WATER DEMAND MANAGEMENT THROUGH WATER PRICING POLICY IN CITRUS GARDENS OF KAZEROON CITY

GESTION DE LA DEMANDE D'EAU PAR LA POLITIQUE DE LA TARIFICATION D'EAU DANS LES JARDINS DE CITRUS DE LA VILLE DE KAZEROUN

A. Nekouifard[1], E. Zare[2], Sh. Shajari[3], A. Zoghipour[4], and E. Ebrahimi[5]

ABSTRACT

The purpose of this study is to estimate water demand function and determine price elasticity of agricultural water demand in the citrus orchards of Kazeroun city. The required data and information for the study have been gathered through interviews and questionnaires.

The studied population comprises citrus growers of Kazeroon from which 61 growers were chosen by two-stage cluster sampling. To estimate water demand function, first, citrus production function was estimated and then matching the results with profit function, the water demand function was extracted. According to the results, the marginal productivity of water equals 0.195kg/m^3 and its monitory value was calculated as 460.96 Rials. Also the finished price of each cubic meter of water is 525.66 Rials. Due to differences between the finished price and value of marginal productivity of water, water demand for agriculture is high in the region because, to get the maximum benefit by using more water grower are looking for equaling the value of marginal productivity of water with its finished price. The results showed that price elasticity of demand for water is -1.21. So we can conclude that pricing water has a role in its use and in managing the water demand. In the study region, the price of 115.3 Rials for each cubic meter of water has been proposed.

Key words: *Production function, profit function, water demand function, price elasticity of demand for water, pricing water and citrus.*

1 Expert of Parab Fars Consulting Eng. Co., Shiraz-Iran. Tel:+98 711 6279857. Fax:+98 711 6279859 .E-mail: amidnekouifard@yahoo.com
2 Assistant Professor of Fars Research Center for Agriculture and Natural Resources, Shiraz-Iran. Tel:+98 711 7235151. .E-mail: zare2970@yahoo.com
3 Assistant Professor of Fars Research Center for Agriculture and Natural Resources, Shiraz-Iran. Tel:+98 711 7235151.E-mail: shajarish@gmail.com
4 Expert of Parab Fars Consulting Eng. Co., Shiraz-Iran. Tel:+98 711 6279857. Fax:+98 711 6279859 .E-mail: a_zoghipour@yahoo.com
5 Expert of Fars Regional Water Authority. Shiraz-Iran. Tel:+98 711 2252061. E-mail: esmaiel_ebrahimi@yahoo.com

RESUME

L'étude vise à évaluer le fonctionnement de la demande d'eau et à déterminer l'élasticité du prix de la demande en eau agricole dans les vergers d'agrumes de la ville de Kazeroun. Les données et les informations requises pour cette étude ont été recueillies par le moyen des entretiens et des questionnaires.

La population comprend les producteurs d'agrumes de Kazeroun dont 61 producteurs ont été retenus par échantillonnage de groupe en deux étapes. Pour évaluer le fonctionnement de la demande, on a évalué le fonctionnement de la production d'agrumes, ensuite les résultats ont été comparés avec le fonctionnement de profit et de demande en eau. Selon les résultats, la productivité marginale de l'eau était de 0,195kg/m^3 et sa valeur était de 460,96 Rials. Le prix définitif de chaque mètre cube d'eau était retenu comme 525,66 Rials.

En raison de la différence entre le prix définitif et la valeur de la productivité marginale de l'eau, la demande en eau agricole augmente dans la région. Les producteurs recherchent le moyen pour équilibrer la valeur de la productivité marginale de l'eau avec son prix définitif. Les résultats montrent que l'élasticité du prix de la demande en eau est de l'ordre de -1,21. Il est donc conclu que les prix de l'eau joue un rôle dans son utilisation et dans la gestion de la demande en eau. Dans la région étudiée, il est proposé de retenir le prix de 115,3 rials pour chaque mètre cube de l'eau.

