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Factors Determining the Adoption of the Pressurized Irrigation Systems by Farmers in Ardabil Province

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Abstract

Purpose- One of the most important strategies facing drought and agriculture water shortage in North-West Iran is developing pressurized irrigation systems (PISs). In this regard, the present study aims to investigate the factors determining the adoption of the PISs by farmers in Ardabil Province .

Design/methodology/approach- First, by drought zoning of Ardabil Province (by SPI method and GIS software), three regions including regions with mild, moderate and severe drought levels were determined. In the second step, using multi-stage cluster sampling, adopter and non-adopter farmers of the PISs were selected from three regions of study (n= 415). Also, the logistic regression was used to determine the affective and distinctive factors of farmers' groups .

Findings- According to the results of logistic regression analysis, the predictive power of model was 0.622 and the sensitivity of the regression model to determine the model validation was obtained as 85.8%. Also, from among 17 factors of study, 7 factors of education level, farm income, knowledge about the PISs, the infrastructure for PISs, the effect of local weather conditions, the trust towards the optimality of PISs and the improvement in farm water management, positively impacted on the adoption and use of PISs. Among effective factors, knowledge about the PISs (Wald: 32.676), the trust towards the optimality of PISs (Wald: 27.855) and the infrastructure for PISs (Wald: 21.648) were the most important factors predicting to the decision to adopt and use PISs among farmers.

Research limitations/implications- Since the study was carried out in a large area of the province, accessing the farmers and experts in the Ardabil Province was difficult and time consuming.

Practical implications- The agricultural extension and education programs and PRA method, can provide the basis for the adoption of PISs among most of the farmers. Also, the infrastructure programs for the implementation and setting up of PISs are the priority of governmental projects to develop the PISs in the regions of the study .

Originality/value- It seems that identifying and providing the necessary infrastructure for implementing pressurized irrigation programs should be based on the scientific needs assessment of the agricultural fields' conditions in different regions. Also, proper the appropriate government funding and financial support for the appropriate infrastructure of PISs will increase the willingness of farmers to adopt and use of the PISs.

Key words- Drought, pressurized irrigation systems (PISs), standardized precipitation index (SPI), Ardabil Province.

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1. Introduction

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 higher than normal temperature in a long time (Thuc, 2012). The average long-term rainfall in Iran is about 250 mm, while the average rainfall in the world 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, Zarafshani, Tavakoli, Mahdizadeh, & Amiri, 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. 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, Surendran, & Manickasundaram, 2015). Development of PISs 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 PISs are beyond the technical and technological issues; socio-economic, education, weather conditions and promotional factors are also effective (Yosefinejhad, Chaharsooghi, Arayesh, & Elyasi, 2014). Pressurized irrigation methods give more water to the roots of the plants. This reduces the amount of water consumption to the defined amount for the products, while plants need adequate water to grow (Schuck, Frasier, Webb, Ellingson, & Umberger, 2005). These methods are suitable for most of the types of soil and prevent erosion (Qassim, 2003). Efficient use of water in agriculture heavily depends on adoption of PISs to increase agricultural production efficiency and to maintain 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 (2012-2017). Obviously, water is the most important barrier to agricultural development in Iran and due to the increase of population, water resource is a major constraint to dealing with increasing demand for food products and more efficient products in agriculture (Dinar, Campbell, & Zilberman, 2004). The studies of Kulshreshtha and Brown (2007) and Al-Subaiee, Al-Ghobari, Baig, EI-Hagi, & Abu-Riziga (2013) concluded that the farmers' knowledge and attitude about PISs had a significant effect on their decision to adopt modern irrigation systems. Also, there was a significant negative correlation between age and farming experience with the use of PISs among farmers. In this study, organizing the agricultural extension and education programs are introduced as an important solution to encourage farmers to use of PISs.

