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Inhibiting factors on adoption of pressurized irrigation methods according to drought zoning in Northwestern Iran (Ardabil province)

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Abstract

In this study was examined the factors affecting the unwillingness to adopt pressurized irrigation methods among farmers' groups (with different levels of drought) in Ardabil province (Iran). Mixed method (Qualitative – Quantitative paradigm) was used for doing this research. First, by drought zoning of Ardabil province (by SPI method and GIS), three regions included the mild, moderate and severe drought levels were selected. In the second stage, using multi-stage cluster sampling from regions with pressurized irrigation methods implemented, non-adopter farmers of pressurized irrigation methods were selected from three regions of study (n= 290). The ordered logistic regression (OLR) (by STATA software) was used to determine the effective and distinctive factors of farmers' groups. The findings showed that 54.5% of farmers had moderate level of unwillingness to adopt pressurized irrigation systems. According to the results of OLR model and marginal effects, farmers in different levels of drought had significant difference in terms of unwillingness to adopt pressurized irrigation systems. Moreover, from among 18 factors of study, only 7 factors of education level, farm income, awareness of pressurized irrigation systems, the effect of local weather conditions, the distrust towards the optimizing of pressurized irrigation systems, non-efficiency of pressurized irrigation methods on farm yield and costs of pressurized irrigation systems were significant and it had been the ability to differentiate among farmers in different levels of drought. This study indicated that improving farm income and awareness of pressurized irrigation systems, compared with other effective factors, create the biggest variations in the probability of placing farmers in different levels of drought.

Keywords**:** Drought; Standardized Precipitation Index (SPI); Pressurized irrigation systems; Farmers; Ardabil province

1. Introduction

A glance at the climatic conditions of Iran shows that in terms of water resources, it is not in a good condition and is among arid and semi-arid countries of the world. The average long-term annual precipitation in Iran is about 250 mm, while the global average is about 850 mm. So, the average rainfall in Iran is one-third of the rain in the world. About 85% of the country consists of dry lands where water is scarce. In fact, more than 90 percent of water consumption in the country is related to the agricultural sector (Saymohammadi *et al*., 2017; Tahmasebi, 2009). Therefore, programming, planning and appropriate investment for the optimal use of water resources must be considered as a major pillar of sustainable development. Any water stress and climate change will have a direct impact on reducing agricultural productivity and will make food security in the country unstable (Arabi *et al*., 2012; Rezaei *et al*. 2016). Therefore, it seems today, one of the largest bio-agriculture and climate crises in Iran is the phenomenon of drought that multiple studies indicate the relentless continuity and expansion of drought across the country, including Ardabil province (northwestern Iran) over the coming years. Drought phenomenon occurs when less than normal rainfall is received over an extended period of time, such as a season or longer. Drought can also occur when there is

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higher than normal temperature in a long time (Thuc, 2012).

One of the efficient ways to reduce the total water required for farm irrigation is to adopt pressurized irrigation (drip and sprinkler), which can improve crops yield per unit volume of water used (Jayakumar *et al*., 2015). Development of pressurized irrigation systems does not follow a sustainable trend in Iran; such that, the imported technology of pressurized irrigation methods is not compatible with the climate, soil, land and agriculture conditions in different areas of Iran. Therefore, adoption process of these systems among farmers in Iran is very slow. On the other hand, Inhibiting factors to adopt of pressurized irrigation systems are beyond the technical and technological issues; socio-economic, education, weather conditions and promotional factors are also effective (Yosefinejhad et al., 2014). The pressurized irrigation methods take more water to plant roots. This will make crop water use as defined and reduce the amount of irrigated crops, while plants needs for enough water is resolved (Schuck et al., 2005). These methods are suitable for most types of soil and prevent erosion (Qassim, 2003). Efficient use of water in agriculture heavily depends on adoption of pressurized irrigation systems to increase agricultural production efficiency and maintain of water resources (Moreno & Sunding, 2005). The most important damage of drought is reducing the amount of water resources. The amount of water needed for agriculture and water efficiency has greatly reduced in Ardabil province during the current drought (2012-2016). Obviously, water is the most important barrier to agricultural development in Iran and due to the increase in population; water resource is a major constraint to dealing with increasing demand for food products and more efficient products in agriculture (Dinar *et al*., 2004).

