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Environmental issues in relation to agricultural practices and attitudes of farmers: A case study from Saudi Arabia



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ABSTRACT

Purpose: The Kingdom of Saudi Arabia is continuously in search of environment-friendly farming practices since mass-scale agriculture was initiated. It is imperative to gauge to the level of awareness of the farmers on the agricultural practices causing environmental issue in order to devise new agricultural extension programs. This research aims to identify the attitudes of farmers towards agriculture and environment in Al-Ghat area of Saudi Arabia.

Methodology: A simple random sample of 110 farms truly representing the farming community was drawn to meet the objectives of the study. Data were collected by using the pre-tested questionnaire during the face-to-face interviews. In order to understand the message of study, data were analyzed for percentages, arithmetic average and standard deviation in addition to the simple Pearson correlation coefficient.

Results: The results showed that the high proportion (87.3%) of farmers was interested in continuing to work farm and 77.3% of farmers did not consider adopting agriculture their main occupation. The findings of the survey reveal that some 55.5% of the respondent farmers were aware of the agricultural practices and their relation to the environment. Some 57.3% of the surveyed farmers are aware of potential benefits of enhanced utilization of agricultural organic wastes. However, main profession, farm employment (as the independent variables) showed a significant positive correlation with the attitudes of farmers towards their working in agriculture (as a dependent variable). Also a significant negative relationship between the educational levels and the attitudes of the farmers towards working in agriculture was noticed. The study also indicated a significant correlation between education and the degree of awareness of agricultural practices related to the environment and maximizing the optimum utilization of agricultural waste i.e. organic residues.

Conclusions: The study suggested the need for new awareness and orientation programs to educate farmers and extension workers, highlighting the environment- friendly agricultural practices.

Recommendation: There is need to offer incentives and facilities to keep the farmers stay in the farming business. Extension staff must keep educating them on beneficial features of organic farm waste and crop residues as organic fertilizers.

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1. Introduction

Universally, sound and sustainable agriculture plays a vital role in the economy of many countries. Sustainability in the agricultural sector is known to address issues like poverty alleviation, food security and the generation of stable income for a rapidly-growing population (Lee, 2005; Bhutto and Bazmi, 2007). In the Arab world, agricultural development occupies an important place in many programs of development and economic reforms.

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However, the number of workers engages in agriculture fell by 20% in 2015 and its was fewer workers than in 2010. Rural-to-town migration is major reason for this drop in the number of workers and it is one of the most difficult challenges faced by the Arab agricultural sector (Arab Monetary Fund, 2018) (see Fig. 1).

The Saudi agricultural sector is one of the sectors that have experienced significant economic growth for having about 7.2% of the labor force (Al-Zahrani et al., 2017). However, the major barrier to achieving sustainable agricultural development in many countries of the world, including Saudi Arabia, remains the high rates of rural-urban migration (AlSakran and Munir, 2007). Agricultural development is not only achieved through the provision of advanced agricultural equipment and supplies but also through development of a highly skilled workforce (Faqih Center for Research and Development, 1997). The Bedouins in the rural areas criticize modern agriculture as blacksmithing and carpentry were their way of life; it was one of the assets prevailing in many of their societies, and even with changing circumstances it is alive today (Al-Shenaifi, 1993). With the change in rural lifestyles, we had to re-examine the attitudes of those who work in the farming profession in Al Ghat province in Saudi Arabia. As attitude is a strong indicator of whether they will remain in the agricultural profession (Onima et al., 2017). Attitude, standards and values are important determinants of human behavior, as they guide and help in identifying goals, indicate behavior, and signify performance in the long term (Hayytia and Kola, 2005). Attitude is defined as an internal state that influences the individual's choice of behavior towards a subject, person or thing, and reflects an educated response characterized by relative stability but is subject to change or modification with learning. This response may be strong or weak and may be positive, negative or neutral (AL-Zagool, 2009).

Many studies indicate the trends of individuals toward working in the field of agriculture. Osborne and Dyer (2000) reported the positive attitudes of the sons working in agriculture in the state of Illinois in the United States without parents, and the attitudes of parents and sons toward agricultural education programs were neutral. Zollinger and Krannich (2002) find that the farmers' expectations of the practice of agriculture would increase or may not be in a continuous process, so farmers may move to occupations other than agriculture or at least they may have other occupations and keep agriculture as a secondary occupation.

Stephen (2011) found that youth in the state of Koji, Nigeria had a negative attitude towards agriculture as a profession. The study recommended that agricultural wages be increased wages or other incentives be introduced in order to attract more young people to agricultural occupations. Similarly, Shenifi (2013) found that first year agricultural students at the King Saud had a more positive

view of agriculture and as a field of study than other students enrolled in other programs. Al-Zaidi et al. (2013) concluded that there is an inverse relationship between the total area and cultivated area and the trends of the farmers toward organic agriculture in Saudi Arabia; it was recommended that awareness-raising programs should be carried out to change the attitudes of farmers, agricultural workers, and extension workers toward organic agriculture.

