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A Survey on the Comparison between Precision and Traditional Agriculture by Budgeting Method

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Abstract

The present study was conducted to compare precision and traditional agriculture by budgeting technique. Its statistical population consists of 210 experts in agricultural jihad organization of Qom province. The validity of Questionnaire as research tool ware confirmed by professors while its reliability was corroborated by Cranach's alpha to 0.78-0.94 intervals. According to the findings, there was the significant difference between economic, social, managerial, and training aspects for both precision and traditional agriculture on average. Also, there was the significant relationship between all economic, social, environmental, managerial and training aspects, limitation and policies on expert' s understanding on each concept of precision agriculture. The findings show that there was no significant relationship between all aspects, limitation and policies on precision agriculture and expert's understanding of each concept of precision agriculture. The findings were indicated that there was no significant link between correlation coefficient of environmental aspect and limitation to understanding the concept of precision agriculture. Results of regression analysis show that economic, social, managerial, training, policies of precision agriculture overall can be explained 44% of changes in independent variables. Also, results of budgeting sector show that there was the significant difference between cost and income of precision and traditional agriculture so that cost of the traditional production was much higher than precision agriculture.

Keywords: Precision Agriculture, Traditional Agriculture, Sense of Precision Agriculture, Agricultural Experts

1. Introduction

Agriculture has been the basis of supplying foods and survival of human civilizations and disrespecting it can yield to undesired consequences in terms of growth, development and splendor of societies. Currently, agricultural section has a special status as the source of supplying the food in global consumption basket and food security and strategic agricultural products have added to its importance. Initiatives by local farmers in territory management is extracted from empirical knowledge overtime is a special context which suggests their comprehensive perception on environment (Parhizirad, 2013). Traditional agricultural system has not achieved a global plausible success in using and managing resources since using chemical poisons and fertilizers would lead into the emergence of unsustainable farming ecosystems, environment pollution, quantitative and qualitative reduction in products and energy efficacy (Pourzabolzadeh, 2016). In addition to damages from environment destruction, damages on human survival is another outcome of natural resources destruction due to using improper manufacturing patterns and one can point out

unsustainability of manufacturing systems and using agriculture and destroying basic resources as the result of limiting manufacturing facilities (Bordbar & Moosavi, 2011). It was toward such target that since the beginning of recent decade, precision farming issue is raised. Obviously, we are facing with different variables in an even small firm. Differences in soil features at different parts of a farm on the one hand and different needs of plants and other factors on the other hand requires change management proportionate to each part of the farm. Such need to change management has been the main philosophy of the emergence of precision farming system (Hassanpour, 2013). It seems that future generations will be forced to turn to such a way, given the major challenges facing the world today in terms of water, food, environmental pollution and energy resources. Obviously, such a management system, given the technology and advanced tools that it requires, will apply to large-scale farms and their economic justification for them. Accordingly, unlike advanced countries that have paid particular attention to this kind of farming system, developing and underdeveloped countries continue to use improved cultivars and in some cases prefer biotechnology to use such methods, although the future will require other requirements. (Amoon, 2014). The findings of a study by Zare Mehrjerdi et al (2015) indicated mechanization ratio and credit/training facilities, the promulgation of agriculture section has positive impacts on productivity growth.

