https://doi.org/10.29321/MAJ.10.A04143

Mixed Cropping Trials with Ragi, Cotton and Groundnut

by

M. RAYAPPA PILLAI, A. SHANMUGASUNDARAM,
M. GOVINDARAJAN and S. MANAMOHAN LAL,
Central Sugarcane Research Station, Palur.

Introduction: Groundnut is an important oilseed crop of South Arcot district which is raised in nearly 4 lakhs of acres. of which 55,000 acres are irrigated and the rest rainfed. Another important crop of this district is *Ragi* which is grown in 75,700 acres of which 61,500 acres are irrigated. Cambodia cotton is yet another important crop, raised in about 16,000 acres. It is grown as a rainfed crop except in a small area of 1,260 acres where it is grown under irrigated conditions. To increase the income per acre and put the land to more profitable use by growing more than one of these crops simultaneously, trials were laid out at the Research Station, Palur, the results of which are incorporated in this paper.

Previous Work: Groundnut grown year after year in the same land resulted in not only a lowering of the yield but also a deterioration in quality. To find out whether growing groundnut in rotation with a cereal or intersowing it with a cereal was more profitable and economical, experiments were laid out in as early as 1907. *Cumbu* and *Thenai* were the cereals included in the trials. *Ragi* was included in the trials conducted from 1912—13. It was found that *Cumbu* was better than *Thenai* for growing as a mixture with groundnut. A cereal crop following another cereal crop intersown with groundnut was decidedly of mutual beneficial effect to the cereal and groundnut crops. Cereal interplanted with groundnut gave a better return than cereal grown in rotation with groundnut. It was also found that under irrigated conditions, Cambodia Cotton was an excellent crop for rotation with groundnut. Trials showed that for growing as a mixture with groundnut, *cumbu* was the best cereal under dry conditions and *ragi* the best cereal under irrigated conditions.

Experiments also showed that there are two seasons in which *ragi* could be raised viz., May to September and December to March. In the former season *ragi* was grown as a pure crop and in the latter season groundnut was dibbled when *ragi* was in the shot blade stage.

Experiments were started in 1941—42 to find out whether cotton could profitably replace groundnut in the ragi-groundnut mixture. These experiments were continued upto 1944—45 and the

data of monetary value of the gross produce valued at constant rates for each of the commodities were analysed. Except in 1942–43 when cotton sown in January and groundnut sown in March topped the list, the local practice of planting *ragi* in January and intersowing groundnut in March was found to be the most remunerative, the next being cotton and groundnut sown together in January.

From 1945—46 the experiment was slightly modified with the following treatments:

(1) *Ragi* planted in January and groundnut dibbled in March.
(2) Cotton and Groundnut both sown in January.
(3) Cotton sown in January and groundnut in March.
(4) Pure crop of cotton sown in January.

The results showed that cotton sown in January and groundnut in March gave the highest monetary return in 1945—46 and that the mixed crop of *ragi* and groundnut gave the highest monetary return in 1947—48.

Experimental Work: To find out whether a mixed crop will result in a larger profit than a pure crop and if so which mixture will yield the largest profit, a co-ordinated experiment was laid out with the following treatments:

1. Ragi PLR. 1 alone.
2. Cotton P. 216 F alone.
3. Groundnut TMV. 4 alone.
4. Ragi + Cotton.
5. Ragi + Groundnut.
6. Ragi + Cotton + Groundnut.

The experiment was conducted in the December—September seasons of 51—52, 52—53 and 53—54, In the December–September season of 1954—55 another treatment namely cotton + groundnut was added on.

The following chronological order of sowing and planting was observed. Ragi nursery was raised in the beginning of December and transplanted by the end of December or beginning of January adopting a spacing of 6″ × 6″. A week later, cotton seeds were dibbled six inches apart in rows 2½ feet apart. Groundnut kernels were dibbled six inches apart in rows 8″ apart when ragi crop was in shot blade stage. Weeding, hoeing and irrigation were given as and when necessary. The ragi crop was harvested by the end of March and the groundnut crop by the end of June or beginning of July. The cotton crop alone remained in the field till the end of July.