Abdul-Lalla and Allah (2014) found that more than half of the students of the Faculty of Agriculture, Tanta University in the Arab Republic of Egypt had the positive attitudes towards the profession of agriculture. They suggested focusing on areas like: developing a positive attitude toward the profession of agriculture, making the agricultural profession for the educated youth more appropriate, and defining the role of agriculture in the labor market. In a similar study on farmers' attitudes of agriculture in southern Gujarat, India, the vast majority of farmers (89.58%) had a neutral attitude while 8.10% had a negative attitude, and only 2.38% had a positive attitude (Onima et al., 2017).

Agricultural residues and plant and animal products within the agricultural production system help achieve clean agriculture and protect the environment from pollution and thus improve the economic and environmental situation (Shadi, 2005). As pointed out by Khalil (2008), recycling of agricultural waste may cause serious issues in Egypt, especially due to the accumulation of these wastes if not properly handled and could lead to environmental pollution. Further, the risk is growing day-by-day as a result of increased crop productivity and subsequently increasing the volume of agricultural residues (Abila and Amar, 2010). There is a lack of awareness of farmers in the Nubaria area to benefit from agricultural waste including legislation relating to the protection of the environment, behaviors of environmental protection, the causes of environmental pollution, and low cognitive and executive levels of respondents regarding methods of agricultural waste recycling. Farmers' desire to participate in projects related to the recycling of agricultural waste was observed between high and medium (Smith and Sullivan, 2014). In the environmental awareness survey conducted in Beijing, farmers' awareness level was found to be between low to the medium, whereas parameters like gender, educational background, and family income had the significant impact on the environmental awareness levels of the farmers.

Such studies in the Kingdom of Saudi Arabia have not been conducted so far. Therefore, present research project was undertaken. The research mainly aims at studying the attitudes of the farmers working in the field of agriculture to promote innovative agricultural practices and maximize the utilization of crop residues in Al-Ghat Province at Riyadh Region - Saudi Arabia.

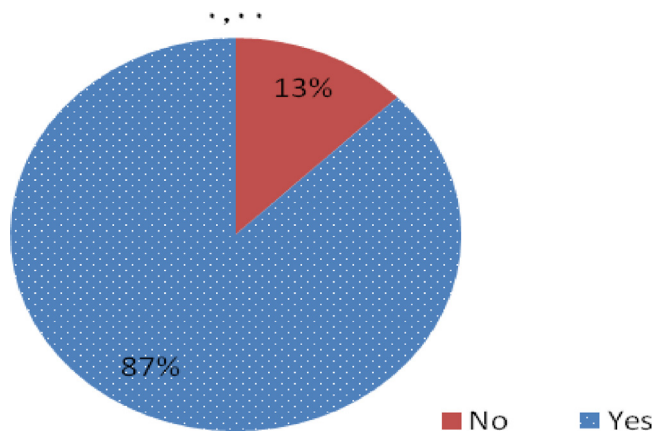


Fig. 1. The percentage of farmers interested in continuing farming.

2. Research method

2.1. Population and sample

Al-Ghat is one of the governorates of the Kingdom of Saudi Arabia administratively located in the Riyadh region. Al-Ghat is located 230 km north of Riyadh. The Emirate of Riyadh is administratively located in the Kingdom of Saudi Arabia. It is located between the Tuaiq Mountains to the east and Nofod Althwairat (Asalabekh) to the west. The region sustains a population of 10,269,000. The area with its unique landscape presents three natural environments, including a mountain environment, an agricultural environment, and the sandy environment (Aloud) (National Park Al Ghat, (Wikipedia, 1440). This study consists of all the farmers (1,200) of the Al-Ghat area of the Kingdom of Saudi Arabia (Agricultural Extension, 2017). A simple random sample of 110

farms representing 9.2% of the total population was included in the study.

2.2. Data collection

Data were collected by conducting face-to-face interviews using a questionnaire prepared for the purpose of achieving the research objectives. The study examined all the required variables related to the personal, social and economic characteristics to identify the degree of farmers' attitudes toward work in agriculture, and the degree of dependence on sources of information. The degree of agricultural practices related to the environment and to optimize the utilization of agricultural waste was also investigated.

2.3. Data analysis

A number of preliminary processes were performed during the analysis of the data including review, coding, unloading and tabulation. Percentages, frequencies, means and standard deviations were calculated. The data were subjected to statistical analyses to describe and identify personal, social and economic characteristics, to identify the degree of farmers' attitudes toward working in agriculture and the degree of dependence on sources of information, and to quantify the degree of farmers' awareness of agricultural practices and their relationship with the environment and the optimum utilization of agricultural wastes/crop residues. The Pearson correlation coefficients were used to determine the strength of the correlation between independent variables studied and agricultural practices related to the environment and the optimum utilization of agricultural waste. The data were analyzed using SPSS version 20 Statistical Package for Social Science.