Mots clés: *Fonctionnement de production, fonctionnement de profit, fonctionnement de demande en eau, élasticité du prix de la demande en eau, tarification de l'eau et des agrumes.*

1. INTRODUCTION

Due to limitations in accessing surface waters of Fars province, the demand for groundwater has increased making it imperative to have a program for optimal and efficient exploitation of groundwater resources. Recent studies demonstrate that due to unscientific exploitation of groundwater in Fars Province, the water table has declined by 20 to 40 percent, exposing saline water aquifer at places. Kazeroon is located in west of Fars province. According to available data, the total consumption of water in the study area of Kazeroon was 221.76 million cubic meter (MCM) in the year 2006. This volume of water comprised 158.88 MCM from deep and medium deep wells, 60.506 MCM frim springs and surface flows and 2.7 MCM from an aqueduct. Of the total water, 97% (or 217.26 MCM) was consumed in agriculture. Groundwater balance of the study region of Kazroon shows annual replenishment of 138.116 MCM, annual exploitation of 140.138 MCM, leaving an annual negative balance of - 2.022 MCM (Shahriyari 2007).

Kazeroon has 21000 ha under tropical, sub-tropical and cold climate fruits, 7000 ha of which is earmarked for citrus. The growers of Kazeroon irrigate 1.86 times more than the need of water for citrus in order to maximize their benefit. They have started well deepening and construction of unauthorized wells. Since agriculture in this city is dependent upon underground water, decline in groundwater table can harm the social, agricultural and economic sectors in the future.

About pricing water in Iran and in the world a lot of studies have been conducted and we refer to some of them.

Soltani (1993) in his study using a linear programming has determined the price of water and the equation of demand for water in two parts of Fars province. The results demonstrate that marginal productivity of water in the study region has been much more than the water price and also the cost of production and distribution of water. The increase in water price gradually and modifying the system of specifying water have been proposed in this study.

Torkamani, et al (1997) looked for the effect of changing the water price on the consumption of water through the water demand function for agriculture. The results showed that the price of water in all regions had an effect on water demand. In addition, the absolute power of price elasticity in most regions has been calculated as less than one and this shows the water demand was not elasticity to price.

Thus, the pricing tool in this region is not adequate to control or reduce water consumption, and a non-pricing tool such as rationing should be thought of.

Chizari and Khalil Abadi (1397[6]) studied the problems of water and irrigation in Rafsajan and proposed strategies to end the current problems. They used Cobb-Douglas type production function for pistachio and value of marginal productivity of water was calculated as 120 Rials/m^3. With finished price of water as 85 Rials/m^3, the elasticity of demand was - 4.6 and for the finished price equal to the value of marginal productivity of water (120 Rials/m^3), the elasticity of demand equals 0.95. This shows that in the finished price of water, demand is elastic and this is why the water price is an appropriate tool to remove the problem of water in Rafsajan.

Samadinejad and Slami (2001) determined the economical value of water (shadow price) in Dashte Markazi. The flexible 2nd degree equation of production (direct method) was estimated for each of the main products of the region. Ccomparing the estimated economical value with cost of water received from farmers, they concluded that the economical value of water was higher than the price of water received from producers and thus in such conditions lack of appropriate and efficient consumption of water and lack of motivation to invest in water technology occurs.

Tahamipoor, et al (2003) estimated the production function and calculated the average and marginal productivity in Zarand and then by using profit function or social welfare they determined the effect of change in groundwater use on the changes of social welfare of pistachio producers. In this research, the economical value of water in Zarand was calculated as 719.86 Rials/m^3.

Shajari (2005) studied the water demand function and determined the water price in palm gardens of Fars using Cobb–Douglas production function. The marginal productivity of water in basin irrigation method is 0.13 kg and value of marginal productivity of water calculated 140.73 Rials in this irrigation method. The cost of water came out as 67.23 Rials/m^3 at 20% interest rate. Demand elasticity for water in gravity drip and basin irrigation was - 2.68 and - 2.093, respectively, showing that demands for water are elastic in the two irrigation methods.

6 For all years starting with 13, add 621 to get the corresponding English year.

Sals (1998) based on his study in India concluded that in order to cover the cost of exploitation and maintenance, the price of water should be 12-15 dollars/ha and in the current price only 2% of exploitation and maintenance cost is covered.

