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Influencing factors on feasibility of precision agriculture in regard to infrastructures in Iran

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ABSTRACT

The purpose of this study was factors affecting feasibility of the precision agriculture in regard to infrastructures. The search population consisted experts and researchers in Iran. By using randomized sampling method, 188 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 9, 62.8 and 28.2 percent of experts and researchers expressed that feasibility of the precision agriculture in regard to infrastructures were weak, moderate and good respectively. The results of multiple regression analysis revealed that attitude; political, economic, educational factors explained a variation of 23 percent of the precision agriculture in regard to infrastructures.

Key words: feasibility, infrastructures, precision agriculture.

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 [14]. 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[2].More exact application of the inputs through the precision agriculture many decreases the undesired bioenvironmental consequences [9], [13], [5], [6].

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 [19]. This concept can prepare the various productive methods for the agricultural producers by allowing the precision management of the inputs [20]. 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 [11].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 [3].

Batte [4] 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.

Omidi Najafabadi et al [10] 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 [12] 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 [7] 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 [21] 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 [18] 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 [17].Program of the integrative cultivation management with GIS for tea is developing in India [8]. Adrin et al [1] 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 [16].

MATERIALS AND METHODS

This research is a correlation-descriptive. The statistical population of this research includes all of the agriculture experts and researches of the agriculture organization of Iran (N=360) who have bachelor diploma and higher in one of the agriculture branches. Random sampling has been used in this research and the community was sampled by using of Cochran formula (n=188). Several of the questionnaires were given to the professors and some of the experts of the agriculture organization in order to determine the validity, and the preliminary testing was taken for the determination of the validity of the research tool and access to the variance for the sampling. In this test, the mentioned questionnaire was given to 25 experts who were similar with the statistical sample in term of the social, cultural, economical and climatic conditions .when data were extracted, coefficient was estimated for all of the variables with rating Cronbach's alpha Scale equals with 0.83.

RESULTS AND DISCUSSION

Feasibility of the infrastructures

Feasibility of the precision agriculture in regard to infrastructures was measured with 13 questions that have 6-choices spectrum Likert. Scoring for the mentioned spectrum was as the following: 0=Nothing; 1= very little, 2=little, 3=moderate, 4=high, 5=very high; so, the maximum score was 65 and the minimum one was zero. Table (2) show the average, rating and changes coefficient of each of the infrastructures needed for the precision agriculture in the experts and researchers view. Based on the table, performance of government for land consolidation, application of the farm precision management systems based on the experiences, insight, experiment results, access to internet in the rural in order to achieve the cost, climate, price and Government investment rate for development of precision agriculture plans were considered the most important infrastructures of the precision agriculture. Table 3 shows the feasibility of the precision agriculture in regard to infrastructures. Given the results, 0.5 percent of the respondents considers the feasibility of precision agriculture in regard to infrastructures very little, 8.5 percent little, 62.8 percent; moderate and 28.2 percent regard it as good. Average feasibility of precision agriculture in regard to infrastructures was 34.5 and it is standard deviation was 7.9.

Table 2: prioritization of the respondents view towards the status of the infrastructures needed for the precision agriculture (n=188)

infrastructures	Mean	SD	C.V	Rank
Performance of government for land consolidation	3.90	1.09	.279	1
Application of the farm precision management systems based on the experiences, experiment results	3.74	1.7	.285	2
Access to internet in the rural in order to achieve the cost, climate, price	3.66	1.07	.292	3
Government investment rate for development of precision agriculture plans	3.80	1.11	.293	4
Evaluation of the farming systems in relation to the environmental effects	3.81	1.13	.296	5
Political affairs of the country that can be effective in the possibility of precision agriculture implementation	3.79	1.13	.298	6
Encouragement and supporting the private sector in order to in vest in the precision agriculture.	3.59	1.08	.302	7
Measurements for preparation of the precision agriculture soft wares that are appropriate for the poor economical conditions of most of	1.48	1.08	.728	8
Some preparations for application of the low- cost strategies especially in the developing countries	1.37	1.02	.746	9
Some programs for implement action of the precision agriculture in the big commercial and cultivation farms	1.47	1.10	.748	10
Establishment of the agriculture co operatives for preparation of the high- cost technologies such as GIS, GPS, and RS.	1.28	1.03	.8.9	11
Enact ion of some laws for presentation form infinite use of the agriculture inputs in order to preserve environment	1.34	1.11	.831	12
Farming multi-courses teams include agriculture scientists ,engineers, manufactures and economists for study of the whole perspective of the precision agriculture	1.28	1.12	.873	13

Likert 6 item spectrum, nothing=0, very little=1, little=1, moderate=2, high=3, very high=5

Table3: Feasibility of precision agriculture in regard to infrastructures from respondents view

situation	Frequency	Frequency%	Cumulative frequency%
Very little(0-13)	1	0.5	0.5
Little(14-26)	16	8.5	9
Moderate(27-39)	118	62.8	71.8
Good(40-52)	53	28.2	100
Very good(53-65)	0	0	100
Total	188	100	-

