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A Feasibility Study on the Application of Precision Agriculture for Productivity of Manufacturing and commercialization of Organic Crops

Mohsen Poorzabolzade [1], Azita Zand[2], Sahar Dehyouri [3]

1-M.S in Agriculture Management, Department of Agriculture, Islamic Azad University, Islamshahr Branch, Islamshahr, Iran
2,3-Assistant Professor of Agricultural Extension & Education, Department of Agriculture, Islamic Azad University, Islamshahr Branch, Islamshahr, Iran

Abstract

The purpose of the present research is a feasibility study on the application of precision agriculture for productivity of manufacturing organic crops from the viewpoint of experts in agricultural department of Tehran province. The sample population of the present research consists of all experts of Agricultural Department of Tehran who are more than 210 people out of which 132 people were selected by simple random sampling method as volume sample. Prioritizing in relation to the effective social factors on the ability of performing precision agriculture for productivity of organic crops with 0.230 coefficient of changes, partnership of farmers and researchers in all stages of production, evaluating and promoting results obtained by researches and assessments for precision agriculture, effective economic factors with 0.182 coefficient of changes, having enough budget for conducting the research and its relationship with precision agriculture among agricultural farms, factors for effective policy making with 0.268 coefficient of changes, regarding plans of precision agriculture as fundamental issue within framework of macro-policies of agriculture and rural development of Iran are deemed as the top priorities. Prioritizing forms based on coefficient of changes revealed from the viewpoint of experts of Agricultural Department, the highest priority for technology related to level of consists of Tillage, Micronutrients and Pesticides. Prioritizing the viewpoint of experts of Agricultural Department in relation to application of precision agriculture for producing organic crops with change coefficient of 0.219, 0.214 and 0.213 are related to increasing economic return, increasing income of producers as well as reducing production costs.

Key Words: Feasibility Study, Application, Precision Agriculture, Productivity, Organic Crops

Introduction

Agriculture has created abundant evolutions in the world. Industrial countries benefit from modern agricultural system with high level of productivity and advanced technology. Most of the developing countries population is still applying from traditional type of agriculture with limited application of advanced technologies in the majority of rural areas. Limitation and monopoly are the main reasons for the retardation of agricultural science and technology (Islamian 2013). In the present century, some important problems such as increasing health considerations for human and environmental pollution from one hand and the necessity of reducing consumption of inputs and sustainable development of agriculture from the other hand have enforced us to apply modern technologies such as precision agriculture (Bagheri 2013). In

precision agriculture, instead of regarding total farm as a managerial unit, the managerial policies are applied to small areas of a farm. This task, in turn, increases the level of management by focusing on the right needs of customers. Precision agriculture is an integrated managerial system that attempts to focus on compatibility of type and amount of inputs based on real requirements of crops in smaller parts of the land (Bakhtiari 2013). Principles of precision agriculture shall be executed in the developing countries due to the following two reasons including: retailer products of traditional owners (like coffee) in many years ago afford the life of many retailer farmers which is presently faced with a great crisis. Here, the main focus is exerted on the recognition and management of best places for production and management. Another choice is the places that are less applied for culturing agricultural crops, which may be replaced with the other products like grass for enabling farmers to increase diversity of their crops. On the other hand, new export crops including fresh fruits, cotton, oil palm and banana are in the focal point of attention for being supplied to local and export markets. Thus focusing on their culture and quality of crops (Cook et al 2003) is required. In Indonesia, it is applied by GIS for re-evaluation of suitable agricultural lands. This system is suitable for recognizing the fertile lands and the best crops in a specific zone (Mondal & Basu 2009). The significant area of agricultural lands of Khuzestan province in Iran is dealing with mechanized planting of Saccharum with frames of developing Saccharum and additional industries. These farms benefit from a suitable structure, drainage, land leveling, land dividing and irrigation. In order to apply precision agriculture system, it is necessary to have access to Global Positioning System (GPS), harvest machines equipped with tools for measurement of crops, sampling and testing soil, software for managerial information especially Saccharum, tractors and other tools equipped with systems for precise applying the inputs. The farms for producing Saccharum in Khuzestan province, in compliance with economic and environmental considerations, have suitable potentials for applying precision agriculture. According to the level of research in Iran, there is the potentiality of applying precision agriculture through analyzing data obtained from protecting performance of crops. Moreover, designing, producing and evaluating performance assessment system has suitable results for Saccharum (Abolzahar 2005). A research under the title of “Feasibility study of application of precision agriculture system for producing pistachios in Rafsanjan city from viewpoint of agricultural experts” concluded that according to the results of correlation analysis and multi-regression, the highest priority is allocated to the application of precision agriculture system including Tillage, map for soil structure, plan for performance of trees and the other issues (Zare Mehrjerdi et al, 2015). Educating professional experts and counselors, establishing scientific association, planning university syllabus related to organic agriculture, introducing organic agriculture through mass media are all effective on increasing application and awareness of the people of the topic of organic agriculture