Unver and Gopta (2002) studied water pricing in turkey and concluded that water price should cover all expenses to decrease the financial burden of government and ensure efficient consumption of water.

Petra and Hallegers (2002) believe that application of water as an economical good means that decision on consumption of water and specialization of that among consumers is based on transformative analysis (economical and social) and also the value of water consumption in other alternatives is important to have a correct choice, efficient consumption and a correct specialization of water as a rare resource.

In the report of the third world conference of water and the training workshop of water pricing in America (2002) it was averred that the economical value of water and the issue of pricing it internationally have increased in recent years and the supporters of water pricing believe that the policy of pricing water improves the functions of managing water in the current conditions. However, this economical exercise must be accompanied by social needs and environmental conditions.

The mathematical programming based study of Gomez and Riesrgo (2004) demonstrates that the increase in price of irrigating water for different groups of farmers, through compensating a part of the expenses by government and increasing the farming jobs, results in an increase in farmers in come.

2. THE OBJECTIVES OF THE RESEARCH

The main objective of the study is to find a technique to help managing the water resources in Kazeroon. The detailed objectives of the study are as follows:

1) Citrus production function estimation of Kazeroun city.
2) Determination value of marginal productivity of water in citrus production.
3) Estimation of water demand functions for citrus.
4) Determination of price elasticity of agricultural water demand in the citrus orchards of Kazeroun city.
5) Determination of water finished price per unit based on annually uniform extracted and transport costs of water and comparison to the marginal value of water productivity in citrus production for water pricing determination through water demand function estimation.

3. MATERIALS AND METHODS

The subjects in the study are the growers of citrus of Kazeroon. Since, orange among the citrus has the most amount of cultivation with 2520 ha; it has been chosen as the representative of the citrus area in Kazeroon. To achieve the objectives of the study the following were done:

Estimating Citrus Production Function

The total form of the equation of orange production is as the following:

$$Y = F(X_1, X_2, ..., X_n) \qquad (1)$$

In the above equation : Y is citrus production in kg/ha, X_1 is water consumption in m^3/ha, X_2 is the number of trees per hectare, X_3 is that average age of the trees, X_4 is the working force per hectares, X_5 is the amount of pesticides and herbicides used in l/ha, X_6 is the chemical fertilizer consumption in kg/ha, X_7 is the amount of manure used in t/ha.

To estimate the production function, the two models of Cobb-Douglas and transcendental has been used which have a move range of use in agriculture.

Assigning Marginal Productivity of Water in Orange Production

After estimating production function of orange production, the value of marginal productivity was determined. By having the marginal productivity we can calculate the last value of product unit. To get the last value of product unit from a unit of consumption water we use the following equation.

$$VMP_{wa} = \frac{\partial y}{\partial wa}.(p_y) = (e_{wa)}) \frac{\overline{y}}{\overline{wa}}.(p_y) \qquad (2)$$

in which: VMP_{wa} is the value of marginal productivity, $\overline{y}$ is the average amount of orange production in each hectare, e_{wa} is the elasticity of water production, p_y is the average price in one kilogram of the product, $\overline{wa}$ is the average amount of consuming water on the basis of m^3/ha.

Estimation of Demand Function

To estimate water demand function we can use the both methods of minimizing the cost in determine levels of production or maximizing the function of profit. Agriculture economists often suppose that the first priority or the best choice of managers of farms or formers has been maximizing the profit. (Zikaee Jahvomi, 2005). If the production function has a increasing return to scale, we should minimize the cost function to calculate the function of demand. But if the production function has a decreasing return to scale, the function of demand can be gained through maximizing the benefit function (Shajari, 2005). In agriculture it is usually assumed that the production function has a decreasing return to scale. (Shajari, 2005).

To have the function of demand function of profit function, if we assign the production function in Cobb-Douglas model, we will have:

$$\pi = TR - TC \qquad (3)$$

$$\pi = (p_y.y) - C = p_y.(A\prod_{i=1}^{n} X_i^{\beta_i}) - (FC + \sum_{i=1}^{n} r_i x_i) \qquad (4)$$

In which: TC is the total cost of orange production, FC is the fixed cost, r_1 to r_n is the price of each unit input and x_1 to x_n is the agents of production.

