lb.	Percentage on control
Groundnut Pure	900	100.0	850	100.0
Groundnut and Cholam	519	57.7	485	57.1
Groundnut and Castor	722	80.2	764	89.9
Groundnut and Cumbu	689	76.6	606	71.3
Groundnut and Redgram	729	81.0	620	73.0
Standard Error	51.5	5.7	42.4	4.9
Whether Significant or not (P=0.05)	yes		yes	
Critical difference	145.6	16.2	120.0	14.1

Conclusion: Groundnut, Redgram, Castor, Cumbu, Cholam
Groundnut, Castor, Redgram, Cumbu, Cholam

TABLE II (a)
Mixed Cropping Experiment
Yield of subsidiary crops when grown with bunch groundnut

First series :

Treatments	Yield in lb. per acre		
	1942 — '43	1943 — '44	1945 — '46
Castor	147	420	87
Cumbu	59	360	221
Tenai	32	354	307
Cholam	128	710	631
Cotton	82	121	76
Redgram	261	317	600

TABLE II (b)
Yield in lb. per acre

Second Series :

Years	Treatments	Pure	When grown with bunch groundnut	Percentage on pure crop	When grown with spreading Groundnut	Percentage on pure crop
1946-'47	Cholam	248	327	131.9	308	124.2
	Castor	254	93	36.6	184	72.4
	Cumbu	590	186	31.5	375	63.6
	Redgram	488	152	31.1	227	46.5
1947-'48	Cholam	822	520	64.3	666	81.0
	Castor	940	288	30.6	536	57.0
	Cumbu	590	70	11.8	68	11.5
	Redgram	822	375	45.6	330	28.0
1948-'49	Cholam	407	237	58.2	319	78.3
	Castor	228	71	31.2	106	46.5
	Cumbu	262	65	24.8	108	41.2
	Redgram	1196	210	17.6	303	25.3

(c) Economics: The economics of growing groundnut as a pure crop and as a mixture crop was worked out in each of the years of the first series of experiment. The results are given below :

TABLE III
Economics of Cultivation on acre Basis in Rupees

Particulars	Treatments						
	Groundnut pure (Bunch)	Groundnut Cumbu	Groundnut Tenai	Groundnut Castor	Groundnut Cotton	Groundnut Redgram	Groundnut Cholam
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1942-'43: Cost of cultivation	31	35	36	37	34	36	35
Gross return	71	60	62	77	77	76	63
Net Profit	40	25	26	40	43	40	28
1943-'44: Cost of cultivation	33	38	38	38	37	38	36
Gross return	64	70	69	69	86	72	63
Net Profit	31	32	31	31	49	34	27
1945-'46: Cost of cultivation	60	65	69	69	66	69	68
Gross return	135	152	157	150	150	173	155
Net Profit	76	87	88	81	84	104	87
<i>Average for three years:</i>							
Cost of cultivation	41	46	48	48	46	48	46
Gross return	90	94	96	99	104	107	23
Net Profit	49	48	48	51	58	59	47

The gross return was calculated by taking into account the value of groundnut produce, haulms, produce of the mixed crop, at the prevailing market prices.

Discussion: (a) *Yield of groundnut: First Series:* In the first year, cotton and castor had very little effect on the yield of groundnut, but the other crops reduced the yield significantly. In the second year, there was significant reduction in yield of groundnut compared with pure groundnut due to the effect of mixed cropping in all cases. But castor and cotton had comparatively lesser effect. In the final year, only redgram and cholam had diminished the yields and the rest had little or no effect. The combined analysis of the three years data showed that the treatment effects were statistically significant independent of seasonal differences. It is evident from the results that the yield of groundnut gets reduced when raised as a mixture crop and that in all the three years *Cholam* caused the maximum reduction (23.8%). The percentage of depression in the yield of groundnut crop is not as much as recorded in the previous series of experiment with spreading groundnut reported by John et al (1943).

Second Series: In the second series the differences in the yield between the crop raised and that grown mixed with other crops were statistically significant only in the first two years. In the first

year, the mixtures of 'Groundnut and Castor' and 'Groundnut and Cumbu' recorded significantly higher yields over the mixture "Groundnut and Cholam" in the case of both bunch and spreading groundnut. In the second year 'Groundnut and Cholam' mixture recorded significantly less yields than all the other treatments in the case of bunch groundnut. In the case of spreading, groundnut pure and "Groundnut - Castor" mixtures recorded significantly higher yields than 'Groundnut and Cholam'. In the third year (1948-'49) the yield differences did not satisfy the 'Z' test. Combined analysis of the data for the three seasons revealed that cholam when grown as mixture with groundnut either bunch or spreading depressed the yield of groundnut significantly than other crops.

