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Awareness and use of soil conservation practices among Iraqi wheat farmers

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Abstract The results showed that 51% and 40.3% of the wheat farmers indicated a medium level of awareness and usage of soil conservation practices respectively. The most aware and used practices were used fertilizer, crop rotation and mixed farming. Respondents within 30-50 years of age had higher mean scores on the soil conservation practices awareness scale, while those cultivated less than 5 ha that higher mean scores on the soil conservation practices use scale. Respondents cultivated more than 10 ha had the lowest mean scores on the soil conservation practices awareness and use scale. It was concluded that Iraqi wheat farmers should be aware of soil conservation practices and the necessity of using them. An appropriate agricultural extension policy can contribute to achieve this based knowledge.

Keywords: Awareness, Soil conservation, Farming practices, Agricultural sustainability

Introduction

Soil is the basis of food production. Soil productivity is continuously diminishing every year, at an alarming pace (Kasaye, 2017). Traditional agricultural practices have diminished soil productivity to the extent that many agricultural soils are depleted of nutrients and unable to naturally sustain crop productivity (Naab *et al*., 2017). Soil needs to be managed in sustainable manner. Sustainable soil management contributes to increasing food production (Anonymous, 2017a). Management of soils in a sustainable manner is achieved through appropriate soil conservation practices (White *et al.,* 2012). Soil conservation practice (SCP) is a combination of all management and land use methods that safeguard the soil against depletion or deterioration by natural or human-induced factors (Anonymous, 2014).

Over the last few decades, many soil conservation practices (SCP) have been developed and practiced, which has given synergistic environmental and economic benefits to farmers (Gomiero *et al*., 2011; Carr *et al*., 2013; Dagnew *et al*., 2015; Dabi *et al*., 2017).

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The degree to which farmers benefit from soil conservation practices (SCP) depends to a large extent on their awareness and use of these practices. Recent studies were conducted to determine farmers' awareness and use of soil conservation practices; Mulat, 2013; Belay, 2014; Ashoori *et al.,* 2016; Kasaye, 2017; Mango *et al.,* 2017; Zerssa *et al.,* 2017.

Iraq suffers from severe land deterioration due to the effects of anthropogenic factors, such as unsustainable and marginal agricultural practices (Anonymous, 2017b), as well as inadequate soil management which contributes to land degradation and low productivity (Anonymous, 2012; Abu Hamad and Kadhim, 2015; Kshash, 2016; AL-Rawi, 2017; Kshash, 2017; Abdulrazzaq, 2020). Ttherefore, there is an urgent need to use SCP. On the other hand, the available studies on farmers' awareness and use of these practices are very few and may be nonexistent. Determination of farmers' awareness and use of SCP could be useful in enhancing productivity. The study was undertaken to determine wheat farmers' awareness and use of SCP in AL-Qassim District and evaluate relationship between extent of awareness, using and socioeconomic characteristics of wheat farmers to determine the differences in farmers' awareness and based on socioeconomic characteristics.

Material and methods

The study was carried out in AL-Qassim District in Babylon Province, located in south central Iraq, between 32.7 ° and 33.8 ° N and 43.42 ° and 45.50 ° E. Babylon Province is located in the Middle of Euphrates provinces, a fifth wheat producing province (Anonymous, 2019). The population for this study consisted of 873 wheat farmers of AL-Qassim district. Of these ten were chosen for testing the questionnaire's reliability, and from the 863 remaining, 300 were randomly selected to provide responses to the questionnaire from 1-20 February 2020.

The used instrument was a two-part questionnaire, namely socio-economic characteristics and awareness and use of SCP. The socio-economic characteristics included age, education level, years of experience in wheat cultivation, and area cultivated with wheat. The awareness and use part listed out likely 7 SCP viz; application of fertilizer, crop rotation, mixed farming, manure/plant residue, cover crops , mulching and minimum tillage..

Content validity of the questionnaire was established by a panel of six experts in the field of soil science, agricultural extension and wheat cultivation. A pilot study was conducted to establish reliability of the instrument. Cronbach's alpha (a reliability coefficient of 0.91) was established, indicating the used instrument was reliable and valid.