In their study, Arayesh and Saboory (2015) indicated that there is a positive and significant relationship between economic requirement, policymaking requirement and training how to use precision farming in in significance level of 1% and training, social, managerial and cultural requirements and training how to use precision farming in significance level of 95%. A study by Esfandiyari et al. (2014) states that in long term, mechanization ratio and per annum income have positive impact on food security of rural households while the impact of food price on food security of rural households is negative. Shirkhani et al. (2013) believe that expert's awareness of precision farming is low to medium and there is significant difference between variables such as age, job records and educational level with awareness on precision farming, interests in learning modern technologies, awareness of conducted activities, participation in training courses, visiting research farms and getting information through scientific and research articles. By using minor budgeting technique and English Method, Shirvanian et al; (2013) indicated that low economic threshold of cotton irrigation ratio to consumed water in total irrigation level yields to 31% saving in irrigating water. In a study by Hosseini et al (2010), a significant relationship between training, economic, technical, managerial and policymaking factors with the possibility of using precision farming is pointed out. Bordbar (2009) showed that precision farming in Iran can aid agricultural products production management adapted to environment. By using unique regional information, precision farming can target the amount of fertilizer, seeds and chemical materials for soil and other conditions. Najafabadi et al (2011) believe that training, economy, administrative features, technical skills, data quality, risk-taking, high risks, time, academic training and incompatibility are, inter alia, challenges for executing precision farming. In this vein, training and economic challenges are more important and training challenges, lack of local experts, lack of understandable researches and lack promulgating staff are more influential than other variables. Omidi and Dinpanah (2013) studied affecting factors on precision farming feasibility study on its infrastructures in Iran. The findings from a multiple regression analysis in this study indicated that political and economic attitudes and varied training factors constitute 32% of precision farming infrastructures. Richardt et al (2009) reported that training the farmers plays a vital role in accepting modern technologies. This study recommends to pay attention to proper consultative services, acquiring more information and training modern issues to farmers. Likewise, he emphasizes that initial challenges from precision farming execution would deter more continuance by farmers in using such technology while more farmers who have removed initial challenges have been satisfied by executing this production system. The results from another research on correlation between small farms and farmers' educational level indicate that there is positive and significant relationship between producers' training level and the productivity of their farms (Onphanhdala, 2009). Based on conducted researches and studying current conditions, it seems that the main problem is to compare using precision farming instead of traditional one which is conducted by the aim of a comparative study on two types of traditional agriculture in terms of budgeting and providing guidelines in order to improve the usage of precision agriculture. The general purpose of this article was to compare agriculture with traditional and traditional agriculture. In line with the general purpose, the following specific objectives are considered:

- Studying the different dimension status of traditional and conventional agricultural in order to identify the weaknesses and failures

- Comparing the precision agricultural budgeting with traditional agriculture.

2. Materials and methods

This descriptive-applied study was conducted in two sections. The first section reviewed the views of 210 agricultural Jihad experts, agricultural development service companies in the city of Kahak, Khalajestan, Gazaran and Dastjerd of Qom province. By random sampling, 140 people were sampled using Cochran's formula[1ans2].

$$n = \frac{\frac{1.96^2(0.5 \times 0.5)}{0.05^2}}{1 + 1/210(\frac{1.96^2(0.5 \times 0.5)}{0.05^2} - 1)}$$

In this section questionnaire was used. Different parts of this questionnaire as research variables included precision agricultural concepts in terms of economic, social, environmental, managerial and educational content. Other variables included barriers and constraints, requirements and policies in precise and traditional agriculture, and individual characteristics that were questioned in the Likert spectrum. Questions are raised by considering research background and considering research goals. To study the validity of questions, the opinions of university professors was used. Questionnaire reliability was confirmed by computing Cronbach's alpha ratio in an interval of 0.78 – 0.94 by using SPSS16 software package. All dimension in two model of agriculture such as economic , social , environmental , managerial and ra ining aspects , limitations and barriers and current pol icies and laws on precision agriculture and experts ' u nderstanding on each concept of precision agriculture used as variables to analyze research hypothesis. In descriptive section, a statistical sample is described in terms of central indices and distributions such as mean, standard deviation, frequency distribution and changes ratio and status quo is expressed. In analytical statistical section, budgeting method and regression and correlation tests are utilized.

In the second sector of this research as the budgeting sector, researchers dealt with the calculation of the income of agricultural units with fully automated and traditional agricultural facilities. The objectives of this study were to estimate the cost, benefits from wheat and barley and maize crops from traditional agriculture and precision agriculture. So, based on the type of product and variety used, information on the cost and yield of wheat, juice and corn in a region with identical climatic conditions was collected in the year 1395. Initially, the cost estimates for wheat, barley, and maize products in Table 1 are as follows:

Table 1. Sources of production costs of wheat, barley and corn forage in farms under various agronomic management and mechanization facilities (crop year).