3. Results and discussion

3.1. Personal, economic and social characteristics of the farmers

The age of farmers in the sample ranged from 27 to 81 years, with an average of 50.5 years and a standard deviation of 15.1 years. The data presented in Table 1 show that most of the surveyed farmers (47.3%) were in the age group 45 to less than 63 years followed by 30% aged less than 45 years, while only 22.7% of the total number of farmers surveyed were elderly (63 years and over). The proportion of people under the age of 59 is a positive indicator to bring desired changes in attitudes. Younger people in farming could have a positive impact on the degree of attitude toward working in agriculture. It also calls for

awareness programs and incentives to enable these young farmers as well as older people who are expected to be more inclined and oriented toward agriculture.

Table 1 shows the educational levels of the surveyed farmers. The percentage of people with university and post-secondary education is 66.4%, while 18.2% have a secondary school education, 10.3% have an elementary certificate, and only 4.5% are illiterate. As those with higher education tend to be more oriented towards government work and administrative functions and stay away from farm work, an appropriate environment of incentives, support and encouragement must be provided to those more willing to work in the area of cultivation as a category capable of keeping pace with modern technology.

Most of the respondents do not consider agriculture as their main occupation; as high as 77.3% of the respondents are being employed outside of agriculture and mainly work in the public and private sectors. Only 22.7% respondents indicate agriculture as their main occupation (Table 1), perhaps due to the high level of education of the respondents in the region.

The number of years of experience of farmers engaged in agricultural work ranged between 40 and 50 years, with a mean of 20.8 years and a standard deviation of 14.7 as shown in Table 1. More than half (60.9%) of the respondents have experience less than 19 years, while 24.5% were in the category of 34 years or more; 14.6% have experience in the middle category (more than 19 years but less than 34 years).

The size of the total agricultural holdings of the farmers ranged from 15 to 700 dunums, with a mean of 151.7 dunums and a standard deviation of 140.4. The study revealed that more than half of the respondents had holdings between 99 and 181 dunums, 33.6% of the respondents were with small holdings with less than 99 dunums, and 15.5% of them had large holdings of 181 dunums or more (Table 1). The area of tenure used in the various agricultural activities ranged between 12 and 400 dunums, with an average of 115.5 dunums and a standard deviation of 101.7 degrees (Table 1). It was noticed that 42.7% of the surveyed farmers have had small holdings of less than 87 dunums and 41.8% of the respondents are farmers with medium-sized holdings (87 to 174 dunums) while 15.5% have large holdings of 174 dunums and more. The increase in the size of farm tenure used may reflect an increase in the degree of farmers' attitudes toward work in agriculture.

The results in Table 1 show that most farmers (80.9%) practice agricultural activities in their own property and as little as 11.8% of the surveyed farmers are engaged in agricultural activities in rented landholdings, while 7.3% undertake their agricultural activities on agricultural holdings in partnership with others. It is

Table 1
Distribution of respondents according to their personal, social and economic characteristics (N = 110).

Percent	Number	Type	Percent	Number	Type
Years of experience in farm work			Age		
60.9	67	Less than 19 years	30	33	Less than 45 years
14.6	16	From 19 to less than 34 years	47.3	52	45 to less than 63 years
24.5	27	34 years and over	22.7	25	63 years and over
Total holding in dunums			Educational Status		
33.6	37	(Small possession) is less than 99 dunums	4.5	5	Illiterate
50.9	56	(Average possession) from 99 but less than 181 dunums	10.9	12	Primary
15.5	17	(Large possession) 181 dunums and more	18.2	20	Secondary
Type of farmland			58.2	64	College
11.8	13	Rented	8.2	9	Above college
7.3	8	Share	Profession		
80.9	89	Owned	11.8	13	Private sector employee
Type of workers in the farm			65.5	72	Government sector employee
0	0	Saudi labor only	22.7	25	Farmer
27.3	30	Non-Saudi labor only	Irrigation system used		
72.7	80	Saudi and some non-Saudi labor	3.6	4	Traditional
			40.9	45	Semi-traditional
			55.5	61	Modern

expected that the farmers who work on rented farms or in partnership could have a higher tendency to work in agriculture and do so as a result of their keenness to practice agricultural activity, most often for commercial purposes. Thus, the rise of owned farm-holdings may have a negative impact on the attitude toward employment in agriculture.

The study reveals that more than half (55.5%) of the farmers use modern irrigation systems and practices, with 40.9% using semi-traditional irrigation, 55.5% using modern irrigation, and 3.6% were using traditional means of water delivery.

The findings presented in Table 1 indicate that 72.7% of Saudi farmer respondents work on their farm and non-Saudi workers do different jobs, noting that Saudi labor is limited to administrative and supervisory work, whether by the owner, a relative or other. About 27.3% of the farmers interviewed depend on foreign labor only, whereas there is a high proportion of those who rely on Saudi and foreign labor, reflecting the degree of interest of farmers and their tendency towards work in the field of agriculture and therefore such engagement of the labor is expected to have a positive impact.