If we derive from the profit function to factors of production and we equals that to zero we will have.

$$\frac{\partial \pi}{\partial x_1} = \left(p_y.\beta_1.x_1^{\beta_1 - 1}\right)\left(A\prod_{i=2}^{n} x_i^{\beta_i}\right) - r_1 = 0 \qquad (5)$$

$$\frac{\partial \pi}{\partial x_1} = \left(p_y.\beta_1.\frac{1}{x_1}.y\right) - r_1 = 0 \qquad (6)$$

$$\frac{\partial \pi}{\partial x_1} = \frac{p_y.\beta_1.y}{x_1} - r_1 = 0 \qquad (7)$$

$$\frac{\partial \pi}{\partial x_1} = \frac{p_y.\beta_1.y}{x_1} - r_1 = 0 \qquad (8)$$

$$\frac{\partial \pi}{\partial x_n} = \frac{p_y.\beta_n.y}{x_n} - r_n = 0 \qquad (9)$$

$$\xrightarrow{7 and 8} \quad x_2 = \frac{\beta_2.r_2.x_1}{\beta_1.r_2} \qquad (10)$$

$$y = A\prod_{i=1}^{n} x_i^{\beta_i} = Ax_1^{\beta_1} x_2^{\beta_2} \ldots x_n^{\beta_n} \qquad (11)$$

The produced amount of production factors are placed in production function of orange production and we calculate the function of production on the basis of X1 (the amount of consuming water) so that we have the function of water demand.

$$y = A\prod_{i=1}^{n} x_i^{\beta_i} = Ax_1^{\beta_1} x_2^{\beta_2} \ldots x_n^{\beta_n} \qquad (12)$$

$$y = Ax_1^{\beta_1}\left[\prod_{i=2}^{n}\left(\frac{\beta_n.r_1.x_1}{\beta_1.r_n}\right)^{\theta - \beta_1}\right] \qquad (13)$$

$$y = Ax_1^{\beta_1} . x_1^{\theta-\beta_1} \left[\prod_{i=2}^{n} \left(\frac{\beta_n . r_1}{\beta_1 . r_n} \right)^{\theta-\beta_1} \right] \quad (14)$$

$$y = Ax_1^{\theta} \left[\prod_{i=2}^{n} \left(\frac{\beta_n . r_1}{\beta_1 . r_n} \right)^{\theta-\beta_1} \right] \quad (15)$$

$$DX_1 = D_{wa} = (y/A)^{\frac{1}{\theta}} \left[\left(\prod_{i=2}^{n} \frac{\beta_i}{r_i} \right) \left(\frac{r_1}{\beta_1} \right) \right]^{-(\theta-\beta_1)/\theta} , \quad \theta = \sum_{i=1}^{n} \beta_i \quad (16)$$

In this function, the water demand is a function from product and input prices. The water demand has a direct relationship with the price of other input and production and a reverse relationship with itself price.

Price Elasticity of Water Demand Using Transcendental Production Function

If we derive from profit function to factors of production and that equals to zero, the water demand will be as the following:

$$\frac{\partial \pi}{\partial x_1} = [p_y . A] \left[(a_1 . x_1^{a_1 - 1} \prod_{i=2}^{n} x_i^{a_i} . e^{\sum b_i x_i}) + (b_1 . e^{\sum b_i x_i} \prod_{i=1}^{n} x_i^{a_i}) \right] - r_1 = 0 \quad (17)$$

$$\frac{\partial \pi}{\partial x_1} = [p_y . A] \left[(a_1 . x_1^{a_1 - 1} \prod_{i=2}^{n} x_i^{a_i} . e^{\sum b_i x_i}) + (b_1 . e^{\sum b_i x_i} \prod_{i=1}^{n} x_i^{a_i}) \right] - r_1 = 0 \quad (18)$$

$$\frac{\partial \pi}{\partial x_1} = (p_y)(a_1 \frac{y}{x_1} + b_1 y) - r_1 = 0 \quad (19)$$

