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Research Article

OPTIMIZATION OF AGRICULTURAL PRODUCTS EXPORT WITH USE OF LINEAR PROGRAMMING MODEL IN MAZANDARAN PROVINCE

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ABSTRACT
In the present study, with help, linear programming mathematical model to determine the appropriate pattern of crops cultivation, including irrigated wheat, dryland wheat, dryland barley, irrigated barley, citrus, sugar beet, rice, dryland sunflower, and irrigated sunflower, in the Mazandaran province, using data from the period 2006 to 2011, and finally, the obtained results show that, the export, which of crop crops, would be beneficial for the province. The results suggest that, citrus and rice, have been selected as the product of choice for the export, as well as the limits of the earth, is a major factor in determining the optimum model for the export of these products.

Keywords: *Mazandaran Province, Linear Programming, Export Crop Crops*

INTRODUCTION
As in recent years, has been highly regarded, development and exports Discussion, due to the downturn in oil markets, and the side effects, the export of a single product, is imposed on the economy, therefore, the choice of policy, is required to assess and identify its advantages in the production of various products, strengthen the advantage, and then export these products to other countries.
Given the role of agriculture in economic development of countries, especially developing countries, it is important that the Government, in its programs, more attention is paid to agriculture, and agricultural products. Therefore, in line with the policy of increasing exports, it is essential, knowledge of products, and producer countries, which have the necessary conditions, in terms of penetration of international markets. Because of the diversity of geographical and climatic conditions of the country, and the possibility of various agricultural products, in different places, making this sector, considered as one of the most important sectors of the economy, and considered, and export of agricultural products that, more than any other time. In most developing countries, like Iran, a large part of the population, they earn their income from agriculture and related activities. Most of the farmers who are engaged in small fields, their use of family labor in the fields. The main obstacle to economic growth in these households is the lack of appropriate infrastructure in rural areas (Zamirman, 1978). The lack of such facilities is the cause of the lack of appropriate financial markets, the emergence of asymmetric information, uncertainty and risk in product prices, cost of inputs, and the yields and income risk (Weiss, 1991). In this case, for the farmers, making undesirable, due to the existence of transaction costs, and therefore it is the dominant phenomenon of market failure (Janevari, 1991). In these circumstances, the farmer does not wish to participate in the exchange, and given the resources used, not as efficient. In this case, most farmers tend to show that to the use of cooperation agreements, in the Crop production. Such agreements, plays an important role for most farmers in developing countries (World Bank, 2008). Agriculture is a process that, at any moment of time associated with the issue of risk, and there is no certainty. For example, many agricultural issues, has a direct relationship with nature, and the environment. Reduction of atmospheric precipitation, extreme cold and frost, drought, and the spread of plant diseases and pests, is only a small portion of the risks that farmers face, throughout his career, with them. So agriculture is dependent on the nature of nature. On the other hand, many of these natural disasters are not under the control of the farmer, it is, in itself, adding that the bulk of problems, and natural barriers, progressive farmers. Market has a huge impact on agriculture. Fluctuations in prices of agricultural products, not the farmers, and is determined by factors outside their control (Debertin, 1997).

Economic analysis, production agricultural sector, each region has certain features. If you have dealt with it in a scientific, systematic and logical, it can be drawn, the current economic behavior, in the pattern of its crop area and production variations, showed prices of products and inputs, and their effective application (Goudarzi and Homayoonifar, 1999).

Mazandaran province, has always been considered as one of the poles of agricultural production, and in recent decades, has been proposed as one of the three provinces, the highest crop production in the country. In this study, we are looking for, use, mathematical model of linear programming, using software WinQSB, see to the review, the situation of agricultural products export in Mazandaran province, and in the end, we introduce the product selected, with using this mathematical model.

MATERIALS AND METHODS

Marketing and Sale of Agricultural Products

Market, is a local supply and demand of products or services. In the market place, to meet the demand and supply, in order to determine the unit price, the market may be geographic location, or even an online marketplace for the sale of products, including agricultural and horticultural products.

The definition of marketing, there is nothing, commercial activity, which is causing the flow of goods or services from the manufacturer to the consumer, in due time. Marketing of agricultural products, which include: transport and handling of goods at the farm level, calibration, and quality and safety, and packaging the product, in order to maintain and improve quality, and avoid wasting it. Next, the transport from the fields to the fields, and central markets, or cold, which is held for a maximum period of several months, and its distribution among consumers, who are the characteristics of marketing. Pricing and sales, and profits of middlemen or intermediaries, as well as the toll and tax law, are the reasons that make the difference in consumer prices, and the amount the producer (farmer), that if a farmer direct marketing, and the eliminating middlemen and advertising, will further benefit the farmer's income, and profits are lower in the pockets of speculators, and the final price in the market for consumer welfare, would be much lower.