Kulshreshtha and Brown (2007) examined the farmers' attitude to adoption of modern irrigation systems (pressurized) by three factors (social, economic and environmental) in Canada's Saskatchewan region. They concluded that the farmers' attitude about economic and environmental effects of modern irrigation systems have had a significant effect on their decision to adopt modern irrigation systems. Moreover, their negative perception about the economic impacts of modern irrigation systems and its harmful effects on environmental quality (especially salinity) was their main inhibiting factor in adoption and use of modern irrigation systems (pressurized). Also, this study showed that planning of large-scale water projects should be with participation and informing farmers in region. In addition, during the planning stages more attention should be paid to the development of training programs for farmers.

In Al-Qasim area, Saudi Arabia, Al-Subaiee *et al*. (2013) investigated the factors affecting the use of traditional and modern irrigation methods among the date palm farmers. Data elated to 429 farmers was collected by face-to-face interviews. According to the findings, most date palm farmers (38.3%) were using traditional flood irrigation method. However, 31.2% of farmers used drip irrigation. In addition, there was a significant positive correlation between education levels with the use of pressurized irrigation systems. This is while there was a significant negative correlation among age and farming experience with the use of pressurized irrigation methods among farmers. In this research, organizing extension and education programs to use and encourage farmers to use pressurized irrigation methods is introduced as an important solution.

Cremades *et al*. (2015) examined major challenges and strategies in the adoption of pressurized irrigation methods in rural China. The aim of this study was to evaluate the impact of government support and economic incentives for using of pressurized irrigation methods by farmers in seven provinces. The results showed that only the half of the rural households have adopted pressurized irrigation methods. Moreover, from among government support factors, the use of agricultural subsidies and extension and education services has an effective role in the further use of pressurized irrigation methods. The results of Madhava Chandran and Surendran (2016) research indicated that socio-economic characteristics such as age, education level, farming experience, land holding size, etc. have a positive effect on adoption of drip irrigation by farmers. Also, high productivity and income from cultivation of crops have acted as an incentive to adopt the costly system of drip irrigation.

The development of pressurized irrigation systems is not only the physical and technical issue, and the conditions of farmers' adoption and the impact of environmental factors play an important role (Khoshnodifar *et al*., 2012). Since water shortages and droughts are increasing in Ardebil province, rate and speed of adoption and use of pressurized irrigation methods is considered an important strategy. So, it can be claimed that development of irrigated lands with current water consumption (by limited water resources) is not practical and the original solution is changing optimal consumption patterns and water management in the farm by saving water. This action is only possible through the development of pressurized irrigation systems and efficient use of available resources and underground water (Noruzi & Chizari, 2006). Whereas new climatic changes in Ardabil province (increasing drought) and reduction of water resources is a major challenge; therefore, any factors affecting on adoption of pressurized irrigation systems among farmers have the positive effects on the production and pricing of agricultural products and optimal management of water resources. So, this study examine whether farmers in different levels of drought are different in terms of willingness to adopt and use of pressurized irrigation methods. Also, in the regions of research, which factors have the important role on the unwillingness to adopt pressurized irrigation methods among farmers, according to drought zoning?

2. Materials and Methods

2.1. The Study Area

Ardabil province is a strip stretching from 36°50′N, 47°E to 39°40′N, 49°E in the north-west of Iran. Ardabil province covers an area of 18011 square kilometers (1.1 percent of the area of Iran) and borders with the Republic of Azerbaijan in the north, Gilan province in the east, Zanjan province in the south, and the East-Azerbaijan province in the west. Its average height is more than 1400 meters over sea level (Naderi *et al*., 2014; Molaei, 2011). In general, the climate of Ardabil province is very diverse, and given the diversity of natural conditions in the province, the temperature and precipitation in different parts of it are very different.

2.2. Research Design and Sampling

Research design of Current research is Mixed Method which was conducted in two main phases: qualitative and quantitative:

2.2.1. Quantitative phase: this phase consists of two steps:

Step 1: Preparing drought zoning in Ardabil province to determine the target regions (by SPI (the Standardized Precipitation Index) and GIS): At this step, with the help of meteorological data and SPI method in GIS, we prepared drought zoning map of Ardabil province. SPI base is deviation from the mean, ratio of the standard deviation of the rainfall index. SPI is designed to determine the lack of rainfall in different time scales when time scales show effects of drought on water resources (Asefjaha *et al*., 2014; Wambua *et al*., 2015). SPI is calculated based on the following equation (1):

$$SPI = \frac{X_i - \overline{X}}{\delta} \qquad (1)$$

Where: X_i: Precipitation for the station; $\bar{X}$: mean precipitation; δ: Standardized deviation.

Table 1 shows classification of drought based on SPI to determine drought conditions in the regions of study.

