International Journal of Agricultural Science, Research and Technology in Extension and Education Systems (IJASRT in EESs)
Available online on: http://ijasrt.iau-shoushtar.ac.ir
ISSN: 2251-7588 Print
ISSN: 2251-7596 Online
2018: 8(1):1-6

Received: 13 July 2017
Reviewed: 24 July 2017
Revised: 26 July 2017
Accepted: 30 July 2017

Impact of Farmer Field Schools on Farmer`s Adoption of Wheat Production Technical Packages in Gezira Scheme, Sudan

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Abstract

The main objective of this study was to assess the impact of farmer field schools on adoption of technical packages of wheat production in Gezira Scheme, Sudan. Field survey was used to collect data from 50 FFS-participants of two schools (25 from each school), and also equal number from Non-FFS participants were selected for comparison. Close ended questionnaire was used in data collection. The data were statistically analyzed using (SPSS), discussed interpreted using percentage, frequency distribution and chi-squire test. The descriptive analyses showed that the FFS-participants were adopted the application of wheat production technical packages: land preparation (First :86%, second:74%) , method of land preparation (92%),use of recommended wheat varieties (92%), seed rate(66%) , seed treatment with gaucho (86%), sowing date (76%), fertilizers rates(66%) ,number of irrigations(82%) , harvesting time (52%).The chi-square test showed significant association between farmer`s adoption of wheat production technical packages and their participation in FFS weekly training. From this study it can be concluded that the FFS is very effective agricultural extension approach which can be adopted to transfer knowledge, recommended cultural practices of agricultural crops to farmers, and consequently increase income of them through their participation in various FFS activities. The study recommends that FFS should become national policy, share authority of extension organizations in finance, control and execution of FFS activities with farmer unions and other partners for more effective participations of farmers in all activities of the schools and the current curriculum of FFS should be developed.

Keywords: Farmers Field Schools, Adoption, Wheat production technical packages, Gezira Scheme, Sudan

1. Introduction

Wheat is grown on around 10 million ha in many African countries and can be seen as an important imported commodity in all of Africa. Wheat imports account for 60% of African's wheat consumption and 80% of Sub-Saharan countries. Wheat consumption was increased in Africa during the past 20 years as a result of growing population, changing food preferences and socioeconomic change associated with urbanization (Macauley, 2015).

Wheat is the second most important cereal crop in the Sudan after sorghum. Wheat is grown in different locations particularly; Northern State, River Nile State, Jabel Mara and Gizera Scheme (Mohamed and Abdalla, 2012). Wheat can provide more than half of the calorie requirements in a healthy daily diet. Wheat is also a major source of protein compared with other foods and contributes more than 25percent of the protein needed for human diet. In Sudan wheat consumption has grown rapidly over the past 15 to 20 years, and production increases have not been sufficient to meet demand. The traditional sorghum and millet-based flat bread (*kisra*) is now baked by urban households just one day per week or on holidays. Similar changes in eating habits are occurring across the country's rural areas, where many farm families now sell part of their sorghum

and millet harvest to have money to purchase bread. Even internally displaced persons (IDPs) in IDP camps in Darfur and other parts of the country have been frequently observed selling a portion of their sorghum ration to buy bread. Consumption of bread is also appealing to households as the price is subsidized and sold at a fixed price, whereas traditional grain prices vary widely (USAID, 2015).

Wheat imports have exerted a heavy burden on the Sudan's meager and deteriorating foreign exchange resources and have worsened its negative trade balance. Therefore, the domestic resources for wheat production should be fully utilized. The gap between potential yield and farmers' yields needs to be closed.

The government strategy aims to exploit the potential gains from improved wheat production technologies developed by the Agricultural Research Corporation (ARC)in collaboration with International Centre for Agricultural Research in the Dry Areas (ICARDA). These technologies have been tested by the (ARC) in farmers' fields over several years. However, a wide gap remains between potential yields and farmers' yields (Abdelrahman, 1998).