In financial accounting, marketing, there are various criteria. Given that, marketing operations, which are for-profit operations, therefore, many of the criteria are the same criteria that are used in the production units. One of these criteria is to calculate the situation of cost, revenue and market sectors, which are included producers, brokers, wholesalers and retailers (Zarei and Siyahooi, 2013).

Research History

An internal study conducted in the field of study, and to determine the relative priority crops in Fars province. The researchers in this study to determine the relative advantage; have used two measures, domestic resource cost (DRC), and proportion of cost on social benefits (SCB). The criteria mentioned above, we have used for 18 crops, including dryland wheat, dryland barley, irrigated wheat, irrigated barley, citrus, irrigated peas, Dryland peas, irrigated lentils, Dryland lentils, sunflower, sugar beet, watermelon, cucumber, potato, onion, tomato, beans and rice, and the products studied, four crops dryland wheat, dryland barley, sugar beet, and sunflower, in exchange rate of the currency, not comparative advantage, and tomato, is dedicated to the highest comparative advantage, and are in the later stages, cucumber, potato, and irrigated lentils. In general, the calculations show that a large number of crops in Fars province, have a comparative advantage, and this show the great potential of Fars province, in crop production (Najafi and Mirzayi, 2003).

Other studies can be traced to the study of comparative advantage in selected agricultural products, which have been published in a book by the Research Institute of Planning and Agricultural Economics. This study sought to estimate the parameters of comparative advantage and supportive of selected agricultural products, based on the attitude of Export Promotion. Most other studies have studied comparative advantage, with attitude of import substitution, so that has been studied, the competitiveness of domestic products, with other countries, the domestic market. In this study, we have investigated, the attitude of export development and competitiveness of domestic products in foreign markets, destination, calculation of comparative advantage shows that, with the exception of tea and palm produce products, market prices,

profitable for the farmer or grower, but with shadow prices, decreased or negative, the benefit growers and farmers, in all products (Research Institute of Planning and Agricultural Economics, 2003).

Noohi Tehrani (1997), in his master's thesis, titled "Iran's comparative advantage in agricultural products, as compared to selected countries" has to calculate and evaluate the advantages of Agricultural products, during the First Development Plan, 1989- 1993. In this calculation, were data base, on the export value. In other words, the products studied that value of their exports, so that, they can be placed in an international comparison. For this purpose, is considered, each of these sectors, agriculture and horticulture, poultry, fisheries and aquaculture, and forest and pasture, and in each of these sub-sectors have been identified important export commodity of the country.

Forghani and Kiani (2005) have studied, cumin of comparative advantage, in comparison with the selected countries, revealed in this study, using the calculation of comparative advantage (RCA), which attempt to determine the position of Iran, in export of cumin, and it ranks among the major countries exporting these products. Therefore, data were collected on exports of cumin, and a few selected countries, which had the highest export this product, in the years 1997-2000, and then calculated the index RCA, for these years, for each country, and set out to Iran, in these year.

The research by the Policy Analysis Matrix focuses on the study of comparative advantage in support of, the major agricultural products in China, for years, 98-1992. The results show that, in China, in the user agricultural products, which have a comparative advantage, and in the products of the earth, is the lack of advantage, and among the product is better, grow vegetables and fruit, in terms of social costs and benefits. Also, the findings suggest that a policy of self-sufficiency in strategic crops (cereals and pulses), which leads to inefficiency, and predicts that in the end, perhaps with China's entry into WTO, changes occur in the pattern agricultural production and trade in China (Fang, 1999).

Jaimin (1995), using indicators revealed comparative advantage (RCA), has been examined comparative advantage in Korea industry, 92-1965 years. He has to do this, have used the classification of goods (code SITC), at three-digit level. The results show that, in 1965, during the Korean early stages of industrialization, light industry products, such as wood products, textiles and clothing, from index of RCA, has more than one. This index is calculated RCA, teaching more than one. Index calculation for the period from 92 to 1965, reveals the fact that some of the products, are in light industry (such as clothing, textiles, Footwear, from travel and handbag) still have had, from amount of upper RCA However, their competitiveness, and is in the process of reduction. On the other hand, Korea, heavy and medium industries, in between 80-1975, has a comparative advantage, and in these years, the competitiveness of the industry, has been in an increasing trend. Lee, in this study, compared with one another, the comparative advantage of different industries in Korea, based on the three-digit SITC code, at intervals of 92 to 1965, and has ranked them, from this point of view (Yosef-zadeh, 1999).