Mahboubi, Esmailie Aval, & Yaghoubi (2011) in studying the barriers and promoters of the use of new methods of irrigation by farmers in West Boshroyeh township in Southern Khorasan (Iran) concluded that there are significant relationships between the amount of farmers' adoption of new irrigation systems (at 95% level of confidence), type of operations for attracting farmers participation (at 99% level of confidence), farmers attitude about threat of their future agriculture affected by water shortage (at 95% level of confidence), the importance of using new irrigation methods in agriculture (at 99% level of confidence), and the number of farmers´ meeting with agricultural extension agents every month and impeding and facilitating factors effecting on using new irrigation methods. Moreover, holding extension and education courses and farmers using loan for setting up new irrigation methods are of the suggestions of this study. In the other study, Cremades, Wang, & Morris (2015) examined major challenges and strategies in the adoption of pressurized irrigation methods in rural China. The aim of their study was to evaluate the impact of government support and economic incentives for using PISs by farmers in seven provinces. The results showed that only the half of the rural households have adopted PISs. 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 PISs. The results of Madhava, Chandran, and Surendran's (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 system by farmers. Also, high productivity and farm income have acted as an incentive to adopt the costly system of drip irrigation. 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 effective use of available resources and underground water (Noruzi & Chizari, 2006). However, the development of PISs is not just a physical and technical issue; the conditions for farmers' adoption and the impact of environmental factors play an important role (Khoshnodifar, Sookhtanlo, & Gholami, 2012). Whereas, new climatic changes in north-west of Iran (Ardabil Province), increasing drought periods and reduction of water resources is a major challenge in the research areas. Therefore, any factors affecting on adoption of PISs among farmers have the positive effects on the production and pricing of agricultural products and optimal management of water resources. Therefore, the present study covers factors that play an important role in adoption of PISs among farmers in research areas, according to drought zoning.

2. Methodology

2.1. Geographical Scope of the Research

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 have 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 (Molaei, 2011; Naderi, Mohammadi, Imani, & Karami, 2014). 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. Methods

In this research, the prevalent approach was survey and a field study was conducted to collect data in 2016-2017. Current research was conducted in two steps:

Step 1. It is preparing drought zoning in Ardabil Province to determine target regions (by SPI method and GIS software. At this step, with the help of meteorological data and SPI method in GIS software, 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 (Wambua, Mutua, & Raude, 2015). SPI is calculated based on the following equation:

$$SPI = \frac{X_i - \bar{X}}{\delta}$$

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

Table 1 shows classification of drought based on SPI to determine drought conditions in the regions of research (Pei, Li, Liu, & Lao, 2013; Xu, Wang, & Duan, 2013; Wambua *et al*., 2015).

Table 1. Drought classification based on SPI

Source: Research findings, 2017

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

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 the end of drought at that period of time and location (McKee, Doesken, & Kleist, 1993**;** Wambua *et al.*, 2015). According to the results in figure 1, due to the absence of values for the extreme drought, only three drought regions (mild drought, moderate drought, and severe drought) were selected.

