Analytical study for the adoption of potato growers of recommendations for rationalizing the use of irrigation water Al Bustan region, Buhaira Governorate

Ismail Abdul Malik Muhammad Ismail

Department of Agricultural Economic and Cooperative Sciences, Higher Institute for Agricultural Cooperation, Egypt
Email: esmaiel.abdelmalek@yahoo.com

Abstract: This research aimed to identify the level of adoption of potato growers of recommendations for rationalizing the use of irrigation water in the Al Bustan area in the Buhaira governorate, determine their level of knowledge about it, to identify their attitudes towards rationalizing the use of irrigation water, and to identify the correlation between the degree of adoption by potato growers of these recommendations and some independent studied variables. The approach of this study is based on the analysis, exploration and evaluation of the extent to which potato growers in this area have adopted recommendations for rationalizing the use of irrigation water, 168 farmers representing comprehensive potato growers in this area have been selected in summer season, in the village of Imam Muhammad Refaat, which is considered one of promising villages for export in the Al Bustan area in Egypt. Data were collected by personal interview using questionnaire prepared for this purpose, the results are shown in the form table of frequency distribution and percentages, data were analyzed by using simple correlation coefficient of Pearson, Chi-square using the statistical packages program for social sciences statistics. SPSS. The most important results were the following; It was found that nearly half of the respondents represent a percentage of (48.8%) had an average level of adoption of recommendations for rationalizing the use of irrigation water, about half of the respondents represent a percentage of (52.4%), their attitudes are neutral towards rationalizing the use of irrigation water in spite of half of the respondents represent a percentage of (51.8%) had a high level of knowledge of these recommendations. Which is due to the fact that these farmers have great experience in potato cultivation and that they have large potato cultivation areas, however, they face some obstacles that hinder the adoption of some of these recommendations, such as the lack of mechanization in the region, the results showed the great role that the private sector plays in the form of commercial shops for the sale of agricultural supplies in transferring agricultural knowledge. It was also found that there is a positive significant relationship between the degree to which farmers adopt recommendations for rationalizing the use of irrigation water, and some of the independent variables which are: age, number of years of experience in planting potato crops, and the land holding area planted with potato crop, and the research presented a set of recommendations that are taken into consideration for workers in the search area, Such as; increasing extension services in the area, providing agricultural mechanization centers, providing laser soil leveling service, and supporting the state's efforts in lining irrigation channels.

Key words: Adoption – knowledge-Attitude- potato' growers –Rationalizing irrigation water

1. Introduction

The agricultural sector is considered one of the most consuming sectors of water, which made strengthening the efforts made in this sector to conserve irrigation water is necessary, and previous studies show that many farmers around the world depend on pumping water from groundwater sources and other sources to irrigate their crops, with excessive quantities of water, which causes many agricultural problems., as excessive irrigation of crops may cause an increase in the spread of pests and crop damage, and the increased movement of excess water on the surface of the soil leads to its erosion, this is in addition to losing a large part of it due to leakage during transportation from the source to the fields, part of it is used for irrigation, and the rest is lost due to evaporation and leaching in the soil (www.watereducation.org). The shortage and limited quantities of available water from the water resources and the lack of available water for agricultural development in addition to the fact that most of these resources originate outside our borders on the other

hand, it became challengeswww.watereducation.org (MWRI, 2017) facing decision-makers in Egypt is to set water usage policies, and one of the most important problems facing agriculture in Egypt has become the excessive use of irrigation water, as farmers used to give a large number of irrigation, in large quantities that exceed the actual need for plants, as a result of adopting old methods of agriculture and irrigation, by flooding.

Al-Moselhi pointed out that there is a great loss in farmers' use of irrigation water, and a decrease in the efficiency of the irrigation process, such as the extreme waste of irrigation water quantities, water losses in irrigation networks, lack of maintenance methods, lack of respect for water laws and legislation, and neglect of private irrigation and drainage channels (Al-Moselhi, 1997).