Table4: relationship between the attitude, technological, policy-making, educational economical and social factors and the innovation characteristics and the feasibility of the precision agriculture in regard to infrastructures

Variables	Pearson coefficient	significance level
Social factors	0.011	0.879
Economical factors	-0.091	0.217
Educational factors	-0.025	0.737
policy – making factors	0.205**	0.005
Technological factors	0.133	0.065
Attitude factors	0.342**	0.000
Relative advantage	-0.058	0.428
compatibility	0.049	0.506
complexity	-0.186**	0.010
observables	-0.132	0.071
Triability	-0.100	0.170

Study of the relationship between the attitude, technological, policy-making, educational, economical, social, innovation factors and feasibility of precision agriculture in regard to infrastructures

Table 4 show the amount, intensity and orientation of the correlation and the significant level. As the table shows, policy -making and attitude factors have positive and significant correlation with the feasibility of precision agriculture in regard to infrastructures and there is a negative and significant correlation between the innovation complexity and the feasibility of precision agriculture.

Effect of the attitude, technological, policy-making educational, economical, social and innovation factors on the feasibility of precision agriculture in regard to infrastructures

Step-by-step regression was used to predict the effect of the attitude, technological, policy-making, educational, economical, social, innovation factors on the feasibility of precision agriculture in regard to infrastructures. This regression analysis was done in five steps as the following:

- First step: In step one of regression analysis, attitude variable entered the equation. The value of multiple correlation coefficients (R) and determination coefficient were 0.342 and 0.117, respectively, meaning 11.7% of variation of feasibility of precision agriculture in regard to infrastructures is explained by this variable.
- Second step: In step of regression analysis, policy-making factors entered the equation. The value of multiple correlation coefficients (R) and determination coefficient were 0.383 and 0.147, respectively, meaning 3% of variation of feasibility of precision agriculture in regard to infrastructures is explained by this variable.
- Third step: In step of regression analysis, economical factors entered the equation. The value of multiple correlation coefficients (R) and determination coefficient were 0.422 and 0.178, respectively, meaning 3.1% of variation of feasibility of precision agriculture in regard to infrastructures is explained by this variable.
- Fourth step: In step of regression analysis, educational factors entered the equation. The value of multiple correlation coefficients (R) and determination coefficient were 0.454 and 0.206, respectively, meaning 2.8% of variation of feasibility of precision agriculture in regard to infrastructures is explained by this variable.
- Fifth step: In steps of regression analysis, observables variable entered the equation. The value of multiple correlation coefficients (R) and determination coefficient were 0.479 and 0.229, respectively, meaning 2.3% of variation of feasibility of precision agriculture in regard to infrastructures is explained by this variable. In general, the five variables that were mentioned explained 22.9 percent of the variation of feasibility of precision agriculture in regard to infrastructures.

Table5: the coefficients of the determination of influential variables on the feasibility of precision agriculture in regard to infrastructures

Step	Variables	Multiple correlation coefficients (R)	Determination coefficient(R2)
1	Attitude factors	0.342	0.117
2	policy-making factors	0.383	0.147
3	economical factors	0.422	0.178
4	educational facto	0.454	0.206
5	observables	0.479	0.229

Table6: Stepwise regression for implications influencing factors on feasibility of precision agriculture in regard to infrastructures

Variables	B	Beta	t	Sig.
constant	25.60	-	3.57	0.000
Attitude factors(X1)	0.86	0.38	5.73	0.000
policy-making factors(x2)	0.52	0.28	3.95	0.000
economical factors(X3)	-0.36	-0.17	-2.55	0.012
educational factors(X4)	-0.36	-0.18	-2.49	0.014
Observables(X5)	-0.40	-0.15	-2.32	0.021
	F=10.82		SigF=0.000	
	R=0.479		R^2=0.229	

$$Y=25.6+0.86X_1+0.52X_2-0.36X_3-0.36X_4-0.4X_5$$

CONCLUSION

Among all factors, attitude and policy-making factors have positive significant relationship with feasibility of precision agriculture. These correlations are 0.205 and 0.342 respectively, and they are the medium level. There is a negative and significant relationship in the level of 95 between the complexity of the innovation and feasibility of precision agriculture in regard to infrastructures. In other words; the innovations that are given in the precision agriculture should have little complexity in order to be understandable for the exploiters. This coefficient equals with 0.186 and it is in low level .the results of the step-by step-regression show that the educational, economical, policy-making and attitude factors and the operability entered the regression equation during five steps that finally they explicate 22.9 percent of the variation of feasibility of precision agriculture. These results conform to the researches of [15]; [3]; [1]; [10]; [7]; [21]; [4].

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. It is suggested that for the development and extension of the precision agriculture the policy-making and economical factors should be more not iced and also we improve the attitude towards the precision agriculture and the technological factors should be considered. It is suggested that for the development and extension of the precision agriculture, the innovation in the precision agriculture should be given and they should have little complexity in addition to the relative advantage in order to be more understandable. It is suggested that for the development and extension of the precision agriculture. The educational courses increase in this field between the experts and researchers also we should try to unite the lands of the farmers, to apply the systems of the precision management of the farm, to access to the internet in the rural and in crease the investments of the government.

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