The cost of cultivation for each treatment was separately worked out as also the gross value of the produce obtained from each treatment, based on the local market rates at the time of harvest (vide Table VI).

Discussion : The results of the trial conducted from December 1951 to September, 1952 are presented in Table I. It may be seen that the returns from the mixed crop of ragi + cotton + groundnut were significantly the highest, though on par with the returns from the mixed crop of ragi and groundnut. The value of the pure crop of groundnut was on par with that of the mixed crop of ragi and groundnut. The yield data show that the yield of ragi was reduced to an appreciable extent when grown mixed with cotton than when grown with groundnut or with both cotton and groundnut. The yield of cotton was reduced when it was grown mixed with ragi or both ragi and groundnut. Taking into consideration the value of the produce and the duration of the crop, it appears that the groundnut crop gave the largest return per unit of time while cotton gave the lowest.

The results of the trials conducted in the second year were in general agreement with those of the trials of the previous year. The mixed crop of ragi + cotton + groundnut, though on par with ragi + groundnut, gave the largest return (Vide Table II). The groundnut crop gave the largest return per unit of time while cotton gave the lowest. It may be seen that the yield of ragi was not however affected when grown mixed with cotton or groundnut or both. On the contrary, these mixtures appear to result in an increase in the yield of ragi. The yields of groundnut and cotton were reduced when grown mixed with ragi than when grown as pure crops.

Analysis of data gathered from the trials conducted in the third year shows that the mixed crop of ragi + groundnut gave significantly the highest return (Vide Table III). The value of the pure crop of groundnut, though on par with the value of the mixed crop of ragi + cotton + groundnut, was the next highest. The yield of ragi was increased when grown mixed with groundnut or cotton and remained unaffected when grown mixed with both groundnut and cotton. As in previous years, groundnut crop was found to give the highest value of produce per unit of time and cotton crop, the lowest value.

The results of the trials conducted in the fourth year were in general agreement with those of the trials of the third year. The value of the produce obtained from the mixed crop of ragi + groundnut was significantly the highest (Vide Table IV). The value of the

produce from the mixed crop of ragi + cotton + groundnut was the next best and was on par with that of the mixed crop of cotton + groundnut. It was found for the fourth year in succession that the highest value of produce per unit of time was obtained from the groundnut crop and the lowest value from cotton.

The results of the trials conducted in all the four years are summarised in Table V and from this table it may be seen that the yield of ragi was not much affected whether grown alone or mixed with either cotton or cotton + groundnut. But when ragi was grown mixed with groundnut, the yield of ragi was higher. An average yield of 735 lb. of Kapas was obtained from a pure crop of cotton whereas only 395 lb. was obtained when cotton was grown mixed with ragi. A still lower yield of 228 lb. of kapas was obtained when cotton was grown with ragi + groundnut. The yield of cotton was however increased when grown with groundnut, probably due to the beneficial influence of the leguminous crop. The average yield of 2084 lb. of pods was obtained from a pure crop of groundnut whereas only 1723 lb., of pods was obtained when groundnut was grown with ragi, 1300 lb. when grown with cotton and 1229 lb., when grown with ragi + cotton.

The mixed crop of ragi + groundnut has given the highest return of Rs. 666/- while ragi + groundnut + cotton has given the next highest return of Rs. 610/-. The pure crop of groundnut has given the next highest return. The pure crop of ragi has given the lowest return. Ragi, however, occupies the field for only 3 months while groundnut remains for 5 months and cotton for 6½ months. To have a better comparison, the value per unit of time was therefore worked out and it was found that the mixed crop of ragi + groundnut was the most profitable and a pure crop of cotton the least profitable.

Summary: It is most profitable to raise a crop of ragi intersown with groundnut. Fairly high returns are obtained by growing together the three crops of ragi, cotton and groundnut. The pure crop of groundnut also gives a good margin of profit. A mixed crop of ragi + groundnut gave the highest value of produce per unit of time while a pure crop of cotton gave the lowest.