There are two types of problems and obstacles facing agriculture as seen in Table 2. It was found that the problems of farmers who wish to continue their agricultural work are the high costs of agricultural inputs, marketing of agricultural products, and the difficulty of borrowing different proportions. As for farmers who wish to leave farm work, their problems were rising costs, difficulty in marketing agricultural commodities, many obstacles to get licenses for agricultural projects, and lack of interest from the Ministry of Environment, Water and Agriculture.

3.2. Farmers' attitudes toward the profession of agriculture

Farmers were distributed according to the degree of their orientation towards the agricultural profession using eight statements as presented in Table 3. Utilizing a Likert-type scale, most of the respondents agree with most of the statements that reflect their desire to be in agricultural work. The farmers surveyed were found to agree with the statement "It is worth it to work in agriculture" (mean score of 4.50) followed by the statement that "They are attracted to work in the field of agriculture with the mean score of 4.44. More than 46% of the surveyed farmers, strongly agreed with the statements "Agriculture is a fun and an attractive profession" and "Income from agriculture is unstable for most of the agricultural products". Farmers expressed their disagreement with the statement, "The cash flow of your agricultural activity is positive during the agricultural season" with a mean of 2.46. This may reflect the higher production costs or that the farmer does not want to disclose its monetary side.

As regards the digital values that represent farmers' attitudes towards farm work, they ranged from 19 to 39 degrees, with a mean of 30.04 degrees, and the standard deviation of 4.7 degrees. The results in Table 4 indicate that 57.2% of the surveyed farmers have had a high degree of attitude (31 degrees and more) towards work in agriculture. About 27.3% of the farmers surveyed have had an average attitude to work in agriculture where their degrees ran-

ged between (25–31) degrees, and 15.5% of the surveyed farmers have a low attitude towards work in agriculture with less than 25 degrees, despite a good indicator of the trend towards working in the field of agriculture was found. However, efforts should be made by the extension institutions to overcome the constraints faced by those working in agriculture and offer incentives to encourage them to stay in the farming profession. Given that most of the farmers are mainly working outside of agriculture because of lifestyle changes, the trend towards working in the field of agriculture expressed by respondents may be due to the environment and the values of society, which recognizes the importance of agriculture.

3.3. Sources of agricultural information

Table 5 depicts the distribution of responding farmers according to the degree of dependence on sources of agricultural information arranged according to the arithmetic average. It is clear from the table that more than 50% of the interviewed farmers are always dependent to have agricultural extension information from the neighboring farmers by achieving an average of 2.54 degrees, then agricultural extension bulletins, followed by social networking programs (Twitter) and Whats app with an arithmetic means of 2.43, 2.36, 2.36 degrees for each of them respectively. The study also indicates that more than 70% of the farmers interviewed do not rely on television or radio with an arithmetic mean value of 1.34 degrees for each of them.

The distribution of farmers interviewed in the Al Ghat region was based according to the numerical value that reflects the degree of dependence on agricultural extension information sources through which farmers obtain agricultural information. The numeric values ranged from 11 to 31 degrees, with a mean of 22 degrees and a standard deviation of 4.4. The farmers are distributed in three categories according to the degree of their reliance on the source of information employed by the farmers as depicted in the Table 6. It is depicted in the table that 58.2% of the surveyed farmers are highly dependent on sources of information and 33.6% have an average reliance on sources of information, while 8.2% have low dependence on the sources of information. The possible reason could be that the 90% of the respondents adopted the sources of information due to their higher educational levels. The social networking and farmers continuously using their network in addition to relying on neighbors attained the first rank in terms of the degree of dependence.

3.4. Agricultural practices related to the environment and the degree of awareness of maximizing the utilization of agricultural waste

The distribution of respondents according to the degree of their awareness on agricultural practices and their relation to the environment is presented in Table 7. Some 84.5% of the surveyed farmers in AL-Ghat province strongly agree with the statement "Fertilization with organic fertilizer" followed by the statements "Fertilization with tillage is beneficial" and "Need to know the dis-

Table 2
Distribution of farmers according to the problems facing them in agricultural work.

Farms do not want to continue working in the farming (N = 14)			Farmer want to continue farming (N = 96)		
Percent	Number	The problems they face:	Percent	Number	The problems they face:
100	14	High costs of agricultural inputs	91.7	88	High costs of agricultural inputs
64.3	9	Marketing of agricultural products	63.5	61	Marketing of agricultural products
35.7	5	Many obstacles to have licenses for agricultural projects	19.8	19	Difficulty in borrowing different loans
14.3	2	Lack of interest of the Ministry of Environment, Water and Agriculture	21.9	21	Decline in profits

Table 3
Distribution of farmers according to their attitudes towards the profession of agriculture arranged by the arithmetic mean (N = 110).

