

# Application of Weather Forecasts in Farm Management Decisions: The Case of Iran

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## ABSTRACT

Weather forecasts have potential for improving adaptation and resilience of agricultural systems to climate changes; however, there is still uncertainty on the factors affecting the use of this information in farm management decisions. This survey study was conducted on the application of weather information by 213 farmers selected through a stratified random sampling technique in 21 rural areas of Veys, in Khuzestan Province. The results indicated that perception of the reliability of weather information providers, availability of weather forecast information, self-efficacy, and subjective norm were the key drivers for using weather forecast information in the farm management decisions. Based on the results, confidence to the information providers was low among farmers. In addition, social norm about using weather information in practice was not strong in the study area. The results of the study highlighted the need for improving beliefs and values of farmers and their communities about the importance of using weather forecast information for adaptation to climate change.

**Keywords:** Adaptation to climate change, Agricultural decision making, Weather threats.

## INTRODUCTION

Agricultural production is significantly affected by extreme temperature events (Jamshidi *et al.*, 2018; Bijani *et al.*, 2017; Hatfield and Prueger, 2015; Zhang *et al.*, 2017; Chen *et al.*, 2016), the variation in the rainfall patterns (Khatri-Chhetri *et al.*, 2017; Crane *et al.*, 2011), wind speed trends (Sharratt *et al.*, 2015), and climate disasters such as floods and droughts (Yu *et al.*, 2014; Maleksaeidi *et al.*, 2016). Based on the statistical estimates, the loss of yield due to climate change could be over 35% for rice, 20% for wheat, 60% for maize and 13% for barely, depending on the region and the severity of changes (Khatri-Chhetri *et al.*, 2017). This drop in agricultural productivity has led to increased poverty and food insecurity in the world, particularly among marginalized and subsistence farmers who

live in the arid and semi-arid regions of developing countries and are vulnerable to climate change due to lack of facilities (Biglari *et al.*, 2019; Erena *et al.*, 2019; Trinh *et al.*, 2018; Kumar *et al.*, 2016; Maleksaeidi and Karami, 2013; Altieri and Nicholls, 2017). In such a situation, it is important to empower farmers in order to make the right management decisions on the farm for withstanding climate changes, adapting to these changes, and improving their resilience capacity to mitigate the impacts of such changes (FAO, 2014).

Many authors including Roudier *et al.* (2014), Kolawole *et al.* (2014), Takle *et al.* (2014), Morton *et al.* (2017), and Nidumolu *et al.* (2018) have emphasize that the capability to forecast climate changes on a seasonal or shorter time scale, adoption of information disseminated from these forecasts and regulating agricultural

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practices according to this information are the key points for building resilience and adaptation to climate change threats. For example, in 1992, when the Brazilian government warned farmers about the occurrence of the El Niño and provided them free drought tolerant seeds, the country witnessed an increase in the agricultural productivity as a result of farmers' adaptation to this phenomenon (Patt *et al.*, 2005). Generally, a precise prediction of climate change gives farmers an opportunity to approach weather threats, allows them enough time to prepare for changes, make informed decisions and tailor their management activities to these changes (Petersen and Fraser, 2001; Losee and Joslyn, 2018).

Over the past two decades, advances in technology have made it possible to improve the quality and lead-time of weather forecasts and their interpretations (Kusunose and Mahmood, 2016; Kenkel and Norris, 1995). Theoretically, with increasing uncertainty in weather and climate patterns, it is expected that the value of weather information for farmers will increase and, under an ideal management scenario, we see more application of such information in decision making (Kusunose and Mahmood, 2016). However, lack of sufficient studies on the adoption of weather information in practice by users, particularly by poor resource and vulnerable farmers who live in developing countries such as Iran, has led to a lack of scientific evidence for this issue (Haigh *et al.*, 2018).