Source of cost	Type of cost	Traditional management (TM)	Advance management (AM)
Preparation Land	Plow	√	√
	Disk	-	√
	Organic fertilizer	√	√
	Chemical fertilizer	√	-
	Plat	-	√
	Plat with 6 plow	√	-
	Seeding	-	√
Planting (seed and seeding)	Planting with machine	√	√
	Seed	-	√
	Labor	√	-
Maintenance	Fertilizer and fertilizing	√	√
	Diseases and weed control	√	√
	Water and irrigation	-	√
Harvest	Combine	√	√

In this study, the net income (profit) of the product under study was as follows:

NR = TR-TC[3]

The status of the study indicates the economic level and the continuation of the production process leads to economic losses. NR = 0. If changing agricultural management from traditional to conventional agriculture, it is evident that the

1 $n = \frac{\frac{z2pq}{d2}}{1+1/N(\frac{z2pq}{d2}-1)}$

2 d is the desired level of precision (i.e. the margin of error),

p is the (estimated) proportion of the population which has the attribute in question,

q Is 1 – p.

3 NR = net yield

TR = total income (Rials per hectare)

TC = total production cost (Rials per hectare)

economic and non-economic production of products depends on the extent of the difference Income and cost difference.

Traditional cultivation management involves land preparation (tillage, six-man plantation), planting operations (seed and seed costs) (kg/ha) (operation costs) (costs of insemination, weed control, diseases) And harvesting operations using combine.

In top-management with full mechanization facilities: including land preparation (laser leveling, disk, plotting), planting operations involving seedling and planting operations, and harvesting using well-equipped and monitored combines that harvested, harvested and closed It does the same at the same time.

Fixed costs in the production of wheat, barley, corn are costs that do not change in the short term with changes in production levels. Such as land costs, depreciation, etc. Therefore, management does not have control over fixed costs in the short term.

Variable costs in production are: Seeds, animal and chemical fertilizers, spraying, tractor fuel, driver, worker, repair, rent of tractors, combine rent, water supply, rent of land, plowing, disc, leveling, calibration, bulking, Conductance and Shipping Costs.

3. Results and discussion

Descriptive statistics

According to the results of descriptive statistics, experts' familiarity with the precision agricultural concepts is less than average .

Also, according to the studied population viewpoint, their average knowledge about socioeconomic, environmental, managerial and educational dimensions in precision agriculture is more than traditional agriculture.

According to the results of descriptive statistics, the average of the total barriers and limitations and the average of the total requirements and policies in the precise agriculture is greater.

Significance difference test of traditional and precision farming mean

In order to study significance difference mean of research population on different aspects of traditional and precision farming, independent t test is utilized. Initially, the assumption on variance equality of both communities (traditional and precision farming) is examined. The results of independent t test on test statistics and freedom degree are 12.22 and 12.414 respectively. Test significance level is less than 1% and 99% confidence, one can say that there is a significant difference between two traditional and precision farming groups in economic aspect mean.

In independent t test, test statistics and freedom degree are 6.38 and 418 respectively. Test significance level is less than 1% and 99% confidence, one can say that there is a significant difference between two traditional and precision farming groups in social aspect mean.

In independent t test, test statistics and freedom degree are 28.525 and 418 respectively. Test significance level is less than 1% and 99% confidence, one can say that there is a significant difference between two traditional and precision farming groups in environmental aspect mean.

In independent t test, test statistics and freedom degree are 11.908 and 418 respectively. Test significance level is less than 1% and 99% confidence, one can say that there is a significant difference between two traditional and precision farming groups in training aspect mean.

