Journal of Hydrosciences and Environment
Available online at http://jhe.usb.ac.ir/

ISSN: 2345-5608

The Impact of New Inputs (drip irrigation technology) on the Production of Pomegranate and Factors Affecting Its Adoption (Case study: Khash City)

N. Aliahmadi*[1], S. Rigi[2], E. Moradi[3]

1. PhD student in Agricultural Economics, University of Sistan and Baluchestan, Zahedan, Iran
2. MSc in Economic Sciences, University of Sistan and Baluchestan, Zahedan, Iran
3. Assistant Professor of Agricultural Economics, University of Sistan and Baluchestan, Zahedan, Iran

ARTICLE INFO

Article history:

Received: *15 February 2016*
Accepted: *20 January 2017*

Keywords:
Bizaliya Model,
Logit Model,
Drip Irrigation,
Pomegranate,
Khash.

ABSTRACT

Due to the limited water resources in arid and semi-arid areas, it is necessary to utilize new high-efficiency irrigation systems to irrigate the horticultural crops. The present study attempted to compare the productivity of pomegranate cultivation per hectare after utilizing two drip irrigation and furrow irrigation methods and examined some of the economic, environmental and managerial factors affecting the adoption of the drip irrigation among pomegranate farmers in Khash city during 2015 crop year using Bizaliya and Logit models. Results of the Bizaliya model indicated that the application of drip irrigation had both direct and indirect effects on increasing the productivity of pomegranate cultivation. As the direct effect, the productivity of the pomegranate cultivation increased by 32.28 percent per unit area without any change in the consumption of inputs and as the indirect effect by changing the consumption of inputs, the productivity of the pomegranate cultivation increased by 6.47 percent per unit area. Generally, the use of drip irrigation in pomegranate orchards led to 12/28 percent change in productivity (kilograms per hectare) of the pomegranate cultivation. On the other hand, the results of the logit model indicated that the farmer's age, number of family labor force working on the farm and the accessibility to water resources have a negative impact on the adoption to the drip irrigation technology. Moreover, it was found that the farm size, level of education, farmer's job, land slope, farmers income, type of land use, instructional and promoting classes, accessibility to credit facilities have positive and significant effects on adoption to drip irrigation.

1. Introduction

Nowadays introduction of technology in all areas of science has attracted the attention of many scholars, policymakers and farmers in agriculture sector all over the world. On the one hand, the population growth and increased restrictions on cultivation has led to one of the most effective strategies to achieve agricultural development and food security is to increase productivity per unit area. One of the strategies recommended to increase the productivity per unit area is the application of new technologies by farmers. In this regard, the promotion of diverse extension training practices provides the possibility of the new technology utilization by farmers (Shahbazi, 1996). Water has long been the world's most important development factor. Early human beings used to live close to rivers and gathered around water resources in order to start agricultural activities (Abrishami, 2006). 97 percent of water resources were salty and very limited water resources were used directly by humans. Moreover, a little more than 1.76 percent of earth's water in the form of crystalline or icy rivers is out of reach and the remaining water is stored at the depth of the earth (Azizi, 2000; Dashti, 1995). These restrictions for high quality water resources as well as exacerbation of water resource constraints due to droughts in addition to the low efficiency of water irrigation led to the persistency of the demand for water resources. In order to achieve the maximum exploitation of water resources and increased productivity, irrigation methods and particularly the use of sprinkler irrigation can largely solve the water shortage and adverse the effects of drought. The consequence of such a process is the increased production of the agricultural products. Survival and human welfare depends on the successful management of natural resources and agriculture. However, over time, the management of water resources along with the development of societies has led to the greater complexity of the issue and the increased global population and economic growth of the nations all over the world has increased demand for food materials (Kennedy, 1986). The supplement food needs of a growing population requires an increase in the exploitation scale technical knowledge of natural and agricultural resources exploitation. The application of appropriate technology in