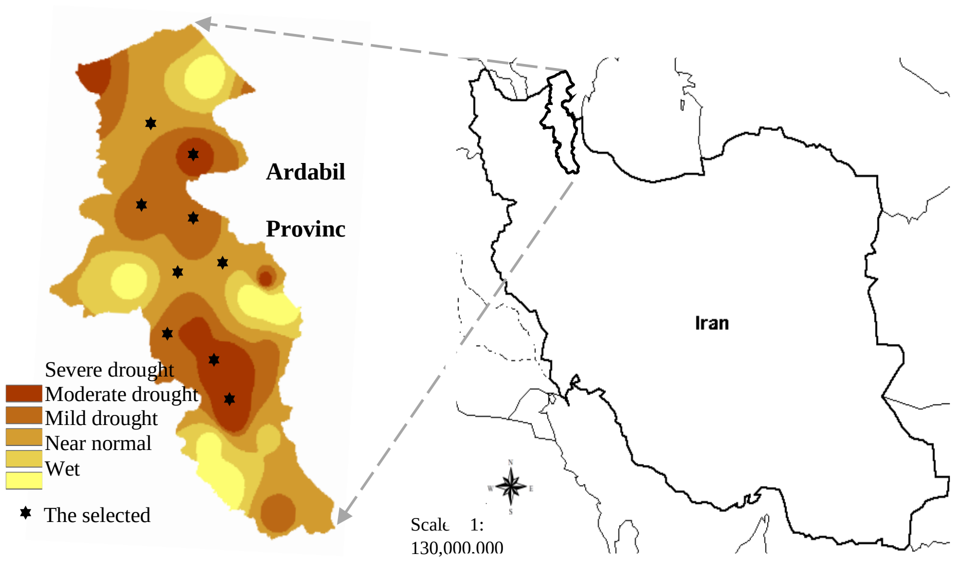

Fig. 1. Drought zoning map of study area and the selected villages
Source: Research findings, 2017

Step 2. At this step, 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 determined. After determining the target regions, using multi-stage cluster sampling and with the help of Cochran formula, two adopter and non-adopter farmers' groups of PISs were selected from three regions of study (415 farmers (125 adopter and 290 non-adopter farmers): the regions with severe drought (31 adopter and 72 non-adopter farmers), moderate drought (34 adopter and 98 non-adopter farmers) an area with mild drought (60 adopter and 120 non-adopter farmers)). In order to minimize the error in the findings, the villages (9 villages) were selected from areas with a history of pressurized irrigation programs (Figure 1). 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 factors studied was done with the help of questionnaire and interview in target regions.

2.3. Instrument of Study

The main instrument of this study was in three parts. The first part was related to personal, demographic and professional characteristics of farmers (15 items) and the second part was related to farm economy (10 items). Also, the third part (7 factors and 33 items) was the socio-economic and technical factors determining adoption of the PISs. These factors (according to the studies of Al-Subaiee *et al.*, 2013; Cremades *et al.*, 2015; Jayakumar *et al.*, 2015; Khoshnodifar *et al.*, 2012; Kulshreshtha & Brown, 2007; Madhava Chandran & Surendran, 2016; Mahboubi *et al.*, 2011; Moreno & Sunding, 2005; Noruzi & Chizari, 2006; and Yosefinejhad *et al.*, 2014) include the knowledge about the PISs (6 items), the effect of local weather conditions (5 items), the trust towards the optimality of PISs (5 items), the effects of pressurized irrigation methods on farming (4 items), the improvement in farm water management (5 items), the financial and technical support (3 items) and the infrastructure of PISs (5

items) that were mentioned in table 2 (in results section).
The mentioned factors were five-point Likert (1: very low to 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. Content validity of the questionnaire was confirmed by a panel of faculty members and agricultural experts after the necessary revisions. The reliability of the instrument of study was determined by Cochran formula and ordinal theta that was higher than 0.7 for each factor. Also, to determine factors affecting adoption of the PISs by farmers, the logistic regression analysis was used.

3. Research Findings

3.1. Demographic Characteristics of Respondents

The most frequency of farmers' age range (44.6 %) was from 45 to 54 years. In terms of gender, 91.3% were male and 8.7% were female. Their maximum education level was 5 to 8 years that were 38.3% of the sample. The most frequency of family size was 5 persons (42.4%). In terms of farm size, the most frequency of farm size range was 2.5 to 5 hectares (38.6%). The highest farm labor force was 3 persons (43.7%) and the highest farm income range was from 8500 to 20000 Iranian Rials (38.4%); while the highest off-farm income was from 200 to 500 million Iranian Rials (33.8%). Majority of farmers (29.8 %) had ownership of two agricultural machines. Demographic characteristics of respondents is provided in table 2

Table 2. Statistical summarization of demographic characteristics among farmers
Source: Research findings, 2017

Factors	Mean	SD	Minimum	Maximum
Age (year)	46.559	10.471	25	74
Education level (year)	7.305	2.226	1	12
Family size (person)	3.523	1.171	2	7
Farm labor force (person)	3.508	1.002	2	5
Farming experience (year)	20.152	12.43	5	50
Farm income (million IRR)	24961.650	11761.74	8260.00	67653.45
Off-farm income(million IRR)	1233.398	863.25	100.00	3800.00
Farm area (ha)	6.214	2.21	2	25
The number of agricultural machines	3.735	2.211	1	8
Farm costs (million IRR)	940.722	315.01	100.00	1750.00