Awareness of SCP were measured on a three-point continuum scale as; fully aware (F), partially aware (P), and not aware (N), they were respectively coded as 2, 1, and 0 in the analysis. Use of SCP were measured on a four-point continuum scale as always (A), occasionally (O), rarely (R), and never (N), they were respectively coded as 3, 2, 1, and 0 in the analysis. In relation to their awareness level and usage level, in overall SCP, each respondent had scores ranging from (0 to 14) and (0 to 21) respectively.

Based on mean (M) ±standard deviation (SD), according to their level of awareness and usage, respondents were assigned and categorized as follows: low (below M−SD), medium (M±SD), and high (above M+SD).

Data were analyzed using frequency, percentage, mean (M), standard deviation (SD), weighted arithmetic mean (WM) and F test, by using SPSS version 22.

Results

Awareness of soil conservation practices

Overall Awareness

The awareness score ranged from zero to 14 with a mean of 7.47 was observed. Result observed that more than half of the respondents (51%) had medium awareness, followed by high (26.7%) and low (22.3%) awareness (Table 1). The average awareness for all respondents was within medium category.

Table 1. Distribution of respondents according to their overall awareness of SCP

Awareness level	% (n=300)	M	SD
Low (< 4.04)	22.3	2.67	1.33
Medium (4.04 –10.05)	51.0	7.34	1.40
High (>10.05)	26.7	11.74	1.18
Total (0-14)	100	7.47	3.43

Awareness categories

Application of fertilizer firstly ranked in term of wheat farmers awareness regarding SCP (2.00), followed by crop rotation (1.73), mixed farming (1.33), manure/plant residue (0.77), cover crops (0.75), mulching (0.50) and minimum tillage (0.39). Application of fertilizer, all respondents had fully awareness. As regard crop rotation, 73% were fully aware, followed by 27% within partially awareness. Also, 54.7% of respondents were fully aware

of mixed farming, followed by 32.7 and 21.6% who were partially and not aware respectively.

Table 2. Distribution of respondents according to their awareness of SCP

SCP	Awareness level			WM	SD
	Fully aware 2 % (n=300)	Partially aware1 % (n=300)	Not aware 0 % (n=300)		
Use of fertilizer	100.0	0.00	0.00	2.00	0.00
Crop rotation	73.0	27.0	0.00	1.73	0.44
Mixed farming	54.7	23.7	21.6	1.33	0.80
Manure/plant residue	19.0	39.0	42.0	0.77	0.74
Use of cover crops	21.7	31.7	46.6	0.75	0.78
Mulching	11.0	28.0	61.0	0.50	0.68
Minimum tillage	11.7	15.7	72.6	0.39	0.68

Use of soil conservation practices

The usage score ranged from zero to 21 was observed with a mean of 11.33. Result observed that (40.3%) of the respondents had medium usage, followed by those that had high (36%) and low (23.7%) usage level (Table 3). The average usage for all respondents was within medium category.

Table 3. Distribution of respondents according to their overall usage of SCP

Usage level	% (n=300)	M	SD
Low (< 5.97)	23.7	3.47	1.87
Medium (5.97 –16.69)	40.3	12.76	2.24
High (>16.69)	36.0	17.76	1.25
Total (0-21)	100	11.33	5.36

Table 4. Distribution of respondents according to their usage of SCP

SCP	Usage level				WM	SD
	Always 3 % (n=300)	occasionally2 % (n=300)	Rarely 1 %(n=300)	Never 0 %(n=300)		
Use of fertilizer	100.0	0	0.00	0.00	3.00	0.00
Crop rotation	81.0	19.0	0	0	2.81	0.39
Mixed farming	71.0	29.0	0.00	0.00	2.71	0.45
Manure/plant residue	10.3	46.7	25.7	17.3	1.50	0.89
Use of cover crops	9.3	18.7	28.7	43.3	0.94	0.99
Minimum tillage	3.00	5.7	11.7	79.6	0.32	0.71
Mulching	0.00	0.00	5.00	95.0	0.05	0.21

Usage categories

Use of fertilizer firstly ranked (3.00) among soil conservation practices (SCP) which used by wheat farmers, followed by crop rotation (2.81), mixed

farming (2.71), manure/plant residue (1.50), cover crops (0.94), minimum tillage (0.32) and mulching (0.05) (Table 4).

For fertilization, all respondents always use it as a SCP. As regard to crop rotation, 81% of respondents always use this, compared with 19% occasionally. The most respondents (71%) always use mixed farming, and followed by 29% within occasional usage.

