Indian Journal of Fundamental and Applied Life Sciences ISSN: 2231-6345 (Online)
An Open Access, Online International Journal Available at http://www.cibtech.org/jls.htm
2014 Vol. 4 (3) July-September, pp.552-558/Dinpanah and Javanmard

Research Article

INFLUENCING FACTORS ON FEASIBILITY OF PRECISION AGRICULTURE IN IRAN

***Gholamreza Dinpanah and Ali Javanmard**
Department of Agricultural Extension & Education, College of Agriculture, Sari Branch, Islamic Azad University, Sari, Iran
**Author for Correspondence*

ABSTRACT
The purpose of this study was factors affecting feasibility of precision agriculture. The search population consisted experts in Iran. By using randomized sampling method, 186 selected as statistic sampling. The methodological approach of this stud was descriptive-correlative. Validity of the instrument was established by a panel of experts consisting of senior faculty members and research committee advisors. Reliability analysis was conducted by using Cronbach alpha formula and result was 0.83.The results showed that 2.7, 50 and 47.3 percent of experts expressed that feasibility of precision agriculture were low, moderate and high respectively. The results of multiple regression analysis revealed that technological factors explained a variation of 37.1 percent of feasibility of precision agriculture.

Keywords: *Feasibility, Precision Agriculture, Iran*

INTRODUCTION
Undoubtedly, every one knows that importance of the food and nutritional security are among the challenges of the population in one hand and shortage of the cultivable lands in other hand, have moved the humankind towards increasing the performance in the level unit. Furthermore, the lack of water and sensitivity of the scientists to preservation of the environment and of the energy resources has caused the experts of the agriculture sciences to develop the new methods in the management of the farm, optimize the in puts consumption, and increase the performance and finally raise the economical yield. The precision agriculture entered the new technology world in the direction of such purposes (Sadeqhipour, 2007). In fact, the precision agriculture is a systemic technique for the selected management of the product and agricultural lands based on their certain needs; meanwhile, many specialties have been applied and the newest tool and information technology methods have been integrated in order to rehabilitate the directors for access to a better understanding of their farms conditions and the better control of them (Alboozahr, 2004). More exact application of the inputs through the precision agriculture many decreases the undesired bioenvironmental consequences (Mondal and Tewari, 2007; Robert *et al.*, 2002; Dobermann *et al.*, 2004).

Iran as a developing country, consist many capabilities for exploitation of the precision agriculture. Given the existence of the wide agriculture lands, the problem of the shortage of irrigation water, being semiarid of the most of the regions of the country and regarding the information technology level and also the current machines that can be changed to the semi-intelligent ones by installation of some systems, the precision agriculture can be applied given some preparations. The precision agriculture concept that has been grounded based on the information technology, has been changed to an interesting view for the management of the natural resources and achieving the modern development of the firmament agriculture, and has given a new concept of the permanent application of the agricultural resources (Wang, 2001). This concept can prepare the various productive methods for the agricultural producers by allowing the precision management of the inputs (Watson *et al.*, 2005). Increasing of the product profit and in conclusion, more production of the nutritional materials due to the increase of the population, optimization of the consumption of the restrict resources such as water, seed and fertilizer, reduction of the bioenvironmental and ecological effects, reduction of the costs, reduction of erosion and reduction of the agricultural losses and employment of the intelligent machines are among the precision agriculture purposes (Reichardt and Turgens, 2009).

In study about the recognition of the technological educational needs of the agriculture experts for adoption of the technologies of the remote testing in the precision agriculture in Pakistan, it was determined that two variables of age and work precedence have a significant correlation with the knowledge of the agriculture experts about the concepts of the remote testing. In the regression analysis, it was determined that the work precedence is significant in the explanation of the difference in the knowledge of the experts (Ashraf, 2007).

Batte (2010) Conducted a research in relation to the adoption of the precision agriculture tool by the farmers and selected 3500 farmers with the income of 50000 Dollar or more and results were obtained that adoption rate and the way of the precision agriculture adoption depend on the factors such as the farm area, annual income of the people and the plant kind.

Najafabadi *et al.,* (2011) Showed that the legitimate, technological, educational and economical factors are necessary for the development of the precision agriculture, so that they explicate the changes of the precision agriculture in percentages as the following: the technological factors about 15 percent; thy economical factors about 20 percent; the educational factors about 18 percent and the legitimate factors about 11 percent.

Reichardt *et al.,* (2009) Showed that the reduction of the technological costs, assertion of the benefits of the precision agriculture and the development of the same standard for compatibility among the different resources are the most important pre-need of the adoption of the precision agriculture in Germany. Also the specialized educational courses about the precision agriculture can be effective in the adoption of the precision agriculture.