* Corresponding author's email:
ahmadi_15877@yahoo.com

addition to the dramatic growth in agricultural production may reduce production costs and result in economic returns to scale (Musser and Shortle, 1995). However, it should be mentioned that the increasing exploitation of natural and agricultural resources to meet the growing needs for food has always faced with serious constraints so that the use of these resources has led to the destruction and annihilation of the resources that in turn will jeopardize the sustainable development process. Increasing of technical knowledge takes time and exorbitant costs in the field of science and research. Therefore, the easiest way for the supplement of food needs is the allocation of the resources in order to achieve the goals of the operators and planners in the natural resource and agricultural sector (Chizari and Ghasemi, 2005). Kohansal *et al* (2009) investigated the environmental and non-invironmental factors affecting the sprinkler irrigation in Khorasan Razavi Province. According to the results of the study the promotion of the farmers knowledge, preparing the ground for credits and increased farm size through land consolidation were proposed as strategies for the adoption of sprinkler irrigation. Nowroozi and Chizari (2006) studied the factors affecting the sprinkler irrigation in Nahavand city. The suggested a diagnostic function which could appropriately classify farmers using sprinkler and surface irrigation with a considerable utility. Towhidlu (1999) examined the efficiency of the water consumption in an alkaline soil for two sprinkler and surface irrigation methods and found that the consumption efficiency was higher in sprinkler irrigation method. The root productivity for sprinkler irrigation method was 41 and for surface irrigation it was equal to 31 tons per hectare, respectively. Akbari (1998) studied the effects of two sprinkler and surface irrigation methods on potato cultivation in Fereidon region, Isfahan, Iran. The study concluded that the sprinkler irrigation had increased the output productivity and the water consumption had decreased by 35% in comparison with furrow irrigation. Authors stated that this amount of water can increase the cultivated area by 50 percent. In the field of new and innovative technologies in the world many studies have been conducted that will be mentioned in the following. Darusman *et al* (1997) found that the utilization of the drip irrigation system supplying 75 percent of the corn crop water requirements and increased the productivity of corn crop and reduced deep percolation below the root zone in the mentioned region. Randhir and Krishnamorthy (1999) compared the productivity of the cultivations in two groups from having irrigation equipment's point of view. The results of the study indicated that the utilization of the irrigation equipment's increased the productivity and farmers revenues significantly. Ascough and Kiker (2002) studied central rotary and semi-fixed sprinkler irrigation systems for sugarcane plantations. They reported the average efficiency for these irrigation systems was equal to 83.6 and 73.5, respectively. Lamm (2004) in his investigations indicated that the cultivation could be done with the least amount of water required for the irrigation of corn crop. The results of the study also showed that the productivity and some improvements in the quality of the corn traits. Kiresur and Manjunath (2011) investigated the socio-economic effects of cotton for 60 farmers in India using Bizaliya method. The results indicated that the use of pesticides decreased the profitability by about 39% and increased farmers' incomes by about 88%. The average rainfall in Sistan and Baluchestan province was less than the average rainfall of the whole country which is about 250 mm. therefore, this province is faced with the shortage of water and due to the recent droughts a comprehensive programmer should be planned for the supplement of required water without taking into account the rainfalls. The management of water in farms could be analyzed and the required strategies could be taken by conducting agricultural research.

Therefore, the present study attempted to compare the productivity of pomegranate cultivation per hectare after utilizing two drip irrigation and furrow irrigation methods and examined some of the economic, environmental and managerial factors affecting the adoption of the drip irrigation among pomegranate farmers in Khash city during 2014-2015 year.

2. Method and Materials:

2.1. Bizaliya model

The current study examined the effect of using drip irrigation technology in the production of pomegranates considering two main assumptions: Changes in production technology (using drip irrigation) leads to changes in the production function (slope and intercept). The objectives of the present study were to answer the following questions due to the technology adoption, firstly how much has intercept of the production function changed. Secondly, how much has the elasticities of the production function changed. Thirdly, with the two mentioned changes in the production function what changes occur in the consumption of inputs? And finally, how much has the productivity per hectare increased?