Factors affecting awareness and use of SCP

Results indicated that there were significant difference between the mean scores of the awareness and use of SCP scale for the groups of age, education, years of experience and cultivated area (Table 5). Respondents within 30-50 years of age had higher mean scores on the SCP awareness scale, while those cultivated less than 5 ha that higher mean scores on the SCP use scale. Respondents who cultivated more than 10 ha had the lowest mean scores on the SCP awareness and use scale.

Table 5. Characteristics of respondents and awareness/usage of SCP

Variable	Categories	% (n=300)	Awareness		Usage	
			M	F	M	F
Age	< 30	27	7.07	5.981*	8.44	6.324*
M= 41.7, SD= 11.9	30 – 50	44.7	8.58		10.77	
	> 50	28.3	7.03		9.12	
Education	< Secondary	21.3	6.70	3.436*	7.79	4.576*
	Secondary	59.0	7.04		8.83	
	University	19.7	7.98		10.71	
Years of experience	< 20	30.3	7.28	4.199*	7.22	6.539*
M= 24.97, SD= 4.8	20 – 30	48.7	7.57		7.44	
	> 30	21.0	7.49		7.67	
Cultivated area(ha)	< 5	24.0	8.12	5.869*	10.96	6.835*
M= 6.5 , SD= 3.1	5 – 10	62.0	7.42		8.71	
	> 10	14.0	6.55		6.66	

* $P \leq 0.05$

Discussion

The SCP respondents were mostly aware of used as application of fertilizer, crop rotation and mixed farming, This result is consistent with the findings of Iheke and Onyenorah (2012); James and Ngala (2015); Ashoori *et al*. (2016) and Olowa *et al.* (2019). The cropped soil will eventually lose its fertility. Loss of soil fertility is major cause of low productivity (Lal, 2015; Yebo, 2015). Fertilization would increase crop yield (Yousaf *et al.*, 2017;

Kiprono *et al.,* 2018); enhance soil health, quality, and fertility (Dong *et al.,* 2012; Singh and Ryan, 2015; Kundu *et al.,* 2016). One major reason for the low productivity of wheat in Iraq is low soil fertility (Mazid *et al.,* 2013), so, farmers widely use fertilizer as soil enhancer to raise the level of nutrients found in soil, which explains the high awareness and use of fertilizer as a SCP among wheat farmers. Crop rotation is the practice of cultivating a series of crop types on the same land in sequential seasons. Crop rotation improves soil quality (Aziz *et al.,* 2011; Kazula *et al.,* 2017), soil health (Degu *et al.,* 2019), soil fertility (Monaci *et al.,* 2017), weed control (Woźniak and Soroka , 2018) and increased crop yield (Woźniak and Soroka , 2018; Mtyobile *et al.,* 2019) .

In Iraq, the common crop rotation sequence practiced by wheat farmers are wheat with maize, or wheat with legumes crops. Mixed farming is a type of farming which involve cultivating crops and raising livestock simultaneously. Mixed crop-livestock systems appear to be a way for an environmental and economically sustainable agriculture (Ryschawy *et al.,* 2012). It improves soil quality (Moraine *et al.,* 2017), maintain soil biodiversity, minimize soil erosion (Anonymous, 2017a), increase yield (Asai *et al.,* 2018) and farm income (Shahbaz *et al.,* 2017). In central and southern Iraq, where agriculture depends mainly on irrigation from the Tigris and Euphrates rivers, mixed farming systems are redominant (Anonymous, 2017c). Wheat and barley are the two major crops grown respectively.

Soil is subjected to continuous deterioration in many of its properties. There is urgently needed for soil sustainability. Poor farming practices deplete soil nutrients faster than they are able to form, leading to loss of soil fertility and degrading soils. Therefore, managing soil sustainably is cheaper than rehabilitating or restoring soil functions. Soil conservation practices can improve soil conditions and reduce soil degradation. Farmers must be aware of and use soil conservation practices to maintain soil fertility and increase production. Iraqi wheat farmers had a medium level of awareness and soil conservation practices. The SCP the farmers were mostly aware of used fertilizer, crop rotation and mixed farming. Farmers who cultivate small land used higher SCP. There is an urgent need to raises awareness and use of soil conservation practices.

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