Selecting the Cultivation Pattern based on Economic Value of Water in Gotvand Township, Iran.

M. A, Sabbagi
Assistant Professor, Shoushtar Branch, Islamic Azad University, Shoushtar, Iran

Abstract

Considering Iran geographical location, water is the most limited factor in agriculture section. Therefore, it would be logical to consider water as one of the most significant criteria in selection of cultivation model. The purpose of this study is assigning cultivation pattern based on economic value of water in Gotvand Township in agronomic year 2008-2009. So it was necessary to computes the water production value in producing important crops such as wheat, barley, corn, potato and water melon. To get objectives production function method was applied. Also different form of production forms such as Translog, Leonteaf and Quadratic estimated.

The results show that the economic value of each m^3 water in the products ranges between Rls.228 to Rls.411. based on the results, corn, wheat, tomato, malt and water melon have respectively priority in regional cultivation. **[Mohammad Aghapour Sabbagi. Selecting the Cultivation pattern based on Economic value of Water in Gotvand Township, Iran. International Journal of Agricultural Science, Research and Technology, 2011; 1(1):27-31].**

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1. Introduction

Iran is among the countries with more that 64 percent of dry and ultra-dry zones there in. Three main problems in internal water supply include: low precipitation, high evaporation and unsuitable Precipitation distribution. In addition, rapid population growth has been the main reason of renewable water resources per capita during the last 8 decades. Various factors and population diversity have caused the water-allocation policies work out of permanent & coordinated frameworks. And the water Section position has been ambiguous in drawing up regional plans & Policies (Mohamadvalisamani, 2006). Some researches declare the low price of water in agriculture section as the reason for this. According to them, non-payment of adjusted price may inspire the users that the value of water is the same low price that they pay. Therefore, low price shall create no stimuli for saving in water (Soltani and Najafie,1996). It shall also prevent the investments of agencies in this sector. Although water pricing issues in agriculture have been discussed for many year, but presently the price paid by the framers for this unique product not match its real value. The present prices only cover 12% of water costs. In most regions of Iran, water share in contracts between water supplier and farmers is one third of price of this product. In an estimation, the price of water for growing sugar beet in Khorasan province has been declared as 60 Rls per m^3(Hossainzad and Salami,1999). Meanwhile, the final price of every m^3 of water gained from surface waters has become 20 folds compared with the last 20 years(Mohammadvalisamani,2006).

On the other hand, unsuitable water pricing has aggravated the demand for this unique product. Therefore, proper water policies for encouraging water saving by the farmers is among policies which many economists believe as an effective measure.

So, several research & Studies have been carried out by specialists of different sciences. In studies done for estimation water prices, various methods have been used (khalilyan & zarehmehrjadi, 2005).

Khalelyan &, Zareh mehjadie in 2005, in an study titled “Evaluating the Under Ground Water Resources in Agricultural Operations: A case study of Wheat Farmers in Kerman City”, the value of ground water was analyzed by production function, and it was revealed that the marginal water value in wheat production is more than water extraction cost and this has caused extra water extraction in these regions. In his Doctorate’s Thesis, Hossein Zad has pointed out the water demand problems and has considered the water pricing as the main issue of water demand policies and plans in agriculture section. The results of the research shows that the value of water for different products in the region are not the same and it ranges between Rls.248 to Rls.365. Moolman et al (2006) declared water pricing as the managerial solution of water shortage in South Africa. The results of their research showed that Mango and Sugar have created the maximum and minimum final income of 25.43 and 1.67 dollars, respectively. Wang and Loo (2006) used production function in order to gain the real value of water in different industrial sectors in China. Result show that water value rang was between 0.5 - 26.8 yoan.

Briand, applied the cost function in 2006 in order to price the agricultural products. The results show that cost- centered pricing may be an acceptable solution for decreasing water crisis in long- term and may increase the social welfare. - Pitafy and Rumasset in 2003 tried to determine the price of under ground water and protective investments in water sheds. They used linear programming method for this purpose. Gayatri and Edward (2000), obtained the social welfare function via Cubb-Douglas function. Then, they determined the effect of under ground water decrease on the social welfare and found that restoring the under ground water resources increases the social welfare noticeably.