First of all, various production functions (Cobb-Douglas and transcendental and translog functions) were estimated in order to understand which of the functional forms fits the best with data and by comparing various R^2 and F statistics the Cobb-Douglas production function was chosen to estimate the model. In order to determine the explanatory variables of the model, significant explanatory variable in the estimated experimental Cobb-Douglas production function were chosen. The specification of the estimated function in the logarithmic form was as follows:

$$LnY = Lnb_0 + b_1 LnL + b_2 lnP + b_3 LnF + b_4 Lnh + b_5 lnW + b_6 lnk + U_i \quad (1)$$

Where Y represented the quantity of the output, L the cultivated area (hectare), P the amount of toxin used in the cultivation process, F the quantity of pesticides (kilograms). H, W and K denoted the labor force (person), the quantity of water consumption (cubic meters) and capital (thousand Rials), respectively. b_0 and $b_1, b_1, \ldots, b_7$ were the intercept and the slopes of the performance function (the partial elasticity of the i factor in the performance function) and U_i shows the disturbance term of the model. Using Bizaliya's model which shows the contribution of various constituent sources to the productivity, the difference between two production functions were obtained (Kiresur & Manjunath, 2011). For both of the presented functions the general change can occur by the change in the production parameters or the change in the quantity of input consumed. As the estimation of the production functions are considered as the easiest method for the decomposition of the difference between the productivity, the production functions for two groups of farmers using drip irrigation and furrow irrigation were specified as follows:

$$Lny_1 = Lnb_{01} + b_{11}LnP_1 + b_{22}LnF_2 + b_{32}LnH_2 + b_{42}lnW_2 + b_{52}lnK_2 + U_i \quad (2)$$

$$Lny_2 = Lnb_{02} + b_{12}LnP_1 + b_{22}LnF_2 + b_{32}LnH_2 + b_{42}lnW_2 + b_{52}lnK_2 + U_i \quad (3)$$

Here, P, W, H, F, K, Y and U_i were defined as equation (1). Equations (2) and (3) represent the production functions of permanganates for drip irrigation and furrow irrigation, respectively. By subtracting (2) and (3) equations and doing some algebraic operations the following function can be achieved:

$$Lny_1 - Lny_2 = \{Lnb_{01} - Lnb_{02}\} + \{(b_{11} - b_{12})\, Ln\, P_2 + (b_{21} - b_{22})\, Ln\, F_2 + (b_{31} - b_{32})\, ln\, H_2 + (b_{41} - b_{42}) lnW_2 + (b_{51} - b_{52})\, ln\, K_2\} + \{b_{11} ln\left(\frac{P_1}{P_2}\right) + b_{21} ln\left(\frac{F_1}{F_2}\right) + b_{31} ln\left(\frac{H_1}{H_2}\right) + b_{41} ln\left(\frac{W_1}{W_2}\right) + b_{51} ln\left(\frac{K_1}{K_2}\right) + U_i \quad (4)$$

The left hand side of the above equation represents the difference of productivity per unit area in response to the application of technology. The first term of the above formula on the right hand side is the effect of neutral component of technology (percent change in the output as the result of change in parameters) and the second bracket shows the effect of the non-neutral component of technology on the productivity which is weightened by the quantity of the consumption of variable input in the orchards using furrow irrigation (percent change in the output in response to the change in the slope of the parameters) and the third bracket refers to the difference in productivity in response to the change in the quantity of the inputs consumed which is weightened by the partial elasticity of the any factors of production in the drip irrigation production function (Kiresur and Manjunath, 2011). Data and statistics required for the calculations and the estimation of the models reffered to the 2014-2015 crop year which was obtained using random sampling method and questionnaires filled up by farmers of the Khash region. After collecting required data, the model was estimated using Ordinary Least Square (OLS) technique in $Eviews_6$ software.