3.2. Prioritizing the Main Socio-Economic and Technical Factors

According to the table (3), for the study factors, the first priorities are regarding the knowledge about the PISs (the nature, importance and urgency pressurized irrigation methods); the effect of local weather conditions (the effect of reducing precipitation); the trust towards the optimality of PISs (trust towards the government agricultural programs in the region); effective of pressurized irrigation methods in farming (the increasing farm income); the improvement in farm water management (the improvement in the reducing water management costs); the financial and technical support (the governmental financial and credit support) and the infrastructure for PISs (the farm conditions for setting up PISs).

Table 3. Prioritizing items related to socio-economic and technical factors
Source: Research findings, 2017

Factors	Items	Mean	SD	Rank
Knowledge about the PISs	The nature, importance and urgency pressurized irrigation methods	3.667	0.983	1
	Efficient and economical use of PISs	2.470	0.900	2
	The conditions and necessary equipment for setting up and using PISs	1.959	1.289	3
	The process of maintenance and management of PISs	1.855	1.023	4
	The process of obtaining financial, technical and facilities support	1.723	0.881	5
	The process of setting up and using PISs	1.583	1.368	6

Table 3.

Factors	Items	Mean	SD	Rank
The effect of local weather conditions	The effect of reducing precipitation	3.814	1.134	1
	The effect reducing groundwater and current resources	3.082	1.395	2
	The effect reducing soil moisture	2.747	1.371	3
	The effect rising temperatures	2.745	1.443	4
	The effect reducing moisture of the air	1.865	1.086	5
The trust towards the optimality of PISs	Trust towards the government agricultural programs in the region	3.116	1289	1
	Trust towards the reducing farm costs	2.831	1.153	2
	Trust towards the increasing farm income	2.882	1.131	3
	Trust towards the financial, technical and facilities support	2.732	1.254	4
	Trust towards the improving farm water management	2.508	0.985	5
Effective of pressurized irrigation methods in farming	The increasing farm income	3.997	1.046	1
	The increasing crop yield	3.747	0.909	2
	The reducing farm labor force	3.549	1.048	3
	The reducing water consumption	3.417	1.186	4
The improvement in farm water management	The improvement in the reducing water management costs	4.164	0.775	1
	Barriers to water transfer to the farm	3.790	0.918	2
	The improvement in the water efficiency of farming	3.072	1.092	3
	The need to more technical knowledge in farm water management	2.855	1.205	4
	Increasing efforts and additional labor force in farm water management	2.048	0.797	5
The financial and technical support	The governmental financial and credit support	3.641	0.801	1
	The governmental technical support by skilled experts in the region	3.202	1.004	2
	The private or semi-private financial and credit support	2.277	1.334	3
The infrastructure for PISs	The farm conditions for setting up PISs	3.445	1.445	1
	Access to adequate water channels	2.908	1.435	2
	The local infrastructure for maintenance and repair of PISs	2.829	1.338	3
	Access to skilled and technical experts in the region	2.494	1.364	4
	Access to adequate standard equipment of PISs	2.400	1.335	5

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

3.3. Logistic Regression Analysis

To determine factors affecting adoption of PISs, logistic regression analysis was used. For this reason, respondents were divided into two groups of adopters and non-adopters (table 5). According to table 4, the predictive power of logistic regression was 0.622 (Negelkerke R Square: 0.622). In other words, the model have predicted high percentage of dependent variable values by factors entered into the model and the adoption was explained by factors in the equation. -2 Log likelihood values, which acts as determining the goodness of fit in model, was desirable and when the model was compatible with the data, it appeared in 7 steps. The goodness of fit of the model (table 4) was 125.241, which confirmed the suitability of the model. In another finding (table 5), the sensitivity of model to determine the validity percentage for those who don't adopted and don't use the PISs production obtained 91.7%. Moreover, the correct prediction percentage of those who adopted and use the PISs obtained 72.0%. In general, the total sensitivity of the model to determine the correct prediction percentage was 85.8%.