S. D	Mean	Strongly Agree %	Agree %	I do not know %	Not agree %	Strongly Disagree %	Standards
0.8	4.50	65.5	22.7	8.2	3.6	0	It is worth to work in the field of agriculture
0.84	4.44	62.7	21.8	11.8	3.6	0	There are attractions to work in the field of agriculture
0.78	4.31	46.4	41.8	8.2	3.6	0	Agriculture is a fun and picturesque profession
1.18	4.06	46.4	30.9	11.8	3.6	7.3	Earned income from agriculture is characterized by instability
1.25	3.75	30.9	38.2	16.4	3.6	10.9	The number of times you get money from agriculture is increasing continuously
1.1	3.68	23.6	42.7	15.5	14.5	3.6	You can earn a lot of money as a farmer
1.73	2.86	25.5	23.6	4.5	3.6	42.7	Agriculture is a very arduous profession
1.39	2.46	7.3	18.2	30.9	0	43.6	The cash flow of your agricultural activity is positive during the agricultural seasons

Table 4
Distribution of farmers according to a numerical value, which expresses their attitude to work in agriculture.

Percentage	Number	Degree of awareness
15.5	17	(Low) less than 25
27.3	30	(Average) 25 to less than 31
57.2	63	(High) 31 and above
100	110	Total
30.04		Average degree of awareness
4.7		S. D

eases affecting crops; with means of 4.74, 4.46 and 4.31 degrees, respectively.

The statements “It is important to know the plant’s needs of nutrients”, “Knowing the contents of soil elements (Soil chemical analyses) is important for fertilization”, and “Crops are exposed to damage from agricultural pests” received means of 4.30, 4.15 and 4.04, respectively. The statements give clear understanding that the farmers are turning to the productive side and focus on statements that reflect their importance in producing high-quality crops and abundant food production.

The statements attaining the lowest ranks were “Pesticides are used on the farm”, “Annual water analysis is essential for crop success”, “Handling pesticides on a regular basis”, and “Chemical fertilizers” and with their means 3.55, 3.55, 2.79, and 2.65, respectively.

The possible reason for the low ranks for the statements related to pesticides could be that farmers do not want to disclose the extent of their use of pesticides. The other possible reason could be their lack of awareness on the use of pesticides as their farm workers who are involved in different production processes apply pesticides as and when needed. Also, farmers may have a lack of knowledge or they do not feel that application of pesticides and chemicals is important from their point of view.

The numerical values expressed for the agricultural practices related to the environment ranged between 50 and 88 degrees, with an average of 73.9 degrees; and standard deviation of 7.4.

Table 5
Distribution of farmers according to their degree of dependence on agricultural extension information sources (N = 110).

S. D	Mean	Always %	Sometimes %	I do not use %	Source of information
0.65	2.54	61.8	30	8.2	Neighbors at the farm
0.70	2.43	54.5	33.6	11.8	Agricultural extension bulletins
0.74	2.36	50.9	33.6	15.5	Social Networking Programs (WhatsApp)
0.74	2.36	50.9	33.6	15.5	Social Networking Programs (Twitter)
0.62	2.31	39.1	52.7	8.2	Relatives and friends
0.44	1.95	7.3	80.9	11.8	Fertilizer seller
0.79	1.94	28.2	37.3	34.5	Agricultural extension agents
0.76	1.91	24.5	41.8	33.6	Branch of the Ministry of Environment, Water and Agriculture
0.55	1.64	3.6	56.4	40	Agricultural Cooperative Association
0.55	1.34	3.6	26.4	70	TV
0.55	1.34	3.6	26.4	70	Radio

Table 6
Distribution of farmers according to the numerical value expressed by their degree of dependence on the sources of agricultural extension information (number = 110).

Percentage	Number	Degree of awareness
8.2	9.0	(Low) less than 17
33.6	37	(Average) 17 to less than 23
58.2	64.0	(High) 23 and above
100.0	110.0	Total
22		Average degree of awareness
4.4		S. D

The findings presented in the Table 8 indicate that some 55.5% of the surveyed farmers had high awareness on agricultural practices related to the environment when expressed in degrees (74 degrees and above), and 37.3% of the farmers surveyed. Farmers with an average awareness on agricultural practices related to the environment were with the degrees ranged between 62 and 74. Only 7.2% had low awareness of agricultural practices related to the environment with their grades (less than 62 degrees).

3.5. Degree of awareness of maximizing the utilization of agricultural waste

The distribution of the respondents based on the agricultural practices related to the environment according to the Likert scale is revealed in the Table 9. It is evident that more than 60% of respondents strongly agree with the statements “Conversion of agricultural waste into by-products help purifying the environment and they happen to be the profitable economic resource” and “Accept agricultural non-traditional ideas” with means of 4.61 and 4.47. Farmers agree with the statements like: “Agricultural residues result economic benefits”; “Agricultural waste is a source of epidemics”, and “The farmer cannot set up small plants that turn agricultural waste into coal (Biochar)”. The means attained for these statements were 4.26, 4.15, and 3.80, respectively.

Table 7
Distribution of farmers according to their awareness of agricultural practices related to the environment ranked by arithmetic average (N = 110).

