https://doi.org/10.29321/MAJ.10.A03921

The role of Legumes in Blacksoil rotations

by

S. S. NARAYANAN[1], S. SANKARAN[2], A. RAJAMANI[3], L. SIVAGNANAM[4] and A. K. NAGARATHNAM[5]

Synopsis : The role of legumes in enriching fertility of the rainfed blacksoils, where organic manure availability either in the soil or for application is limited as studied in a comprehensive experiment conducted at the Agricultural Research Station, Kovilpatti is discussed in this paper. Though statistical results have not given any correct indication, practical observations show that cotton - *cumbu* - cotton - blackgram rotation could be the most remunerative one for the Southern blacksoils of the Madras State. This is being confirmed by running a few more series of cycles of the rotations.

Introduction : The intensity of cropping practice affects the yield of each crop very greatly and is intimately connected with every problem in farming practice. The problems connected with the effects of different rotations on the fertility of the soil are very important and the effects of rotations must be compared on three principles viz., (i) comparative out-turn, (ii) effects on soil fertility and (iii) net financial returns obtained. Based on earlier experiments conducted in the blacksoils of the Agricultural Research Station, Kovilpatti, a two-course rotation of Cotton-*cumbu*-cotton-*cumbu* was recommended to the cultivators. In the present experiment, legumes like groundnut, blackgram and horsegram were included for studying their role in crop rotations in the rainfed blacksoils for increasing the *karunganni* cotton yields by increasing the soil fertility. The results obtained from this complex legume rotational experiment conducted at the Agricultural Research Station, Kovilpatti are presented in this paper.

Material and methods : The blacksoil area of the Agricultural Research Station, Kovilpatti which is the venue of the experiment represents the vast stretches of rainfed blacksoils of the southern region of the Madras State. The lay out of the experiment was 4 x 4 randomized blocks, split plot in design with four phases of the rotations as follows :

Rotations	Years			
	I year	II year	III year	IV year
A	Cotton	*Cumbu*	Cotton	*Cumbu*
B	Cotton	*Cumbu*	Cotton	Blackgram
C	Cotton	*Cumbu*	Cotton	Groundnut
D	Cotton	*Cumbu*	Cotton	Horsegram.

* Received for publication on 12—6—1962.

1. Assistant in cotton, A. C. & R. I., Coimbatore - 3; 2. Assistant in Pulses, Coimbatore - 3; 3. Assistant in cotton, Srivilliputhur; 4. Assistant Agronomist and 5. Assistant Chillies Specialist, Kovilpatti.

The net area of each plot was 0·91 cent and the plots were all marked with permanent pegs. No manure was applied to the plots. The sowings were done in October-November on receipt of the North East monsoon rains. All the crops were sown with *gorru* and the normal after-cultivation operations were followed. The yields of the different crops in each plot were recorded. The experiment was conducted for five years from 1955–'56 and the data were analysed statistically. The market value of the produce was taken into consideration to assess the monetary benefits of the results.

Results : The first cycle of the rotations was completed in 1958–'59 and the data of the first year of the second cycle commencing from 1959–'60 was also taken to study the effects of one complete cycle of rotation. The data of the year 1955–'56 being the preliminary year was deleted from the analysis. The consolidated data and the results of analysis are furnished below :

TABLE I.

Monetary yields of rotations

Years	Monetary values of rotations			
	A	*B*	*C*	*D*
	Rs. nP.	Rs. nP.	Rs. nP.	Rs. nP.
1956—'57	36·06	38·44	34·31	47·13
1957—'58	73·19	59·69	85·58	62·69
1958—'59	36·50	43·00	38·00	33·88
1959—'60	91·19	84·50	102·42	89·25

(a) *Analysis of monetary yields of rotations*

Source	*D. F.*	*S. S.*	*M. S.*	*F.*
Replication ...	3	3104	1035	
Rotations	3	1125	375	
Error ...	9	756	84	4·46*
Total ...	15	4985		

* Significant at P = 0·05 level.

Standard errors of comparison and critical difference :

	SED	CD. (P = 0·05)
(i) For comparison among A, B and D rotations ...	1·73	3·91
(ii) For comparison of C rotation with other rotations ...	1·80	4·07

Mean monetary yield of rotations (conclusions) :

C,	A,	D,	B
(65)	(62)	(62)	(58)

The rotation B has given significantly less monetary returns than the other three which are on a par.

(b) *Monetary yields taken yearwise*

Source	*D. F.*	*S. S.*	*M. S.*	*F.*
Replications ...	3	3,104	1,035	
Rotations ...	3	1,125	375	1·33
Years ...	3	1,06,650	35,550	125·62**
Interaction on years x Rotations ...	9	8,669	963	3·40**
Error ...	45	12,723	283	
Total ...	63	1,32,271		

** Significant at P = 0·01 level.

It is of no interest to compare the different years in regard to the performance of the rotations, though it may be stated that the final year, viz., 1959—'60 has been particularly favourable followed by 1957—'58. The monetary returns in the other two years viz., 1956—'57 and 1958—'59 are nearly equal, but far less than in 1959—'60 and 1957—'58. In the above analysis, it is possible that the wide variations between the years has masked the differences among rotations and rendered them non-significant. However, the interaction in the differences among rotations as between the years are significant.

(c) *Comparison of rotations and conclusions*

Year	S. E. D.	C. D. (P = 0·05)	Conclusions
1956—'57	5·95	12·02	D, B, A, C.
1957—'58	5·95	12·02	C, A, D, B.
1958—'59	8·41	16·99	B, C, A, D.
1959—'60	5·95	12·02	C, A, D, B.