Kutter *et al.,* (2009) Obtained these results about the role of the communications and interactions in the adoption of the precision agriculture that the common making the technological operations of the precision agriculture to be common, and the application of the external resources can be effective in the reduction of the costs and the adoption of the precision agriculture.

Winstea and Fulton (2010) Showed that the precision agriculture is a way for the intense management in the farms and the adoption of the precision agriculture in US increases quickly among the farmers, also they use the technologies of the precision agriculture to apply better the inputs, resolutions and the management of the information.

Velania *et al.,* (2010) Showed that the US farmers use extension as an information resource for the precision agriculture. Also the younger and more knowledgeable farmers with the better income tend more to use the extension as the information resource for access to the precision agriculture. Also the precision agriculture helps the extensional program to be designed better. The precision agriculture is fulfilled in the tropical parts of the big farms in Mexico and South Africa (Swinton and Lowenberg, 2006). Program of the integrative cultivation management with GIS for tea is developing in India (Mondale and Basu, 2009).

Adrin *et al.,* (2007) divide the precision agriculture benefits to 3 groups in a study under the factors affecting the adoption and application of the precision agriculture: 1-the economical benefits: 2-using the information for the management strategies; 3-the environmental information.

Argentina, Brazil, China, India, Malaya among the developing countries and the other countries have began to adopt the precision agriculture factors specially in their farms, But still the adoption had been very limited (Srinivasan, 2006).

The purpose of this study was to determine effect of factors on feasibility of precision agriculture. In order to achieve this objective, specific objectives are presented as below:

- Study of feasibility of precision agriculture
- Relation of social, economical, educational, technological and policy making factors with feasibility of precision agriculture
- The role of social, economical, educational, technological and policy making factors on feasibility of precision agriculture

MATERIALS AND METHODS

In relation to objective, this research is functional, since the results can be employed by programmer and policy makers. In order to reach precise and reliable data we used quantitative method. Because this research simply investigates existed conditions and defines them and there is no possibility to control or manipulate the variables, it is descriptive.

Because the gathering of information about the views, beliefs, thoughts and behaviors or group characteristics of a society is statistical and also it is under recognition, so it is measuring. Furthermore, because it investigates and analyzes the relations between independent and dependent variables, it is correctional. Statistical society of this research involve all the gathering experts of agriculture organization in Mazandaran Province, Iran (N=360).

Random sampling has been used in this research and the community was sampled by using of Cochran formula (n=186). Content and face validity were established by a panel of experts consisting of faculty members and some specialists. Minor wording and structuring of the instrument were made based on the recommendation of the panel of experts.

We gave the questionnaire to 25 experts which were similar to statistical society in regional, economical, cultural and social conditions. After gaining the data concluded the Cronbach alpha coefficient for all the variables with degree scale of 83%. Dependent variable was feasibility of precision agriculture. Independent variables include social, economical, educational, technological and policy making factors.

In order to determine the social factor we measured 6 questions, 5 questions for economical factors, 9 questions for educational, 8 questions for policy making and 6 questions for technological (none=0, very low=1, low=2, average=3, high=4, very high=5).

Consequently, the minimal score for social, economical, educational, policy making and technological was zero and the maximal was 30, 25, 45, 40 and 30, respectively.

Table 1: Validity of research variables

Variables	Cronbach alpha
Social factors	0.77
Economical factors	0.79
Educational factors	0.85
Policy making factors	0.75
Technological factors	0.75
Feasibility of precision agriculture	0.86

RESULTS AND DISCUSSION

Feasibility of precision agriculture

The feasibility of precision agriculture was measured by 18 questions including: 6 pieces spectrum of likret. Score giving to the mentioned spectrum was as follows: none=0, very low=1, low=2, average=3, high=4, very high=5. Then, the maximum score was 90, and the minimal was zero.

Table 2 illustrates the mean, coefficient of variance (C.V) and the rank of each question related to feasibility of precision agriculture, from the viewpoint of experts. According to the table, establish of multi-courses teams include agriculture scientists, training experts related to precision agriculture and constant joint between research and execution had been important related to feasibility of precision agriculture. Table3 shows the feasibility of precision agriculture.

According to results, 2.7 percent of experts expressed that feasibility of precision agriculture was low, 50 percent answered that it was moderate and the last 47.3 percent answer was high and very high. The mean of feasibility of precision agriculture was 54.8 and its measure standard deviation (SD) was 10.9.

