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Farmer`s Adoption of Soybean Cultivation in Gezira Scheme, Sudan

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ABSTRACT

The present study seeks to assess farmer`s adoption of soybean cultivation in Gezira Scheme, Sudan. A field survey was used to collect data from 100 participant farmers in soybean extension programme and 100 non-participant farmers in the programme in Gezira Scheme, Sudan. The collected data were coded, fed to the computer, statistically analyzed using (SPSS), discussed, and interpreted using descriptive statistics and chi-square test. The descriptive statistics revealed high rate of adoption among participant farmers and the test of significance showed significant association between participation in soybean extension programme and the adoption of agricultural technology of soybean crop cultivation. From this study, it can be concluded that participation in extension soybean programme has positive impact on the adoption rate of the participant farmers, which in turn helped them to increase their production in comparison to non-participant farmers and, consequently will increase their income too. The study recommends that this extension programme of soybean crop should continue, the agricultural inputs of the crop should be available to farmers and, further agricultural extension research in the area of this new crop should be continue.

Keywords: Farmers, Soybean, Gezira Scheme, Adoption, Participation

Introduction

Soybean crop (*Glycine max* L. Merrill) is considered as one of the important legume crop in Africa, in addition to its potential for expansion of cultivated area. The majority of world soybean production (90%) was found in USA, Brazil, China, Argentina and India. Soybean accounts for about 84.5% of the grain legumes trade globally, and Sub-Saharan Africa (SSA) accounts for about 1.3% of the total land area under soybean and 0.6% of production in the world (Abate *et al.,* 2012). Soybean is a high protein legume, and used globally as food, animal feed, and as an industrial raw material. It is oil is used in the manufacture of many foods and industrial products.

The increasing demand of Soybean is based on its usefulness as a livestock feed, food and fuel crop (Mubichi, 2017). It is an alternative crop to bridge the gap of malnutrition among agricultural communities because it comprises more than 36% protein, 20% oil, 30% carbohydrates, dietary fiber, minerals, and vitamins (Bruns, 2016; Sales *et al.,* 2016). Soybean is known as less risky production crop because it is more tolerant to pests and diseases and has good grain storage quality compared to cereals (Giller, *et al.,* 2011). But despite these advantages, soybean production remains very low in Africa (Abate *et al.,* 2012). To meet the increasing demand of Soybean in SSA region, the countries imported 6.8 million tons of soybeans annually at the cost of 4.4 billion USD from 2013 to 2016. Imports in 2011 were estimated at 1.6 million tons, valued at $1.22 billion (Khojely *et al.,* 2018).

Soybeans is seen as one of Sudan's new and promising cash crop which was introduced in both irrigated and rainfed sectors before more than five years ago. The cultivated area of the crop has grown from 3000 acres in 2013 to about 25000 acres in 2020, in both the rainfed and irrigated sectors. The average production of this new crop is ranging between 1.1 - 1.5 tons per acre (Sudan now, 2921). Soybean crop is a grain legume that is considered as an important nutritious containing about 40%

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protein and other useful ingredients. It can be used directly for food in the household, or processed for soy-milk, cooking oil and many other products, including infant weaning food. Soybean as a new oilseed crop in Sudan was attained a significant importance according to its adaptability and multipurpose use such as human food, livestock feed and industrial row material. The domestic use of it has changed dramatically in the past ten years because it was became a major ingredient in poultry feed, Increasing protein production is needed to fil the gab of food security and improving human nutrition of rural areas of Sudan that was led to introducing its cultivation in both irrigated and rainfed agricultural sector of the country. The expansion of soybean production in Sudan was resulted from the increasing demand of it as a high-protein ingredient in livestock feed, release of improved varieties, ease of production, low production costs, and highly marketing demand, in addition to its ability to fix nitrogen (N) through symbiosis that has supported its widespread use as a rotational crop in sugarcane sector (Ibrahim, 2016). The agricultural extension service of Gezira Scheme has designed soybean extension programme to train farmers on the application of agricultural technology of the crop cultivation released by Agricultural Research corporation (ARC).