2.2. Logit model

The Logit model is used in situations where the dependent variable is not observable. The dependent variable in this case occurs in a binary choice. The logistic model also follows the properties of the logistic curves so that the fitted curve is estimated based on the actual data. The actual data for the dependent variable take the value of 0 or 1 based on the occurrence or the non-occurrence of the corresponding phenomenon; therefore, the top and the bottom of the graph are determined due to various levels of linear combinations of the explanatory variables. The superiority of the logistic model is that having information about the occurrence of the corresponding phenomenon is enough for the estimation of the model. Thus, the dependent variable can be used to estimate the occurrence or the non-occurrence of the corresponding phenomenon. For the identification and the analysis of the factors affecting the decisions of the farmers about the adoption with the irrigation technologies as the decisions of the farmers is made based on the acceptance or rejection of new irrigation system, the related regression model will have a dependent variable which naturally takes two values of 0 or 1(Zare Mehrjardi and Aknari, 2001). On the other hand structures influencing farmers decisions, individual, social, economic and physical situations which may be qualitative or quantitative variables. These models include linear probability model, Logit, Probit and Tobit models. For example based on the Logit model the probability that the ith farmer accept the irrigation technology will be as follows:

$$P_i = F(Z_i) = F(\alpha + \beta X_i) = {}^1\!/_{1 + e^{-Z_i}} = {}^1\!/_{1 + e^{-(\alpha + \beta X_i)}} \quad (5)$$

Where e is called the base of the natural logarithm (Neperian number). Equation (1) refers to the formula that is called the logistic cumulative distribution function. As the sum of the probabilities should be equal to 1 the probability that the ith farmer doesn't accept the irrigation technology can be calculated as follows:

$$1 - P_i = {}^1\!/_{1 + e^{Z_i}} = {}^1\!/_{1 + e^{(\alpha + \beta X_i)}} \quad (6)$$

Thus, we have:

$$\frac{P_i}{1-P_i} = \frac{1+e^{Z_i}}{1+e^{-Z_i}} = e^{Z_i} \quad (7)$$

The probability of the event occurrence to its alternative as the probability of the occurrence of the adoption of the technology to the non-adoption:

$$L_i = Ln\frac{P_i}{1-P_i} = \alpha + \beta X_i \quad (8)$$

Where L_i is the logarithm of the adoption to the non-adoption of the technology in terms of X and other linear parameters (Jahromi and Mohammadi, 2007). The dependent variable of the current study was the decision of the farmers for the adoption or non-adoption of the new drip irrigation technology. Thus, the Logit model was used to examine the determinants of the adoption or non-adoption of new drip irrigation technology for the pomegranate in Kash city that can be specified as follows:

$$Y_{i=}F(Z_i)$$

$$Z_i = \alpha + \sum_{j=1}^{N} \beta_j X_{ij} \quad (9)$$

$$Z_i = \alpha + \beta_1 X_{i1} + \beta_2 X_{i2} + \beta_3 X_{i3} + \cdots + \beta_n X_{in} + u_i$$

$$Z_i = \alpha + \sum_{j=1}^{9} \beta_j X_i + u_i$$

Where Y_i (dependent qualitative variable) which represented the probability of the adoption with the irrigation technology (Y_i = 1 for the adoption with the irrigation technology and Y_i = 0 for the non-adoption of the irrigation technology). α was the intercept of the model and n was the number of observations. Bj, u_i and Xj were the estimated parameters of the model, the disturbance term and the independent (explanatory) variables which including the economic, managerial and environmental features of the farmer. The explanatory variables of the model were defined in table (1).

Table (1): The explanatory variables affecting the adoption of drip irrigation

Variables	Definition
X_1	Farmer's age
X_2	Number of labor force in the family
X_3	Area under cultivation
X_4	Farmer's income

2.3. The collection of data and statistics

Data and statistics required for the calculations and the estimation of the models referred to the 2014- 2015 crop year which was obtained using random sampling method and questionnaires filled up by farmers of the Khash region. In this study, the population included the farmers of pomegranate in Khash city of Sistan and Balouchestan province. The sample selected from the farmer's population of the region were chosen by a two-step random approach using Chocran formula both from the farmers who have implemented drip irrigation system as well as those that have not implemented the mentioned systems and 205 individuals were selected who filled up the questionnaires by through interviews.

