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Research Article

MAXIMISING INCOME IN FARMS OF THOOTHUKUDI DISTRICT THROUGH RESOURCE OPTIMISATION

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A B S T R A C T

The study has been conducted to optimize farm plans in sample farms under irrigated and rainfed conditions in Karungulam block of Thoothukudi district by selecting 120 sample farmers from 6 villages. A linear programming (LP) model has been developed to arrive the optimal farm plans of irrigated and rainfed situation. The study shows that, in irrigated condition the optimum plan – I suggest that the highest net income of 25.20 per cent increase over the existing plan. The optimum plan - II was 3.93 per cent increase in the existing net income. In rainfed situation, the optimum plan – I had the net income of Rs.78050 per acre which is 16.32 per cent increase over the existing plan. Thus the net income could be increased 22.63 per cent in the optimum plan - II.

INTRODUCTION

In India, agriculture development strategies have traditionally been seen from the perspectives of attaining self-sufficiency in production and food security. The majority of the programmes and schemes essentially concentrated on the area expansion and yield improvements with little focus on farmer's income (Deshpande *et al*., 2004). The viability of agriculture sector is highly dependent on income received by the farmers and it is high time to understand the severity of prevailing farm distress and address those concerns to sustain the Indian agriculture (Chand, 2016). India succeeded in achieving the target of self-sufficiency in food grain production. However, it has not addressed the problem of farm distress, as the farm income does not always follow the increase in output (Chand, 2017). Farm planning is a guide to the farmers in making the best use of their resources to increase productivity. Thus, the proper allocation of limited resources amongst the opportunities available to them increases productive efficiency and also income possibilities in relation to the available resources. Complementary relations that could exist among farm enterprises are rarely exploited as farmers have been increasingly depending on purchased inputs and preferring solo enterprises rather than a mix of them.

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In the present study, a scope for increasing farm income through adoption of optimal plan based on availability of limited resources was explored. The objective of this study was to maximize net income subject to land, labour, capital and water constraints. The optimum plan was developed through linear programming model.

METHODOLOGY

The study was carried under two situations viz., irrigated and rainfed. Karungulam block was selected on the basis of highest net irrigated area by canal. In Karungulam block, six villages were selected at random from the alphabetical list prepared. Particularly three villages were selected to represent the irrigated agriculture and another three villages were selected to represent the rainfed agriculture. From each village 20 farmers were selected at random. The total sample size was 120 in which 60 represented irrigated agriculture and 60 represented the rainfed agriculture. Linear programming technique was used as an analytical tool to develop the possibilities of optimizing crop plans undertwo optimum plans in rainfed and irrigated situation. In linear programming analysis, a linear function of a number of variables is to be maximized subject to a number of constraints in the form of linear equalities and inequalities. In mathematical form, one year (two seasons) linear programming model at farm level can be expressed in the following way.

$$\text{Maximize } Z = \sum_{j=1}^{n} CjXj$$

Subject to constraints

$$\sum_{j=1}^{n} aij\ Xj \leq bi \quad (i = 1 \ldots n)$$

and all $Xj \geq 0$

where,

Z = Net returns from all crop activities

Cj = Net returns from jth activity measured in rupees per unit of jth activity

Xj = Level of jth activity

aij = The quantity/amount of ith resource/input required per unit of jth activity

bi = Total availability of ith resource on the farm

Objective function

Objective function was to maximize the annual net income from farm (from crop enterprises) subject to the resource constraints specified in the model. The net returns were measured by deducting the variable expenses from gross income. The variable costs were cost of seeds, manures, fertilizers, water, hired human labour, plant protection charges etc. the harvest prices were taken as output prices and the actual market prices of inputs at the time of application were taken as input prices.

The Constraint structure

Five vital resources supply of which worked as impediments in the production process, were taken as constraints

1. Land: Land is one of the limiting resources on all farm situations. The size of the selected farm is two acres. Present supply of land in both irrigated and rainfed agriculture is taken as constraint which is classified into kharif, rabi and summer.
2. Hired Labour: The level of hired human labour supply during the season.
3. Family Labour: The level of family labour work in the season.
4. Water: The irrigation water available during the cropping season from the canal and rainfall.
5. Capital: Present level of working capital expenditure on seed, chemical fertilizers, manures, plant protection chemicals, hired labour expenditure, etc.

In short, the existing levels of all resources used on the farms were taken as the maximum supply available on the farms in rainfed and irrigated agriculture regions.

The data were tabulated and processed. The optimal plans under different situations were obtained for both irrigated and rainfed condition. For this the Simplex method of linear programming was carried out in package of LP solver version 5.5.2.5.