(Elhamoly et al, 2014). Feasibility Study of Application of Precision Agriculture for Productivity of Manufacturing Organic Crops from Viewpoint of Experts of Agricultural Department of Tehran Province is the overall objective of this research.

Materials & Methods: The present research is regarded as an applied research whose methodology is descriptive-correlation. The theoretical and qualitative parts of the research were performed on documentary method and the quantitative part of research was conducted on field method using questionnaires. Results of Cronbach's alpha for the questionnaire of IT and communication part was obtained as 0.88. The sample population of the present research is all agricultural experts of Tehran province who are 210 people and the volume sample based on Cochran's formula was obtained as 132 subjects that were selected by simple random sampling method. In order to describe the research variables, the research benefited from statistical properties including: table of distributing frequency, percentage of frequency, cumulative frequency, average, standard deviation, coefficient of changes, maximum and minimum values. In order to calculate and determine the content validity of the questionnaire, the questionnaire was confirmed by scholars and experts.

Results:

- Individual Properties of Agricultural Experts: According to the results of the research, the experts average age of Agricultural Department of Tehran province is 46 years; in which the youngest one is aged 27 and the oldest one is aged 67. 76% of the experts are male and the remaining 24% are female. Regarding their education, 13.9% of the experts held Diploma of High School; 25.4%, Associate Degree; 50%, Bachelor's Degree; and 10.7%, Master's Degree. Average service record of the experts was 16 and the minimum and maximum service records were 3 and 30 respectively.

- Prioritizing effective social factors on ability of applying precision agriculture system for productivity of manufacturing organic products: As it is presented in Table 1-1, the prioritizing forms based on coefficient of changes show that the highest viewpoint of Agricultural Department experts in relation to the effective social factors of applying precision agriculture system for manufacturing organic crops with coefficient of changes including: 0.230, 0.251 and 0.269 which include partnership of farmers, researches and scholars in all stages of production, evaluation and progress results of research and assessment for precision agriculture system, establishing association of farmers as active agricultural organizations for mutual communication among policy makers, planners and farmers for applying precision agriculture system and general status of farm and farmers as real condition for application of precise result of agricultural research.

- Prioritizing effective economic factors on ability of applying precision agriculture system for productivity of manufacturing organic products: As it is presented in Table 1-2, the prioritizing forms based on coefficient of changes show that the highest viewpoint of The Agricultural Department experts in relation to highest.

Table 1-1: Prioritizing viewpoint of experts of agricultural department in relation to effective social factors on application of precision agriculture system for productivity of manufacturing organic crops

Priority	Forms	Average	Standard Deviation	Coefficient of Change
1	Partnership of farmers, researchers and scholars in all stages of producing, evaluating and progressing results of research and evaluation for precision agriculture system	4.14	1.04	0.230
2	Establishing association for farmers as active agricultural organizations for mutual communication between policy makers, planners and farmers with the purpose of precision agriculture system	4.07	0.94	0.251
3	Attention to general status of farms and farmers as real condition for application of results of research with the purpose of precision agriculture system	3.89	1.05	0.269

Evaluation Level: 1: Very low 2: Low 3: Medium 4: High 5: Very high

viewpoint of the Agricultural Department experts in relation to the effective economic factors of applying precision agriculture system for manufacturing organic crops with coefficient of changes including: 0.205, 0.189, 0.182 which consist of preparing enough budget for conducting research related to precision agriculture system at farms, preparing enough and easy budget (loan without interest, loan without requirement for refunding) for farmers in order to buy required equipment for precision agriculture system, offering required financial encouragements for farmers with the purpose of executing precision agriculture system.