Iran is one of the developing countries where agricultural production faces great deal of uncertainties in climate. The main characteristic of arid or semi-arid climate of Iran is low rainfall and high evaporation (Amiri and Eslamian, 2010). The average annual rainfall of 224 to 275 mm has made Iran one of the driest countries in the world (Keshavarz *et al.*, 2013). In addition, the average temperature in this country is predicted to increase from 1.5 to 4°C, if the CO<sub>2</sub> concentration doubles by 2100 (Amiri and Eslamian, 2010). While agriculture is

the second-largest economic sector in Iran that provides employment opportunities for 23% of the country's population and supplies 80% of the country's food (Mohammadian Mosammam *et al.*, 2016), various studies have indicated significant impacts of climate change on agricultural productivity in Iran. For instance, Nassiri *et al.* (2006) estimated that by 2025, with an increase of 2.7°C in the average temperature, the average yield of rainfed wheat - as one of the most important cereals in Iran (Mohammadian Mosammam *et al.*, 2016)- would be reduced by 18%. In addition, based on a simulation, Moradi *et al.* (2014) estimated that if no adaptation strategy were applied, the corn yield would drop between 1 and 42% by 2100 due to climate change. Overall, without paying attention to the adaptation strategies, climate change would limit agricultural production in different areas of Iran (Karimi *et al.*, 2018). In such circumstances, providing weather forecasts and using them in practice is crucial for farmers to prepare for climate changes and adaptation to these changes (Losee and Joslyn, 2018).

Farmer's decision to rely on weather forecast information is likely a function of many factors (Kusunose and Mahmood, 2016). These include availability of weather forecasts (Changnon, 2004; Frisvold and Murugesan, 2013; Artikov *et al.*, 2006), confidence in accuracy of these forecasts (Kusunose and Mahmood, 2016; Kox *et al.*, 2015; Hu *et al.* (2006); Changnon (2004) and Artikov *et al.* (2006)), trust in the reliability of the sources making the forecasts (Kox *et al.*, 2015; Artikov *et al.*, 2006; Hu *et al.*, 2006), perception of the forecasts' usability (Changnon, 2004; Sharifzadeh *et al.*, 2010), subjective norms (Artikov *et al.*, 2006; Sharifzadeh *et al.*, 2010), and self-efficacy such as ability for interpreting and understanding weather forecasts and having adequate motivation for using these information (Artikov *et al.*, 2006; Hu *et al.*, 2006). In this regard, access to scientific evidence about using weather information in practice by farmers is necessary to clear the value of climate

information for farmers as the main on-farm decision makers (Roudier *et al.*, 2014). In addition, an understanding of the factors affecting the application of weather information by farmers in agricultural decision making may create a base to formulate policy commendations that can increase the use of this information among farmers, thereby not only reducing their vulnerability to climate change but also the costs involved in producing this information due to its use in practice.

Therefore, the aim of this study was to understand Iranian farmers' use of weather information, as well as factors affecting the use of this information in farm management decision by the studied farmers.

## MATERIALS AND METHODS

### Study Area

Veys is the capital of Veys District in Bavi County, Khuzestan Province, southwest of Iran. This area is a part of Karun River Basin (Molaali and Babaei, 2017). Veys has fertile fields, large gardens, and vast modern farms. Based on the country divisions in 2016, Veys consists of 30 villages, 9 of which have been vacant for various reasons, mainly climate disasters including drought (Statistical Center of Iran, 2016). While Khuzestan is one of the main agricultural pillars in Iran, temperature in different parts of this province, such as Veys, sometimes reach over 50°C. However, the predictions indicate an increase in the average temperature of this area in the coming years (Masoudi and Elhaesahar, 2016). Also, though the average annual rainfall in the region is 226 mm, it is predicted that reducing rainfall in the future years will turn different parts of this region into a drier area (Masoudi and Elhaesahar, 2016). Now also, climate change, particularly drought, has caused serious challenges for farmers in the area. For example, Molaali and Babaei (2017) found that Veys and two other cities near it experienced a sharp fall in irrigated

wheat yields between 2006-2010 as a result of drought. Based on this, in 2010, Jihad-e-Agriculture Organization of Khuzestan Province converted 130 hectares of land from the city of Veys to a training site and organized training courses in various fields, including the use of weather information for farmers. However, investigations have not been conducted on farmers in the area about the use of meteorological information in agricultural decisions, as well as their level of trust in and access to this information. Accordingly, in this study, Veys city was selected as the study area. Figure 1 shows the geographic location of the study area.