Table 1. Drought classification based on SPI

State	Criterion	Drought classification
1	2.00 or more	Extremely wet
2	1.50 to 1.99	Severe wet
3	1.00 to 1.49	Moderate wet
4	0.50 to 0.99	Mild wet
5	-0.49 to 0.49	Near normal
6	-0.99 to -0.50	Mild drought
7	-1.49 to -1.00	Moderate drought
8	-1.99 to -1.50	Severe drought
9	-2.00 or less	Extreme drought

(Reference: Hayes *et al*., 2011; Xu *et al*., 2012; Pei *et al*., 2013; Wambua *et al*., 2015)

The positive value of SPI represents higher precipitation than the average, and the negative value of SPI represents lower precipitation than the average. When calculated SPI is negative, it marks the beginning of drought, and when the calculated value of SPI is positive, it shows end of the drought at that period of time and location (McKee et al., 1993; Wambua *et al*., 2015). According to the results in Fig. 1, due to the absence of values for the extreme drought, only three drought regions (mild drought, moderate drought and severe drought) were selected.

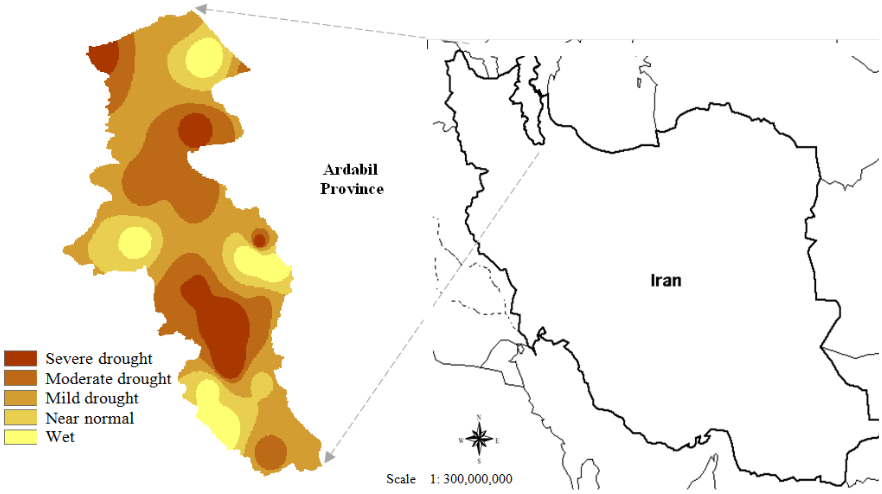

Fig. 1. Drought zoning map of the study area, based on SPI

Step 2: At this stage, by referring to drought zoning map obtained and adaptation of drought regions (three regions with mild, moderate and severe droughts) with location of rural areas (by GIS software), target regions were designated. After determining the target regions, using multi-stage cluster sampling, 9 villages (3 villages from each region) were selected that in proportion to the population in targeted regions. With the help of Cochran formula, three non-adopter farmers' groups of pressurized irrigation methods were selected from three regions of study (290 farmers: the regions with severe drought (72 farmers), moderate drought (98 farmers) an area with mild drought (120 farmers)). To create at least error the findings, in target regions, the villages were selected where there was a history of pressurized irrigation programs. Moreover, the farmers were selected that had irrigated farming in the regions and had at least 5 years farming experience in the region. Collecting data on variables studied was done with the help of questionnaire and interview in target regions.

2.2.2. Qualitative phase

The base of qualitative phase of study was using Delphi method (consensus of agricultural experts in Ardabil province). The purpose of using Delphi method was to determine the socio-economic and technical factors that are the compatible with local conditions and study regions and effective on the unwillingness to adopt pressurized irrigation methods among farmers in study regions (with different levels of drought). Agricultural experts were those who had executive or scientific experiences in study area such as drought issues in Ardabil province. The method of data collection and sampling was snowball sampling. Delphi method was conducted in three steps that with regard to the participation of respondents and reaching of theoretical saturation in answers, the information of 27 experts was collected and categorized. The results of socio-economic and technical factors obtained are given in the table (4) that is used in the questionnaire design (in the quantitative phase).

2.3. Research instrumentation

Research instrument in the quantitative phase was a questionnaire that included factors of demographic and professional (15 items), factors of farm economy (10 items), factors of socio-economic and technical obtained from the Delphi method (38 items) and items of unwillingness to adopt pressurized irrigation methods (score of 0: the lowest, and score 10: the highest). The factors of socio-economic and technical which were obtained in the qualitative phase had 8 main factors.