The present study seeks to assess farmer`s adoption of soybean cultivation in Gezira Scheme, Sudan.

2. Materials and Methods

This study was carried out in Tayba office, Masalamia Division, Gezira Scheme, Sudan in the 2021/2022 growing season. All participant farmers in soybean cultivation programme were used, i.e. 100 participant farmers and equal number of non- participant farmers (100) was used for comparison, by using the simple random sampling technique. The population was used to determine farmer`s adoption of cultivating Soybean in above mentioned area. A questionnaire consisting of some questions addressed selected socio-economic characteristics of famers and the main soybean cultural practices was constructed and the personal interview technique was used to administer the questionnaire. The collected data were statistically analyzed and interpreted using percentage, frequency distribution and chi-square test

3. Results and Discussion

3.1. Selected socio-economic profile of farmers

The socioeconomic characteristics investigated in the study include education level, age, and gender (Table 1).

Table 1: Distribution of farmers according to their selected socioeconomic profile

Selected socioeconomic characteristics of farmers				
Participation in the programme	**Participants**		**Non-participants**	
Educational level	**Frequency**	**%**	**Frequency**	**%**
Illiterate	01	01	01	01
Primary schools	04	7	7	7
Secondary schools	20	22	22	22
University and above	75	70	70	70
Total	100	100	100	100
Age group	**Frequency**		**Frequency**	**%**
20-30	02	02	04	04
31-40	30	30	26	26
41-50	60	60	55	55
51 and above	08	08	15	15
Total	100	100	100	100

I. Educational level:

One Percent of farmers were illiterate, 07% of them have primary education, and 22% of them have secondary education and, the majority of them 70% have University and above education. This result

showed that the farmers in the study area obtained the enough education that required for better understanding and consequently adopt the new agricultural technologies which is in conformity to Sennuga *et al.* (2020).

II. Age:

Two percent of farmers fell within the age of 20-30 years, 30% of them fell within the age of 31-40 years, and the majority of them 60% fell within the middle age of 41-50 years. Only 08% of them fell within the age of 51years and above. In general, the assumption is that younger people tend to be more productive than that of their older counterparts.

3.2. Land preparation method

From table (2) it can be observed that the majority of participant farmers 90% prepared their land as recommended by the Agricultural Research Corporation (ARC) compared to30%of non-participant farmers, 06% of participant farmers used their traditional methods compared to 57% of non-participant farmers and, 03% of participant farmers used mixed methods from the recommended and traditional methods compared to 08%of non-participant farmers.01% of participant farmers did not know which method they used in preparing their land compared to 05% of non-participant farmers . The result of this study is in line with the result obtained by Kumar *et al.* (2012) who found that 53.33 % of respondents have fully adopted the recommended practice of land preparation.

Table (2) also, revealed that there was a significant association between participation in soybean extension programme and the land preparation method.

Table 2: Distribution of farmers according to the land preparation method

Land preparation	Participants		Non-participants		Sign.
	Frequency	%	Frequency	%	
1-As recommended by ARC	90	90	30	30	.000
2-Use of traditional method	06	06	57	57	
3-Mixed between the two above	03	03	08	08	
4- Did not know	01	01	05	05	
Total	100	100	100	100	

3.3. Spacing and sowing method

From table (3) it can be seen that the majority of participant farmers 87% used the recommended spacing and sowing method of the (ARC) compared to34% of non-participant farmers. 08% of participant used their traditional methods compared to 46% of non-participant farmers and, 03% of participant farmers used mixed methods from the recommended and traditional methods compared to 12% of non-participant farmers.02% of participant farmers did not know which spacing and sowing method they used in cultivating their crop compared to 08% of non-participant farmers.

Table 3: Distribution of farmers according to the sowing method

Spacing and sowing method	Participants		Non-participants		Sig.
	Frequency	%	Frequency	%	
1-As recommended by ARC	87	87	34	34	.000
2-Use of traditional method	08	08	46	46	
3-Mixed between the two above	03	03	12	12	
4- Did not know	02	02	08	08	
Total	100	100	100	100	

The results of this study were agreed with the results obtained by Kumar *et al.* (2012) who reported that full adoption of spacing and sowing method was noted by 56.67 % respondents.