Table 2: Priority of related questions with feasibility of precision agriculture

Items	M	SD	C.V	Rank
Establish of multi-courses teams include agriculture scientists	3.68	0.87	0.236	1
Training experts related to precision agriculture	3.69	1.01	0.274	2
Constant joint between research and execution	3.41	0.96	0.283	3
Some preparations for application of the low- cost strategies especially in the developing countries	3.42	1.05	0.308	4
Encouragement and supporting the private sector in order to in vest in the precision agriculture	3.28	1.06	0.322	5
Present of Information related to precision agriculture	3.66	1.18	0.323	6
Reveal of advantages of precision agriculture	3.28	0.93	0.324	7
Government investment rate for development of precision agriculture plans	2.98	1.13	0.347	8
Establish of research station of precision agriculture	2.99	1.09	0.367	9
Accomplishment of research projects in field of precision agriculture	2.94	1.09	0.373	10
Application of the farm precision management systems based on the experiences, experiment results	2.61	1.02	0.391	11
Dispose seminar and conference in field of precision agriculture	2.70	1.07	0.397	12
Training of initiator' farmers in field of precision agriculture	3.23	1.29	0.400	13
Access to internet in the rural	2.60	1.15	0.442	14
Education of farmers related effect of use of chemical matters	2.84	1.27	0.449	15
Evaluation of the farming systems in relation to the environmental effects	2.31	1.07	0.463	16
Political affairs of the country that can be effective in the possibility of precision agriculture implementation	2.53	1.23	0.485	17
Performance of government for land consolidation	2.28	1.30	0.572	18

None=0, very low=1, low=2, average=3, high=4, very high=5

Table 3: feasibility of precision agriculture from the viewpoints of participants

Situation	Frequency	Percentage	Cumulative percentage
Very low(0-18)	0	0	0
low(19-36)	5	2.7	2.7
Moderate(37-54)	93	50	52.7
High(55-72)	77	41.4	94.1
Very high(73-90)	11	5.9	100
Total	186	100	-

M = 54.8 SD = 10.9

Relation of Social, Economical, Educational, Technological and Policy Making Factors with Feasibility of Precision Agriculture

Fourth table showed intensity, relation orientation and a meaningful level of social, economical, educational, technological and policy making factors with feasibility of precision agriculture. As the table shows technological factors have 99 percent of meaningful and positive relation with feasibility of precision agriculture.

Table 4: The relation of social, economical, educational, technological and policy making factors with feasibility of precision agriculture

Variables	Pearson correlation coefficient	Significant level
Social factors	0.034	0.641
Economical factors	0.090	0.221
Educational factors	0.044	0.554
Technological factors	0.609**	0.000
policy making factors	0.039	0.597

*p<0.05 **p< 0.01

The Role of Social, Educational, Economical, Technological and Policy Making Factors on Feasibility of Precision Agriculture

In order to predict the role of research variables on feasibility of precision agriculture, we used step by step regression. Analyzing the regression enables the researcher to predict the variance of dependent variable through independent variables and determine the role of every independent variable in explanation of dependent variable. In step by step method, the strongest variables enter the equation one after another. This process goes on until the errors of meaning exam reaches to 0.05 errors. Results showed technological factors enter the equation in one of step. This means that technological factors have the influence on feasibility of precision agriculture. This factor alone explained 37.1 percent of variance in dependent variable.

Table 5: Analyzing the regression of feasibility of precision agriculture

Step	R	R Square	Adjusted R Square	F	sig
1	0.609	0.371[a]	0.367	108.43	0.000

a: technological factors

Table 6: The standardized and non- standardized coefficients of feasibility of precision agriculture

Variables	B	Beta	t	Sig
technological factors	1.59	0.61	10.41	0.000
Constant	29.08	-	11.39	0.000

According to the amount of beta in table 6, we can write the regression equation as follows:

$\mathbf{Y= 0.61X_1}$

X_1 = technological factors

Conclusions

This study aimed at studying the feasibility of precision agriculture, indicated that half of the respondents (47.3 percent) believed that feasibility of precision agriculture was high. According of results establish of multi-courses teams include agriculture scientists, training experts related to precision agriculture and constant joint between research and execution had been important related to feasibility of precision agriculture. Results from analyzing the Pearson correlation showed that technological factors have 99 percent of positive and meaningful relation with feasibility of precision agriculture. Results show that the correlation level of technological factors with feasibility of precision agriculture was equal to 0.61. According to Davis table these correlations were in high level. Furthermore, the results of step- by- step regression illustrated that technological factors explained 37.1 percent of variance of feasibility of precision agriculture. These results conform to the researches of Shirkhani (2009); Ashraf (2007); Adrin *et al.*, (2007); Nagafabadi *et al.*, (2011); Kutter *et al.*, (2009); Winstead and Fulton (2010); Batee (2010). According on result suggest that establish of multi-courses teams include agriculture scientists and inclusion of the policies of the precision agriculture plan in the national developmental programs of the country and the valuation of these plans after their implementation for more proper carrying out of the mentioned plans in the next cultivation season and establishment of the research centers and using some

programs for the application of the precision agriculture and gradual transformation of this technology to the special regions can spread the possibility of the precision agriculture. Also education and training of the specialized and skilled human force, increasing of the interactions and coordination between the research parts and exertion for more partnership of the farmers, experts and researchers in relation to the precision agriculture implementation and the exact survey and of the forms and the current status of the farmers for the recognition of the results of the researches in the fulfillment of the precision agriculture can pay the way for the precision agriculture in the country.

