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

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Abstract

The purpose of present research is feasibility study of application of precision agriculture for productivity of manufacturing organic crops from viewpoint of experts of agricultural department of Tehran province. The statistical society of the present research consists of all experts of agricultural department of Tehran that are more than 210 persons and among this number, total number of 132 persons was selected by simple random sampling method as volume sample. Prioritizing in relation to effective social factors on 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 of researches and assessments for precision agriculture, effective economic factors with 0.182 coefficient of changes, having enough budget for performing 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 frame of macro-policies of agriculture and rural development of Iran are regarded as first priority. Prioritizing forms based on coefficient of changes reveal that from viewpoint of experts of agricultural department, the highest priority for technology related to level of changes are including: 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 0.219, 0.214 and 0.213 are related to increasing economic return, increasing income of producers and 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 population of developing countries is still applying from traditional type of agriculture with limited application of advanced technologies in most of rural areas. Limitation and monopoly are the main reasons of retardation of agricultural science and technology (Islamian 2013). In the present century, some important problems including: increasing health considerations for human, environmental pollution from one hand and necessity of reducing consumption of inputs, sustainable development agriculture from the other hand have enforced us for application of modern technologies including: precision agriculture (Bagheri 2013). In precision agriculture instead of regarding total farm as a managerial unit, the managerial policies

are applied over small areas of farm and this task increases the level of management by focusing on correct requirements of customers. Precision agriculture is an integrated managerial system that attempts for compatibility of type and amount of inputs based on real requirements of crops in smaller parts of land (Bakhtiari 2013). Principles of precision agriculture shall be executed in developing countries due to following 2 reasons including: retailer products of traditional owners (like coffee) in many years ago afford the life of many retailer farmers and at the present time, it is faced with a great crisis. Here, it is mainly focused on recognition and management of best places for production and management. Another choice is places that are less applied for culturing agricultural crops and may be replaced with 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 at center of attention for being supplied to local and export markets and thus it is required to focus on their culture and quality of crops (Cook et al 2003). At Indonesia, it is applied from GIS for reevaluation of suitable agricultural lands and this system is suitable for recognizing fertile lands and best crops for 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 through benefiting from suitable structure, drainage, land leveling, land dividing and irrigation. In order to apply precision agriculture system, it is necessary for having access to Global Positioning System (GPS), harvest machines equipped with tools for measurement of crops, sampling and testing soil, software for managerial information specially Saccharum, tractor 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 and according to the level of research in Iran, there is potential 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). In a research with title of "Feasibility study of application of precision agriculture system for producing pistachio 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 application of precision agriculture system including: Tillage, map for structure of soil, plan for performance of tree and 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 people from 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 General Objective of this research.

Materials & Methods:

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

Results:

- Individual Properties of Agricultural Experts

According to the results of research, the average age of experts of agricultural department of Tehran province is 46 years; in which the youngest one is aged 27 years and the oldest one is aged 67 years, 76% of experts are male and 24% of experts are female, 13.9% of experts have Diploma of High School, 25.4% have Associate Degree, 50% have Bachelor's Degree, 10.7% have Master's Degree, average service record of experts was 16 years, the minimum service records was 3 years and the maximum service record was 30 years.

- Prioritizing effective social factors on ability of applying precision agriculture system for productivity of manufacturing organic products:

As it is obvious in table 1-1, the prioritizing forms based on coefficient of changes show that the highest viewpoint of experts of agricultural department in relation to effective social factors of applying precision agriculture system for manufacturing organic crops with coefficient of changes including: 0.230, 0.251 and 0.269 are including: partnership of farmers, researches and scholars in all stages of producing, evaluating and progressing results of research and assessment for precision agriculture system, establishing association of farmers as active agricultural organizations for mutual communicating between 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 obvious in table 1-2, the prioritizing forms based on coefficient of changes show that the highest viewpoint of experts of agricultural department 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 experts of agricultural department in relation to effective economic factors of applying precision agriculture system for manufacturing organic crops with coefficient of changes including: 0.205, 0.189, 0.182 are including: Preparing enough budget for performing 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 experts of agricultural department 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 obvious in table 1-3, the prioritizing forms based on coefficient of changes show that the highest viewpoint of experts of agricultural department in relation to effective policy-making factors of applying precision agriculture system for

manufacturing organic crops with coefficient of changes including: 0.278, 0.277 and 0.268 are including: 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 performing research for executing precision agriculture system in farm for policy makers and planners with the purpose of determining research priorities for next researches.