The factors of awareness of pressurized irrigation systems (6 items), the effect of local weather conditions (5 items), the distrust towards the optimizing of pressurized irrigation systems (5 items), non-efficiency of pressurized irrigation methods on farm yield (4 items), costs of pressurized irrigation systems (5 items), the lack of improvement in farm water management (5 items), the weak financial and technical supports (3 items) and the inadequate infrastructure for pressurized irrigation systems in the study regions (5 items). The mentioned factors measured by a five-point Likert type scale (1: very low; 2: low; 3: moderate; 4: high and 5: very high). The size of each factor for the respondent was calculated from the average rating of his responses to all items on a factor.

Face and Content validity of the questionnaire was revised and verified by a panel means group of faculty members and agricultural experts. The reliability of research questionnaire was determined by Cronbach's alpha and ordinal theta that was higher than 0.7 for the variables (Table 2). Cronbach's alpha and Ordinal theta are the statistic generally used as the measure of internal consistency or reliability (Gliem & Gliem, 2003).

Table 2. The reliability of research questionnaire (Cronbach's alpha and ordinal theta)

Variables	Number of items	Cronbach's alpha	Ordinal theta
- Awareness of pressurized irrigation systems	6	0.79	0.77
- The effect of local weather conditions	5	0.81	0.80
- the distrust towards the optimizing of pressurized irrigation systems	6	0.71	0.70
- Non-efficiency of pressurized irrigation methods on farm yield	4	0.77	0.79
- Costs of pressurized irrigation systems	4	0.83	0.80
- The lack of improvement in farm water management	5	0.76	0.74
- The weak financial and technical supports	3	0.85	0.82
- The inadequate infrastructure for pressurized irrigation systems	5	0.74	0.71

2.4. Ordered Logestic Regression model

Given that the dependent variable has ordinal scale (drought levels with mild, moderate and severe droughts) and shows different ranks of drought conditions in the study regions, the appropriate model to determine the factors affecting the respondents' groups was OLR model. To perform OLR, it used STATA software. The ordinal logistic regression model can be expressed as a latent variable model (Agresti, 2002; Greene, 2003; Long & Freese, 2006). So, Let "y_i" be the observed R_i value for the i^th^ respondent, y_i = 1, 2, 3…; i= 1,2,…, N. Given the discrete nature of y_i, we assume there is a latent variable (equation 2) (Desalegn, 2011; Xue & Reed, 2015):

$$y_i^* = \beta x_i + \sigma \varepsilon_i \quad (2)$$

Where x_i is a row vector consisting of a constant term and K characteristics associated with respondent i, β is a $K+1$ column vector of coefficients, ε_i is an error term assumed to be logistically distributed with mean and variance (π2/3), and σ is a scale parameter. The relationship between the observed R_i value, y_i, and its unobserved, latent value, y_i^*, is given by the following (equation 3) (Liao, 1995; Liu, 2008; Saffari *et al*., 2015):

$$\begin{aligned} y_i &= 1 \quad if \quad -\infty < y_i^*/\sigma < k_1/\sigma \\ y_i &= 2 \quad if \quad k_1/\sigma < y_i^*/\sigma < k_2/\sigma \\ y_i &= 3 \quad if \quad k_2/\sigma < y_i^*/\sigma < k_3/\sigma \\ y_i &= 4 \quad if \quad k_3/\sigma < y_i^*/\sigma < +\infty \end{aligned} \quad (3)$$

Where k_j / σ the are the "cut points" that cause the observed value of the respondent's R_i to change in discrete units. The model above is known as the OLR model (Liu, 2008; Xue & Reed, 2015). In OLR model, the amount of R^2 Pseudo which is between zero and one, doesn't have the natural and usual interpretation of R^2 and in its interpretation we can only say that by increasing the amount of the model goodness of fit, its value increases (Greene, 2003; Saffari *et al*., 2015). In this model, the marginal effect or marginal probability (in STATA) is also calculated to obtain the effect of independent variables on the dependent variable's predicted probabilities or to choose the alternatives order. Also, due to the sum of the possibilities is always equal to one, therefore, the sum of the marginal effects is equal to zero for every variable. β coefficients are not directly relevant to marginal effects; so we can calculate the marginal effects of variables in 3 levels of probabilities (levels of drought) using the following equations of 4, 5 and 6 (Williams, 2010; Xue & Reed, 2015):

$$\frac{\sigma \text{Prob}\,(y = 0|x)}{\sigma x_i} = F(-x'\beta)\beta| \quad (4)$$

$$\frac{\sigma \text{Prob}\,(y = 1|x)}{\sigma x_i} = [F(-x'\beta) - F(\mu_1 - x'\beta)] \quad (5)$$

$$\frac{\sigma \text{Prob}\,(y = j|x)}{\sigma x_i} = F(\mu_{j-1} - x'\beta)\beta \quad (6)$$