### Survey of Farmers

A survey was conducted on farmers in the rural areas of Veys. The total number of farmers in the study area was 480. The sample size was determined as 213, based on Cochran (1963) formula. This number of farmers was randomly selected based on stratified random sampling from 21 villages. Each village was considered as a stratum and then farmers were randomly selected in proportion to the farmers' population in each village. Farmers were interviewed individually through a structured questionnaire. Face validity of the questionnaire was confirmed by a panel of experts of climatology and agricultural extension and education. Before survey was done, the questionnaire was pre-tested with 30 farmers in the rural areas of Ahvaz to correct the questions and examine their reliability by calculating Cronbach's Alpha. The questionnaire was divided into three sections. The first section included socio-economic characteristics of the farmers. In the second section, farmers were asked to state if they used weather forecast information in farm management decisions. Farmers were asked to specify their response on a double spectrum (YES= 1 or NO= 0). The third section was designed to assess availability of weather forecasts, farmers' perception about the accuracy of weather



Figure 1. Geographic location of the study area.

forecasts, farmers' perception about the reliability of the weather information providers, farmers' perception about forecasts' usability, subjective norm and self-efficacy to interpret and apply these forecasts in the farm management decisions. Each of these variables was assessed using several closed-ended questions on a 5-point Likert scale (Completely disagree= 1; Disagree= 2; No idea= 3; Agree= 4; Completely agree=5). Table 1 shows research variables, items used to measure them and the calculated Cronbach's Alpha coefficients for variables measured with Likert spectrum.

### Analysis

Binary logistic regression analysis was used to explore factors influencing use of weather forecasts information by the studied farmers. Forward stepwise (conditional) method was used to eliminate variables. The

$$P_i = \frac{e^{(\alpha + B_1X_1 + B_2X_2 + \dots + B_nX_n)}}{1 + e^{(\alpha + B_1X_1 + B_2X_2 + \dots + B_nX_n)}} \quad (1)$$

logistic model here is as follows:

Where,  $P_i$  represents probability of putting  $i$  th farmer in a group that uses weather forecast information in farm management decisions,  $e$  is exponential function and has a value of approximately 2.718 (Meyers *et*

*al.*, 2006),  $\alpha$  is a constant (the value of the criterion when the predictor is equal to zero),  $X_1, X_2, \dots, X_n$  represent the predictors (independent variables) and  $B_1, B_2, \dots, B_n$ , are the partial regression coefficients that indicate the change in probability of membership for any 1-unit change in the independent variable.  $B$  weights are calculated through maximum likelihood estimation after transforming the dependent variable into a logit variable (Meyers *et al.*, 2006).

Also,

$$Y_i = \alpha + B_1X_1 + B_2X_2 + \dots + B_nX_n \quad (2)$$

Where,  $Y_i$  signifies the total distinction value that indicates the quantitative characteristics of  $i$  th farmer, Equation (1) can be converted to Equation (3).

$$P_i = \frac{e^{(Y_i)}}{1 + e^{(Y_i)}} \quad (3)$$

If  $P_i \geq 0.50$ , then the  $i$  th farmer is classified as a user of weather forecast information, and if  $P_i < 0.50$ , then the  $i$  th farmer is classified as a non-user of weather forecast information.

Indices that are applied for evaluation of logistic regression model here are Cox and Snell and the Nagelkerke tests, Wald test and the significance level of Chi square ( $\chi^2$ ). SPSS version 23 was used for doing analyses.