$$\frac{\partial \pi}{\partial x_1} = (p_y . y)(\frac{a_1}{x_1} + b_1) - r_1 = 0 \quad (20)$$

$$(p_y . y)(\frac{a_1}{x_1} + b_1) = r_1 \quad (21)$$

$$(\frac{a_1}{x_1} + b_1) = \frac{r_1}{(p_y . y)} \quad (22)$$

$$(\frac{a_1}{x_1}) = \frac{r_1}{(p_y.y)} - b_1 \quad (23)$$

$$(\frac{x_1}{a_1}) = \frac{(p_y.y)}{r_1 - b_1(p_y.y)} \quad (24)$$

$$x_1 = a_1 \frac{(p_y.y)}{r_1 - b_1(p_y.y)} \quad (25)$$

In which: x_1 is the water demand, p_y is the amount of productivity, a_1 is the variable parameter of consuming water in logarithmic condition, b_1 is the variable parameter of consuming water in linear condition and r_1 is the price of water.

Calculating Price Elasticity of Water Demand

Using the equation of (25) the price elasticity of water demand is determined as follows:

$$E_{wa} = E_{x_1} = \frac{\partial x_{wa}}{\partial r_{wa}} . \frac{r_{wa}}{x_{wa}} \quad (26)$$

$$E_{wa} = \frac{-a_1.p_y.y}{(r_1 - b_1.p_y.y)^2} . \frac{r_{wa}}{x_{wa}} \quad (27)$$

In which: E_{wa} is the price elasticity of water, p_y is the price of each unit of product, y is the average production of citrus, x_{wa} is the amount of consumed water on the basis of square meter in hectare and r_{wa} is the price of water.

Pricing Water

Pricing water must follow the three aims of economical efficiency, distribution of income and preserving the water sources for future. The most appropriate price is one which equals the share of the data in increase of production. And on the other hand, since water is a public object it contains two costs: the private cost and the social cost. Therefore, the best price for water in agriculture of a certain region is the value of finished price of each unit of water subtracted from the marginal productivity:

The price of water = Value of marginal productivity- the finished price of each unit of water. (28)

The final price of water is the price of exploitation and transformation of each square meter of water to the farm.

The prices of exploitation are divided in two groups:

1) The expenses of investment including: the expense of digging well, equipments, purchasing and installing the pump engine and the network of transferring water.
2) The expenses of exploitation including; preservation and management, fuel, repair, transportation and supervision.

The expenses of network of water include the expense of plumbing or generating the channel from the place of pump engine to the farm. To transfer the expenses of investment to a steady annual expense the following formula was used.

$$EUAC = (A/P,\ i,n) - S.V(A/F,i,n) \tag{29}$$

In which *EUAC* is the equivalent uniform annual cost, *P* is the current value of expenses of investment, (*A/P, I, N*) are the conversion ratio the current value of expenses of investment to the Uniform annual, *S.V* is the salvage value of equipments and machines and (*A/P, i, n*) are the conversion ratio salvage next value to the equivalent uniform annual.

After calculating the equivalent uniform annual of expenses investment, the above amounts are added to the annual expenses of exploitation to get the annual expense of consuming water.

By calculating the amount of water exploitation from each well, the final price in each square meter is determined:

The finished price in each m^3 = the total annual expense of exploitation and transportation of water on the basis of Rials / the annual amount of water exploitation on the basis of m^3. (30)

4. RESULTS AND DISCUSSION

In this research, through the gathered information from citrus growers of the city and using the software Eviews 4.0 and the method of ordinary squares, the citrus production function was determined in two models of Cub-Doglass and transcendental. Using the F test, the Minimum efficient squares of the transcendental model has been chosen as the best model for interpreting the the citrus production function and determining the price elasticity of demand of agriculture water of city kazeroon. But, since it was not possible to get the agriculture water demand function from the profit function due to better results of the transcendental production function, the function model of Cub-Doglass has also been used. The results of the citrus production function in kazeroon are a follows:

$$\ln y = 6.84 + .142 \ln x_1 - 0.78 \ln x_3 - 0.066 x_3 + 0.008 x_4 - 0.01 x_7$$

(8.37)*** (1.67)* (-3.09)*** (3.64)*** (5.43)*** (-2.16)**

$F = 21$ ‘ $R^2 = 0.77$ ‘ $\overline{R}^2 = 0.74$ ‘ $D.W = 1.91$

In this function, Y is the amount of orange production on the basis of kilogram in hectare, X_1 is the amount of consuming water on the basis of square meter in hectare, X_3 is the age of the frees, X_4 is the working force on the basis of individual-day in hectare, X_7 is the amount of consuming animal fertilizer on the basis of tone in hectare.