Data showed a decrease in the annual consumption of renewable fresh water per capita of the Egyptian people, reaching 650 cubic meters per year, which is far below the water poverty line of 1,000 cubic meters per person per year. (Central Agency for Public Mobilization and Statistics, 2015)

The Nile River is the main source of renewable water in Egypt, along with some other sources such as deep groundwater in oases and small amounts of rain on a narrow strip of the northern coast Limited quantities are produced from desalination from the sea (Sharaki, 2018)

Among the non-conventional water resources are agricultural drainage water, desalinated brackish groundwater, desalinated sea water, and sewage water after treatment, and it is usually used for agriculture to irrigate green areas, and it is also used for some industrial purposes (Sustainable Development Strategy, Egypt 2030).

According to the FAO, water desalination is practiced on a small scale at present, in Egypt mainly on the Red Sea coast (UN. water.org).

Providing water to the agricultural sector is considered one of the main strategic objectives that Egypt aims behind to secure enough water to meet the water needs of the population, whose numbers are increasing with water resources remaining limited. Therefore, the Central Administration of Horticulture and Agricultural Crops at the Egyptian Ministry of Agriculture issued some recommendations and technical practices for vegetable crops within its "monthly technical recommendations" program, with the aim of increasing production and avoiding agricultural diseases and pests that affect vegetable crops, as well as facing climate changes, (Central Administration of Horticulture and Agricultural Crops, January 2020).

Despite all the efforts made in the field of rationalizing water consumption and developing its

various sources, there is an urgent need to make more efforts to support the role of agricultural extension in adopting the concept of rationalizing the use of irrigation water, and disseminating it among farmers, as it is one of the main bodies responsible for increasing agricultural production and rural development through educational change in the knowledge, skills, and attitudes of farmers by transfer results of research, and innovations to them. (Abdo et al, 2018), also more efforts for developing a sense of environmental responsibility, because the absence of such a feeling is a major reason behind the spread of the phenomenon of over-consumption of water.

The study focused on identifying the level of adoption by potato growers in the recommendations to rationalize the use of irrigation water and the factors that affect it, and to identify their knowledge of the recommendations and their attitudes towards them.

Research problem

The study problem appeared in answering the following questions;

What are the characteristics of the surveyed potato growers in the Al Bustan area of Al Buhaira governorate?\

What is the level of farmers' knowledge of knowing the recommendations of rationalizing the use of irrigation water?

What are the farmers' attitudes' towards rationalizing the use of irrigation water?

What is the level of farmers' adoption of applying the recommendations of rationalizing the use of irrigation water?

What are the variables affect the degree of farmers' adoption?

Research objectives:

1-Description of the surveyed potato growers according to their Characteristics in the Al Bustan area.

2- Identify the level of knowledge of potato growers regarding recommendations for rationalizing the use of irrigation water.

3- Determine the attitudes of potato growers towards rationalizing the use of irrigation water.

4-Detrmine the level of farmers' adoption of applying the recommendations for rationalizing the use of irrigation water.

5-Determining the significance of the relationship between the degrees of farmers' adoption regarding recommendations for rationalizing the use of irrigation water as a dependent variable, and some of their independent variables, such as; Age, educational status, years of experience in growing potato crops, size of agricultural land tenure, The size of the land holdings planted with the potato crop, and multiple the sources of obtaining their information on

recommendations for rationalizing the use of irrigation water.

Research hypothesis:

- There is a significant relationship between the degree to which farmers adopt the recommendations of rationalizing the use of irrigation water, and each of the studied independent variables.

2. Method:

The study is based on exploration and evaluation of the efforts made by the Horticultural Extension Department of the Horticulture Administration at the Ministry of Agriculture and other efforts have been done in the field of rationalizing the use of irrigation water in the cultivation of potatoes crop. The village of Imam Muhammad Refaatone of the villages in the Al Bustan area in the Buhaira governorate was chosen to conduct this research because it is famous for its large area of potato cultivation for export in the region.

The research was conducted on a number of 168 farmers representing the total potato growers in summer planting season in the village.

Data were collected by personal interview using questionnaire prepared for this purpose, the results are shown in the form table of frequency distribution and percentages, data were analyzed by using simple correlation coefficient of Pearson, Chi-square using the statistical packages program for social sciences statistics. SPSS.