**Table 1.** Variables, definitions, measuring items and Cronbach's Alpha coefficients.

Variables	Definition	Statements	Source	Cronbach's alpha coefficients
<b>Dependent variable</b>				
Using weather forecast information in farm management decisions (Y)		Using weather forecast information is a binary variable. It was given a value of 1, if a farmer used weather information in farm management decisions, and 0 if not.		
<b>Independent variables</b>				
Socio-economic variables:				
Age (Year) (X <sub>1</sub> )				
Farm experience (Year) (X <sub>2</sub> )				
Education (Years of schooling) (X <sub>3</sub> )				
Farm size (ha) (X <sub>4</sub> )				
Availability of weather forecasts (X <sub>5</sub> )	The ability to access weather information via media and other tools	Access to weather forecasts is possible for me via: 1) Radio 2) National TV 3) Web sites and web sources 4) Newspaper 5) Satellite TV 6) Contacting the 1559 weather phone answering service	Changnon (2004); Frisvold and Murugesan (2013); Artikov <i>et al.</i> (2006)	0.77
Perceived accuracy of weather forecasts (X <sub>6</sub> )	Individual's confidence in the accuracy of weather forecasts.	I confidence in the accuracy of forecast regarding: 1) Temperature 2) Chance of precipitation 3) Amount of precipitation 4) Chance of thunderstorm 5) Chance of storm 6) Chance of dust	Kusunose and Mahmood (2016); Kox <i>et al.</i> (2015); Artikov <i>et al.</i> (2006), Hu <i>et al.</i> (2006)	0.74
Perceived reliability of the weather information providers (X <sub>7</sub> )	Individual's trust to the reliability of the weather information providers and the informants.	I trust to the reliability of weather information providers including: 1) Radio 2) National TV 3) Web sites and web sources 4) Newspaper 5) Satellite TV 6) Contacting the 1559 weather phone answering service	Kox <i>et al.</i> (2015); Artikov <i>et al.</i> (2006), Hu <i>et al.</i> (2006)	0.72
Perceived forecasts' usability (X <sub>8</sub> )	Individual's perception of the applicability of weather forecasts information in practice.	1) Weather forecasts are simple to interpret and use in practice. 2) Weather forecasts are produced according to local conditions. 3) Weather forecasts are provided on time for use. 4) Predictions for crop-specific critical periods are available.	Changnon (2004); Sharifzadeh <i>et al.</i> (2010)	0.76
Subjective norm (X <sub>9</sub> )	Individual's perception of the community expectations about using or not using weather forecasts in farm management decision.	1) My family believe that weather forecasts should influence my crop-related decisions. 2) My friends and neighbors believe that I should use weather forecasts in farm management decisions. 3) Most people who are valuable to me believe that I should use weather forecasts in farm management decisions.	Articov <i>et al.</i> (2006); Sharifzadeh <i>et al.</i> (2010), Hu <i>et al.</i> (2006)	0.79
Self-efficacy (X <sub>10</sub> )	Individual capabilities to interpret, understand and use of weather forecasts in farm management decision.	1) I have enough literacy to understand and use of weather forecasts. 2) I have enough motivation to use weather forecasts.	Articov <i>et al.</i> (2006); Hu <i>et al.</i> (2006)	0.71



## RESULTS

## Predictive Model of Factors Affecting Use of Weather Information

## Overview of Profiles of Farmers

The mean age of farmers was 35.04 years with a Standard Deviation (SD) of 10.56. They had 1-40 years of farming experience (SD= 8.58) (Table 2). Majority of farmers were male (95.8%) and married (93.4%). Agriculture was the main occupation of about 80% of the studied farmers. Based on Table 2, the average education level of farmers was 8.12 years with the minimum of 0 and maximum of 16 (SD= 2.94). Also, the mean farm size of farmers was 1.9 ha, with the minimum of 0.6 and maximum of 6 ha (SD= 0.87).

Based on Table 2, the mean value of availability of weather forecasts among farmers was moderate (16.77 out of 30). Also, from farmers' point of view, the accuracy of weather forecasts information was moderate (15.05 out of 30). However, farmers had relatively little confidence in reliability of the weather information providers such as radio and national TV (11.53 out of 30). From the perspective of the farmers, the usability of weather forecast information was moderate (10.30 out of 20). While farmers' perceptions of their ability to understand and apply weather forecast information (self-efficacy) was relatively high (6.71 out of 10), based on the findings in Table 2, the mean value of subjective norm among farmers was moderate (7.20 out of 15).