RESULTS AND DISCUSSION

Data collected from the sample farms were analysed to prepare the optimum crop plan(s) and the salient features of the plans are presented below.

Irrigated farm

The optimum plans of irrigated farm were divided as:

Plan I : Farm plan with resource constraints

Plan II : Farm plan with resource constraints and minimum requirement of Paddy II area for family consumption.

In optimum plan I, it was observed that the both Rabi and Summer paddy were non-profitable with the available capital and constraints. While in the existing cropping pattern it occupies 2 acres. The Rabi paddy had been cultivated in 1 acre with the yield of 30 quintals subjected to their family consumption 15 quintals only marketed in that season. Hence the profit of Rabi Paddy I might be Rs. 2250. The summer Paddy II had been cultivated in 1 acre with the yield of 30 quintal, the farmer marketed all the 30 quintals that might have a profit of Rs.14225. In linear programming model these two season paddy was non profitable because the banana was more profitable than the paddy. In existing model the banana were cultivated under 1 acre, but in the optimum model it was carried over to 1.54 acres with the available resources.

Table 1 Crop plans under existing and optimum plan for irrigated farm

S.No.	Particulars	Existing plan (ac)	Optimum crop plans (ac)	
			Plan I	Plan II
1	Paddy I	1(33.33)	0	0
2	Paddy II	1(33.33)	0	0.5*(29.76)
3	Banana	1(33.33)	1.54(100.00)	1.18(70.24)
	Gross cropped area	3(100.00)	1.54(100.00)	1.68(100.00)

(Figures in the parentheses are the percentage to gross cropped area)

Note: *denotes that the Paddy II has minimum requirement in optimum plan II for the need of consumption purpose of sample farmer.

In optimum plan II, the model considered minimum area under paddy as a staple food crop even though paddy was not profitable crop. So, in this optimum model the summer paddy was included with minimum requirement of 0.5 acre. The area under banana was increased to 1.18 acre from 1 acre in the existing cropping pattern. Compared to optimum plan I the banana area was decreased in plan-II because of paddy area was increased to 0.5 acre. In optimum plan I the area under banana was decreased to 1.8 acre in the optimum plan II from 1.54 acre in Plan I.

Rainfed condition

The optimum plans for rainfed region of same size groups were followed.

Optimum plan-I : Farm plan with existing resource constraints

Optimum plan-II : Farm plan with the introduction of new crop and relaxing water constraint

The cropping pattern for the sample farm and those of optimum plans for small size farm with 2 acres are presented in Table 2.

Table 2 Crop plan under Rainfed condition

S.No.	Particulars	Existing plan (ac)	Optimum plan (ac)	
			Plan I	Plan II
1	Cotton	1(50.00)	0	0
2	Groundnut	1(50.00)	1.41(100.00)	1.5(75.00)
3	Maize	0	0	0.5(25.00)
	Gross cropped area	2(100.00)	1.41(100.00)	2(100.00)

(Figures in the parentheses are the percentage to gross cropped area)

From optimum crop plan-I, it was found that the kharif cotton was not profitable as compared to summer Groundnut. In the optimum plan the cotton became zero but in existing plan the cotton was cultivated under 1 acre. The area under groundnut was increased to 1.41 acres from 1 acre in the existing plan. This was mainly because groundnut has minimum water,

labour and capital usage compared to the cotton crop in plan-I. This plan suggests that out of 2 acres the groundnut will be cultivated for 1.41 acres the net farm income will be Rs. 78050.

In optimum crop plan-II, it was observed that when additional capital was made available the area under groundnut will be increased to 1.5 acre from 1 acre in the existing plan. This is because of the groundnut was a more profitable crop compared to other crops. In this model maize was introduced as a new crop with area under 0.5 acre. If kharif maize and summer groundnut was cultivated then the net farm income might be increased to Rs. 93924 from Rs.67000 in the existing plan.

Optimum crop plan-II was better than the plan-I. As the result of optimal plan I only groundnut crop was adopt in the model with the net income of Rs.78050 whereas the existing income was Rs.67000. The optimum plan-II has the groundnut and maize crops were cultivated with the additional use of capital and water resources with the net income of Rs.93924.

Input utilization of sample farm

It is essential to study the utilization of important inputs in the process of optimal crop planning. It will indicate as to study whether the higher or lower or the same level of inputs should be used in comparison to that in the existing crop plan for maximization of farm income.