The reason of the reverse relationship of the variable of animal fertilizer with the amount of production in the model can be due to the different usages of animal fertilizers by growers and different fertilizing in changing years or the lack of any certain formula according to the age or functions of the trees, although, it is expected that the factor of animal fertilizer is an important and effective factor in production and there exists a direct relationship between this factor and the amount of production.

The indirect relationship existing between the variable of age of the tree and the amount of production, can be justified according to the age of the gardens and passing through the range of increasing growth of biological growth curve and starting a stage of decreasing growth which has a negative effect on the amount of production. (the average of best productivity period is between the ages 8-15).

Since, the average of citrus production in each hectare is 25443 kg and the average amount of water for irrigating each hectare is 18530 square meter, the marginal productivity of each square meter of water is determined as follows.

$$MP_{wa} = 0.142(25443\text{kg}/18530\ \text{m}^3) = 0.1950\ \ kg/m^3$$

So, the value of marginal productivity of water of each square meter of water equals as follows:

$$\text{VMP}_{wa} = 0.142\,(25443\,\text{kg}/18530\ \text{m}^3) \times 3287 = 640.96$$

In the above calculations, the elasticity of production of water is 0.142 and the average amount of selling leach kilogram of orange in the garden equals 3287 Rials.

According to the calculations, the marginal productivity of water has been estimated as 0.195 kilogram which means for each extra square meter of water, 195 grams has been added to the citrus production in each hectare. The value of marginal productivity of water has been gained as 640.96 Rials. In other words, by adding each extra square meter of water in the process of production, the gardener's income has been increased by 640.96 Rials in each hectare.

After determining the value of marginal productivity of water and motivation for more consumption of water in citrus gardens of kazeroon, to get a toll for policy making in water consumption, the water demand function in citrus gardens was estimated.

Demand Estimation Function

Using relationship (16) water demand was estimated as follows:

$$DX_1 = D_{wa} = \left(\frac{y}{5.1}\right)^{\frac{1}{0.729}} \left(\frac{r_{wa}}{0.164}\right)^{\frac{-0.565}{0.729}} \left(\frac{-0.116}{r_3}\right)^{\frac{0.116}{0.729}} \left(\frac{0.871}{r_4}\right)^{\frac{-0.871}{0.729}} \left(\frac{\text{-}0.190}{r_7}\right)^{\frac{0.190}{0.729}}$$

In this function: DX_1 is the amount of demand for water in citrus production, y is the amount of citrus production, r_3 is the annual cost of depreciation tree, r_4 is the worker's salary on the basis of persons-day-work r_7 is the price of each tone of animal fertilizer, p is the price of each kilogram of orange and r_{wa} is the finished price of water on the basis of Rials in square meter.

According to the above model, the amount of water demand has a reverse relationship with the price of each square meter of water. In other words, as the price of water increases, the amount of water demand in the production of orange decreases. In this function, the water demand has a direct relationship with the worker's salary and and indirect relationship with the annul price of planting tree and the price of each tone of animal fertilizer.

To calculate the final price of water which includes the expenses of exploitation and transportation of each square meter of water up to the place of irrigation, the equivalent uniform annual cost of exploitation and transportation of water in citrus gardens of kazeroon have been determined as the chart 1.