As described in the methodology section, logistic regression analysis using forward conditional method was applied for developing a predictive model of factors determining use of weather forecasts information by the surveyed farmers. Data analysis revealed that only 37.09% of farmers in the study area used weather forecast information in the farm management decisions, while the majority of them (62.91%) did not use weather information in practice. Table 3 indicates the goodness of fit indices for the logistic model. Based on this table, the logistic regression went up to four steps. As shown in this table, the Nagelkerke  $R^2$  revealed that 41% of the variation in the use of weather forecast information in the farm management decisions is explained by the model. This percentage is appropriate, as the values of logistic regression scales are most of the time much lower than the corresponding ones for a linear model (Norusis, 2005). Chi-square ( $\chi^2$ ) improvements presented in Table 3 evaluate the contribution of each predictive variable to the model. Since, the value of Chi-square ( $\chi^2$ ) has improved in each step and the significance level of chi-squares improvements are smaller than 0.05, it can be concluded that independent variables can increase the predictive power of the model

**Table 2.** Summary statistics of the research variables used in the binary logistic model.

Variables <sup>a</sup>	Min	Max	Mean $\pm$ Std deviation
Age (years) ( $X_1$ )	22	75	35.04 $\pm$ 10.56
Farm experience (Year) ( $X_2$ )	1	40	15.33 $\pm$ 8.58
Education (Years of schooling) ( $X_3$ )	0	16	8.12 $\pm$ 2.94
Farm size (ha) ( $X_4$ )	0.6	6	1.9 $\pm$ 0.87
Availability of weather forecasts ( $X_5$ )	7	22	16.77 $\pm$ 2.49
Perceived accuracy of weather forecasts ( $X_6$ )	9	20	15.05 $\pm$ 4.70
Perceived reliability of the weather information providers ( $X_7$ )	6	27	11.53 $\pm$ 3.60
Perceived forecasts' usability ( $X_8$ )	4	20	10.30 $\pm$ 3.54
Subjective norm ( $X_9$ )	3	15	7.20 $\pm$ 2.83
Self-efficacy ( $X_{10}$ )	2	10	6.71 $\pm$ 2.18

<sup>a</sup> Range of variables: ( $X_5$ )= 6-30; ( $X_6$ )= 6-30; ( $X_7$ )=6-30; ( $X_8$ )=4-20; ( $X_9$ )= 3-15; ( $X_{10}$ )=2-10.

**Table 3.** Fit indices for the logistic regression model.

Steps	Cox and Snell R <sup>2</sup>	Nagelkerke R <sup>2</sup>	-2 log likelihood	Chi-square ( $\chi^2$ ) improvement	df	Sig
1	0.14	0.19	249.38	31.53	1	0.000
2	0.22	0.30	228.69	20.68	1	0.000
3	0.26	0.36	215.73	12.96	1	0.000
4	0.30	0.41	204.22	11.50	1	0.001

compared to the situation where they are not used. In addition, reducing the value of -2 log likelihood in each step represents an increase in the model power by adding each new variable in each step.

Table 4 indicates the variables entered into the regression model and their coefficients of influence. As shown in this table, of the ten independent variables examined, including socio-economic variables and other independent measures (see Table 1), four variables including perceived reliability of the weather information providers, availability of weather forecasts, self-efficacy, and subjective norm entered into the logistic model. In this table, the positivity of B coefficients indicates that by increasing the value of independent variables, the probability of using weather forecast information in the farm management decisions improves. Also, the significance of Wald statistics indicates the significance of coefficients of the variables entered into the regression model. In addition, the "odds ratio" is an estimate of increasing the percentage of membership in the target group (a group that uses weather information in farm-level management decisions) by increasing one unit in the predictive variable.