Table 3 Resources required for optimum crop plan per farm under Irrigated farm

S.No.	Particulars	Existing plan	Optimum plans	
			Plan I	Plan II
1	Hired labour (Mandays)	121	75	75
2	Family labour (Mandays)	30	16.05	17.29
3	Irrigation water (Cu. M)	4500	3204.60	3652.80
4	Capital (Rs.)	40000	36714.26	36701.09

In the present study hired labour, family labour, irrigation water and capital (which include value of purchased input) were considered to be the most important inputs. Utilization of the inputs of optimum crop plan are given in the Table 3 and 4 for irrigated and rainfed regions repectively.

Table 4 Resources required for optimum crop plan per farm under Rainfed farm

S.No.	Particulars	Existing plan	Optimum plans	
			Plan I	Plan II
1	Hired labour	40	29.11	37.17
2	Family labour	26	15.56	23.23
3	Irrigation water	1200	1349.57	1941.04
4	Capital	24000	17315.37	24000

Hired Human labour

The Hired human labour utilization per farm in the existing and the optimum plans in both the regions were presented in the above Tables 3 and 4. In irrigated region, under plan I and II the hired labour was not increased over the existing plan had more number of labour utilization. Thus the existing plan has employment of labour was more where as in optimum plans the employment of labour is less.

In rainfed farm, under plan I and II the hired human labour use showed decreasing trend. From the results, human labour utilization increased in the optimum plan II indicating greater scope for increasing the human labour employment compared to the optimum plan I. Compared to existing plan, the decreasing trend shows that the hired labour must be increase the variable cost of the farmer hence, the hired human labour was good to have decreasing trend in the optimum plan.

Family labour

The family labour utilization per farm in the existing and optimum crop plans in both irrigated and rainfed region were presented in the Table 3 and 4.

In general, it was observed that there was no exact relationship between the family labour utilization in different optimum crop plans in rainfed and irrigated region. The family labour was increased in the existing plan whereas in the optimum plans I and II had the decreasing trends of labour use. Compared to optimum plan I the family labour usage was increased in optimum plan II in both the irrigated and rainfed situation.

Water

Water utilization per farm under the existing plan was greater than the optimum plans in both the regions of irrigated and rainfed situation were presented in Table 3 and 4.

In irrigated farm, the irrigation water will be surplus because the canal water had been used for the rabi season hence the farmer had used 4500 cubic meters in the existing plan while in the optimum plan I the water required was 3204.60 cubic metre and 3652.80 cubic metre for optimum plan II. This shows that if fluctuations in flows of canal water these two optimum plans will be useful to the farmers.

In rainfed farm, the source of water must be rainfall and some of them were stored rainwater in pond or tank to reuse the rainwater for irrigation purpose. Due to lack of rainfall, at that time the stored water will be used to irrigate the crops in rainfed region. The existing plan has 1200 cubic meter water usage while in the optimum plan I the irrigation water might be 1349.57 cubic metres and 1941.04 cubic metres for optimum plan II with relaxation of irrigation water constraint.

Capital

Per farm capital utilization under the existing available resources and different optimum plans with limited or unlimited capital is presented in the Tables 3 and 4.

The use of capital in the irrigated region in the existing plan was quite high when compared to the optimum plans I and II. Under the plan I the available capital with the farmer is Rs.40000 and the optimum capital usage was Rs.36714.26. Hence the optimum plan I might be best compared to the optimum plan II, because the capital usage was slightly increased in plan II.

In rainfed condition, the capital usage was less compared to the irrigated region because in the irrigated region the cost of irrigation, fertilizers were occupied in the capital utilization while in rainfed region there is no cost of irrigation and some of them were not use fertilizers and plant protection chemicals so the capital usage is less. Under optimum plan I the capital usage was Rs.17315.37 while in the existing plan the capital use was Rs.24000. under the plan II the capital usage was Rs.24000 there was no change in the existing plan of capital

use. Eventually, the optimum plan I will be better than the other optimum plans.

Per Farm net income of sample farm

Per farm net income in the existing and optimum plans for both irrigated and rainfed region were presented in the Table 5. It was found that per farm net income can be increased in varying magnitudes in all the optimum plans over the existing plan in both the regions.

In irrigated region, the optimum plan I was the highest net income with 25.20 per cent increase over the existing plan. The optimum plan II was 3.93 per cent increase in the net income. This was due to specifically in the optimum plan II the minimum requirement of paddy was given as 0.5 acre so the income decreased from the level of optimum plan I. This shows that the farmer could, further increase the net income by using improved technology even under the existing resource situation.

As regards the irrigated region, it was observed from Table 5 that the per cent increase in the per farm net income in the optimum plan I with the existing resource use will be good to follow for the farmers. Under the plan I the farmers recommend to put 1.5 acres of banana because it was so profitable and suitable to the study area.Under the optimum plan II the farmers might want to put 0.5 acre of paddy for consumption purpose with the existing resources and 1.5 acres of banana were cultivated they can get an net income of Rs.91227.10 which is 3.93 per cent of income might be increased from the existing income.