Table (2): dummy variables influencing the adoption of drip irrigation

Variable	Value		Definition
	0	1	
D_1	Under diploma	Above diploma	Level of Education
D_2	Secondary job	Main job	Main job
D_3	Low	High	Slope of the land
D_4	Non-attendance	Attendance	Educational and promotional classes
D_5	Low	High	Water
D_6	One getting loans	Getting loans	Loan
D_7	Rent	Owner of the land	Type of the land use

Table (3): The estimation of the production functions

Variables	Coefficient			
	Fourth Function	Third Functions	Second Function	First Function
Intercept	3.77***	3.47***	4.27***	4.34***
Dummy Variable	0.114*	-	-	-
Cultivated Area (Hectare)	0.2749***	0.3817***	0.195***	0.105***
Amount Of Toxin	0.054***	0.247***	0.297*	0.012*
Quantity Of Pestisides (Kilograms)	0.010*	0.019*	0.098*	0.166**
Labor Force (Person)	0.015***	0.127***	0.215**	0.088***
Quantity Of Water Consumption (Cubic Meters)	0.100*	0.015*	0.043***	0.088*
Capital (Thousand Rials)	0.0456**	0.0543*	0.0226*	0.0313*
R^2	0.95	0.97	0.92	0.95
(N) (Number Of Samples)	197	197	104	93

***99% level of confidence **95% level of confidence *90% level of confidence

Source: Research finding

3. Results and discussion

3.1. The results of the Bizaliya's model

In the current study using equation (1) function, the production functions were estimated in cases where farmers have used drip irrigation (53 farmers), and cases in which farmers didn't use drip irrigation (152 farmers) and all the total case. In the next step using the pooled data (205 farmers) a production function with intercept and dummy slope was estimated (the dummy variable took value 1 when the drip irrigation was used and the dummy variable took value 0 when the furrow irrigation method was used. First of all, various production functions (Cobb-Douglas and transcendental and translog) were estimated in order to understand which of the functional forms fits the best with data and the Cobb-Douglas function was selected as a well behaved model. In order to determine the explanatory variables of the model, significant explanatory variable in the estimated experimental Cobb-Douglas production function were chosen. In this step the production function was estimated using four different estimation method: the first function was estimated applying the function farmers used for the drip irrigation, the second function was estimated by the function in which farmers did not use drip irrigation. The third function was estimated using all the variables for all farma and the fourth function was estimated using all farms and dummy variables. The results of the estimation were presented in table (3).

The value of estimated F statistic was significant at 1% level of significance and the values of the determination coefficient (R^2) in all equations were higher than 90% which indicated the goodness of fit for the models. The value of the partial elasticities with respect to the labor force, amount of toxin in the function that farmers didn't use the drip irrigation technology was greater than the corresponding values in the function in which farmers had used drip irrigation technology, while in other cases the partial elasticities were smaller. The value of the F-statistic in both the third function which was estimated including the variables of all farms and the fourth function which was estimated using variables of all farms and dummy variables was significant at 1% level of significance. Meaning that there was a significant difference between the estimated coefficients of the two functions. Therefore, by using the drip irrigation the intercept of the model is decreased and the partial elasticities with respect to the inputs is changed as well.

Table (4): the estimation of the production functions based on the unit area

Explanatory variables	Regression coefficient		
	Third Function	Second Function	First Function
Intercept	4.05***	3.23***	3.97***
amount of toxin	0.087***	0.060***	0.057*
quantity of pesticides (kilograms)	0.130*	0.067*	0.054**
labor force (person)	0.061*	0.095***	0.046*
quantity of water consumption (cubic meters)	0.135***	0.089***	0.137***
capital (thousand rials)	0.1024*	0.0965*	0.125*
R^2	0.72	0.62	0.68
(n) (number of samples)	197	104	93

**95% level of confidence *90% level of confidence ***99% level of confidence

Source: Research finding

In order to separate the effects of factors affecting the performance change first of all we have to estimate the functions for the farmers who had used the drip irrigation technology and farmers who hadn't use the corresponding technology based on the unit area (hectare). For this purpose (1), (2) and (3) functions were used. The estimated coefficients for the functions of the input performance were presented in table (4). All the coefficients were significant. Moreover, it can be seen in table (4) that the estimated intercept for the first function was greater than the estimated intercept of the second one. In other words, by using the drip irrigation technology the production function had shifted upward. The partial elasticities of the amount of toxin and labor force in the second function were greater than the first one. On the other hand, the partial elasticities with respect to water and capital explanatory variables in the first function was greater than the second one. To determine the effects of drip irrigation on the production quantity and the consumption of the inputs as well as the average production functions is used for the inputs in two cases of the drip and furrow irrigation. The average of the input consumption in different cases were presented in table (6) which indicated that using drip irrigation, the quantity produced per unit area increased by average of 25.12 percent.