Based on the results (table 6), among the research factors, 7 factors of education level, farm income, knowledge about the PISs, the infrastructure for PISs, the effect of local weather conditions, the trust towards the optimality of PISs and the improvement in farm water management positively impacted on the adoption and use of PISs. Moreover, the Wald statistic indicating the relative contribution of factors to the probability of adoption and use of PISs revealed that knowledge about the PISs (Wald: 32.676), the trust towards the optimality of PISs (Wald: 27.855) and the infrastructure for PISs (Wald: 21.648) were the most important factors predicting the decision to adopt and use PISs among farmers.

Table 4. Model Summary

Source: Research findings, 2017

Steps	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	184.396	0.212	0.237
2	177.587	0.284	0.321
3	173.104	0.318	0.387
4	163.297	0.357	0.402
5	159.341	0.423	0.459
6	142.475	0.495	0.534
7	125.241	0.554	0.622

Table 5. Classification table

Source: Research findings, 2017

	Observed		Predicted		
			Adaption		Percentage Correct
			No	Yes	
Step 1	Adaption	No	266	24	91.7
		Yes	35	90	72.0
	Overall Percentage				85.8

Table 6. The result of logistic regression for study factors

Source: Research findings, 2017

Factors	B	S.E.	Wald	Sig.	Exp(B)
X_1= Education level	0.264**	0.158	11.826	0.002	2.684
X_2= Farm income	0.003**	0.001	1.294	0.001	1.005
X_3= Knowledge about the PISs	0.489**	0.086	32.676	0.000	1.582
X_4= The infrastructure for PISs	0.324**	0.261	21.648	0.000	5.604
X_5= The effect of local weather conditions	0.310**	0.265	13.628	0.007	2.054
X_6= The trust towards the optimality of PISs	0.443**	0.283	27.855	0.000	2.590
X_7= The improvement in farm water management	0.252**	.205	9.398	0.005	0.453
Constant	-17.493**	2.700	41.965	0.000	0.000

** P< 0.01(2-tailed).

Based on the fixed value of B, the optimal regression equation for the variables entered in the equation is as follows:

$$g= -17.493+ 0.264 X_1+ 0.003X_2+ 0.489X_3+ 0.324X_4+ 0.310X_5+ 0.443X_6+ 0.252X_7$$

4. Discussion and Conclusion

In the current situation, climate changes in north-west of Iran has increased drought periods and reduced water resources. Considering that more than 90 percent of the water consumed in Iran is spent on agricultural activities, one of the most important strategies facing water shortage in the agricultural sector is promoting and developing PISs among farmers. Therefore, this study sought to determine the factors effecting on the adoption of the PISs by farmers with different drought conditions in Ardabil Province. According to logistic regression analysis, the results showed that the effect of local weather conditions in study areas on the adoption of the PISs among farmers was positive and significant. Also, according to the results of prioritizing for this factor, the item of the effect of reducing precipitation was the first priority. So, the intensity of change in reducing precipitation compared to other local weather conditions is more effective in adopting PISs among farmers. In this regard, it is suggested that priority should be given to the implementation of pressured irrigation projects in regions that are more prone to reducing precipitation than in the other regions. According to the results of logistic regression, the factor of knowledge about the PISs (consistent with the results of Al-Subaiee *et al.* (2013)) was the important factor predicting the decision to adopt and to use the system among farmers in different levels of drought. In addition, "the process of setting up and using pressurized irrigation methods" was the last priority of knowledge variable in relation to PISs. Therefore, it seems that holding extension-education courses in the region to promote farmers' awareness, attitudes and trust about pressurized irrigation methods could play an important role in a in the probability of adoption of PISs by farmers in the area.