Based on the results in Table 4, the first

variable entered into the regression model was perceived reliability of the weather information providers. This variable shows a positive coefficient for the logistic model (B= 0.29). By increasing one unit in the value of this variable, the probability of membership of a farmer in the group that uses weather information in practice will increase 1.47 times. The significance level of the Wald statistic (0.000) shows this parameter is different from zero. The second variable that entered into the logistic model was availability of weather forecasts (B= 0.26). According to the regression results in Table 4, by increasing one unit in the value of this variable, the probability of membership of a farmer in the group that uses weather information in practice will increase 1.30 times. Self-efficacy was the third variable that entered the regression model (B= 0.66). In fact, by increasing one unit in the value of this variable, the probability of membership of a farmer in the group that uses weather information in farm-level decisions will increase 1.93 times. The last variable that entered into the equation was subjective norm (B= 0.25). Based on Table 4, by increasing one unit in the value of subjective norm, the probability of membership of a farmer in the group that uses weather information in practice will

**Table 4.** Variables entered in the logistic regression (forward conditional) model at the end of step 4.

Variables	B	SE	Wald	df	Sig	Odd ratio (Exp(B))
Perceived reliability of the weather information providers (X <sub>7</sub> )	0.29	0.06	24.41	1	0.000	1.47
Availability of weather forecasts (X <sub>5</sub> )	0.26	0.08	10.73	1	0.001	1.30
Self-efficacy (X <sub>10</sub> )	0.66	0.12	32.11	1	0.000	1.93
Subjective norm (X <sub>9</sub> )	0.25	0.07	11.57	1	0.001	1.28
Constant	6.26	1.46	18.35	1	0.000	5.14



increase 1.28 times. Finally, the regression equation is constructed with these four variables.

Based on Equation (2), the following formula is obtained:

$$Y_i = 6.26 + 0.29X_7 + 0.26X_5 + 0.66X_{10} + 0.25X_9 \quad (4)$$

Then, by merging Equation (4) into Equation (3), the following equation is obtained:

$$P_i = \frac{e^{(6.26 + 0.29X_7 + 0.26X_5 + 0.66X_{10} + 0.25X_9)}}{1 + e^{(6.26 + 0.29X_7 + 0.26X_5 + 0.66X_{10} + 0.25X_9)}} \quad (5)$$

## DISCUSSION

Production in the agricultural sector faces many uncertainties, most of which are due to day-to-day weather variability and annual climate fluctuations (Kusunose and Mahmood, 2016). Under such situations, it is necessary to look for options that will improve the adaptation and resilience of farmers, particularly vulnerable smallholder farmers in developing countries, against these threats (Keshavarz *et al.*, 2017). From the viewpoint of many researchers (e.g. Morton *et al.*, (2017) and Nidumolu *et al.* (2018)), regulating agricultural activities based on weather forecasts information is a main option for building resilience and adaptation to climate change. In theory, it seems that with the advancement of weather forecast technologies and the dissemination of the information, farmers quickly get this information and use it in their management decisions on the farm. However, in practice, farmers' decision for adaptation to weather forecast information is influenced by a variety of factors (Kusunose and Mahmood, 2016) and their recognition is essential for understanding the value of this information to farmers and improving its use in farm management decisions. Therefore, the aim of this study was to understand the use of weather information in practice by farmers and factors affecting it.

The results of analysis showed that the majority of farmers do not use weather information in their farm management decisions. This finding is consistent with the results of study by Sharifzadeh *et al.* (2010), which showed that wheat growers in Fars Province of Iran rarely use weather information in agronomic decision making. The results of logistic regression analysis indicated that using weather information by farmers was influenced by their perception of the reliability of the weather information providers, availability of weather forecast information, their self-efficacy, and subjective norm. Accordingly, it is expected that by increasing farmers' trust in the reliability of the weather information providers and the informants, the extent of using this information in farm management decisions will be increased. While this finding is in line with the results of the study by Artikov *et al.* (2006) and Hu *et al.* (2006), another part of our study showed that farmers in the study area had little trust in the reliability of the resources they used to receive weather information. This issue could be one of the reasons for not applying weather information by the majority of the studied farmers. The availability of weather information is the second factor that is expected by increasing it, using information in farm management decisions will be increased by farmers. This finding is in agreement with the results of studies by Changnon (2004) and Artikov *et al.* (2006). On the other hand, the results of study showed farmers access to weather information in the study area is at medium level. Perhaps, as Hosseini *et al.* (2009) point out, one of the reasons for this is the lack of farmers' access to internet websites due to the shortage of proper telecommunication infrastructure in rural areas of Iran. Based on the results of logistic regression analysis, the third factor affecting the use of weather information by farmers is their level of self-efficacy regarding their ability to understand and use this information. This finding also confirms the results of studies by Articov *et al.* (2006),