Table (5): factors affecting the production per unit area		
Factors affecting the production per unit area	**Percent change**	
	Total	Components
Real change in the production	25.12	
Changes in production as the results of the technology change	32.28	
Change as the result of neutral technology	74	
Change as the result of non-neutral technology	-49.86	
Change in the production as the result of change in the input consumed	6.47	
Labor force		-0.81
Fertilizers		1.95
Toxin		-0.45
Water		0.23
Capital		3.43
Total estimated change in the production	28.49	

Source: Research finding

Table (6): estimation of the Logit model using Maximum Likelihood Estimator

Variable	Name of The Variable	Marginal Effect of The Variable	T-Statistic	Standard Deviation	Coefficient
Intercept	C	-0.5680	-3.2317	1.8527	-3.1165***
Age of the farmer	X1	-0.392	-6.0898	0.0354	-0.2156***
Number of the labor force in the family	X2	-0.0371	-0.3240	0.6293	-0.2039
Farm size	X3	0.0110	3.075	0.0197	0.0608***
Farmer's income	X4	0.990	1.8679	0.2909	0.5434*
Level of education	D_1	0.920	2.3183	0.1586	0.0505**
Main job	D_2	0.2605	1.8579	1.6274	2.4397*
Slope of the land	D_3	0.2275	1.7265	0.7228	1.2483*
Educational and promotional courses	D_4	0.1231	2.0031	0.6788	0.6758**
Water	D_5	-0.2223	-1.6469	0.7497	-1.2198*
Taking loans	D_6	0.2812	1.7243	0.6047	1.5428*
Type of the land use	D_7	0.3252	2.8434	0.6277	1.7845***

Factor for the calculation of marginal effects = .18227
Maximized value of the log-likelihood function = -96.60
Goodness of fit = .8137

***99% level of confidence **95% level of confidence *90% level of confidence

Source: Research finding

The percent change in the production function was calculated using equation (4) which was equal to 32.28 percent that the calculation steps were presented in table (6). The comparison of the values with the observed percentage in table (5) indicated that there was a little difference between these two values. The difference could be attributed to the disturbance term of the models. It can be seen in table (6) using drip irrigation has changed the production technology and increased the production per unit area (kilogram/ hectare) by 25.12 percent and 6.47 percent directly and indirectly (by changing the consumption of inputs).

3.2. The results of the Logit model

For the estimation of the Logit model the Maximum Likelihood Estimator (MLE) was used. Before the estimation of the Logit model and after the primary estimations, counteraction, heteroscedasticity of the disturbance term was tested in the specification of the model and there was no problem about the estimation of the spurious regression. The results of the estimation of the Logit model can be seen in table (6)

As it can be seen in table (6) the goodness of fit in the model was equal to 81 percent which indicated a suitable estimation of the model. On the other hand, the marginal effect of the variables was equal to 0.18 and the marginal effect of any variable can be calculated by multiplying the value of the marginal effect into the estimated coefficient. The results of all mentioned statistics indicated the good fitness of the model in explaining the behavior of the variables. The results of the model estimation indicated that the age of the farmer had a negative and significant effect on the production at 99 percent level of confidence which shows the reverse relationship between the farmers age and their willingness to invest in drip irrigation technology. The effect of this variable was negative and consistent with theoretical expectations so that by the increase of the farmers age the probability their adoption with the drip irrigation technology decreased. The reason of this phenomenon generally refers their personal characteristics and their higher risk aversion in comparison with younger farmers.

Level of education was one of the variables which had a positive and significant effect (at 95% level of significance) on the probability of the adoption of drip irrigation and indicated that the increase in the level of education increases the willingness for investment in the water-saving irrigation systems and this variable had a marginal effect equal to 92%. The result of the estimation indicated suggested that by the probability of 9.2 percent farmers with above diploma level of education adopt with drip irrigation system more than farmers with lower education level. This result can make a great contribution to demine the target groups in the use of drip irrigation.