Acknowledgments: The authors are deeply indebted to all Assistants of this Station who were in charge of these experiments.

TABLE 1.

(December 1951 to September, 1952)

Treatments:

1. Ragi alone (PLR. 1)	Date of transplanting ragi	31—1—1952	6″×6″
2. Cotton alone (P. 216 F.)	Date of dibbling cotton	3—2—1952	2½′×6″
3. Groundnut alone (TMV. 4)	Date of dibbling groundnut	7—3—1952	8″×6″
4. Ragi + Cotton			
5. Ragi + Groundnut			
6. Ragi + Cotton + Groundnut			

Particulars	Ragi	Cotton	Ground-nut	Ragi+ Cotton	Ragi+ Ground-nut	Ragi+ Cotton Ground-nut	General mean	'Z' test satisfied or not	S'an-dard error	Critical Diffe-rence P=0·05
	1	2	3	4	5	6				
Yield per acre in lb. ..	1150	217	1291	734+156	1017+ 1036	961+156 +838	..	..	..	..
Value of produce per acre (Rs.) ..	114	96	268	141	311	344	212	Yes	22·4	65·8
Percentage on control ..	100	84	235	124	273	302	186	Yes	19·5	57·5
Cost of cultivation per acre (Rs.) ..	307	233	305	363	424	490	..	..	..	..
Net Profit or loss (Rs.) ..	193	—137	— 37	—222	—113	—146	..	..	..	..

Conclusion: 6, 5, 3, 4, 1, 2

TABLE II.

(January 1953 to September, 1953)

Treatments:

1. Ragi alone (PLR. 1)
2. Cotton alone (P. 216 F.)
3. Groundnut alone (TMV. 4)
4. Ragi + Cotton
5. Ragi + Groundnut
6. Ragi + Cotton + Groundnut

Spacing:

Date of sowing ragi	4—1—1953	
Date of transplanting ragi	3—2—1953	6" × 6"
Date of dibbling cotton	12—2—1953	2½' × 6"
Date of dibbling groundnut	4—1—1953	8" × 6"

Particulars	Ragi	Cotton	Ground-nut	Ragi+ Cotton	Ragi+ Ground-nut	Ragi+ Cotton Ground-nut	General mean	'Z' test satisfied or not	Stan-dard error	Critical Diffe-rence P=0·05
	1	2	3	4	5	6				
Acre yield of produce in lb. ..	1144	758	1149	1208+416	1286+910	1296+289 +691	..	..	..	..
Value of produce per acre in (Rs.) ..	190	332	381	384	516	574	396	Yes	24·81	73·19
Percentage on control ..	100	175	201	203	272	302	208	Yes	13·04	38·47
Cost of cultivation per acre in (Rs.) ..	175	180	215	230	265	320	..	..	..	..
Net profit per acre in (Rs.) ..	+15	+152	+166	+154	+251	+254	..	..	..	..

Conclusion : 6, 5. 4, 3, 2, 1.

TABLE III

(December 1953 to September 1954)

Treatments:

1. Ragi alone—PLR. 1.
2. Cotton alone—P. 216 F.
3. Groundnut alone—TMV. 4.
4. Ragi+Cotton
5. Ragi+Groundnut
6. Ragi+Cotton+Groundnut

		Spacing:
Date of sowing ragi	7—12—53	
,, transplanting ragi	2— 1—54	6" × 6"
,, dibbling cotton	12— 1—54	2½' × 6"
,, dibbling groundnut	18— 2—54	8" ×6"

Particulars	Ragi	Cotton	Ground-nut	Ragi+ Cotton	Ragi+ Ground-nut	Ragi+ Cotton+ Groundnut	'Z' test satisfied or not	Stan-dard error	Critical Differ-ence P=0.05
	1	2	3	4	5	6			
Acre yield in lb.	1420	962½	3345	1712+560	1813+3045	1414+240½+2237			
Value of produce per acre (Rs.)	237	421	1115	285+345	302+1015	236+105 + 746			
Percentage on control	100	204·6	477·2	228	562·7	468·8	Yes	5·4	16·4
Cost of cultivation per acre (Rs.)	311	208	219	404	460	524			
Net profit or loss per acre (Rs.)	—74	+213	+896	+126	+357	+563			

Conclusion: $\overline{5}$ 3 6 4 2 1

TABLE IV.