The finding of logistic regression for factor of the trust towards the optimality of PISs indicated this factor has a significant and positive effect on adoption of PISs by farmers. Also, according to the results of prioritizing this factor, trust towards the government agricultural programs in the region was the first priority. Since the restoration of farmers' trust is a time-consuming process, it is suggested that focus on attracting local elders on the need for PISs can play a constructive role in increasing willingness to adopt pressurized irrigation methods by farmers in the studied regions. The other finding of logistic regression indicated that the factor of farm income have a significant effect on adoption of 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 low-interest loans to farmers who set up the PISs can have a positive effect on adoption of pressurized irrigation among farmers. According to the findings of logistic regression, farmers who had more impact on the use of pressured irrigation methods for improving farm water management, also had the higher possibility of adoption of PISs. Also, by paying attention to the results of prioritizing for this factor, item of the improvement in the reducing water management costs was the first priority. Therefore, extension and education programs and PRI method that emphasize the role of PISs on reducing farm irrigation costs and improving knowledge, and information and skills for farm irrigation management can provide the basis for the adoption of pressure systems among more farmers. Also, the factor of the infrastructure for PISs was the most important factor predicting the decision to adopt and to use the system among farmers. Moreover, according to the results of prioritizing this factor, item of the farm conditions for setting up PISs was the first priority. It is suggested that infrastructure programs for the implementation and setting up of PISs (building pipes or using cement blocks in pressurized irrigation routes, designing water reservoirs for PISs, providing electricity power, etc.) are the priority of governmental projects to develop the PISs in the studied regions. In other words, identifying and providing the necessary infrastructure for implementing pressure-driven irrigation programs should be based on a scientific needs analysis of the conditions of agricultural fields in different regions and provide appropriate government funding and financial support for the appropriate infrastructure that results in increasing the willingness of farmers to adopt the PISs. In total, according to the results of logistic regression, from among 17 factors of study, consistent with the results of Al-Subaiee *et al*. (2013)**,** Kulshreshtha and Brown (2007) and Khoshnodifar *et al.* (2012), only 7 factors of education level, farm income, knowledge about the PISs, the infrastructure for PISs, the effect of local weather conditions, the trust towards the optimality of PISs and the improvement in farm water management positively impacted on the adoption and use of PISs. Among effective factors, knowledge about the PISs (Wald: 32.676), the trust towards the optimality of PISs (Wald: 27.855) and the infrastructure for PISs (Wald: 21.648) were the most important factors predicting the decision to adopt and to use PISs among farmers.

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عوامل تعیین‌کننده پذیرش سیستم‌های آبیاری تحت فشار توسط کشاورزان استان اردبیل

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چکیده مبسوط

۱. مقدمه

یکی از مهم‌ترین راهکارهای موثر در مواجهه با خشکسالی و کمبود آب کشاورزی در شمال غرب ایران (استان اردبیل)، توسعه سیستم‌های آبیاری تحت فشار است. تغییرات آب و هوایی در شمال غرب ایران (استان اردبیل)، افزایش دوره‌های خشکسالی و کاهش منابع آب یکی از چالش‌های عمده در منطقه تحقیق محسوب می‌شود و هر گونه عوامل مؤثر بر پذیرش سیستم‌های آبیاری تحت فشار در میان کشاورزان تأثیر مثبتی بر تولید و قیمت محصولات کشاورزی و مدیریت بهینه منابع آب دارد. بدیهی است مهمترین آسیب های خشکسالی، کاهش میزان منابع آب است. مقدار آب مورد نیاز برای کشاورزی و بهره وری آب، در سال‌های ۲۰۱۲-۲۰۱۷ در استان اردبیل بسیار کاهش یافته است. بدیهی است که آب مهم ترین مانع توسعه کشاورزی در ایران است و به دلیل افزایش جمعیت، منابع آب یکی از محدودیت های اصلی برای مقابله با افزایش تقاضا برای محصولات غذایی و محصولات کارآمد در بخش کشاورزی است. بنابراین، این مطالعه به دنبال آن است تا عواملی که نقش مؤثری در پذیرش سیستم‌های آبیاری تحت فشار، میان کشاورزان را دارند، براساس سطوح پهنه بندی خشکسالی در مناطق مختلف مورد بررسی قرار دهد.