One of the other variables was the number of labor force in the family which had a negative in the probability of the adoption with the drip irrigation. Although this variable didn't have a significant effect on the production. The negative sign of the variable indicated that the inverse relationship is available between the number of labor force in the family and willingness to invest in the drip irrigation technology. Moreover, the size of the farm had a positive and significant effect on the probability of the adoption with the drip irrigation technology. In other words, by increasing 1 hectare in the area under cultivation, the probability of the adoption with the drip irrigation technology is increased and its replacement with the furrow irrigation is also increased by 11 percent. This is mainly due to the efficiency and the good performance of all drip irrigation systems in medium and large farms and also farms in which it is possible to install these systems. On the other hand, the increase of the area under cultivation and in fact the increase of the farm size made the farmers more willing to use methods and equipment's which saves the labor force and increase the return on inputs.

Farming as the main job of the farmers had a positive and significant effect (at 95 percent level of confidence) in the adoption with drip irrigation technology. The marginal effect of this variable was equal to 0.26 which indicated that by probability of 26 percent the farmers whose main job is agricultural activities adopt with drip irrigation technology more than other farmers (whose main job is not agricultural activities). This refers to the farmer's attempts to improve the level of their agricultural activities.

One of the other explanatory variables was the farmers income which had a positive and significant effect (at 90 percent level of the confidence) on the probability of the drip irrigation technology. Meaning that the increase of the farmers income increased the willingness to invest on the drip irrigation systems. Due to the value of the marginal effect 1 million increase in the farmers income per hectare increased the willingness to invest by 9.9 percent. The value of the estimated coefficient for the type of ownership was positive and significant. The results indicated that the willingness of farmers to invest in the lands with private ownership was greater than rented lands. Due to the value of the marginal effect the probability of investment in lands with private ownership in drip irrigation systems was 32% more than rented lands. One of the main variables in the selection of the drip irrigation was the slope of the land. The slope of the land had a positive and significant effect (at 90 percent level of confidence) on the probability of the adoption with drip irrigation technology so that more the slope of the land more the probability of the adoption with the drip irrigation technology. The marginal effect the slope of land showed that farmers in land slope more than average with the probability of 1.8 percent use the drip irrigation technology more than other farmers.

Getting loans and having enough access to the banking facilities had a positive and significant effect on the adoption of the drip irrigation system. The marginal effect of this explanatory variable was equal to 0.28 which indicated that ceteris paribus, the probability of the adoption with the drip irrigation system for farmers who have enough access to bank loans was probably 28 percent higher than farmers who didn't have any access to banking facilities. Therefore, the restrictions and barriers against the financial resources especially agricultural banks should be solved to increase the probability of the adoption with the drip irrigation system. Finally, attending in the educational and promotional had a positive nd significant effect on the adoption of the drip irrigation systems. The marginal effect of this variable was equal to 0.12 which showed that ceteris paribus the probability of the drip irrigation systems by the farmers who attended in the educational and promotional courses had increased by 12 percent.

4. Conclusions

Regarding to the problem of drought one of the most important strategies for increasing water use efficiency in agriculture is scientific and systematic use of surface irrigation systems, as well as the development of local irrigation or drip irrigation. In this regard, in recent years the use of drip irrigation and horticultural crops in the country considered and to a large extent the level of its use is expanding. This includes detailed studies and design of a system crash, standard and proper use of equipment, evaluate the system after implementation and fix its problems, training of operators and maintenance service, the correct management compliance to obtain an acceptable efficiency.