Planning techniques used in this study to determine the optimal choice of agricultural products for export is a linear programming model. The period studied in this research, is the crop years 2006 to 2011. The data for this study were collected from the website of the Ministry of Agriculture, Agricultural Jihad Organization of Mazandaran province, and jihad centers, in cities of the province. Since the mathematical programming models, it is important to homogeneity beneficiaries, and in this study, is the population of a state, therefore, the use of information and data used in this analysis, we used the mean values. Put simply, all terms used in the models are average values obtained from the data, and various centers of jihad.

The purpose of applying the techniques discussed in this paper is to achieve the best model for crop cultivation, taking into account the constraints and limitations of the Mazandaran province, in order to achieve the highest level of exports in the agricultural sector in this province.

Linear Programming Model (L. P)

A typical linear programming model, is one of the simplest, yet most widely used mathematical programming models. In the linear programming problems, is goal of the Max or Min, an inline function, which applies to variables, in number of constraints (restrictions) linear.

General model, a linear programming problem (L. P), is defined as follows:

Objective function: $\overset{Max}{s.t}(Min)\colon Z = C_1X_1 + C_2X_2 + \cdots + C_nX_n$

Subject to:

$$a_{11}x_1 + a_{12}x_2 + \cdots + a_{1n}x_n \quad (\leq \text{or} = \text{or} \geq) b_1$$
$$a_{21}x_1 + a_{22}x_2 + \cdots + a_{2n}x_n \quad (\leq \text{or} = \text{or} \geq) b_2$$
$$\vdots$$
$$a_{m1}x_1 + a_{m2}x_2 + \cdots + a_{mn}x_n \quad (\leq \text{or} = \text{or} \geq) b_m$$
$$x_1, \ldots, x_n \geq 0 \text{ or } \leq 0 \text{ free or}$$

Functional limitations

In this model, Cj and bi and aij, are fixed values, and xj are called decision variables (activities). Cj's called the coefficient of cost, or profit, and bi are the numbers right. aij, a technology called coefficients, and if bi, represents the i th source, in this case, aij, which represents the value of the i-th source, which is used, for a j-th unit of activity. As well,

The function $Z = C_1X_1 + C_2X_2 + \cdots + C_nX_n$ Call objective function, which is to represent, to make decisions, such as profit maximization or cost minimization. Restriction $a_{i1}x_1 + a_{i2}x_2 + \cdots + a_{in}x_n \leq b_i$, Which represents the total consumption activities, of i-th source, and call them, functional limitations.

Table 1: Results of the model for linear programming

Gross profit	irrigated Sunflower	dryland Sunflower	Rice	Sugar beet	Citrus	irrigated Barley	dryland Barley	Dryland wheat	irrigated wheat	Product of the Year
2583947	-	-	-	-	9153.914	-	-	-	-	2006-2007
1.358684	-	-	-	-	0679.291	-	-	-	-	2007-2008
9.183079	-	-	2716.47	-	-	-	-	-	-	2008-2009
3915232	-	-	-	-	0320.1673	-	-	-	-	2009-2010
4.660268	35.4197	-	-	-	-	-	-	-	-	2010-2011

Source: Research Findings

According to the results presented in Table 1, can be named as citrus fruits, as the main product, from 2006 to 2011. In addition, in 2008-2009, due to lack of this crop, the product that is most profitable for the province is the rice.

On the other hand, in the years 2010-2011, despite not growing, sugar beet and rice crops, irrigated sunflower crop has been selected as a lucrative product. Given to the linear programming model, you can order products, citrus, rice, sunflower, termed as the agricultural products of the province, in the interest of the products in this province.

Table 2: The results of linear programming model to reduce the cost of products

irrigated Sunflower	dryland Sunflower	Rice	Sugar beet	Citrus	irrigated Barley	dryland Barley	Dryland wheat	irrigated wheat	Product of the Year
-	-5.97752	-7.120006	-99.65941	-	-27.44723	-6.489282	-199433	-6.7057056	2006-2007
-665.1672	-424.9265	-75.11531	-558.3743	-	-65.41611	-437.8449	-48.22721	-41.96634	2007-2008
-	-933.5306	-	-218.2782	-	-49.29720	-604.4963	-02.10065	-93.40066	2008-2009
-77.12854	-98.94877	-9.105870	-57.53083	-	-4.378157	-8.112228	-3.154609	-1.771747	2009-2010
-	-34.14292	-	-	-7961.381	-27.77026	-147.8992	-14.20905	-6.122709	2010-2011