۲. مبانی نظری

با توجه به ضرورت توجه به تأثیر شرایط محیطی و آب و هوایی محلی بر پذیرش سیستم‌های آبیاری تحت فشار، به شیوه‌ای نوآورانه تلفیق نقشه پهنه‌بندی خشکسالی با تعیین گروه‌های هدف و تحلیل‌های اقتصادی-اجتماعی اثرگذار بر پذیرش سیستم‌های آبیاری تحت فشار مدنظر این تحقیق قرار گرفت. پدیده خشکسالی زمانی اتفاق می افتد که کمتر از بارندگی معمولی در طی مدت زمان طولانی مانند یک فصل یا بیشتر طول می‌کشد. آنچه مسلم است توسعه سیستم‌های آبیاری تحت فشار، از یک روند پایدار در ایران پیروی نمی کند؛ به طوری که تکنولوژی وارد شده از روش های آبیاری تحت فشار با شرایط آب و هوایی، خاک، زمین و کشاورزی در مناطق مختلف ایران سازگار نیست. بنابراین روند پذیرش این سیستم‌ها در میان کشاورزان ایران بسیار کند است. از سوی دیگر، عوامل مهار کننده برای پذیرش سیستم‌های آبیاری تحت فشار فراتر از مسائل فنی و فن آوری هستند و عوامل اجتماعی و اقتصادی، سطح آموزش، شرایط آب و هوایی و عوامل انگیزشی نیز موثر هستند. در مطالعات متعددی بر نقش دانش و نگرش و عوامل اجتماعی-اقتصادی و فردی کشاورزان بر بکارگیری سیستم‌های آبیاری تحت‌فشار و تأثیر آن در تصمیم‌گیری آنان برای پذیرش سیستم‌های آبیاری مدرن پرداخته شده است که در این تحقیق به اجماع کاملی درباره متغیرهای اثرگذار اشاره می شود.

۳. روش تحقیق

در مرحله اول، به روش پهنه بندی خشکسالی استان اردبیل (با کمک شاخص SPI و نرم افزار GIS)، با توجه به مقادیر شاخص سه منطقه مرتبط با خشکسالی، شامل مناطق با سطوح خشکسالی ملایم، متوسط و شدید تعیین شد و نقشه پهنه‌بندی خشکسالی استان اردبیل در این سه منطقه با کمک نرم افزار GIS تدوین گردید. در مرحله دوم، با مراجعه به نقشه پهنه‌بندی خشکسالی بدست آمده و انطباق مناطق خشکسالی (سه منطقه دارای شرایط خشکسالی شدید، خشکسالی متوسط و خشکسالی ملایم) با مکان مناطق روستایی منتخب تحقیق (توسط نرم افزار GIS)، مناطق هدف برای جمع‌آوری اطلاعات تعیین شد. پس از تعیین مناطق هدف، به روش نمونه‌گیری خوشه‌ای چندمرحله‌ای و به کمک فرمول کوکران، دو گروه از کشاورزان پذیرنده و نپذیرنده روش‌های آبیاری

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تحت‌فشار از سه منطقه مطالعه (از هر منطقه سه روستا) انتخاب شدند. نمونه آماری شامل ۴۱۵ کشاورز بود. از میان آنان ۱۲۵ نفر پذیرنده و ۲۹۰ نفر نپذیرنده روش‌های آبیاری تحت فشار بودند. همچنین تعداد نمونه ها بر اساس پهنه بندی خشکسالی بدین شرح بود: ۱- منطقه با خشکسالی شدید (۳۱ نفر پذیرنده و ۷۲ نفر نپذیرنده سیستم‌های آبیاری تحت فشار)؛ ۲- منطقه با خشکسالی متوسط (۹۸ نفر) و ۳- منطقه با خشکسالی ملایم (۱۲۰ نفر)). جمع‌آوری داده ها بر روی عوامل مورد بررسی، با استفاده از پرسشنامه و مصاحبه در مناطق هدف انجام شد