Table 1-2: Prioritizing viewpoint of the Agricultural Department experts in relation to effective economic factors on application of precision agriculture system for productivity of manufacturing organic crops

Priority	Forms	Average	Standard Deviation	Coefficient of Change
1	Preparing enough budget for performing research related to precision agriculture system at farms	4.16	0.76	0.182
2	preparing enough and easy budget (loan without interest, loan without requirement for refunding) for farmers in order to buy required equipment for precision agriculture system	4.15	0.78	0.189
3	offering required financial encouragements for farmers with the purpose of executing precision agriculture system	4.13	0.85	0.205
	Offering suitable subsidy for preparing inputs and required equipment for executing precision agriculture system	4.03	0.87	0.215

Evaluation Level: 1: Very low 2: Low 3: Medium 4: High 5: Very high

- Prioritizing effective policy-making factors on ability of applying precision agriculture system for productivity of manufacturing organic products: As it is

presented in Table 1-3, the prioritizing forms based on coefficient of changes show that the highest viewpoint of the Agricultural Department experts in relation to effective policy-making factors of applying precision agriculture system for manufacturing organic crops with coefficient of changes includes 0.278, 0.277 and 0.268. Regarding precision agriculture system plan as fundamentals within macro-system of structure and policies of agriculture and developing rural affairs, evaluation of precision agriculture system after each season of harvest for better execution aforesaid plan in the next harvest season, offering feedbacks of conducting research for executing precision agriculture system in farm for policy makers and planners with the purpose of determining research priorities for the subsequent researches.

Table 1-3: Prioritizing viewpoint of the Agricultural Department experts in relation to the effective policy-making factors on application of precision agriculture system for productivity of manufacturing organic crops

Priority	Forms	Average	Standard Deviation	Coefficient of Change
1	Regarding precision agriculture system plan as fundamentals within macro-system of structure and policies of agriculture and developing rural affairs	3.39	0.91	0.268
2	evaluation of precision agriculture system after each season of harvest for better execution aforesaid plan in the next harvest season	2.99	0.83	0.277
3	offering feedbacks of performing research for executing precision agriculture system in farm for policy makers and planners with the purpose of determining research priorities for next researches	3.20	0.89	0.278
4	Policy for allocation of agricultural inputs in compliance with obligations and requirements of precision agriculture system	3.35	0.94	0.280
5	Executing same-planting system for retailer farmers with the purpose of precision agriculture system	3.79	1.10	0.290

Evaluation Level: 1: Very low 2: Low 3: Medium 4: High 5: Very high

- Prioritizing Technologies of precision agriculture system: As it is presented in Table 1-4, prioritizing forms based on coefficient of changes show that from viewpoint of the Agricultural Department experts, the highest priority of technology is allocated to Tillage, micronutrients and pesticides. Prioritizing forms based on coefficient of changes show that from viewpoint of the Agricultural Department experts, the highest priority for technology of soil sampling includes topography map, slope and depth of soil, map for structure of soil and mesh map of soil. Prioritizing forms based on coefficient of changes show that from viewpoint of experts of agricultural department, the highest priority for technology of supervision over the performance includes map for performance of product, supervision of the performance of working with GPS and map for the performance of grain. Prioritizing forms based on coefficient of changes show that from the viewpoint of the Agricultural Department experts the highest priority for technology of sensors and other technologies

includes other technologies, long-distance assessment, aerial imaging and sensors for weeds.

Table 1-4: Prioritizing viewpoint of experts of agricultural department in relation to ability of using technology of precision agriculture system

	Forms	Average	Standard Deviation	Coefficient	Priority
Technology for level of variable	Tillage	4.29	0.57	0.122	1
	micronutrients	3.88	0.71	0.182	2
	Pesticides	3.598	0.780	0.216	3
	Irrigation	3.90	0.90	0.231	4
	Insecticide	3.64	1.03	0.282	5
	Fertilizer	3.71	1.11	0.299	6
	Fungicide	3.75	1.14	0.304	7
Technology of soil sampling	Map for topography, slope and depth of soil	3.14	0.80	0.254	8
	Map for structure of soil	3.42	0.94	0.274	9
	Sampling for mesh sol	3.44	1.06	0.308	10
	Map for electric directing soil	3.49	1.09	0.312	11
Technology of supervising performance	Map for performance of soil	3.681	0.902	0.245	12
	Supervision for performance with GPS	3.75	1.14	0.304	13
	Map for performance of grain	3.75	1.15	0.306	14
Technology of sensor and other technologies	Other technologies	3.99	1.69	0.423	15
	Long-distant assessment and aerial imaging	4.12	1.76	0.427	16
	Weed sensor	4.01	1.74	0.433	17

- Properties preparing suitable grounds for using precision agriculture system: As it is presented in Table 1-5, the prioritizing level of the agreement of the respondents with the application of precision agriculture system shows that the highest priority is cost-effective and compatible technology.