Table (3) also, indicate that there was a significant association between participation in soybean extension programme and the sowing method of the crop.

3.4. Sowing date and irrigation method

Table (4) indicates that the majority of participant farmers 95% applied the recommended sowing date and irrigation method of the (ARC) compared to 48% of non-participant farmers.01% of participant farmers applied their traditional sowing date and irrigation method compared to30% of non-participant farmers and, 01% of participant farmers applied mixed methods from the recommended sowing date and irrigation method compared to12% of non-participant farmers.03% of participant farmers did not know which sowing date and irrigation method they applied compared to 10% of non-participant farmers. Similar results were reported by Kumar *et al.* (2012) who found that the majority of respondents (70%) were adopting the recommended time of sowing.

Table (4) also, showed that there was a significant association between participation in soybean extension programme and the irrigation method of the crop.

Table 4: Distribution of farmers according to the sowing date and irrigation method

Sowing date and irrigation method	Participants		Non-participants		Sig.
	Frequency	%	Frequency	%	
1-As recommended by ARC	95	95	48	48	.000
2-Use of traditional method	01	01	30	30	
3-Mixed between the two above	01	01	12	12	
4- Did not know	03	03	10	10	
Total	100	100	100	100	

3.5. Seed rate

Table (5) showed that the majority of participant farmers 77% applied the recommended seed rate of the (ARC) compared to 50% of non-participant farmers, 01% of participant farmers applied their traditional methods compared to 38% of non-participant farmers and, 01% of participant farmers used mixed methods from the recommended and traditional methods compared to 05% of non-participant farmres.03% of participant farmers did not know which seed rate they applied compared to 07% of non-participant farmers. Similarly, Datarkar *et al.* (2016) found that in medium and low adoption groups the extent of level of adoption of use of seed rate was at higher level.

Table (5) also, revealed that there was a significant association between participation in soybean extension programme and the seed rate of the crop.

Table 5: Distribution of farmers according to the seed rate

Seed rate	Participants		Non-participants		Sig.
	Frequency	%	Frequency	%	
1-As recommended by ARC	77	77	50	50	
2-Use of traditional rate	13	13	38	38	
3-Mixed between the two above	06	06	05	05	.000
4- Did not know	04	04	07	07	
Total	100	100	100	100	

3.6. Improved varieties used

Table (6) showed that all the participant farmers 100% used the improved varieties recommended by the (ARC) compared to 48% of non-participant farmers, 01% of participant farmers used their traditional methods compared to 38% of non-participant farmers and, 01% of participant farmers used mixed methods from the recommended and traditional methods compared to 05% of non-participant farmres.03% of participant farmers did not know which improved varieties they used compared to 07% of non-participant farmers. This result is in line with the result reported by Kumar *et al.* (2012) who indicated that the majority of respondents 63.33 % were using the recommended soybean variety.

Table (6) also, indicate that there was a significant association between participation in soybean extension programme and the use of improved varieties of the crop.

Table 6: Distribution of farmers according to use of improved varieties

Improved varieties used	Participants		Non-participants		Sig.
	Frequency	%	Frequency	%	
1- Use of improved varieties only	100	100	48	48	.000
2- Use of traditional varieties	00	06	40	40	
3-Mixed between the two above	03	03	07	07	
4- Did not know	00	00	05	05	
Total	100	100	100	100	

3.7. Kind/dose of fertilizer used

Table (7) revealed that the majority of participant farmers 82% used the recommended kind/dose of super phosphate only of the (ARC) compared to 15% of non-participant farmers, 08% of participant farmers used superphosphate without the recommended dose only compared to 20% of non-participant farmers and, 08% of participant farmers used urea only compared to 60% of non-participant farmres.02% of participant farmers did not know which kind/dose of fertilizer they used compared to 05% of non-participant farmers. This result is disagreed with the result reported by Kumar *et al.* (2012) mentioned that the majority of respondents (52.00%) were using partial dose of manure in their field.