(December 1954 to September, 1955)

Treatments :

1. Ragi alone PLR. I.
2. Cotton alone P. 216 F.
3. Groundnut alone — TMV. 4.
4. Ragi + Cotton.
5. Ragi + Groundnut
6. Cotton + Groundnut
7. Ragi + Cotton + Groundnut.

Spacing :

Date of sowing ragi	5—12—54	
Date of transplanting	31—12—54	6" × 6"
Date of dibbling cotton	12— 1—55	2½' × 6"
Date of dibbling groundnut	14— 2—55	8" × 6"

Particulars	Ragi	Cotton	Ground-nut	Ragi + Cotton	Ragi + Ground-nut	Cotton + Ground-nut	Ragi + Cotton + groundnut	'Z' Test satisfied or not	Standard error	Critical Difference P=0·05
	1	2	3	4	5	6	7			
Acre yield of produce in lb. ..	2646	1002	2550	2349 + 445	2835 + 1900	820 + 1300	2349 + 227 + 1150	..	..	..
Value of produce per acre (Rs.) ..	234	282	359	208 + 125 = 333	251 + 267 = 518	231 + 182 = 413	208 + 64 + 161 = 434	Yes	17·7	52·4
Percentage on Standard ..	100	120·5	153·4	142·3	221·4	176·5	185·5	Yes	7·56	22·4
Cost of cultivation per acre (Rs.) ..	199	224	237	335	350	375	456	..	..	..
Net profit or loss (−) per acre (Rs.) ..	35	58	122	− 2	168	38	− 22			

Conclusion : 5 7 6 3 4 2 1

TABLE V

	Ragi	Cotton	Groundnut	Ragi + Cotton	Ragi + Groundnut	Cotton + Groundnut	Ragi + Cotton + Groundnut
1952 Yield per acre in lb.	1150	217	1291	734 + 156	1017 + 1036	.. ..	961 + 156 + 838
1953 " " "	1144	758	1149	1208 + 419	1286 + 910	.. ..	1296 + 289 + 691
1954 " " "	1420	963	3345	1712 + 560	1813 + 3045	.. ..	1414 + 241 + 2237
1955 " " "	2646	1002	2550	2349 + 445	2835 + 1900	820 + 1300	2349 + 227 + 1150
Average yield per acre (4 years)	1590	735	2084	1501 + 395	1738 + 1723	820 + 1300	1505 + 228 + 1229
1952 Value of produce Rs.	114	96	268	141 ..	311 ..	.. ..	344 .. ..
1953 " " "	190	332	381	384 ..	516 ..	.. ..	574 .. ..
1954 " " "	237	421	1115	630 ..	1317 ..	.. ..	1087 .. ..
1955 " " "	234	282	359	333 ..	518 ..	413 ..	434 .. ..
Average value of produce (4 years)	194	283	531	372 ..	666 ..	413 ..	610 .. ..
Period for which the crop remains in the field (days)	90	195	130	195 ..	130 ..	195 ..	195 .. ..
Value of produce per unit of duration (per day)	2·16	1·45	4·08	1·91 ..	5·12 ..	2·12 ..	3·10 .. ..

TABLE VI

Value of produce in different years

	Ragi						Cotton			Groundnut					
	Grain per lb.			Straw per 100 lb.			per lb.			Grain per lb.			Haulms per 100 lb.		
	Rs.	A.	P.	Rs.	A.	P.	Rs.	A.	P.	Rs.	A.	P.	Rs.	A.	P.
1952	0	1	7	1	0	0	0	7	0	0	3	4	1	0	0
1953	0	2	0	1	0	0	0	6	0	0	4	6	1	0	0
1954	0	3	1	1	0	0	0	7	0	0	4	0	1	0	0
1955	0	1	4	1	0	0	0	4	6	0	2	3	1	0	0