Quantitative estimation of the studied variables

First: the studied independent variables

Age: Age was expressed in raw numbers

Educational status: This variable was measured by dividing educational status into four categories: illiterate, read and write, intermediate qualification, higher qualification, and grades were given ranges from 0 to 3 degrees respectively.

Area of agricultural land holding: This variable was measured by asking about the area he owns in feddans.

- The number of years of experience in the field of potato cultivation: This variable was expressed in raw numbers per year.

The land holding area planted with the potato crop: This variable was measured by feddan.

- Multiple sources of obtaining information on recommendations for rationalizing the use of irrigation water: This variable was measured by presenting six sources of information, such as; Agricultural change agent, posters and brochures, experienced farmers, dealers of agricultural supplies, extension programs on radio and television, the Internet and social media, the scores obtained by the respondent were collected.

Second, the dependent variable;

1-The degree of farmers' adoption of recommendations for rationalizing the use of irrigation water: measured by their implementation of 16 practices, a graded scale was developed such as; always, sometimes, rarely, and the scores were given 3, 2, and 1 respectively.

The recommendations for rationalizing the use of irrigation water have been determined as the following;

Plowing under the soil. - Add agricultural gypsum in the soil at the beginning of the season. - Good leveling the ground by using laser before planting. - Planting on long straight lines.- Intensification of crops by loading crops together. - Cultivation of high-yielding varieties. Choose the right time for the irrigation process - Stop irrigation when signs of maturity appear. - Lining canals of irrigation.- Cultivation of early-ripening varieties.- Concern to irrigate the land during the night. - Commitment the crop structure of the basin.- Periodic cleansing of the canals of irrigation.- Determine the appropriate irrigation periods for the crop according to the climate.- Determine the amount of water appropriate for the age of the crop. Removing weeds from irrigation water.

2-The level of farmers 'knowledge of recommendations for rationalizing the use of irrigation water: It was measured by their responses to the number of 16 statements, on a binary scale known and unknown and the scores were given 1 and 0, respectively.

3 -Determining the attitudes of farmers towards rationalizing the use of irrigation water: it means the behavioral willingness to agree, disagree, or neutral towards a group of statements that express their attitudes towards rationalizing the use of irrigation water it was measured by the farmers ' responses to 10 statements, on a triple scale, and the scores were given 3, 2, and 1, respectively, and by combining the scores that the respondent obtained in each statement.

The attitudes' statements are as the following;

1. I hate to irrigate the plant with more water.

2. I don't like new ways of irrigation.

3. When water is available, the crops are watered in larger quantities.

4. I prefer to irrigate the land at night so that it consumes less water.

5. It annoys me who tells me to reduce the irrigation water.

6. I don't prefer growing late-ripening varieties.

7. The more I water the crops, the more yield will be.

8. I prefer to grow varieties that consume less water.

9. When I give more irrigation water, I feel more assured of the crop.

10. Calculate the appropriate irrigation time well and take care of it.

3. Results
First: Description of the surveyed farmers according to their Characteristics

The results in Table (1) showed that

1-Calculating the mode the age of the respondents came in the age group (46-52 years), where their percentage reached (52.4%).

2- Calculating the mode the number of years of experience of the respondents in potato cultivation came in group (6-9 years), as their percentage reached (51.2%).

3- Calculating the mode of agricultural land tenure of the respondents came in group (5-10 feddans), where their percentage was (54.8%).

4- The mode of the size of the land cultivated with potatoes is (3-6 feddans), where their percentage was (58.9%).

5-Almost half of the respondents (48.8%) can read and write without obtaining qualifications.

6- About a third of the respondents (33.9%) get their agricultural information from dealers selling agricultural supplies.