Table 1-3: Prioritizing viewpoint of experts of agricultural department in relation to 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 obvious from table 1-4, prioritizing forms based on coefficient of changes show that from viewpoint of experts of agricultural department, the highest priority of technology is allocated to: Tillage, micronutrients and pesticides. Prioritizing forms based on coefficient of changes show that from viewpoint of experts of agricultural department, the highest priority for technology of soil sampling are including: 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 performance are including: Map for performance of product, supervision of performance of working with GPS and map for performance of grain. Prioritizing forms based on coefficient of changes show that from viewpoint of experts of agricultural department, the highest priority for technology of sensors and other technologies are including: Other technologies, long-distant 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 obvious in table 1-5, the prioritizing level of agreement of respondents with application of precision agriculture system show 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 obvious in table 1-6, the prioritizing forms based on coefficient of change show that the highest viewpoint of experts of agricultural department in relation to application of precision agriculture system for productivity of manufacturing organic crops with change coefficient of 0.219, 0.214 and 0.213 are including: 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 experts of agricultural department 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	Increasing quality of products	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 experts of agricultural department of Tehran province is 46 years, the youngest one is aged 27 years and the oldest one is aged 67 years old, 76% of experts are male, 24% of experts are female, 13.9% have Diploma of High School, 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 viewpoint of experts of agricultural department in relation to effective social factors for ability of application of precision agriculture system for productivity of manufacturing organic crops are including: Partnership of farmers, researchers and scholars in all stages of production, evaluating and progressing results of research and evaluating plan of precision agriculture system. First priority from viewpoint of experts of agricultural department in relation to effective economic factors for application of precision agriculture system for productivity of manufacturing organic crops is including: Preparing enough budget for performing research related to precision agriculture system in farms. First priority from viewpoint of experts of agricultural department in relation to effective policy-making factors for application of precision agriculture system for productivity of manufacturing organic crops is including: Regarding 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 are agree and confirmed with 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 viewpoint of experts of agricultural department in relation to application of precision agriculture system for productivity of organic crops are including: 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 viewpoint of experts of agricultural department in relation to priority of agricultural technologies are including: 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 opportunities of using precision agriculture system, show that the highest priority is related to item of cost-effectiveness and compatibility of technology. Rajabi et al 2013 in his research with title of "Studying items of adopting organic agricultural crops from viewpoint of consumers in Karaj city by using factor analysis has anticipated 4 effective factors for adoption of organic products including: Informing and education, improving access, improving properties of product, offering support facilities; in which, these factors have described 68.42% of total variance. Adrian et al 2005 in the way of studying perceive and attitude of producers in relation to precision agriculture system, has benefit from model of structural equations and multi-variable analysis and reported that attitude in the field of trust to application of precision agriculture system, perceiving net profit, size of farm, level of education offered to farmer have positive influence on concept of adopting precision agriculture system. The study of Batte 2008 increases level of adopting equipment of precision agriculture system with offering counseling, guiding and supervising over products.

Recommendations:

- Ability of creating condition for more partnership of farmers and experts in precision agriculture system
- Discovering compatible technology with process of producing crop, supplying enough budget and low-interest loan for buying required equipment for the farmers and experts are among the most important economic factors for application of precision agriculture system
- Regarding precision agriculture system as fundamental element within frame of macro-system of structure and policy of agriculture and rural development of Iran
- Allocation of required budget on behalf of government for more application of precision agriculture system for organic crops

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