Table 1-5: Prioritizing for viewpoint of experts of agricultural department in relation preparing suitable grounds for using precision agriculture system

Priority	Forms	Average	Standard Deviation	Coefficient of Change
1	Cost-effective	4.41	0.63	0.142
2	Compatible technology	4.33	0.71	0.163
3	Accessible technology	4.27	0.75	0.175
4	Available technology	4.06	0.93	0.229

Evaluation Level: 1: Very low 2: Low 3: Medium 4: High 5: Very high

- Prioritizing for viewpoint of experts of agricultural department in relation to application of precision agriculture system for manufacturing organic crops: As it is presented in table 1-6, the prioritizing forms based on coefficient of change show that the highest viewpoint of the Agricultural Department experts in

relation to the application of precision agriculture system for productivity of manufacturing organic crops with change coefficient of 0.219, 0.214 and 0.213 include increasing economic return, increasing productive income and reducing production costs, maintaining environment and reducing environmental pollution, controlling pests and diseases of weeds.

Table 1-6: Prioritizing for viewpoint of the Agricultural Department experts **in relation to application of precision agriculture system for manufacturing organic crops**

Priority	Forms	Average	Standard Deviation	Coefficient of Change
1	Increasing economic return, increasing productive activity and reducing production cost	4.03	0.86	0.213
2	Maintaining environment and reducing environmental pollution	4.06	0.87	0.214
3	Controlling pests and diseases of weeds	4.10	0.90	0.219
4	Increasing production and performance of organic agricultural crops	3.96	0.89	0.224
5	Upgrading products quality	3.99	0.90	0.225
6	Optimum consumption of inputs (reducing consumed inputs)	4.05	0.93	0.229
7	Reducing agricultural waste materials	3.90	0.91	0.233
8	Recommendation for pattern of planting in compliance with potentials of area	3.83	0.96	0.250
9	Developing scientific and industrial agriculture	3.90	0.99	0.253
10	Developing sustainable agriculture	3.91	0.99	0.253
11	Management of changes and recognition of precise changing	3.92	1.03	0.262

Evaluation Level: 1: Very low 2: Low 3: Medium 4: High 5: Very high

Conclusion: According to the results of research, the average age of the Agricultural Department experts of Tehran province is 46, the youngest one is aged 27 and the oldest one is aged 67, 76% of the experts are male, the remaining 24% are female, 13.9% have High School Diploma, 25.4% have Associate Degree, 50% have Bachelor's Degree, 10.7% have Master's Degree and higher, average service record of experts is 16 years, minimum service record is 3 years and maximum service record is 30 years. Prioritizing forms based on coefficient of changes show that the first priority from the viewpoint of the Agricultural Department experts in relation to the effective social factors for ability of application of precision agriculture system for productivity of manufacturing organic crops include: partnership of farmers, researchers and scholars in all stages of production, evaluating and progressing the results of the research and evaluating plan of precision agriculture system. First priority from the viewpoint of the Agricultural Department experts in relation to the effective economic factors for application of precision agriculture system for productivity of manufacturing organic crops include: preparing enough budget for conducting the research related to precision agriculture system in farms. First priority from the