Table 5 Net income per farm under the existing and the optimum plans in the irrigated and rainfed region

(Rupees)

Region	Existing plan	Optimum plans		Increase over existing plan	
		Plan I	Plan II	Plan I	Plan II
Irrigated	87780	109896.26	91227.10	22116.26 (25.20)	3447.1 (3.93)
Rainfed	67100	78050	93234	10950 (16.32)	15184 (22.63)

In rainfed region, it was observed that the optimum plan I was developed with the existing resources. Thus the net income was Rs.78050 which is 16.32 per cent increased over the existing plan. Under the optimum plan I, the farmers recommended to put 1.41 acres of groundnut it could be profitable in the study area. Under the optimum plan II, it was developed with the existing resources with the relaxation of irrigation water and introducing a new crop into the model. Thus the net income could be increased by 22.63 per cent in the optimum plan II which recommended the farmers to grow 0.5 acre of maize crop and 1.5 acres of groundnut.

CONCLUSIONS

The existing cropping pattern and resource allocation among different crops were not optimum in the farm. The net income was maximized through optimum plans at farm level.In irrigated region, the optimum plan I revealed the potential of increasing net income by 25.20 per cent over the existing plan. Similarly, optimum plan II was found to have the potential of increasing net farm income by 3.93 per cent. In rainfed region, the optimum plan I was developed with the existing resources. Thus the net income was Rs.78050 which was 16.32 per cent increase over the existing plan. The net income could be increased by 22.63 per cent in the optimum plan II.

References

Agarwal, G., & Pathak, S. (1957). Budgeting Approach in Farm Planning. *Agricultural Situation in India, 12*, 238-248.

Chand, R. (2016).Addressing Agrarian Distress; Sops Vs Development. 23rd*Dr. B.P. Pal Memorial Lecture,* held at Indian Agricultural Research Institute, New Delhi.26 May.

Chand, R. (2017) *Doubling Farmers Income: Rationale, Strategy, Prospects and Action plan.* NITI Policy Paper No.1/2017.National Institution for Transforming India.Government of India. New Delhi.

Deshpande, R.S., Bhende, M.J., Hippias, P. and Vivekananda, M. (2004).*State of the Indian Farmer: Crops and Cultivation.* Academic Foundation, New Delhi.

Deoghare, P. (1997). An Economic Analysis of Farm Income, Labour Employment and Credit Needs of Farms in Mathura District of Uttar Pradesh. *Agricultural Situation in India, 54*, 561-568.

Desai, D. (1962). Budgeting and Programming in Farm Management. *Indian Journal of Agricultural Economics, 17*(1).

Igwe, K., & Onyenweaku, C. (2013). A Linear programming approach to food crops and livestock enterprises planning in Aba agricultural zone of Abia State, Nigeria. *American Journal of Experimental Agriculture, 3*(2), 412.

Kaur, B., Sidhu, R., & Vatta, K. (2008). *Optimal crop plans for sustainable water use in Punjab.* Agricultural Economics, PAU, Ludhiana.

Mahendran, R., Chandrasekaran, M., & Gurunathan, S. (2006). A study on evolving optimal cropping patterns in groundwater over-exploited region of Perambalur district of Tamil Nadu. *Agricultural Economics Research Review, 19*(1), 95-108.

Majeke, F., Mubvuma, M. T., Makaza, K., & Mutambara, J. (2013). Optimum combination of crop farm activities: application of a linear programming model to a rural farmer in Zimbabwe. *Greener Journal of Economics and Accountancy, 2*(2), 058-061.

Nedunchezhian, P., & Thirunavukkarasu, M. (2007). Optimising Farm Plans in Different Farming Systems. *Agricultural Economics Research Review, 20*(1).

Ramakrishnaiah, G. (1998). *An Optimum Crop and Live Stock Pattern for Farmers in Nandyal Mandal of Kurnool District of Andhra Pradesh.* ANGRAU ACT: Agricultural Economics.

Satyanarayana, C., & Rao, B. S. (2016). Income generation through livestock and crop enterprises as a means of livelihood. *Indian Research Journal of Extension Education, 12*(2), 132-138.

Singh, A., & Sharma, J. (1988). Income and employment increasing possibilities under different farming systems on small farms in Mid-Western region of Uttar Pradesh. *Agricultural Situation in India, 43*(1), 17-23.

Singh, I., & Rai, K. (1981). Income and Employment Effects of the New Dry Land Farm Technology in Haryana. *Indian Journal of Agricultural Economics, 36*(2), 45.