S. D	Mean	Strongly Agree%	Agree %	I do not know%	Do Not agree%	Strongly Disagree%	Agricultural practices
0.70	4.74	84.5	8.2	3.6	3.6	0	Fertilization with organic fertilizers
0.75	4.46	61.8	22.7	15.5	0	0	Fertilization with tillage is beneficial
0.54	4.31	34.5	61.8	3.6	0	0	Need to know the diseases affecting crops
0.97	4.30	55.5	26.4	14.5	0	3.6	It is important to know the plant's needs of elements
0.93	4.15	40	41.8	14.5	0	3.6	Knowing the contents of soil elements (Soil chemical analyses) is important for fertilization
1.45	4.04	56.4	23.6	3.6	0	16.4	Crops are exposed to damage from agricultural pests
0.81	3.99	24.5	57.3	10.9	7.3	0	Fertilization with irrigation during agriculture helps grow the crop
0.47	3.94	4.5	88.2	3.6	3.6	0	Collect agricultural waste and add it to the soil
1.13	3.91	37.3	30.9	24.5	0	7.3	The use of pesticides is beneficial in increasing productivity
1.02	3.9	28.2	49.1	10.9	8.2	3.6	Adding fertilizer after planting is more beneficial
0.48	3.87	15.5	72.7	3.6	0	8.2	Agricultural waste collection and add to the soil after burning
0.96	3.85	20.9	57.3	10.9	7.3	3.6	Agricultural record daily important
1.05	3.84	36.4	18.2	41.8	0	3.6	Soil analysis before planting is important and necessary
0.91	3.81	19.1	54.5	19.1	3.6	3.6	Consider it necessary to switch to organic farming
1.20	3.55	26.4	27.3	28.2	10.9	7.3	Pesticides are used on your farm
1.05	3.55	19.1	31.8	41.8	0	7.3	Annual water analysis is essential for successful crop production
1.55	2.79	20.9	15.5	19.1	10.9	33.6	Handle pesticides on a regular basis
1.43	2.65	3.6	42.7	3.6	14.5	35.5	Chemical fertilizer application

Table 8
Distribution of farmers according to the numerical value expressed in their degree of awareness of agricultural practices related to the environment.

Percentage	Number	Degree of awareness
7.2	8	(Low) less than 62
37.3	41	(Average) 62–74
55.5	61	(High) 74 and above
100.0	110	Total
73.9		Average degree of awareness
7.4		S. D

The results showed that farmers did not know what bio-coal (biochar), was with an average of 2.65 degrees. The statement “The remnants of palms and trees are useless” attained the lowest mean value of 1.83 degrees. The response of farmers on this statement indicates that their knowledge on use of leaves of palm and other trees for agricultural and rural purposes is really poor and they deserve to be educated.

As regards the numeric values to express the environment-related agricultural practices, they range between 36 and 50 degrees with an average of 42.7 degrees and standard deviation of 3.7. The results in Table 10 reveal that 57.3% of the surveyed farmers have a high awareness on maximizing the utilization of agricultural waste, attaining 44 degrees and more. About 23.6% of the surveyed farmers have a medium degree of awareness of maximizing the utilization of agricultural waste and their scores

Table 9
Distribution of farmers according to their awareness of maximizing the optimum utilization of agricultural waste by an arithmetic mean (N = 110).

S. D	Mean	Strongly Agree %	Agree %	Do not know%	Do not agree%	Strongly Disagree%	Statements
0.64	4.61	69.1	22.7	8.2	0	0	Conversion of agricultural waste into by-products help purifying the environment and they happen to be the profitable economic resource
0.75	4.47	62.7	21.8	15.5	0	0	Accept agricultural non-traditional ideas
0.76	4.26	45.5	35.5	19.1	0	0	Agricultural residues result economic benefits
0.73	4.15	34.5	45.5	20	0	0	Agricultural waste is a source of epidemics
1.24	3.8	44.5	15.5	15.5	24.5	0	The farmer cannot set up small plants that turn agricultural waste into coal (Biochar)
1.56	3.74	48.2	19.1	11.8	0	20.9	The farmer can convert agricultural waste into useful organic fertilizer
1.12	3.43	20.9	26.4	30.9	18.2	3.6	Adding bio-charcoal from waste to soil to increase soil productivity is a good practice
1.01	3.38	20.9	14.5	46.4	18.2	0	Agricultural waste can be converted into a vital coal
0.97	3.35	14.5	26.4	38.2	20.9	0	Agricultural waste recycling is a step towards the sustainability of agricultural resources
1.08	3.09	10.9	22.7	38.2	20.9	7.3	Agricultural waste is a wide area to create jobs
1.19	2.65	0	31.8	27.3	14.5	26.4	I know what is the bio-coal (biochar)
1.11	1.83	4.5	3.6	15.5	22.7	53.6	The remnants of palms and trees are useless

Table 10
Distribution of the farmers in question according to the numerical value expressed in their awareness of maximizing the utilization of agricultural waste.

Percentage	Number	Degree of awareness
19.1	21	(Low) less than 40 Degree
23.6	26	(Medium) 40–44 Degree
57.3	63	(High) 44 Degree and more
100	110	Total
42.7		Average
3.7		S. D

ranged between 40 and 44 degrees. About 19.1% of the surveyed farmers adopted agricultural practices having low relationship with the environment and are with less than 40 degrees.