Overall, 17 factors were entered in two groups of personal and professional (9 factors) and socio-economic and technical factors (8 factors) into OLR. Therefore, OLR model used in this study is as follows:

$Y_i = \beta_0 + \beta_1 Age + \beta_2$ Education $+ \beta_3$ Household $+ \beta_4$ Labor $+ \beta_5$ Experience $+ \beta_6$ Income $+ \beta_7$ Offincome $+ \beta_8$ Land $+ \beta_9$ Machinery $+ \beta_{10}$ Awareness $+ \beta_{11}$ Weather $+ \beta_{12}$ Distrust $+ \beta_{13}$ Efficienc $+ \beta_{14}$ Cost $+ \beta_{15}$ WaterM $+ \beta_{16}$ Support $+ \beta_{17}$ Infrast

Yi is dependent variable that shows the drought intensity of study regions in three levels: mild drought (code 1), moderate drought (code 2), and severe drought (code 3). Age: age (year); Education: education level (year); Household: household size (person); Labor: farm labor force (person); Experience: farming experience (year); Income: farm income (million Rials); Offincome: off-farm income (million Rials); Land: land size (hectare); Machinery: the number of agricultural machines; Awareness: awareness of pressurized irrigation systems; Weather: the effect of local weather conditions; Distrust: the distrust towards the optimizing of pressurized irrigation systems; Efficienc: non-efficiency of pressurized irrigation methods on farm yield; Cost: costs of pressurized irrigation systems; WaterM: The lack of improvement in farm water management; Support: the weak financial and technical supports and Infrast: the inadequate infrastructure for pressurized irrigation systems in the study regions.

3. Results

3.1. Demographic characteristics of farmers

The age range of most farmers (39.0 %) was from 45 to 54 years. 91.4% of farmers were male and 8.6% were female. Their maximum education level was 4 to 6 years (elementary) that were 32.1% of the sample. Their maximum household size was 5 persons (33.5%). In terms of land size, the most frequency of land size range was 2.5 to 5 hectares (40.7%). The highest work force was 3 persons (36.1%) and the highest farm income range was from 89.7 to 1500 million Rials (33.8%); while the highest off-farm income was from 30 to 100 million Rials (24.8%). Majority of farmers (25.5 %) had ownership of two agricultural machines. Demographic characteristics of respondents are provided in Table 3.

Table 3. Statistical summarization of demographic characteristics among farmers

Factors	Mean	SD	Minimum	Maximum
Age (year)	49.593	10.978	25.0	74
Education level (year)	6.470	2.168	1.0	12
Household size (person)	4.534	1.217	2.0	7
Farm labor force (person)	3.514	0.996	2.0	5
Farming experience (year)	22.145	12.470	5.0	50
Farm income (Million Rials)	235.422	1119.424	89.7	2520
Off-farm income (Million Rials)	126.727	89.382	30.0	280
Land size (Hectare)	5.607	2.082	2.0	25
The number of agricultural machines	3.783	2.221	1.0	8

3.2. Prioritizin*g the main socio-economic and technical factors*

According to the Table (4), for the study factors, the first priorities are regarding the awareness of pressurized irrigation systems (the nature, importance and urgency pressurized irrigation methods); the effect of local weather conditions (the effect on reducing precipitation); the distrust towards the optimizing of pressurized irrigation systems (distrust towards the government agricultural programs); non-efficiency of pressurized irrigation methods on farm yield (the increasing farm income); costs of pressurized irrigation systems (amount of start-up equipment costs); the lack of improvement in farm water management (the improvement in the reducing water management costs); the weak financial and technical supports (the governmental financial and credit support) and the inadequate infrastructure for pressurized irrigation systems (the farm topography conditions for setting up pressurized irrigation systems).

3.3. Classification of respondents based on unwillingness levels to adopt of pressurized irrigation systems

To classify of the farmers, according to unwillingness levels to adopt of pressurized irrigation systems, interval of standard deviation from mean (ISDM) was used. This classification conducted according to following formula (Gangadharappa et al., 2007; Khoshnodifar *et al*., 2016).

- Low: A < (Mean - ½ SD)
- Moderate: Mean - ½ SD <B < (Mean + ½ SD)
- High: C > (Mean + ½ SD)

As showed in Table (5), 44 farmers (15.2%) have a high unwillingness for acceptance of pressurized irrigation systems, while 88 (30.3%) of them have low unwillingness and 158 (54.5%) of them has a moderate unwillingness. Therefore, it can be stated that the majority of farmers have moderate unwillingness for acceptance of pressurized irrigation systems.