In independent t test, test statistics and freedom degree are 27.436 and 418 respectively. Test significance level is less than 1% and 99% confidence, one can say that there is a significant difference between two traditional and precision farming groups in managerial aspect mean (table 2). Considering the positive rate of confidence two extremes among all aspects, one can say that:

Precise-traditional> →0precise<traditional

Correlation test

Correlation tests are used to study the significant relationship between estimated amount of different aspects in precision farming and amount of understanding precision farming concepts. As shown in table 3, correlation coefficient between social, economic, managerial, training, policies and laws in v and the amount of understanding precision farming concepts while there is no significant relationship between environmental aspect and existing barriers/limitations and dependent variable.

Stepwise Multiple Regression analysis

Multiple regressions is used to predict changes in dependent variable of understanding precision farming concepts and studying the role of each independent variable on dependent one. According to results, t statistic by Durbin and Watson (1.735) is in interval of 1.5 – 2.5. Therefore, the assumption of no correlation among errors is not refused and one can use regression, determination ratio is 0.44 which shows that 44% of changes in independent variable can be explained by dependent variables.

Table 2. Studying Mean Test for Each Aspect of Traditional and Precision Farming

Intergroup comparison aspects	Mean equality test					Result
	T	Freedom degree	Significance level	Confidence level 99%		
				Higher level	Lower level	
Economic	12.22	414/12	0.000	0.817	0.591	**
Social	6.38	418	0.000	0.652	0.345	**
Environmental	28.525	418	0.000	1.84	1.6	**
Managerial	27.436	418	0.000	1.83	1.59	**
Training	11.908	418	0.000	1.25	0.89	**

**: significance in 99%

Table 3. Pearson's Correlation Test on Raised Aspects in Precision Farming and the Amount of Understanding Precision Farming Concepts

First variable	Second variable	Correlation coefficient	Significance ratio (Sig)
Economic	Understanding precision farming concepts	0.389**	0.000
Social	Understanding precision farming concepts	0.376**	0.000
Environmental	Understanding precision farming concepts	0.039	0.572
Managerial	Understanding precision farming concepts	0.279**	0.000
Training	Understanding precision farming concepts	0.471**	0.000
Existing barriers and limitations in precision farming	Understanding precision farming concepts	0.047-	0.494
Existing policies and laws in precision farming	Understanding precision farming concepts	0.291	0.000

**: significance in 99%

Table 4. stepwise regression analysis results

Steps	Independent variable	B	SE B	Beta	t
-	Constant figure	2.197	0.276	-	7.956
1st step	Economic	0.446	0.079	0.447	5.66
2nd step	Social	0.179	0.041	0.263	4.366
3rd step	Managerial	0.143	0.038	0.181	3.763
4th step	Training	0.529	0.073	0.535	7.247
5th step	Existing policies and laws in precision farming	0.54	0.064	0.578	7.428

Table 5: Average Yield, Cost and Gross Income and Net Income of Crops in Various Agronomic Management and Mechanization Facilities

	Net income		Gross returns (Rials per hectare)		Total cost of production (Rials per hectare)		Performance (Kg / Ha)	
Type of crop	(AM)	(TM)	(AM)	(TM)	(AM)	(TM)	(AM)	(TM)
Water wheat	113200000	50100000	122400000	76500000	9200000	2640000	8000	000‹6
Water breeze	34150000	11750000	54000000	3600000	19580000	24250000	6000	4000
Maize	10043000	64880000	10200000	67500000	1570000	2620000	750000	45000

AM: Advance management, TM: Traditional management

Also, research results indicate that among those independent variables which play a significant role on dependent variable of knowledge management, five economic, social, managerial, training and existing policies/laws are the most important affecting independent variables on dependent variable which explain 44% of changes in research dependent variable interactively. The amount T-Test statistic and its significance (0.000) in 99% confidence of regression equation is valid and their results are analyzable. Considering the amount of standardized Beta ratio, it becomes clear that existing policies and laws in precise agriculture with standard Beta standard (0.578) have the highest impact on understanding farming concepts while managerial aspect with standard Beta ratio (0.181) has the lowest impact. Table 4 outlines regression analysis results.