3.6. Personal, social and economic characteristics and their correlations with the farmer's attitudes

Pearson's correlation coefficient was used to determine the relationship between personal, social and economic characteristics as independent variables and the degree of farmers' attitudes toward working in the field of agriculture and the degree of dependence on sources of information in the Ghat area of the Kingdom of Saudi Arabia as dependent variables. The results of the analysis as depicted in Table 11 reveal a significant positive correlation at the 0.01 level of significance between the primary profession and the

type of workers on the farm as independent variables and between farmers' attitudes toward agriculture as a dependent variable with Pearson correlation coefficients of 0.355 and 0.295, respectively. Main occupation of the farmer means he is working in agriculture; the trend towards agricultural work has increased. If the farmer relies on Saudi and non-Saudi agricultural workers on his farm, Saudis will have a higher attitude toward work on the farm.

Those who practice agriculture as a major profession are more dependent on sources of information. A significant correlation was found (at a significance level of 0.05) between years of experience, total area, and cultivated area and the degree of attitude towards work in agriculture, with Pearson correlation coefficients of 0.191, 0.20, and 0.229, respectively. This explains that the existence of high experience in the field of agriculture or the possession of large agricultural lands practiced by the agricultural activity or practiced on some of them leads to an increase in the trend toward work in agriculture. With regard to the degree of reliance on sources of information, there was a significant correlation at a significance level of 0.05 between the variables age of farmers, total area, and the cultivated area as independent variables and the degree of reliance on sources of agricultural extension information. The dependence of older people on sources of agricultural extension information may be due to the rapid development of agricultural technologies and practices as well as the high proportion of learners in the sample; in addition, as the total area and cultivated area increased, the need for information sources will be increased.

However, a negative correlation at the significance level of 0.01 between the educational situation as an independent variable and the degree to which he farmers' attitude to work in agriculture as a dependent variable was realized. It means that the higher the level of education the less would be the attitude towards agriculture.

Pearson's correlation coefficient was used to identify the strength of the correlation between personal, social and economic characteristics as independent variables, and the degree of awareness of farmers' agricultural practices related to the environment and maximize the use of agricultural waste as variables (Table 12). There was a significant, positive correlation between the cultivated area and the level of awareness on maximizing the utilization of agricultural waste as a dependent variable (at a significance level of 0.01). The correlation coefficient of Pearson 0.304 indicates that farmers with the larger cultivated areas had the greater awareness levels regarding the utilization of agricultural wastes/residues. A farmer with a larger area is more conscious of economic prosperity and would be more appreciative having greater awareness of the environmental or other issues faced in farming.

A significant correlation was found ($p = 0.05$) between education level and the degree of awareness of agricultural practices

Table 11

Relationships between the independent variables and the attitude of the farmers toward agricultural work and the degree of dependence on the sources of agricultural information.

The simple Pearson correlation coefficient		
Independent variables	Attitude of the farmers toward agricultural work	Degree of dependence on the sources of agricultural information
Age	0.144	0.234*
Education	-0.372**	0.036
Profession	0.355**	0.459**
Years of Experience	0.191*	0.139
Agricultural employment	0.295**	0.068
The total area	0.204*	0.237*
Cultivated Area	0.229*	0.191*
Type of tenure farm	-0.014	-0.138

** significant at the significance level of 0.01 * significant at the significance level of 0.05.

Table 12

Correlations between independent variables and farmers' awareness of agricultural practices and optimization of agricultural waste.

Optimization of agricultural waste	Agricultural practices	Variables
0.027	0.041	Age
0.23 *	0.10 *	The educational level
-0.055	-0.172	Profession
-0.111	-0.088	Years of experience in agricultural work
0.234 *	0.115	The total area
0.304 **	0.035	Cultivated Area
-0.228 *	-0.187 *	Type of tenure

related to the environment and maximizing the optimum utilization of agricultural waste. The Pearson correlation coefficients were 0.10 and 0.23, respectively.

The rich experience in the field of agriculture or the agricultural practices on the large agricultural lands leads to an increase in the trends or their inclinations to work in the agricultural sector. As regards to the degree of reliance on sources of information, a significant correlation (at a significance level of 0.05) among the variables age of the farmers, total land area, and the cultivated area as the independent variables with the degree of reliance on sources of agricultural extension information. The dependence of older people on sources of agricultural extension information may be due to the rapid development of agriculture as well as the high proportion of learners in the sample. In addition, if the total area and cultivated area increase, the need for information sources will be also be increased.

A significant negative relationship was found (at a significance level of 0.05) between the type of agricultural tenure as an independent variable and the degree of awareness of agricultural practices related to the environment and maximizing the utilization of agricultural waste.

In other words, the smaller the farm area, the farmers may have a lower environmental awareness related to agricultural practices and the utilization of agricultural waste. This may be due to the fact that farmers renting or having land in partnerships are keener to make more profits and thus more interested in different practices aiming at adopting environmental friendly agriculture practices and reusing farm residues to enhance the nutrition of their crops and improving soil health by converting farm residues into biochar by sequestering more CO₂.