In addition, we concluded that the adoption with drip irrigation led to 28 percent change in the production (kilogram/hectare). Therefore, the usage of the drip irrigation shifted the production function and the change of the partial elasticities with respect to inputs which led to the increase of the production per unit area as well as the change in the consumption of some inputs. In the studied region farmers who had used the drip irrigation system could have a higher production as well as a lower input consumption in comparison with using furrow irrigation. The government should apply appropriate policies make capital and other inputs (irrigation equipment, fertilizers, seeds, etc.) available to farmers at the right time to allow the adoption of drip irrigation technology in order to use the optimal amount of inputs. According to the results of the study in the Khash region the following guidelines and strategies could be recommended to expand and develop the investment and usage of the drip irrigation technology:

According to the positive and significant effect of the level of education on the adoption of drip irrigation it is necessary to increase the level of farmers information about the drip irrigation and its advantage through the appropriate promotion of the drip irrigation technology. On the other hand, farmers with higher levels of education should be prioritized in determining the target groups in developing the adoption of the drip irrigation systems.

Organizing more effective and continuous educational and promotional courses about the introduction of irrigation systems especially in rural areas and regions in which irrigation systems have been implemented less than other regions.

Because farmers usually "the amount of water needed and the number of emitters required trees without detailed information should be based on climatic conditions, irrigation, watering time and discharge rates to be formulated and submitted to the agriculturists.

5. References

1. Abrishami, H., 2006. Principles of Econometrics. Volume II. Fourth edition. Tehran University Press: 910-907.
2. Akbari, M., 1998. Comparison of Surface Irrigation (groove) on Quantitative and Qualitative Factors Agricultural Engineering Research Publication No. 121.
3. Tohidloo, GH., Kashani A. 1999. The Efficiency of Water Use and Some Agronomic Traits and Physiological Three Strips Wines in Optimal Conditions and Drought. Master thesies. Karaj Azad Univercity.
4. Chizari, A. Ghasemi A., 2005. Planning the Production of Crops in the Absence of Certainty (Fuzzy Approach: Planning Possible), Journal of Agricultural Economics and Development, Special productivity and efficiency, pp. 131-155.
5. Dashti, GH., 1995. Pricing Policy and Agricultural Water Demand in Iran, Proceedings of the Regional Conference on Water Resource Management. Isfhan: 180.
6. Jahromi, R., A., Mohammadi H., 2007. The Productivity and Demand for Water in Agriculture, Wheat (Jahrom City). Development and productivity, Year 2. No 5: 24.
7. Zare Mehrjardi M., Aknari A. 2001. The Effect of New Inputs (Improved Seeds) on Crop Production. Agricultural Economics and Development, 9 (36): 150-137. .
8. Shahbazi, A., 1996. Promoting rural. Tehran University Press: 448.
9. Azizi, J., 2000. Water Sustainability in Agriculture. Agriculture Economic and Development, 36: 160-153.
10. Kohansal, M., Ghorbani, M., Rafiei, H., 2009. Investigation of Environmental and Non-Environmental Factors Affecting the Adoption of Drip irrigation: A Case Study of Khorasan Razavi Province, Economics and Development, 65, 112-97.
11. Nowroozi, O., Chizari, M., 2006. Factors on Adoption with Drip Irrigation in the Nahavand City, Economics and Development, 54, 87-98.
12. Ascough, G. W, Kiker, G.A., 2002. The effect of irrigation on irrigation water requirements. Water SA, 28(2), 235-241.
13. Kennedy, J.O.S., 1986. Dynamic Programming: Applications to agriculture and natural resources. 1th. Edn. Elsevier Applied Science Publishers Ltd, UK.
14. Randhir, S., Krishnamoorthy, O., 1999. Productivity variation and use in farm of Madratkam Takfed area of Chengalpatuu district, Tamil Nadu. Indian Journal of Agriculture Economics, 45, 56-60.
15. Kiresur, V.R. Manjunath. I., 2011. Socio-Economic Impact of Bt Cotton- A Case Study of Karnataka, agricultural Economics Research Review, 24, 67-68.
16. Musser, W,C., Shortle, J.S., 1995. An Economic Analysis of the Presidas Soil Nitrogen test for Pennsylvanian Corn Production, Review of Agricultural Economic, 17, 25-352.
17. Darusman, A. H., Stone, L. R., Spurgeon, W. E., Lamm, F. R., 1997. Water flux below the root zone vs. irrigation amount in drip-irrigated corn, Agronomy Journal, 89, 375–379.
18. Lamm, F.R. 2004. Corn production as related to sprinkler irrigation capacity. Pp. 23-36.