۴. یافته‌های تحقیق

نقشه پهنه بندی خشکسالی در استان اردبیل، سه منطقه خشکسالی با سطوح ملایم، متوسط و شدید را نشان داد. تحلیل رگرسیون لجستیک مورد استفاده در تحقیق، دارای توان پیش بینی مدل ۰/۶۲۲ بود و حساسیت مدل به منظور تعیین درصد صحت ۸۵/۸ درصد نشان داد. بر اساس نتایج تحلیل رگرسیون لجستیک، از میان ۱۷ عامل مطالعه، تنها ۷ عامل سطح تحصیلات، درآمد مزرعه، دانش درباره سیستم‌های آبیاری تحت فشار، زیرساخت‌های سیستم‌های آبیاری تحت فشار، تأثیر شرایط آب و هوای محلی، اعتماد نسبت به بهینه بودن سیستم‌های آبیاری تحت فشار و بهبود مدیریت آب در مزرعه به طور مثبت و معنی‌داری بر پذیرش و استفاده از سیستم‌های آبیاری تحت فشار تاثیر داشته است. در میان عوامل مؤثر، دانش درباره سیستم‌های آبیاری تحت فشار (Wald: ۳۲/۶۷۶)، اعتماد نسبت به بهینه بودن سیستم‌های آبیاری تحت فشار (Wald: ۲۷/۸۵۵) و زیرساخت‌های سیستم‌های آبیاری تحت فشار در منطقه (Wald: ۲۱/۶۴۸)، مهم‌ترین عوامل پیش‌بینی کننده تصمیم کشاورزان برای پذیرش و استفاده از زیرساخت‌های سیستم‌های آبیاری تحت فشار را شامل می‌شد.

۵. نتیجه گیری

برنامه‌های ترویج و آموزش کشاورزی و روش ارزیابی مشارکتی روستایی (PRA) که بر نقش سیستم‌های آبیاری تحت فشار در کاهش هزینه‌های آبیاری مزرعه و بهبود دانش، اطلاعات و مهارت‌ها برای مدیریت آبیاری مزرعه تأکید دارد، می‌تواند زمینه‌ای برای پذیرش سیستم‌های آبیاری تحت فشار در میان کشاورزان بیشتری را فراهم کند. همچنین برنامه‌های زیربنایی برای پیاده‌سازی و راه‌اندازی سیستم‌های آبیاری تحت فشار (ساخت لوله‌ها یا استفاده از بلوک‌های سیمان در مسیرهای آبیاری تحت فشار، طراحی مخازن آب برای سیستم‌های آبیاری تحت فشار، تأمین منابع برق و غیره) بایستی در اولویت پروژه‌های دولتی در مناطق مطالعه قرار گیرد. به نظر می‌رسد شناسایی و فراهم ساختن زیرساخت‌های لازم برای اجرای برنامه‌های آبیاری تحت فشار، باید براساس یک نیازسنجی علمی از شرایط زمین‌های کشاورزی در مناطق مختلف انجام شود. همچنین تأمین مالی مناسب دولتی و حمایت مالی از زیرساخت های مناسب سیستم‌های آبیاری تحت فشار، زمینه افزایش تمایل کشاورزان برای پذیرش و استفاده از سیستم‌های آبیاری تحت فشار را افزایش می‌دهد.

کلیدواژه‌ها: خشکسالی، سیستم‌های آبیاری تحت فشار، شاخص بارش استاندارد، استان اردبیل.

تشکر و قدردانی

پژوهش حاضر برگرفته از یک طرح تحقیقاتی جامع در زمینه عوامل بازدانده پذیرش روش‌های آبیاری تحت فشار بر اساس پهنه‌بندی خشکسالی در استان اردبیل است و لذا از دانشگاه محقق اردبیلی (اردبیل، ایران) به خاطر حمایت‌های مالی از این مطالعه تشکر و قدردانی می شود.

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