Table 4. Prioritizing items related to socio-economic and technical factors

Factors	Items	Mean	SD	Rank
Awareness of pressurized irrigation systems	- The nature, importance and urgency pressurized irrigation methods	4.179	0.773	1
	- Efficient and economical use of pressurized irrigation systems	2.462	.900	2
	- The process of obtaining financial, technical and facilities support	1.917	1.270	3
	- The process of maintenance and management of pressurized irrigation systems	1.866	1.025	4
	- The conditions and necessary equipment for setting up and using pressurized irrigation systems	1.710	0.876	5
	- The process of setting up and using pressurized irrigation systems	1.559	1.343	6
The effect of local weather conditions	- The effect on reducing precipitation	3.821	1.133	1
	- The effect reducing groundwater and current resources	3.079	1.379	2
	- The effect rising temperatures	2.741	1.369	3
	- The effect reducing moisture of the air	2.707	1.424	4
	- The effect reducing soil moisture	1.838	1.064	5
The distrust towards the optimizing of pressurized irrigation systems	- Distrust towards the government agricultural programs in the region	3.524	0.995	1
	- Distrust towards the financial, technical and facilities support	3.121	1.290	2
	- Distrust towards the increasing farm income	2.872	1.138	3
	- Distrust towards the reducing farm costs	2.834	1.147	4
	- Distrust towards the improving farm water management	2.752	1.259	5
Non-efficiency of pressurized irrigation methods on farm yield	- The increasing farm income	3.972	1.045	1
	- The increasing crop yield	3.728	0.910	2
	- The reducing water consumption	3.559	1.058	3
	- The reducing farm labor force	3.441	1.196	4
Costs of pressurized irrigation systems	- Amount of start-up equipment costs	3.079	1.041	1
	- Increasing the fixed costs of farming	2.886	1.358	2
	- Amount of maintenance equipment costs	2.755	1.222	3
	- Amount of skilled labor force costs	2.566	0.704	4
	- Amount of technical costs in start-up and maintenance	2.186	1.012	5
The lack of improvement in farm water management	- The improvement in the reducing water management costs	4.179	0.773	1
	- The improvement in the water efficiency of farming	3.766	0.915	2
	- Barriers to water transfer to the farm	3.100	1.036	3
	- The need to more technical knowledge in farm water management	2.862	1.147	4
	- Increasing efforts and additional labor force in farm water management	2.062	0.804	5
The weak financial and technical supports	- The governmental financial and credit support	3.648	0.815	1
	- The private or semi-private financial and credit support	3.197	1.012	2
	- The governmental technical support by skilled experts in the region	2.266	1.332	3
The inadequate infrastructure for pressurized irrigation systems	- The farm topography conditions for setting up pressurized irrigation systems	2.910	1.433	1
	- The local infrastructure for maintenance and repair of pressurized irrigation systems	2.903	1.340	2
	- Access to adequate water channels	2.600	1.343	3
	- Access to adequate standard equipment of pressurized irrigation systems	2.531	1.331	4
	- Access to skilled and technical experts in the region	1.343	1.340	5

Scale: 1 = very low, 2-low, 3 average, 4 high, 5-very high

Table 5. Classification of unwillingness levels

Unwillingness levels	Frequency	Percent	Cumulative Percent
Low	88	30.3	30.3
Moderate	158	54.5	84.8
High	44	15.2	100.0
Total	290	100.0	-

Mean= 4.2517, Standard deviation= 2.63108

3.4. Estimating OLR model

As shown in Table 6, the farmers were divided into three groups due to different levels of drought: code 1 (41.4 percent of respondents); code 2: (33.8 percent of respondents); and code 3: (24.8 percent of respondents).

Table 6. Distribution of respondents based on drought severity

Drought levels	Codding	Frequency	Percent	Cumulative percent
Mild drought	1	120	41.4	100.0
Moderate drought	2	98	33.8	58.6
Severe drought	3	72	24.8	24.8
Total	-	290	100.0	-

According to initial regression model, 18 factors entered the analysis for doing ordered logistic regression, so that the main distinguishing and effective factors be determined among farmers' groups with different levels of drought. According to the table 7, the chi-square (-130.79) and significant (0.000) represent the significance of regression model. Pseudo R2 statistics is equal to 58.15 percent that is an acceptable percentage for predicting regression model. According to significance level and Z-statistic values for all factors used in the analysis, only 7 out of 18 factors had the significant correlation with different levels of drought among farmers. The factors of education level, farm income and awareness of pressurized irrigation systems showed a significant negative correlation with the dependent variable; but, the factors of the effect of local weather conditions, the distrust towards the optimizing of pressurized irrigation systems, Non-efficiency of pressurized irrigation methods on farm yield and costs of pressurized irrigation systems had a significant positive correlation with drought levels.