4. Conclusion

This work investigated the attitudes of the farmers in Al-Ghat area in Saudi Arabia towards working in agriculture and utilization of crop residues to make farming environment friendly. The study leads to conclude that:

- There is a need to provide more incentives and facilities to the farmers help them continue with the farming and they utilize the crop residues as organic fertilizers as much as possible.

4.1. Recommendations:

- New awareness and orientation programs to educate farmers would help farmers to stay in the farming business.
- Concerted efforts are needed to elevate the role of agricultural extension in the different farming regions of the Kingdom.

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References

- Abdul-Lalla, Mokhtar Mohammed, Allah, Muhammad Fathallah Abad, 2014. Attitudes of students of the Faculty of Agriculture towards the profession of agriculture. *J. Agric. Econ. Soc. Sci., Mansoura University* 5 (4), (Arabic).
- Al-shenaifi, M., 1993. General Feature of Agricultural Education System in Saudi Arabia, Research Bulletin No. 34. College of Agriculture, King Saud University, Riyadh, Saudi Arabia.
- Al-Zahrani, K.H., Aldosari, F.O., Baig, M.B., Shalaby, M.Y., Straquadine, G.S., 2017. Assessing the Competencies and Training Needs of Agricultural Extension Workers in Saudi Arabia. *J. Agr. Sci. Tech.* 19, 33–46.
- Amar, Yasmeen A., Abila A.E.M., Handi, 2010. The Study on Environmental Awareness Among Farmers to Benefit from Waste Farmers in Noubariya Region. *J. Agric. Econ. Soc. Sci.*, 1(3), 205–219.
- Bhutto, A.W., Bazmi, A.A., 2007. Sustainable agriculture and eradication of poverty in Pakistan. *Nat. Resour. Forum* 31, 253–262.
- Faqih Center for Research and Development (1997). Obstacles to agricultural development in the Kingdom of Saudi Arabia (Arabic).
- Lee, D.R., 2005. Agricultural sustainability and technology adoption: Issues and policies for developing countries. *Am. J. Agr. Econ.* 87, 1325–1333. <https://doi.org/10.1111/j.1467-8276.2005.00826x>.
- Onima, V.T., Timbadia, C.K., Gulkari, Krunal D., Bhuva, R.M., 2017. Attitude of Farmers towards Farming as an Occupation. *Int. J. Pure App. Biosci.* 5 (5), 833–837.
- Osborne, E., Dyer, J., 2000. Attitudes of Illinois Agriscience Students and their Parents toward Agriculture and Agricultural Education Programs. *J. Agric. Educ.* 41 (3), 50–59.
- Shadi, Sami Ali, 2005. Some variables affecting the level of knowledge of agricultural extension workers in the methods of utilization of agricultural waste in Dakahlia Governorate. *Egypt. J. Agric. Res.* 83 (4).
- Smith, H.F., Sullivan, C.A., 2014. Ecosystem services within agricultural landscapes—Farmers' perceptions. *Ecol. Econ.* 98, 72–80.
- Arab Monetary Fund (2018). Arab Consolidated Economic Report 2017. (Arabic).
- Zollinger, B., Krannich, R.S., 2002. Factors Influencing Farmers Expectations to Sell Agricultural Land for Non-Agricultural Uses. *Rural Sociol.* 67 (3), 442–463.

Further reading

- Allen, C.T., Machleit, R.A., Kleine, S.S., Notani, A.S., 2003. A place for emotion in attitude models. *J. Bus. Res.* 56 (1), 1–6.
- Alzaidi, A.A., Baig, M.B., Elhag, E.A., 2013. An Investigation into the Farmers' Attitudes towards Organic Farming in Riyadh Region – Kingdom of Saudi Arabia. *Bulgarian J. Agric. Sci.* 19 (3), 426–431.
- Bergevoet, R.H.M., Ondersteijn, C.J.M., Saatkamp, H.W., Woerkum, C.M.J., Huirne, R. B.M., 2004. Entrepreneurial behavior of Dutch dairy farmers under a milk quota system: Goals, objectives and attitudes. *Agr. Sys.* 80, 1–21.
- Hyytia, N., Kola, J., 2005. Citizens Attitudes towards Multifunctional Agriculture. Department of Economics and Management. University of Helsinki. *Agric. Policy* 8, 1–25.
- Shenaifi, M.S., 2013. Attitudes of students at college of food and agricultural sciences toward agriculture. *J. Saudi Soc. Agric. Sci.* 12 (2), 117–120.
- Ibitoye, Stephen J., 2011. Attitude of Youths towards Career in Agriculture in Kogi State. Kogi State University, Anyigba, Kogi State, Nigeria, Nigeria.
- Zoghoul, Emad Abdel Rahim, 2009. Principles of Educational Psychology, University Book House, First Edition, Dar Al Masirah for Publishing, Distribution and Printing, Mutah University, Amman, Jordan. (Arabic).