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Based on the results, one can extract regression equation by standard beta as below:

Y = 2.197 + 0.446 (economic) + 0.179 (training) 0.529 + (managerial) 0.143 + (social) + 0.54 (existing policies and laws in agriculture)

Budgeting of precision agriculture compared to conventional agriculture

According to the description of budgeting method in research method section, in the next step, in farms with full mechanization facilities, discs, land plots, all planting and harvesting operations, and harvesting using personalized or rented devices are used in each unit. To be if the units with traditional facilities are not used by advanced devices, and all operations are traditional and conventional. The average yield, cost, gross income and net income of wheat, barley and corn are as shown in Table (5).

As indicated in the table, there is a significant difference between the performance level of the mechanization and production facilities in the traditional and conventional way.

Accordingly, according to the formula, the net income from modern and precision agriculture and traditional agriculture is significantly different, and according to the research, the traditional production cost is much higher than precision agriculture.

4. Conclusion and recommendations

Results indicate that based on experts' opinions at Qom Agricultural Jihad Organization on the amount of understanding precision farming concepts, the average of economic aspect in precision farming is higher than traditional farming. Such finding is consistent with a research by Omidi & Dinpanah (2013). They emphasized that economic factors are important in using precision farming. The average of social aspect in precision farming is higher than traditional farming. In their study, Arayesh & Saboory (2015) indicated that there is a positive and significant relationship between economic and policymaking requirements and training how to use precision farming in confidence level of 99% and between training, social, managerial and cultural aspects and training how to use precision farming in confidence level of 95%. The results of environmental aspect in precision farming is higher than traditional one. This result is consistent with the results of a study by Bordbar (2009). In his study, Bordbar indicated that precision farming in Iran can help agricultural production management through environment. The average of managerial aspect in precision farming is higher than traditional one. In their study titled the impact of management on producing agricultural products in Kenya, Onyuma et al (2006) investigated the role of managerial skills. The results indicate that it is fully necessary to call minor farmers in order to improve their managerial skills. Some guidelines to improve skills include motivating to increase farm effective management, organizational training courses, empowering minor farmers to improve cultivation level and creation of cooperatives. Average training aspect in precision farming is higher than traditional one. Najafabadi et al (2011) believe that training, economy, executive features, technical skills, data quality, risk-taking, high risks, academic training and incompatibility are, inter alia, challenges encountering precision farming. In this vein, training and economic challenges had higher importance while training challenges, lack of local experts, lack of conceivable researches and lack of promulgating staff had more impacts than other items. Likewise, Arayesh and Saboory (2015) indicated a positive relationship between economic aspect and dependent variable. Research data suggest

that since correlation coefficient is positive, one can say that there is a positive correlation between social aspect and the amount of understanding precision farming concepts while Hosseini et al (2010) found no significant relationship between social factors and the possibility to utilize precision farming. Research data indicated that correlation coefficient between environmental aspect and the amount of understanding precision farming concepts has no significant relationship while Bramley et al (2008) concluded that better notification in agriculture can have a valuable share in alleviating negative impacts on environment in Australia.

Research data suggested that considering positive correlation coefficient, one can say that there is a positive correlation between managerial aspect and the amount of understanding precision farming concept. This result is consistent with Arayesh and Saboory (2015) and Omidi and Dinpanah (2013).

Research data suggested that considering positive correlation coefficient, one can say that there is a positive correlation between training aspect and the amount of understanding precision farming concepts. This result is consistent with Onphanhdala (2009) and Richardt et al (2009). Also, research findings suggest that there is no significant relationship between existing barriers and limitations and the amount of understanding precision farming. This result is consistent with Najafabadi et al (2011).

Considering positive correlation coefficient, one can say that there is a positive correlation between existing policies and laws and the amount of understanding precision farming concepts. This result is consistent with Omidi and Dinpanah (2013).

Regression results indicated that by confidence level of 99%, one can say that economic, social, managerial and training aspects as well as existing policies and laws in precision farming have a significant impact on understanding agricultural concepts. This is consistent with results by Arayesh and Saboory (2015).

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