Table 7. The estimating OLR model

Dependent variable: Drought levels
(1- Mild drought; 2- Moderate drought; 3- Severe drought)

Factors	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
- Age	0.014034	0.016317	0.86	0.390	-0.017948	0.046016
- Education level	-0.343649	0.097635	-3.52**	0.000	-0.535011	-0.152288
- Household size	0.073200	0.136480	0.54	0.592	-0.194295	0.340696
- Farm labor force	-0.192808	0.173806	-1.11	0.267	-0.533462	0.147846
- Farming experience	-0.016614	0.014611	-1.14	0.256	-0.045252	0.012024
- Farm income	-0.000207	0.000024	-8.59**	0.000	-0.000254	-0.000159
- Off-farm income	0.000151	0.000192	0.79	0.432	-0.000226	0.000529
- Farm costs	-0.076599	0.084812	-1.33	0.225	-0.206653	0.068433
- Land size	-0.093602	0.084839	-1.10	0.270	-0.259886	0.072680
- The number of agricultural machines	0.050441	0.076688	0.66	0.511	-0.099864	0.200746
- Awareness of pressurized irrigation systems	-1.296014	0.214943	-6.03**	0.000	-1.717295	-0.874733
- The effect of local weather conditions	1.631306	0.508027	3.21**	0.001	-2.627021	-0.635590
- The distrust towards the optimizing of pressurized irrigation systems	0.550342	0.204433	2.69**	0.007	0.149660	0.951025
- Non-efficiency of pressurized irrigation methods on farm yield	0.653385	0.199076	3.28**	0.001	-1.043567	-0.263204
- Costs of pressurized irrigation systems	1.319306	0.309375	4.26**	0.000	-1.925670	-0.712942
- The lack of improvement in farm water management	-0.223769	0.298356	-0.75	0.453	-0.808537	0.360998
- The weak financial and technical supports	-0.005353	0.40114	-0.01	0.989	-0.791581	0.780874
- The inadequate infrastructure for pressurized irrigation systems	0.072439	0.264957	0.27	0.785	-0.446868	0.591746
Log likelihood = -130.79103; Pseudo R^2 = 0.5815; Prob > chi^2 = 0.000; LR chi^2 = 363.46; Number of obs= 290						

* P< 0.05; ** P< 0.01(2-tailed)

3.5. Determining the marginal effects

To measure the effect of each factor on dependent variable of model (drought levels), the marginal effects is calculated. The sum of marginal effects of each factor for different levels of drought is equal to zero; because the sum of the probabilities for different levels of drought is equal to one. Therefore, in dependent variable, the amount of increase in probabilities of a level is equivalent to the amount of reduction in probabilities of a level or other levels. Also, the marginal effects indicate the amount of a factor at each level of dependent variable (drought levels) in comparison with other levels of dependent variable.

According to the results presented in table 8, in the first and second levels of dependent variable, the amount of marginal effects in factors of education level and awareness of pressurized irrigation systems are positive; but in the third level these are negative, that in total, these effects have a decreasing trend. In other hands, increasing the mentioned factors decrease the probability of placing farmers in lower levels of drought. In the first and second levels of dependent variable, the amount of marginal effects in factors of the distrust towards the optimizing of pressurized irrigation systems and costs of pressurized irrigation systems are negative; but in the third level these are positive, that in total, these effects have an increasing trend. This means that increasing the mentioned factors increase the probability of placing farmers in higher levels of drought. Also, in the second and third levels of dependent variable, the amount of marginal effects in factor of farm income is negative (a decreasing trend); but for the factors of the effect of local weather conditions and Non-efficiency of pressurized irrigation methods on farm yield are positive (an increasing trend).

The marginal effects of each factor indicate the amount of change in the predicted probabilities of dependent variable, per a unit of change in that factor (if other factors remain stable). For example, per a unit of change in factor of awareness of pressurized irrigation systems, the probability of placing farmers in the first, second levels of drought to 47.0%, 0.19% will be increased, but in third level to 49.0% will be decreased, respectively. This results and provided interpretations can be seen in table 8, for the other factors. In total, according to the obtained coefficients among significance factors, two factors of farm income and awareness of pressurized irrigation systems were the most important of effective factors compared to other factors. Because, these factors lead to the biggest variations in the probability of placing farmers in different levels of drought.