Table (7) also, showed that there was a significant association between participation in soybean extension programme and kind/dose of fertilizer used.

Table 7: Distribution of farmers according to kind/dose of fertilizer used

Kind/dose of fertilizer used	Participants		Non-participants		Sig.
	Frequency	%	Frequency	%	
1- Use of recommended dose of super phosphate only	82	82	15	15	.000
2- Use of superphosphate without the recommended dose only	08	08	20	20	
3-Use of urea only	08	08	60	60	
4- Did not know	02	02	05	05	
Total	100	100	100	100	

3.8. Weed control

From table (8) it can be seen that the majority of participant farmers 86% applied the chemical weeding control method recommended by the (ARC) compared to 55% of non-participant farmers.04% of participant farmers applied the hand weeding control method compared to 30% of non-participant farmers and, 06 % of participant farmers mixed the two weed control methods compared to 05% of non-participant farmers.04% of participant farmers did not know which weed control method they applied compared to 10% of non-participant farmers. This result is not in line with the result reported by Ashish Kumar *et al.* (2012) who found that only33.33 % of respondents have partially adopted the recommended chemical weed control practice

Table (8) also, indicate that there was a significant association between participation in soybean extension programme and the weed control of the crop.

Table 8: Distribution of farmers according to the weed control method

Weed control method	Participants		Non-participants		Sig.
	Frequency	%	Frequency	%	
1-Chemica; weeding	86	86	55	55	.000
2-Hand weeding	04	04	30	30	
3-Mixed between the two above	06	06	05	05	
4- Did not know	04	04	10	10	
Total	100	100	100	100	

3.9. Plant protection Practices

From table (9) it can be observed that the majority of participant farmers 87% applied the plant protection practices recommended by the (ARC) compared to 25% of non-participant farmers.02% of

participant farmers applied the traditional protection practices compared to 45% of non-participant farmers and, 06 % of participant farmers mixed the two practices compared to 29% of non-participant farmers.05% of participant farmers did not know which practices they applied compared to 10% of non-participant farmers. Similar results were obtained by Kumar *et al.* (2012) who indicated that regarding adoption of plant protection practices, majority of respondents (46.67%) had partial adoption followed by the respondents (33.33%) of full adoption.

Table (9) also, revealed that there was a significant association between participation in soybean extension programme and the plant protection practices of the crop.

Table 9: Distribution of farmers according to the plant protection practices

Plant protection practices	Participants		Non-participants		Sig.
	Frequency	%	Frequency	%	
1-As recommended by ARC	87	87	25	25	.000
2-Ue of traditional practices	02	02	45	45	
3-Mixed between the two above	06	06	20	20	
4- Did not know	05	05	10	10	
Total	100	100	100	100	

3.10. Production

Table (10) indicates that the production/ Sac/feddan of the majority of participant and non-participant farmers (80%, 72%) ranged from 8 to 13 sac/feddan respectively (the average yield/feddan ranging between 11 to 12 sac) .13%, 72% of participant and non-participant farmers their production ranged from 1 to 7 sac/fed respectively and, 02%, 01% of participant and non-participant farmers their production ranged from 14 and above respectively. Similarly, Tufa *et al.* (2019) mentioned that 61% of non-adopters obtain less than or equal to 1000 kg/ha (the average yield for the full sample) compared to only 46% of adopters.

Table 10: Distribution of farmers according to their production

Production/ Sac/feddan	Participants		Non-participants	
	Frequency	%	Frequency	%
1-7	13	13	72	72
8-13	80	80	27	27
14- and above	02	02	01	01
Total	100	100	100	100

1 sac = 100kg

4. Conclusion and Recommendations

From this study, it can be concluded that participation in extension soybean programme has positive impact on the adoption rate of the participant farmers, which in turn helped them to increase their production in comparison to non-participant farmers and, consequently will increase their income too. The study recommends that this extension programme of soybean crop should continue, the agricultural inputs of the crop should be available to farmers and, further agricultural extension research in the area of this new crop should be continue.

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