2. Material and Methods

In relevant literature, there were found two general methods for determining the economical value of water from user's point of view: Parametric and Non- parametric. In non parametric method, the water economical value is computed through analytical and mathematical methods within the framework of economic theories(hosainzad &salami,2004). The said methods are based on accounting, farm budgeting analysis or mathematical techniques such as the linear programming in which a function is selected to increase or decrease the same regarding the number of factors. Non parametric methods of water value determination include marginal rating, budgeting method and linear programming. The basis of parametric methods is profit, production and cost functions. In these models, firstly a profit, cost or production function is estimated in order to determine the production structure. Finally, the water value is determined via the estimated parameters. Parametric methods have priority over the non parametric ones. That is, it is possible to test the parameters resulted (Chambers,1988). The said parameters are the basis of water value determination. Therefore, we may be more insured about the authenticity of the resulted parameters. There is no need to determine the limitations of water resources or type of water supply compared with some non parametric methods. Also, in these methods we can benefit from different functions specially more flexible and easier functions by using Economical models. Considering theses advantages, the present research uses parametric models and production function in order to determine the real value of water.

According to theories of production economy, the amount of produced product is a function of consumption of different inputs. This relationship may be shown in different forms as follows:

$$Q= f(X, Z) \quad (1)$$

In which:

Q= Amount of production, f= sub relation, X= variable input vector, Z= Fixed or Semi- fixed inputs vector. The value of each input in production process is defined through its final production, i.e the more the final production, the more value in production process. According to optimized use of inputs, every input must be used in production process in a way that the final production value of each input shall be equal to the price paid for that input.

$$Py*MPx= Px \quad (2)$$

In the above relation, Py = the product's price, MPx= final input's production, Px= input's price. Final production of each input will derive from the production function regarding the considered input. The following formula shows this:

$$MPx= \partial f(x)/ \partial x \quad (3)$$

The above relation shows that the price of water shall be a function of its final production price. As we shall see, water marginal production shall be a function of level of consumption of other inputs in production functions such as Translog, Transdental and Leontief functions. There for, we can say that the amount of consumption of other products shall be effective on the economical value of water. It is commonly accepted that the economic value of a semi- fixed input such as water is computed in average level of other products. Also, considering the production elasticity of water we can study the reaction of farmers towards the price changes of this product. Production elasticity function of a input such as water may be defined as follows:

$$Ew= \partial f(x)/ \partial w. W/Q \quad (4)$$

Ew= the production elasticity of water which is itself a function of water and other products consumption in production process. In order to determine the suitable form of production function, different forms of production function shall be applied and the most suitable function will be selected for each product by applying the common indices in Economy such as low number of independent variables, model processing power, non existence of problems such as variance difference and variables such as Akaik and Schwarts variables. Then, the real price of each input (including water) shall be extracted via mathematical relations. The said price shall be equal to final value of that input in its production. In order to estimate the said production function, we need data and statistical info about the price and quantity of different used inputs including fertilizer, water, seed, labor and machineries, quantity and price of the produced products and the area under their cultivation in the region. These data have been collected by designing questionnaire and sampling from the farmers in rural regions of Gotvand city

3. Results and discussion

In order to have more accuracy in selecting the form, flexible and inflexible forms including Cubb Douglas, transcendental, Leontief and quadratic forms have been studied in the present research. Different criteria such as meaningfulness of estimated coefficients, well estimation and theory conformity for various products have been displayed in Table 1, For wheat and potato, malt and water melon and corn the best production forms are respectively Translog, Leonteaf and quadratic forms .Also, the present research studies the hypothesis of elements normality resulting from estimation of various production functions by Jarque- Bera test.

Table 1: Compare different models about normality test

crop	Functional form	Jarque- Bera test	Normality hypothesis
wheat	Translog	0.04	Accept
	Leonteaf	2.17	reject
	Quadratic	1.02	reject
barely	Translog	1.23	reject
	Leonteaf	.02	Accept
	Quadratic	2.07	reject
corn	Translog	1.55	reject
	Leonteaf	2.17	reject
	Quadratic	0.04	Accept
potato	Translog	0.01	Accept
	Leonteaf	3.03	reject
	Quadratic	2.54	reject
Water melon	Translog	1.56	reject
	Leonteaf	1.92	reject
	Quadratic	0.02	Accept

Also, heteroscedasticity problem in all models was studied by White test and the problem was removed by the said factor. The results of different functions are shown in Table 2.