Table 8. Marginal effects of effective factors in the OLR model

Factors	Y=1	Y=2	Y=3
Constant	-	-	-
Education level	0.267	0.038	- 0.305
Farm income	0.492	- 0.184	- 0.308
Awareness of pressurized irrigation systems	0.470	0.019	- 0.490
The effect of local weather conditions	- 0.077	0.029	0.048
The distrust towards the optimizing of pressurized irrigation systems	- 0.150	- 0.086	0.236
Non-efficiency of pressurized irrigation methods on farm yield	- 0.325	0.161	0.164
Costs of pressurized irrigation systems	- 0.109	- 0.006	0.115

4. Discussion and Conclusion

According to study findings, in different levels of drought, there is significant difference among farmers in terms of the unwillingness to adopt pressurized irrigation methods. Thus, study hypothesis related to the first question was confirmed. Findings indicated the majority of farmers (54.5%) have moderate unwillingness to adopt pressurized irrigation methods. Also, the major governmental programs to develop pressurized irrigation systems relies on the assumption that farmers in different regions of a province are homogeneous groups and their methods in the face of drought and adopting pressurized irrigation systems are similar. This procedure is mainly due to centralized government planning in agricultural plans. However, paying attention to regional differences based on drought levels will increase the effectiveness of programs for developing pressurized irrigation systems.

According to the results of OLR model, the factors of awareness of pressurized irrigation systems (consistent with the results of Al-Subaiee, 2013) and non-efficiency of pressurized irrigation methods on farm yield (consistent with the results of Kulshreshtha & Brown, 2007) have the ability to differentiate among farmers' groups and increase the probability to adopting pressurized irrigation methods among farmers in different levels of drought. In attention to the marginal effects and as the item of "the process of setting up and using pressurized irrigation methods" was the last priority of awareness of pressurized irrigation systems; it seems that holding of extension and education courses aimed at improving farmers' awareness and attitude about pressurized irrigation methods and it can play an effective role in the probability of adoption of pressurized irrigation systems by farmers. The other finding of OLR and marginal effects indicated that the factors of farm income and costs of pressurized irrigation systems have significant effect on grouping farmers in different levels of drought. It seems that strengthening the access to formal and informal loans and facilities in the design of governmental support, strengthening rural micro-credit and local credit funds, allocation of subsidies and interest-free loans or Interest-low loans to farmers who setting up the pressurized irrigation systems can have a positive effect on the willingness to adopt pressurized irrigation among farmers.

The finding of OLR model and marginal effect for factor of the distrust towards the optimizing of pressurized irrigation systems indicated this factor has a significant and positive effect on farmers' groups in different levels of drought. Also, according to the results of prioritizing for this factor, distrust towards the government agricultural programs in the region was the first priority. Since the restoration of farmers' trust is a time-consuming process, therefore, focus on attracting local elders on the need for pressurized irrigation systems can play a constructive role in increasing willingness to adopt pressurized irrigation methods by farmers in the study regions. In total, according to the results of OLR model, from among 18 factors of study, only 7 factors are significant and it had been the ability to differentiate among farmers' groups with different levels of drought. Among the significant factors, three factors (education level, farm income and awareness of pressurized irrigation systems) had a significant negative correlation with the dependent variable; but, four factors (the effect of local weather conditions, the distrust towards the optimizing of pressurized irrigation systems, non-efficiency of pressurized irrigation methods on farm yield and costs of pressurized irrigation systems) had a significant positive correlation with different levels of drought. In other words, the results of OLR model predict that non-adopter farmers of pressurized irrigation methods in more drought conditions significantly had more the distrust towards the optimizing of pressurized irrigation systems and more costs of pressurized irrigation systems. Moreover, non-adopter farmers of pressurized irrigation methods in more drought conditions significantly had lower education level and farm income, little awareness about pressurized irrigation systems, less belief in the effect of local weather conditions on their non-adoption of pressurized irrigation methods and less belief in effective of pressurized irrigation methods in farming.

According to the results of marginal effects, the amount of marginal effects in 4 factors of education level, farm income and awareness of pressurized irrigation systems and Non-efficiency of pressurized irrigation methods on farm yield have a decreasing trend; but the amount of marginal effects in 3 factors of the effect of local weather conditions, the distrust towards the optimizing of pressurized irrigation systems and costs of pressurized irrigation systems have an increasing trend. Totally, according coefficients obtained, improving farm income and awareness of pressurized irrigation systems, compared with other effective factors, create the biggest variations in the probability of placing farmers in different levels of drought. Therefore, these two factors are considered the most effective factors.

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