Source: Research Findings

According to Table 2, it is shown that, for a linear model to reduce the cost of agricultural production based on the optimum model of our products is as above. For example, reducing the cost of planting one hectare irrigated wheat in the agricultural sector of the province is 6.705 756 million Rials, and this means that, in case of reducing the cultivation, to the amount of one hectare of this product, at the optimum model, the agricultural sector in the province, there will be as much as 6.705756million Rials, reducing cost. Similarly, for other products, this model can be described. Another thing, mathematical programming models, especially to the linear model, is concept, as the cost of the cloud. Shadow prices, based on linear programming model, the constraints are shown in Table 3. Accordingly, the above table can be interpreted as follows.

Table 3: Results of the linear programming model (shadow price)

Capital	Tractor	Task Force	Fertilizer	Poison	Land	Water	Seed	Restriction
-	-	-	-	-	9343.23	-	-	2006-2007
-	-	-	-	-	8860.2	-	-	2007-2008
-	-	-	-	-	3485.1	-	-	2008-2009
-	-	-	-	-	8958.24	-	-	2009-2010
-	-	-	-	-	9327.3	-	-	2010-2011

Source: Research Findings

According to the table, in this model, the shadow price for land constraints, in agricultural year 2006-2007, based on the 23. 9343 million Rials. In other words, we can say that in the linear programming model, land constraints, has a very important role in the structure of the model, and crops in the province. For the other years, is the shadow price for land constraints, that the amount of which can be seen in Table 3.

Conclusion

According to the results, from the linear programming model, in this study, the combination of citrus and rice agricultural products, which are products, optimization of their culture, and is a very low cost, in agriculture. In other words, investment and exports, in Mazandaran province, compared to other agricultural crops, has been beneficial for the province. On the other hand, land constraints, has a very important role in determining the optimum model, which eventually will lead to a reduction of exports, and agricultural production in the province. Also, due to the optimization of citrus crop, in linear programming model, in this study, it is suggested that, in priority, this crop in the province, as well as increased funding for this product. According to find the limits of farming, in the agricultural sector of Mazandaran province to this province, it is suggested that, in the agricultural sector, to increase the productivity of agricultural products, reduce these restrictions. It is suggested that, given the objectives of

the research, if possible, carried out research on a broader level, and with larger samples, and compare the results with the results obtained in this study.

REFERENCES

Debertin David L (1997). *Agricultural Production Economics*, translated by Mohammad Qoli Muosanad and Reza Najarzadeh (published by Institute of Tarbiat Modarres University Economic Research).

Fang C and Jon CB (2000). Food Self –Sufficiently, Comparative Advantage, and Agricultural Trade: A policy Analysis Matrix for Chinese Agriculture, working paper 99–WP 223, FAO, Available: www.fao.org.

Forghani Kian and Abri Mehdi (1991). The study of comparative advantage cumin, compared with selected countries, *Journal of Agricultural and Development Economics* **XIII**(52) 152.

Goudarzi R and Homayoonifar M (1999). The application of game theory, in cultivation agricultural products of Fars province, *Iran Economic Research Journal* **34** 144-125.

Institute for Planning and Agricultural Economics (2003). Examined the comparative advantage of selected agricultural products, Ministry of Agriculture, Department of Planning and Economy.

Janevary A, Fafchamps M and Sadoulet E (1991). Peasant household behavior with missing markets: some paradoxes explained. *The Economic Journal* **101** 1400-1417.

Najafi Bahaaldin and Mirzayi Afrasiab (2003). Determinations, comparative advantage agricultural products in Fars province, *Journal of Business Research* **26** 50-35.

Nouhi Tehrani Alireza (1997). Agriculture's relative advantage compared with the group of selected agricultural, MA thesis, University of Isfahan.

Vieth RG (1991). An evaluation of selected decision in northernthailan. *Journal of Agriculture and Applied Economic* **28**(2) 381-391.

World Bank (2008). *Bringing Agriculture to the Market*, Chapter 5. In: *World Bank Development Report 2008*, Agriculture for Development.

Yosef-zadeh Kaveh (1999). Study of comparative advantage, in industries, master's thesis, University of Isfahan.

Zarei Dariush and Ameri Siyahooi Nazila (2013). Examining barriers to marketing, and sale of agricultural products in the Hormozgan province, with the purpose of export, Available: http:// MarketingArticles.ir.

Zimmermann HJ (1978). Fuzzy programming and Linear.