REFERENCES

Adrin AM, Norwood SH and Mask PL (2007). Producers' perceptions and attitudes toward precision agriculture technologies. *Computers and Electronics in Agriculture* **48**(3) 256–271.

Alboozahr A (2005). *Precision Agriculture Principles and its Application Field in the Country Agriculture* (Sonboleh publication) **47** 149-150.

Ashraf E (2007). In-service educational needs of agricultural officers for adaptation of Remote Sensing technology for precision agriculture in the province of Baluchistan, Pakistan. Unpublished doctoral dissertation, Mississippi State University, Mississippi State, Mississippi. Available: http://proquest.umi.com/pqdweb

Batte MT (2010). Adoption and Use of Precisions Farming Technology in Ohio. Available: www.eado.ag.ohio-state.edu.

Breazeale D (2006). A precision agriculture fertilization program for alfalfa hay production: will it pay for itself, Fact Sheet-07-23, University of Nevada Cooperative Extension, Reno.

Dobermann A, Blackmore S, Cook SE and Adamchuk VI (2004). Precision farming: Challenges and future directions. *Proceedings of the 4th International Crop Science Congress, 26 Sep- 1 Oct, Brisbane, Australia.* Available: http://www.cropscience.org.au/icsc2004

Kutter T, Tiemann S, Siebert R and Fountas S (2009). The role of communication and cooperation in the adoption of precision farming. *Precision Agriculture.* DOI 10.1007/s11119-009 9150-0.

Mondal P and Basu M (2009). Adoption of PA Technologies in India and Some Developing Countries: Scope, Present Status and Strategies. *Progress in Natural Science* **19** 659-666

Mondal P and Tewari VK (2007). Present status of precision farming: a review. *International Journal of Agricultural Research* **2**(1) 1-10.

Omidi Najafabadi M, Farajollah Hosseini SJ and Bahramnejad S (2011). Perception of specialists about precision agricultural requirements; Bayesian confirmatory factor analysis. *Journal of Agricultural Technology* **7**(3) 575-587.

Reichardt M and Jürgens C (2009). Adoption and Future Perspective of Precision Farming in Germany: Results of Several Surveys among Different Agricultural Target Groups. *Precision Agriculture* **10**(1) 73-94.

Reichardt M, Jurgens C, Kloble C, Huter J and Moser K (2009). Dissemination of precision farming in Germany: acceptance, adoption, obstacles, knowledge transfer and training activities. *Precision Agriculture* **10** 525-545.

Robert RK, English BC and Larson JA (2002). Factors Affecting the Location of Precision Farming Technology Adoption in Tennessee. *Journal of Extension* [On-line] **40**(1). Available: http://www.joe.org/joe/2002february/rb3.html

Sadeghipour M (2008). *Precision Agriculture* (Industry and agriculture publication) 105.

Shirkhani M (2010). Relative possibility of the precision agriculture in the view of the emperts of the agriculture (Jehad) organization in Tehran province. *M.S thesis*, Tarbiat Modares University, Iran.

Srinivasan A (2006). *Handbook of Precision Agriculture-Principles and Application* (Food products press-the Haworth press Binghamton, NY).

Swinton SM and Lowenberg DJ (2006). Global adoption of precision agriculture technologies: who, when, why? *Proceedings of the Third European Conference on Precision Agriculture* 557–562.

Velandia M, Lambert DM, Jenkins A, Roberts RK, Larson JA, English BC and Martin SW (2010). Precision Farming Information Sources Used by Cotton Farmers and Implications for Extension. *Journal of Extension* **48**(5).

Wang M (2001). Possible adoption of precision agriculture for developing countries at the threshold of the new millennium. *Computers and Electronics in Agriculture* **30** 45–50.

Watson S, Segarra E, Lascano R, Bronson K and Schubert AM (2005). Guidelines for Recommending Precision Agriculture in Southern Crops. *Journal of Extension* **43**(2) [On-line].

Winstead A and Fulton J (2010). Getting Started with Precision Agriculture. *Better Crops* **94**(3) 29-31.