Table1: Equivalent uniform annual cost of exploitation and transportation of water in citrus gardens of Kazeroon

Description	**Interest rate**	
	12%	**18%**
equivalent uniform annual cost of digging well and equipment(Rials)	7924125	11343618
equivalent uniform annual cost of purchasing and installing the pump engine(Rials)	1608402	2051309
equivalent uniform annual cost of transporting water(Rials)	10288147	12967132
The annual current cost of repayment, preservation, (Rials)	12600000	12600000
total annual cost(Rials)	32420674	38962059

Resource: The information's of the study

According to this fact that each well in citrus gardens of kazroon at least irrigates 4 hectare of garden and approximately 74120 square meter of water is exploited from each well in the year, using the function of (30) and by assuming an interest rate of 18% and 12% the final price of water is determined as 525.66 and 437.4 Rials respectively.

In the next stage, by placing the price of each kilogram of orange, the average production of orange, the amount of consuming water on the basis of square meter in hectare and the final price of water, through the equation of 27 the price elasticity of water demand in production of orange is determined.

$$E_{wa} = \frac{-(0/142 \times 3287 \times 25443)}{(525/66)^2} \times \frac{525/66}{18530} = -1/21$$

As it is observed, in the calculated price of water (525.66 Rials for each square meter of water) the price elasticity of demand for water is -1.21 which shows that demand for water is elastic. So that one percent of an increase in price of water leads to a 1.21 percent decrease in demand for water.

Therefore can tell elastic demand for water, water pricing will have special role in water use. The main reason of high demand of agriculture water in the region is due to the difference between the finished price and value of marginal productivity of water. According to the calculation, the value of marginal productivity of water is 640.96 Rail and the finished price of water is 525.66 Rail. This condition leads the growers to equal the value of marginal productivity of water with its finished price to maximize their benefit by consuming more water. This causes the growers to use more water in the process of production. Thus, in order to decrease the pressures on the water resources of the region, the additional value of water in production which equals the value of marginal productivity of water subtracted from the finished price of water must be taken from the growers as water price so that the growers are satisfied with the profit of their management and the motivation of exploiting extra water is taken from them.. The amount of water price which equals the value of marginal productivity of water subtracted from the final price in this study, has been estimated as 115.3 Rials for each square meter of water.

Using the square data, the price capacity of water demand for all exploiters has been determined as follows. The results showed that for 16.4 percent of the growers, the absolute power of price elasticity of water demand is less than one which demonstrates that demand for this group is not elasticity. Also, the value of marginal productivity of water for this group is less than the finished price of the water which has been determined in the region. Therefore, the policy of pricing and receiving water price must be done gradually in time, otherwise the growers whit a low exploitation will be deleted from the circle of production.

5. SUGGESTIONS

1) According to the fact that water demand is elastic able in the region, an appropriate water price on the basis of its final price must be taken by water organization so that it causes more motivation for saving and economizing water in the growers. According to the calculations, the price of 115.3 Rials for each square meter of water has been proposed.

2) Since only pricing water is not enough to keep and maintain and efficient consumption of water resources, the earnings of gathering and receiving water price must be invested to improve the water resources of agriculture section and manage the programs of irrigation such as covering the channels of water in the region. In such conditions, pricing water will have a positive effect. Also, it is suggested that in order to increase the efficiency of consuming water not only pricing tools but also non pricing tools be used. These non pricing tools are as follows:

a) rationing water and conducting limitations and controls for exploiting the water resources such as installing meter on the exits of the exploiting wells and making the growers to exploit less water by having hours of no electricity of course, the effective conduction of such policy requires a accurate super visional system.

b) Creating and developing unions of exploitation which has the responsibilities of supervising the water resources, and gathering water price to improve the water resources.

c) Informing the exploiters of the region about the effects of this pattern pf exploitation and the decrease in the amount of underground water by training of agriculture organization and the water experts of the region.

d) Encouraging the exploiters and giving them loans and required equipments to conduct new patterns of irrigating so that the productivity of water is increased.

e) Assigning the irrigation program of the region based on the need of citrus for water and advancing the usage of this pattern through training classes of agriculture organization of the city.

6) Modifying the structures of water management and involvement of the people in all aspects of management of water from the policy stage to exploitation and improving the regional management through a better inform of medias.

f) The improvement of the role of supervising of the government on accurate and efficient use of water resources to protect and keep the water resources to protect and keep the water resources of the country.

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Note: Years starting with 13 are according to Iran calender. Add 621 to get the corresponding English calender year.

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