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Resource Variable Programming for Different Water Supply Positions

By

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ABSTRACT

Irrigation water is a crucial factor in gardenland farming in Coimbatore Taluk, (Tamil Nadu—India). Optimum crop plan to maximise farm income is illustrated by using programming technique.

INTRODUCTION

Water is the crucial factor determining the choice of crops in the farms especially where well irrigation is prevalent. Acreage allocation for different crops in a farm is determined with an optimistic view about the water resource in the well. When the farmer is to consider the net profits of different crops and the other restrictive resources, the decision making process is complicated. Under such situation, resource variable programming may be adopted. In this technique the optimum plans can be determined as the supply of one or more resources are varied continuously with the other restricting resource supplies and prices of products assumed constant. The objective of this study is to develop a resource variable programme considering the availability of water for irrigation from zero to infinity with restricted labour supply.

MATERIALS AND METHODS

A farm in Sarkarsamakulam Block, Coimbatore District having 15.70 acres of land with limited labour and irrigation water is selected for the case study. The input-output co-efficients and net profit per unit crop area for different crops that are profitably grown in the farm and total available resources are given in Table 1. Land is classified into three seasons so that crops that can be grown in different seasons can be considered. Peak season labour *viz.*, during the month of October only is considered as a restriction. It is assumed that if labour during October is available there will not be any difficulty for labour during other months. Irrigation water that is available for irrigation during different months are specified to correspond with different seasons. July and March irrigation are considered to vary and determine the crops to be grown in the farm. While July irrigation restricts *khariff* crop, March irrigation restricts the summer crop.

The procedure for the Resource Variable Programming is to find out the ridge line tracing out the optimum plans as the supply of July irrigation increases and with production not limited by March irrigation. A modified 'simplex method' allows us to follow all changes in the optimum plan as the irrigation water in July and March increases from zero to any finite estimated amount. The basic principle is : each acre of water (each unit of the

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resource being varied) must be utilized where its marginal return is the highest.

RESULTS AND DISCUSSION

The continuous plans/solutions obtained in the exercise are summarized in Table 2.

Table 2 will allow us to construct the plans in real terms necessary for maximum income. It also indicates both July and March Irrigation necessary for each plan. Using the coordinates July and March irrigation we can locate the points which corresponds to each section of the simplex solution available for the problem considered. (iterative process of the problem is not furnished in the article). If the optimum plan for point 't' required, this plan will correspond to the optimum plan for 'u'. 't' is a point where March irrigation is 35.00 units and July irrigation is 11.60 units. The optimum plan at point 'u' is having $OPQUU_1$ as the boundary. This plan can be obtained precisely by :

(i) Finding the section of the Table 2 in which absolute value of July irrigation was just smaller than the irrigation available at 't'

(ii) Adding the quantity of irrigation water available at July and March at 't' to the July and March irrigation level entries of the B. column of the section specified in (i) and

(iii) Completing the simplex solution.

In the example section 3 and section 4 are considered. The optimum plan will lie between these two sections. An iterative process from section 3 will give the intermediate optimum plan between section 3 and section 4.

The result of the iterative process is a plan having 4.10 acres of dry cholam, 11.60 acres of cotton, 12.10 acres of summer cholam and 3.60 acres of maize (III season). The net profit is Rs. 35,106/-.

In the graph if the point 't' is extended it will cut the production boundary OPQRS at U and the income line at point U_2, which gives the optimum income for the intermediate optimum plan. It is in confirmity with the level of income derived from the iterative process. Thus it is possible to specify optimum activity-mix for any level of irrigation, the mechanism being Resource Variable Programming.

Paddy, being less profitable and requiring a large quantity of water than cotton, is not profitable to cultivate. Sugarcane gives a high per acre profit. But, when water requirement is considered two crops *viz.*, cotton and maize can be cultivated instead a single crop of sugarcane and more profit can be realised. Out of the crops considered in March - June season, summer cholam eventhough less profitable finds a place in the optimum solution whenever water available in the farm is not sufficient to cultivate maize. Ragi, cumbu and maize require same amount of water. Since maize is more profitable than cumbu or ragi it finds the place. The mechanism of entry or exit of these three crops will be governed by the net profit. If the net profit of maize due to any change in its price falls short of cumbu, cumbu will be preferred for maize.

TABLE 1. Input-output coefficient and net profit of activities with resources availability in the farm

Resources	Units	Total availa-bility	Sugar-cane	Paddy	Cotton	Dry Cholam	Maize II season	Ragi	Summer Cholam	Cumbu	Maize III season
Net profit Rs.			2548	1252	1993	380	978	719	576	843	961
			Input-output co-efficient per acre of crop								
Land July October	Acres	15.70	1.00	1.00	1.00	1.00	—	—	—	—	—
Land November February	Acres	15.70	1.00	1.00	1.00	1.00	1.00	—	—	—	—
Land March June	Acres	15.70	1.00	—	—	—	—	1.00	1.00	1.00	1.00
October labour	Man-days	78.00	1.33	9.03	2.63	—	3.00	—	—	—	—
July irrigation	Acres	22.40	3.00	8.00	1.00	—	—	—	—	—	—
March irrigation	Acres	20.88	3.00	—	—	—	—	3.00	2.00	3.00	3.00

TABLE 2. Optimum plans with specified levels of irrigation and corresponding income

Section	July irrigation	March irrigation	Sugar-cane	Paddy	Cotton	Dry Cholam	Maize II season	Ragi	Summer Cholam	Cumbu	Maize III season	Income	
			Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Rs.	P.
1.	0	0	—	—	—	15.70	—	—	—	—	—	5,966	00
2.	11.60	0	—	—	11.60	4.10	—	—	—	—	—	24,676	80
3.	11.60	31.40	—	—	11.60	4.10	—	—	15.70	—	—	33,720	00
4.	11.60	47.10	—	—	11.60	4.10	—	—	—	—	15.70	39,764	50
5.	15.70	47.10	—	—	15.70	—	—	—	—	—	15.70	46,377	80