Table (1) The numerical distribution and percentage of the respondents according to their Characteristics

Series	Variables	Frequency	%	Series	Variables	Frequency	%
1	The age			4	The size of the land cultivated with potatoes		
	40-45	56	33.3		Small (1-3)	48	28.6
	<45- 52	88	52.4		Medium (<3 – 6)	99	58.9
	<52	24	14.3		Large <6	21	12.5
2	Number of years of experience in potato cultivation			5	Educational Status		
					Ignorant	18	10.7
	3-5 years	56	33.3		Reads and writes	82	48.8
	<5 -8 years	86	51.2		holds diploma	46	27.4
	<8 years	26	15.5		High qualified	22	13.1
3	Agricultural land tenure (Feddans)			6	Multiple Sources of agricultural information		
	Small (1-5)	63	37.5		Dealers of agricultural supplies	57	33.9
					Experienced farmers	40	23.8
	Medium (<5-10)	92	54.8		Social media	34	20.3
					Posters and extension pamphlets	17	10.2
					Change agents	10	5.9
	Large < 10	13	7.7		Extension programs in radio and television	10	5.9

The total no. of potato growers is 168

Second-A – Identify the level of knowledge of potato grower's recommendations for rationalizing the use of irrigation water

The results presented in table (2) indicate that the degree of knowledge of farmers about the recommendations for rationalizing the use of irrigation water was arranged in descending order according to the percentage of knowledge, it ranged between 96.4% as maximum, and83.3% as a minimum, and it was found that the most familiar in the recommendations was the necessity of plowing under the soil, its ratio is 96.4% of the total respondents, then adding agricultural gypsum in the soil at the beginning of the season, good leveling the ground by using laser before planting, and planting on long straight lines by 94% in the second rate, then in the third place, intensification of crops by loading crops together, cultivation of high-yielding varieties, choose the right time for the irrigation process, and stop irrigation when signs of maturity appear with ratio 92.3%, and in the fourth place was lining canals of irrigation, by 91.1 % of all respondents, in the fifth place came the cultivation of early-ripening varieties, at a rate of 89.9%, then in sixth place came the concern to irrigate the land during the night, Commitment the crop structure of the basin., and the periodic cleansing of the canals of irrigation., at a rate of 89.3%. The total arithmetic mean of farmers 'knowledge about the recommendations for rationalizing the use of irrigation water reached 90.9 %, which reflects the high degree of their knowledge.

Second- B-The level of farmers 'knowledge of recommendations for rationalizing the use of irrigation water

The actual range of knowledge ranged between a maximum of 14 degrees and a minimum of 4 degrees, and farmers were distributed into three categories, as the results contained in Table (3) are explained. More than half of the respondents (51.8%) fall into the high level category, less than half fall in the middle level category (42.8%), and only 9% of them fall into the low level category.

Table (2): Numerical distribution and percentage of farmers according to their knowledge of recommendations for rationalizing the use of irrigation water

| series | The recommendations for rationalizing the use of irrigation water | Know | | Rate |
		Frequency	%	
1	Plowing under the soil.	162	96.4	1
2	Add agricultural gypsum in the soil at the beginning of the season	158	94	2
3	Good leveling the ground by using laser before planting	158	94	2
4	Planting on long straight lines	158	94	2
5	Intensification of crops by loading crops together	155	92.3	3
6	Cultivation of high-yielding varieties	155	92.3	3
7	-Choose the right time for the irrigation process	155	92.3	3
8	Stop irrigation when signs of maturity appear	155	92.3	3
9	Lining canals of irrigation.	153	91.1	4
10	Cultivation of early-ripening varieties.	151	89.9	5
11	Concern to irrigate the land during the night,	150	89.3	6
12	Commitment the crop structure of the basin.	150	89.3	6
13	Periodic cleansing of the canals of irrigation.	150	89.3	6
14	Determine the appropriate irrigation periods for the crop according to the climate.	149	88.7	7
15	Determine the amount of water appropriate for the age of the crop.	143	85.1	8
16	Removing weeds from irrigation water.	140	83.3	9
Arithmetic mean		153	90.9	

The total no. of potato growers is 168

Table (3): The numerical distribution and percentage of the respondents according to their level of knowledge of the recommendations for rationalizing the use of irrigation water

series	levels of farmers 'knowledge of the recommendation	frequency	%
1	Low (4 -7 degrees)	9	5.4
2	Medium (more than 7 -11 degrees)	72	42.8
3	High (more than 11 degree)	87	51.8
Total		168	100

Third; determining the attitudes of farmers towards rationalizing the use of irrigation water

The actual range of the farmers 'attitudes towards rationalizing the use of irrigation water ranged between 26 degrees as a maximum and 10 degrees as a minimum. Therefore, the respondents were divided into three categories as shown in Table (4) data are explained that more than half of the respondents are in the neutral attitude 'category, their percentage (52.4%), then more than a third (35.7%) represent in the negative attitude' category, and only 11.9% of them represent in the positive attitude' category.