viewpoint of the Agricultural Department experts in relation to the effective policy-making factors for application of precision agriculture system for productivity of manufacturing organic crops include: plans of precision agriculture system as basic element with macro-system of structure and policy of agriculture and rural development. Research findings show that maximum persons in this study agreed and confirmed the offering aforesaid plans for application of precision agriculture system for productivity of manufacturing organic crops. Prioritizing forms based on coefficient of changes show that the first priority from the viewpoint of the Agricultural Department experts in relation to application of precision agriculture system for productivity of organic crops include: Increasing economic return, increasing income of productive, reducing production costs, maintaining environment, reducing environmental pollution, controlling pests and diseases of weeds. Priority of forms based on coefficient of changes from the viewpoint of Agricultural Department experts in relation to priority of agricultural technologies include: Tillage, micronutrients and pesticides, topography map, slope and depth of soil, map for structure of soil, sampling mesh of soil, map for performance of product, supervision of performance with GPS, map for performance of grain and other technologies, long-distant evaluation, aerial imaging and weed sensors. Prioritizing for adopting respondents in relation to the opportunities of using precision agriculture system show that the highest priority is related to the items of cost-effectiveness and compatibility of technology. Rajabi et al 2013 in his research entitled "Studying items of adopting organic agricultural crops from the viewpoint of consumers in Karaj city by using factor analysis has anticipated 4 effective factors for the adoption of organic products including: informing and education, improving access, improving properties of product, offering support facilities in which, these factors have accounted for 68.42% of the total variance. Adrian et al 2005 in the way of studying perceive and attitude of producers in relation to precision agriculture system, has benefited from the model of structural equations and multi-variable analysis and reported that attitude in the field of trust in application of precision agriculture system, perceiving net profit, farm size, level of education offered to farmer have positive influence on concept of adopting precision agriculture system. The study of Batte 2008 increases the level of adopting equipment of precision agriculture system with offering counseling, guiding and supervising products.

Recommendations:

- Providing appropriate conditions for more partnership of farmers and experts in precision agriculture system.
- Discovering compatible technology with process of producing crops, supplying enough budget and low-interest loan for buying required equipment for the farmers and experts are among the most important economic factors for the application of precision agriculture system.
- Regarding precision agriculture system as fundamental element within the framework of macro-system of structure and policy of agriculture and rural development of Iran.

- Allocation of required budget on behalf of government to more application of precision agriculture system in the organic crops.

References:

-Albo Zahr 2005, Fundamentals of precision agriculture system and opportunities for its application in the Iranian agriculture, Sonboleh Journal, 147, 149, 150 Islamian 2013, Studying impediments and limitations of application of precision agriculture system from the viewpoint of the Agricultural Department experts of Tehran, M.A. thesis, field of rural development, Faculty of Agriculture, University of Science and Research of Tehran

-Adrian, M.A., Norwood, S.H., & Mask, p.L. (2005), Producer's Perceptions and Attitudes towards Precision Agriculture Technologies, Computers and Electronics in Agriculture, 48, 256-271.

-Bagheri 2014, Feasibility study of application of precision agriculture system in Iran, Quarterly journal of Environment Engineering, Vol.3, Issue.1, Autumn 2014.

-Bakhtiari, A., Hematian, A. (2013). Precision Farming Technology, Opportunities and Difficulty, International Journal for Science and Emerging Technologies with Latest Trends, 5(1): 1-14.

-Batte, M. (2008). Survey: Number of farmers adopting precision agricultural tools soaring. Agriculture online, the Ohio state university, Retrieved from . http://www.csiro.au/science/precisionag/

-Cook, s. e. o brien, R, corner, R. J., & Oberthur, T. (2003). Is precision agriculture irrelevant to developing countries? Proceedings of the 4th European conference on precision agriculture, vol 115-119, The Netherlands: Wageningen Aacademic publishers, Available on the http://ciat-libarary. Ciat. cgiar. org/ documdnetos_electronicos_ciat/articulos_ciat/ID379-Cook-evised.pdf.

-Elhamoly, A. I., Koledoye, G. F., & Kamel, A. (2014). Assessment of Training Needs for Egyptian Extension Specialists (SMSs) in Organic Farming Field: Use of the Borich Needs Model. Journal of Agricultural & Food Information, 15(3), 180-190.

-Mondal, P., Basu, M. (2009). Adoption of precision agriculture technologies in India and in some developing countries: scope, present status, and strategies. Progress in natural science, available on the: http://www.sciencedirect.com.

-Rajabi Shabaanlai Femi Pouratashi 2013, Studying items of adopting organic agricultural crops from viewpoint of consumers (case-study of Karaj), Food science and industry, issue.38, period.10, spring, page.33-43

-Zare Mehrjerdi Khodaei Ziabadi Fathi 2015, Feasibility study of application of precision agriculture system in producing pistachios in Rafsanjan province from the viewpoint of the Agricultural Department experts, Journal of research for development and education of agriculture, 8th year, issue.3, Autumn 2015.