Comparing the effect of other crops on the bunch and spreading types it is seen that bunch crop suffers lesser reduction in yield than the spreading groundnut particularly when grown mixed with cumbu and redgram. The percentage of reduction in yield of bunch and spreading groundnut when grown mixed with other crops are given below in Table IV for each year and also the three year average.

TABLE IV
Mixed cropping experiment reduction in yield of groundnut

	Bunch Groundnut	Spreading Groundnut
<i>1946—'47 :</i>		
With Cholam	36.3	42.3
With Castor	8.3	8.2
With Cumbu	6.6	3.5
With Redgram	23.4	31.0
<i>1947—'48 :</i>		
With Cholam	45.6	48.8
With Castor	10.9	2.1
With Cumbu	21.7	48.4
With Redgram	24.0	32.8
<i>1948—'49 :</i>		
With Cholam	44.6	37.9
With Castor	43.8	18.0
With Cumbu	43.5	32.1
With Redgram	19.3	17.1
<i>Average for three years :</i>		
With Cholam	42.2	43.0
With Castor	21.0	9.4
With Cumbu	23.9	31.3
With Redgram	22.2	27.0

(b) *Yield of other crops: First Series:* None of the subsidiary crops has given consistently good yields in all the three seasons. In the second year when the season was adverse for the bunch groundnut all the subsidiary crops have fared fairly well. The wide variations in the yield of subsidiary crops are not only due to the seasonal effect. The bunch groundnut crop being very vigorous in the initial stages especially in years when the rainfall distribution is favourable as in 1942—'43, the growth of the subsidiary crops is much affected and it is only after the harvest of the main crop (groundnut) that the other crops pull up. The average of the yields of the subsidiary crops are low compared with the yields of the same crops during the previous three years when they were raised as mixture with the spreading groundnut. This leads to the conclusion that other crops do not fare well when mixed with bunch groundnut.

Second Series: The yields of subsidiary crops were compared when raised mixed with bunch and spreading groundnut by expressing them as percentages on the yield of pure crops raised in the same season. The data are given below in Table V.

TABLE V

Yield of Subsidiary crops 'Average of three years' expressed as a percentage of the pure crop

	Cholam	Castor	Cumbu	Redgram
With bunch groundnut	84.8	25.9	22.8	31.9
With spreading groundnut	94.5	45.1	38.8	33.3

From the above data it is seen that the bunch groundnut has greater depressing effect on the yield of other crops forming the mixtures than the spreading groundnut.

(c) *Economics:* 'Groundnut plus cotton' mixture has given the maximum returns, in two of the three years and the mixture 'Groundnut and Redgram' in one year. As the subsidiary crops failed badly, the mixtures groundnut plus Cumbu and groundnut plus Tenai have given lesser returns than the pure crop of groundnut. Mixed cropping of groundnut with castor and redgram has given high returns consistently and these may profitably be adopted by ryots. Groundnut and cotton mixture may specially recommended in view of the extension programme in Cotton.

The results obtained from this experiment are in conformity with the results obtained in the experiments carried out with the bunch and spreading groundnuts separately.

The principle underlying the practice of mixed cropping is not only to get maximum returns from an unit area but also to utilise the soil fully and in a proper way. By growing two crops with two different feeding zones the soil is fully exploited. For this, both the crops must have fair opportunities to develop. Groundnut is a shallow rooted crop and crops like Redgram, Castor and Cotton with deeper root systems are better suited to mixed cropping. The bunch groundnut on account of its initial vigour, over grows the young crops sown with it and inhibits their growth. This results in low yield of the subsidiary crops. Though the fact that it undergoes lesser reduction in yield is an advantage in favour of bunch groundnut, its effect on the subsidiary crops is not negligible enough to be over looked. It can safely be concluded that spreading variety of groundnut is more suited to mixed cropping with other crops than the bunch.

Conclusion: The following conclusions are drawn from the experiments :

1. The bunch groundnut suffers comparatively smaller depression in yield than the spreading groundnut when grown mixed with other crops.
2. The bunch groundnut has greater depressing effect on the yield of other crops forming the mixtures than the spreading groundnut.
3. Of the subsidiary crops forming mixtures, Cholan causes the maximum reduction in yield of the groundnut.

Based on the above conclusions the following recommendations are made :

1. Mixed cropping is remunerative than pure cropping.
2. The spreading variety of groundnut is more suited to mixed cropping.
3. The following mixtures are more economical than others.
 - Groundnut and Castor.
 - Groundnut and Redgram.
 - Groundnut and Cotton.

REFERENCES

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