Table (4): The numerical distribution and percentage of farmers according to their attitudes towards rationalizing the use of irrigation water.

series	levels of farmers 'attitudes towards rationalizing the use of irrigation water	frequency	%
1	Negative attitudes (10- 15) degree	60	35.7
2	Neutral attitudes (more than 15 -20) degree	88	52.4
3	Positive attitudes (more than 20) degree	20	11.9
Total		168	100

Fourth: The level of adoption of potato growers for the rationalization of irrigation water use

The range of the farmers' adoption of recommendations for rationalizing the use of irrigation water were between 38 degrees as a maximum and 16 degrees as a minimum. Therefore, the respondents were divided into three categories, as the results contained in Table (5) indicated that about half of the respondents (48, 8%) were in the middle level of adoption category, about a third (33.3%) were in the low level of adoption category, and only 17.9% of them fall into the high level of adoption category.

Table (5): The numerical distribution and percentage of farmers according to the level of their adoption of recommendation of rationalizing the use of irrigation water.

Series	Levels of farmers 'adoption of rationalizing the use of irrigation water	Frequency	%
1	Low (16 – 24) degree	56	33.3
2	Medium (< 24 -30) degree	82	48.8
3	High (< 30) degree	30	17.9
	Total	168	100

The most frequent practices in adoption were cultivation on long straight lines, and cultivation of high-yielding varieties, the second frequent practices were good laser leveling of land before planting, and plowing under the soil, then third frequent practices were the addition of agricultural gypsum at the beginning of the season, stopping irrigation when signs of ripeness appeared, choosing the right time for the irrigation process, and cultivation of early ripening varieties.

The least practices in adoption were periodic cleaning of the canals of irrigation, commitment the crop structure of the basin, and removing weeds from irrigation water.

Fifth: Determining the significance of the relationship between the degree of adoption by potato growers of recommendations for rationalizing the use of irrigation water as a dependent variable and some independent variables

The following statistical hypothesis was tested, "There is no significant relationship between the degree of adoption by farmers of recommendations for rationalizing the use of irrigation water, and between some independent variables, such as; Age, educational status, years of experience in growing potato crops, size of agricultural land tenure, The size of the land holdings planted with the potato crop, and the sources of obtaining their information on recommendations for rationalizing the use of irrigation water.

To test the validity of this hypothesis, the simple correlation coefficient of Pearson was calculated with respect to the quantitative variables, and the chi-square was calculated for the nominal variables.

The results presented in Table (6) indicated that:

There is a positive significant relationship at the level of significance 0.01between the degree to which farmers have adopted recommendations for rationalizing the use of irrigation water, and each of the following variables: the number of years of experience in cultivating the potato crop, and the size of the land holdings planted with the potato crop, the values of Pearson's simple correlation coefficient were 0.257 and 0.134, respectively.

- There is a positive significant relationship at a significance level of 0.05 between the degree of adoption by potato growers of recommendations for rationalizing the use of irrigation water, and the age variable, as the value of the simple correlation coefficient of Pearson was 0.096.

- There is no significant relationship between the degree of adoption by potato growers of recommendations for rationalizing the use of irrigation water, and the variable of size of agricultural land tenure as the value of the simple correlation coefficient of Pearson was 0.059.

The results presented in Table (7) indicated that there was no significant relationship between the degree of adoption by potato growers of recommendations for rationalizing the use of irrigation water, and between the educational status variable, and the multiple of sources for obtaining agricultural information, Reached values of Chi-square values were such as 1.15 and 1.06, respectively.