Hu *et al.* (2006) and Sharifzadeh *et al.* (2010). Based on the results, social norm was the fourth and last effective factor in prediction of the application of weather information by farmers. This finding indicates that more pressure from the community for using weather information leads to more use of this information in practice. This is in congruent with the results of studies by Articov *et al.* (2006), Hu *et al.* (2006), and Sharifzadeh *et al.* (2010). Despite this fact, contrary to the findings of the study by Articov *et al.* (2006), farmers in the present study did not feel considerable pressure from the community for using weather forecast information in the farm management decisions. This is another reason for not using weather information by the majority of farmers in the study area.

## CONCLUSIONS

This research adds new knowledge to the existing scientific literature about factors driving application of weather forecasts in farm management decisions. The study indicated that perception of the reliability of the weather information providers, availability of weather forecast information, self-efficacy, and subjective norm are the key determinants of using weather forecast information in farm management decisions by farmers. Based on the results, the amount of confidence in the information providers was low among farmers, while availability of weather information by farmers and social norm about using weather forecast in practice was moderate in the study area.

The lack of social norms regarding the use of weather forecasts in agriculture emphasizes the need for improving beliefs and values of farmers and their communities about the importance of climate information in coping with climate change as an important step in the application of this information in practice. Also, given the importance of confidence in the information providers as one of the most important determinants of application of weather

forecasts in agriculture, involving farmers, particularly the local leaders who are often trusted by farmers, in the dissemination of climate information can play an important role in using this information in the farm management decisions. Considering the importance of meteorological information availability in the application of this information in practice, in order to increase the access of farmers groups to such information, it is recommended that different, multiple, and varied channels be used for transmitting this information to different groups of farmers. Finally, pointing out the tips for future research will be worthwhile. Firstly, due to the limitations of quantitative research methods such as their reliance on self-reported measures, it is suggested that qualitative research also be used to obtain more accurate and deeper information on the use of climate information in farm management decisions. Secondly, other important variables can certainly be useful in explaining and forecasting the use of climate information in farm management decisions by farmers. Hence, it is necessary to consider such variables in the future studies.

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## کاربرد پیش‌بینی‌های هواشناسی در تصمیمات مدیریت مزرعه: مورد ایران

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### چکیده

پیش‌بینی‌های هواشناسی دارای ظرفیتی برای بهبود سازگاری و تاب‌آوری سیستم‌های کشاورزی با تغییرات اقلیمی هستند، هرچند همچنان در مورد عوامل مؤثر در استفاده از این پیش‌بینی‌ها در تصمیمات مربوط به مدیریت مزرعه اطمینان وجود ندارد. یک مطالعه پیمایشی در مورد کاربرد اطلاعات هواشناسی توسط ۲۱۳ کشاورز از ۲۱ منطقه روستایی ویس در استان خوزستان که از طریق روش نمونه‌گیری تصادفی طبقه‌ای انتخاب شدند، نشان داد که اطمینان به ارائه‌دهندگان اطلاعات هواشناسی، در دسترس بودن پیش‌بینی‌های هواشناسی، خودکارآمدی و هنجار ذهنی محرک‌های اصلی استفاده از این پیش‌بینی‌ها در تصمیمات مربوط به مدیریت مزرعه هستند. براساس یافته‌ها، اطمینان به ارائه‌دهندگان اطلاعات در بین کشاورزان کم بود. علاوه بر این، هنجار اجتماعی در مورد استفاده از اطلاعات هواشناسی در عمل در منطقه مورد مطالعه قوی نبود. نتایج تحقیق حاکی از نیاز به ارتقاء اعتقادات و ارزش‌های کشاورزان و جوامع آنها در مورد اهمیت استفاده از پیش‌بینی‌های هواشناسی برای سازگاری با تغییرات اقلیمی است.