

Linear Programming In Agriculture Using The Solver Tool Of Excel.

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Abstract: Business research consists of a set of important quantitative techniques based on mathematical programming, which have been used effectively in various management processes. Linear programming is one of the most widely used techniques in this group. For a long time, linear programming was used for programming in agriculture and crop management. The present study uses linear programming for crop management in an area in central Greece. The current situation is compared with the best solution proposed by the methodology. The solver tool of excel is used. Constraints taken into account are fertilization, irrigation, working hours and land uses. As a result, there are savings of restrictions and a significant increase in yields of the proposed crops.

Keywords: Linear Programming, Crop management, Agriculture, Constraints, Function, Solver, Excel

1 INTRODUCTION

Each producer must make the right decisions about the products he will produce through the crop or crops he has, the method he will use, the final quantities he will produce and the time period in which he will produce the products. In order to make these decisions, he must take into account both the physical and financial constraints of his exploitation as well as the relative uncertainty about the period ahead of him in order to implement his decision. Uncertainty is affected by forecasts of crop yields, costs, prices of each product produced as well as the requirements of the factors of production in relation to their available quantities. Producers tend to rely on their experiences, comparisons with neighboring crops and their intuition to make specific decisions [1]. Linear Programming (LP) methodology is the most popular model in business research and management science. Its success in decision-making problems in both public and private companies as well as in organizations is due to the achievements of economists and mathematicians as well as to the development of technology and information technology. It is now widely accepted that most applications of business research models to management problems are solved by linear programming [2]. Linear programming is used to provide the optimal or minimum solution to a limited problem. It deals with the planning of the activities of a system in order to produce the best result, that is, the one that among all possible alternatives achieves the predetermined purpose in the best way [3]. Linear programming applies solutions to theoretical computation as well. Used to model combinational problems that at first glance do not seem to be related to linear programming [4]. The first mathematical formulation of the problem as well as a process of solving it, the Simplex algorithm, is due to G.B. Dantzig in 1947 [5]. In this study, 8 crops in the study area were evaluated according to the current situation and through the linear

programming methodology, the optimal solution was proposed. The data of the Ministry of Rural Development and Food of Greece and from OPEKEPE (Hellenic Common Agricultural Policy Payment Authority) were used to calculate the total yields of the crops, as well as the needs of crops for irrigation, fertilization and working hours (labor).

2 LITERATURE REVIEW

Many studies have been performed using linear programming. The following are 3 typical examples. In their 2012 study, Andreea, I. R., & Adrian, T. R. applied an econometric model using linear programming to optimize profits. After the application of the model, the profit was compared. The results showed that profits increased by 143% and costs decreased by 8.1% [6]. In another study by Ward, JD et al. in 2016 in North Adelaide, Australia, linear programming was used to explore different food preferences and determine the suitability of urban farming. The results showed that linear programming can be used effectively to explore optimal cultivation based on the amount of land available [7]. Otoo, J. et al., in 2015, used the linear programming methodology in their study to present the best crop solution in the Fanteakwa area of Eastern Ghana. The model significantly increased crop yields, while saving available resources on capital and labor. This resulted in an increase in producers' profits [8].

3 MATERIALS AND METHOD

3.1 Study Area and data

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