Table. (6): Values of the simple correlation coefficient of the relationship between the degree of adoption by potato growers of recommendations for rationalizing the use of irrigation water and some independent quantitative variables

Series	Independent quantitative variables	Pearson correlation coefficient value
1	Age	0.096*
2	years of experience in growing potato crops	0.257**
3	size of agricultural land tenure	0.081
4	The size of the land holdings planted with the potato crop	0.134**

Table (7): Values of Chi-square between the degree of adoption by potato growers of recommendations for rationalizing the use of irrigation water and some studied independent nominal variables

series	independent nominal variables	Chi-square
1	Educational status	1.15
2	Multiplicity of obtaining their agricultural information	1.06

Interpretation of results

The results showed that the level of adoption by potato growers of recommendations for rationalizing the use of irrigation water was moderate and that their attitudes towards the idea of rationalizing the use of water was neutral despite the high awareness of farmers and knowing the importance of these recommendations, which is due to the fact that these farmers have great experience in potato cultivation and that they have large potato cultivation areas, however, they face some obstacles that hinder the adoption of some of these recommendations, such as the lack of mechanization in the region.

The results showed the great role that the private sector plays in the form of commercial shops for the sale of agricultural supplies in transferring knowledge and adopting recommendations, as it was found that it is one of the most common sources of agricultural information among farmers. Dependable on it in light of the insufficient number of extension agents, upon which it relied to perform this role.

Recommendations resulting from the study

1-1-Increasing interest in the educational extension efforts related to increasing knowledge of the following practices.

1-2-Determine the appropriate irrigation periods for the crop according to the climate.

1-3 -Determine the amount of water appropriate for the age of the crop.

1-4-Knowing the reasons for non-compliance with Commitment the crop structure of the basin.

2 -Providing mechanization in the area that helps in rationalizing the use of irrigation water such as;2-1- provide a plow to plow under the soil, 2-2 -Provision

of equipment for Periodic cleansing of irrigation canals.

3 -1-Providing support to local administrations for removing weeds from irrigation waterand,3 -2 - lining canals of irrigation.

References
1. Abdo, o., Mohamed, yousria, a, Allam, et al, 2018, "Efficiency of Agricultural Extension in the Application of Integrated Control of Olive Fruit Fly in some villages of Ismailia Governorate "Journal by Innovative scientific information & services Network on line, Bioscience Research, 15 (4) 3020-3032, ISSN:2218-3973.
2. Agricultural Conservation", www.watereducation.org, Retrieved 29-5-2020. Edited.
3. Al-Moselhi, A., Fouad,1997 "Challenges and Mechanisms for Rationalizing Water Irrigation in the Old Valley Lands in the Arab Republic of Egypt", Third Conference - The Role of Agricultural Extension in Rationalizing the Use of Irrigation Water in the Old Valley Lands in the Arab Republic of Egypt, Journal of the Scientific Society for Agricultural Extension, 26-27 November.
4. 4 -Central Administration of Horticulture and Agricultural Crops,2020., "Monthly Technical Recommendations Program, January " Ministry of Agriculture and Land Reclamation, Egypt.
5. Central Agency for Public Mobilization and Statistics, Egypt Statistics for the year 2015"
6. MWRI, 2017. 'Facts Regarding the Water Situation in Egypt Report.

7. 7-Sharaki, Abbas Mohamed, The Implications of the Grand Ethiopian Renaissance Dam on Egyptian Water Security, The Fifteenth International Conference of Crop Sciences, Institute of African Research and Studies, Cairo University, Egypt, October 2011.

8. Sustainable Development Strategy: Egypt Vision 2030, the environmental component "Ministry of Agriculture and Land Reclamation, Egypt. Technical report, 2015.

9. UN-Water Activity Information System. 'Safe wastewater use in agriculture in Egypt: Case study.' Available at www.ais.unwater.org/ais/pluginfile.php/356/mod _page/content/114/Egypt%20FAO-Essam_3.pdf, accessed (10- 11-2018).

10. www.fao.org/nr/water/aquastat/countries_regions /EGY/10,Nov.2018.

2/27/2021