Table 2: Result of different functional form for crops

input	wheat		barely		corn		potato		Water melon	
	coefficient	T statistic	coefficient	T statistic	coefficient	T statistic	coefficient	T statistic	coefficient	T statistic
Intercept	52.3	3.12	-201	23.2	832.5	5.5	78.1	2.08	662.4	4.02
Land(hec)	-22.7	-3.22	-23.3	-1.64	0.09	1.34	-41.07	-2/01	0.17	2.19
Seed(kg)	30.1	2.19	3/2	2.97	1.12	2.78	21.3	3.09	5.02	3.06
Water(m^3)	-7.1	-1.78	107.2	3.5	0.7	3.5	-3.8	-2.12	0.5	2.08
Machin(toman)	12.3	2.2	6.12	1.75	1.3	2.9	17.03	2.12	---	---
Fertilizer(kg)	1.13	2.28	198.1	1.65	-3.5	-1.65	7.02	1.01	1.05	-3.32
Labor	-2.11	-1.93	-112.2	-1.96	0.04	3.97	-12.7	-2.03	0.12	1.91
Land2	2.3	1.96	6.4	2.3	-0.003	-6.17	5.09	1.96	-0/007	-3.22
Water2	0.3	1.17	0.6	3.5	-.0032	-3.4	0.09	2.08	-0.0008	-1.87
Fert2	0/003	2.46	21.5	2.67	.00045	1.67	0.08	1.91	0.0001	2.2
Seed2	4.7	3.29	---	---	0.002	2.43	1.1	2.11	0.002	1.73
Land*water	3.4	2.78	7.7	3.21	0.00003	2.78	3.4	1.71	-0.0004	-1.57
Land*fertilizer	-0.78	-1.23	-2.3	-3.04	-0.000001	-1.65	-0.66	-1.73	-0.0003	-2.18
Water*fertilizer	-1/05	-1.78	-1.5	-1.78	-0.000004	1.98	-3.21	-2.11	-0.0005	-3.08
Watet*seed	-1.9	-3/93	---	---	0.000008	2.1	-2.12	-1.97	0.00002	2.45
Fertilizer*machin	1.53	2.27	-1.32	-1.84	-0.00005	1.65	0.73	1.77	---	---
Fertilizer*seed	1.13	1.42	0.08	2.98	0.04	2.32	0.11	1.32	0.007	1.82
R^2	87		78		65		81		87	

As seen in the table, the interaction effect of some inputs have not been reported. The reason is the meaninglessness of these coefficients even at 15 percent level. It is observed that R2 of the above models show the suitable estimation of the model. Based on inputs elasticity in different functions, it becomes known that this elasticity is a function of consumption level of other factors such as cultivation area, fertilizer and seed, as well. That is, the economic value and water elasticity shall change by the change in theses factors. Water economic value of the products is reported in following table based on the results of present model.

Table 3: Water shadow price and elasticity in different crops

crop	Water Shadow price(Rls)	Cost share(%)	elasticity
Wheat	362	21	-0.35
Barely	301	16	-0. 11
Corn	411	28	-0.19
Potato	319	26	-0.22
Water melon	228	25	0.67

It is observed that the economic value of each agricultural product is differently computed by different production functions. The economical value of each m^3 of water amongst the said products ranges between Rls.228 to Rls.411. As seen, the results how that the maximum and minimum value of water is resulted in production of corn and water melon, respectively. The study of consumption level of products used for producing the main products in Gotvand shows that for all products except water melon, the farmers use water in excess of their economic proficiency.

Discussion

As results showed, water value is different in mentioned crops. Godarzi in 2009 showed that, water value in wheat, cotton, soya and different rice varieties in Mazandaran province were different Moolman and et al. (2006) obtained different value for water, using production function. Result showed that mentioned value fluctuated between 1.67 in Mango till 25.34 in sugar. This means that in regions such as Iran that face with water scarcity, water is an important factor for cultivation pattern choice. Zare and Shahbazi considered water value for input quantity choice in sugar beet cultivation systems, and emphasize on system that provide maximum value for water input. Godarzi (2009), showed that in Mazandaran province change in water input value can change land allocation for crop and effect on cultivation pattern. Bageryan and et al. (2007), in a research in Kazeron region, considering dry and semi dry climate of Iran, expressed that water is an important factor for determination of cultivation pattern. Musavi and Ghargani (2008), research in Marvdasht city emphasize that; in crop cultivation pattern choice water sustainability should be considered. Hence, this study suggest cultivation pattern that, cause increase in water resource sustainability. Also, results showed that other inputs quantity effect on water value that was emphasized in other research such as Hossian zad and Salami (2004) and Gayatri and Edward (2000).

4. Recommendation

Considering the limited water resources in Iran, it is suggested that the limited resources be allocated to the production of products that can produce higher value for each m^3 of water. Based on this, we can say that the priority is with the cultivation of corn, wheat, potato, malt and water melon in this region respectively. Although the selection of cultivation model just based on water value may cause overlook in other economic and social aspects but it is possible to consider this criterion with other factors in order to select the models based on the limited water resources in Iran.

Meanwhile, this cultivation model may be overlooked by the regional farmers for several reasons. Therefore, we suggest that relevant authorities may support the farmers through policies and enable them to gain the maximum profit from each m^3 of water. Another result of the present study is the fact that water value in producing the agricultural products depends on other water consumption level in addition to being a function of level of consumption of other inputs. In other words, any change in consumption level of other inputs and even their price may cause change in the value of water. Therefore, considering the consumption level and price of other inputs is being suggested for pricing water.

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