In the year 1956—'57, rotation D has given significantly higher monetary return than C, while it is on a par with B & A rotations. In 1957—'58, the rotations C and A have proved superior to B, but are on a par with D. The rotations D and B are on a par. There are no significant differences among the rotations in the year 1958—'59. In the year 1959—'60, the rotation C is superior to D and B, but is on a par with A. The rotations A, D and B are on a par. This inference would show that the results of comparison of the rotations have not been uniform from year to year.

(d) *Yield of cotton in the four rotations*

Source	*D. F.*	*S. S.*	*M. S.*	*F.*	
Replications	3	2,245	748		
Cotton between rotations	3	994	331	2·15	Not significant
Error	9	1,384	154		
Total	15	4,623			

The differences in the yield of cotton as between the rotations are not significant.

(e) *Yield of cotton taken yearwise*

Source	*D. F.*	*S. S.*	*M. S.*	*F.*	
Replications	3	2245	748		
Cotton between rotations	3	994	331	1·10	Not significant
Between years	3	64,910	21,637	72·12**	
Interaction (Rotations x years)	9	1,910	212		
Error	45	13,485	300		
Total	63	83,544			

** Significant at P = 0·01 level.

The trend of comparisons of the rotations in respect of the yield of cotton is uniform from year to year as shown by the non-significant interaction.

TABLE II.

Mean yield and monetary values of individual components:

S. No.	Crops		*Mean acre yield in Kilos.*	*Mean monetary returns*
				Rs. nP.
1.	*Cumbu*	...	222	78·24
2.	Blackgram	...	82	65·10
3.	Horsegram	...	109	38·40
4.	Groundnut:	...	failure	...
5.	Cotton (*Kapas*)			
	(a) after *cumbu*	...	155	154·00
	(b) after blackgram	...	176	174·50
	(c) after groundnut	...	175	173·70
	(d) after horsegram	...	186	184·05

It is seen from the above table drawn from the farmers' point of view, that (i) the groundnut crop has failed in all the four years proving its unsuitability for the Southern blacksoil tract, (2) cotton following pulses has recorded higher yields than when it followed *cumbu* and cotton yields have been increased by 13% when succeeding blackgram, 11% by succeeding groundnut and 19% by succeeding horsegram than when it followed *cumbu*, (3) the net monetary yield of blackgram is higher than that of horsegram and (4) the combined monetary return from blackgram and the cotton following it has been higher than any other combination.

Discussion: Kalamkar (1950) rightly stressed the role of good rotations with leguminous crops in supplying additional nitrogen and replenishing of organic matter in the soil. He has also stated that the yield of cotton was increased when it followed sunnhemp and redgram in the order of merit. Thakar (1953) emphasised that cotton in black retentive clay soil following *Lathyrus sativus* gave 28% more yield than when it followed *cholam*. Desai *et al* (1953) stated that wheat in legume rotation removed more N, P, K than in other treatments. Burt (1928) has calculated that cotton in a four year rotation including maize, wheat and leguminous crops gave increased yields per acre by 100%. Balasubramaniam *et al* (1947) summarising the dryland experiments conducted at Kovilpatti ranked horsegram as the best among pure pulse crops like groundnut, blackgram and horsegram and also stated that the South-West monsoon rains were seldom useful for sowing early legumes like groundnut etc. From the

present experiment (Vide table 1), statistical conclusions reveal (1) that rotation B has given less monetary returns than the other three which are on a par, (2) that the results of rotations have not been uniform from year to year and (3) that the differences in the yield of cotton as between the four rotations are not significant.

However, a consideration of the practical aspects in which the farmers are interested will necessitate a practical and sound approach to the problem. This means that the data presented in table II should be the basis on which any conclusion should be drawn.

Conclusions and summary: Seasonal variations appear to have had a major share in the total variation and no clear cut differences are noticed. From experience, however, it may be argued that since groundnut was a consistent failure, the legumes possible of cultivation in Kovilpatti black soils are blackgram and horsegram. In considering the relative utility of these two pulses and the market value of the crops and the restoration of the soil fertility as reflected from the succeeding cotton yields taken together point to the superiority of blackgram over horsegram. The experiment is being continued further to confirm the indications already obtained.

Acknowledgements: Our thanks are due to Sri K. A. Seshu, Statistical Assistant for carrying out the analysis of the data and to Sri S. Rajarathnam, Agronomist and Associate Professor of Agronomy, Agricultural College and Research Institute, Coimbatore for his valuable guidance in the conduct of the experiment.

REFERENCES

Balasubramaniam, R. *et al* 1947 A review of experiments with legumes preceding cotton in the Madras State., *Ind. Cott. Grow. Rev.* *I*:87.

Burt, B. C. 1928 Effect of legume rotation on Cotton production. *Agric. J. Ind.* 23:309.

Desai, S. V. *et al* 1953 A lysimeter study of crop rotations *Ind. J. Agric Sci.* 13:(I) 243.

Kalamkar, R. J. 1930 Increasing crop production by improving soil fertility through rotation of crops., *Indian Fmg.* *II*:448-52.

———, *et al* 1953 Effect of preceding crops on the succeeding crop of cotton *Ind. cott. Grow. Rev.* 7-I:233.

Thakar, R. J. 1953 Effect of rotational crops to cotton in Broach district., *Ind. cott. Grow. Rev.* 7.