Many factors are affecting the productivity of wheat in its main growing areas in the Sudan. These factors include weather, cultivars and sowing dates, crop establishment practices, and biological factors. The short wheat growing season (90-100days) and the excessively high temperatures at early and late crop growth stages contribute greatly to the low wheat productivity. Sudan currently produces only 30% of the wheat it consumes and relies on imports of some 1.5 million tons of wheat each year. With growing population, the dependence on imports is growing, exposing the country to the vagaries of global commodity markets (Alsaffar et al, 1997a).

Stated that the Farmer Field Schools (FFS) are excellent instruments in reaching farmers groups. They are creative and realistic in implementing extension and IPM philosophy, principles and practices. They also strengthen linkages and interaction among farmers, researchers, so that they can work together to challenge main constraints. As a result, farmers become more organized, cooperative, independent, open minded and communicative in expressing their needs and experiences specialists, managers and extensionists at various levels. In addition, they help in reducing cost, effort and time in motivating farmers to improve their lives; they create a healthy environment which democratic and humanistic. Farmers are motivated to actively participate in rural development (Alsaffar et al, 1997a).

In 1993, Sudan became the first African country to apply the approach, modify it to suit the socio-economic structure of the rural community, evaluate it and present it as a model that can easily be assimilated and adopted by small farmers in the rest of the Sudan and other parts of Africa (Alsaffar et al, 1997b).

1.1 Research problem:

Wheat is one of the most important corps of Sudan according to its economic and nutrition value. The uses of traditional cultural practices are the major problem of wheat production in the country. Therefore the Agricultural Research Corporation (ARC) in collaboration with International Centre for Agricultural Research in the Dry Areas (ICARDA) were developed improved cultural practices (wheat production technical packages) and validated them through FFS in order to overcome the abiotic and biotic stresses in the region which in turn will help farmers to increase their production.

1.2 Research objectives:

Main Objective:

The main objective of this study was to assess the impact of farmer field schools on adoption of technical packages of wheat production in Gezira Scheme/Sudan.

Specific objectives:

The Specific objectives of this study are to measure the following:

- ✓ Farmer`s participation in FFS weekly field training per season.
- ✓ Selected socioeconomic characteristics of FFS participants and non- FFS participants (Age and education level).
- ✓ Application of wheat production technical packages (land preparation, use of recommended wheat varieties, seed rate , fertilizers rates ,number of irrigations ,sowing date and harvesting time).
- ✓ Wheat production of FFS and non FFS participants.

2. Materials and methods

2.1 Area of the study:

This study was conducted in the Gezira Scheme .The Gezira Scheme is Sudan's oldest and largest gravity irrigation system, located between the Blue Nile and the White Nile. Started in 1925 and progressively expanded thereafter, in particular with its Managil expansion. It covers about 870 000 ha– one of the largest continuous irrigation schemes under a single administration in the world (UNEP, 2007)–and is divided into some 138 000 tenancies with an average size of about 8 ha (NBI, 2008). It receives water from the Sennar Dam on the Blue Nile and withdraws over a third of Sudan's share of Nile water under the 1959 Agreement (UNEP, 2007)– from 2 km³ in 1958 to 7.1 km³ in 1998 (NBI, 2008).

The scheme has played an important role in the economic development of Sudan, serving as a major source of foreign exchange earnings and of Government revenue. It has also contributed to national food security and in generating a livelihood for the estimated 2.7 million people who live in the command area of the scheme.

2.2 Study population, sampling procedure and sample size:

This study was carried out in two Farmers Field Schools (FFS) in the Gezira Scheme namely: Wadalbour and Elbsatna. All FSS participants (25from each school) were selected using full count method. Equal number of non- FSS participants (50) was selected for comparison using the simple random sampling technique.

2.3 Data Collection:

Field surveys were used to collect data from 50 FFS- participants and 50 Non-FFS-participants in 2014-2015 growing season. A close ended questionnaire was constructed consisting of14 questions addressed selected socioeconomic characteristics of farmers and wheat production technical packages .The personal interview technique was used to administer the questionnaire. A pretest for the questionnaire was made with 15 farmers. The interview continued from May to June 2015.

2.4 Data Analysis:

The collected data were coded, fed to computer and statistically analyzed using Statistical Packages for Social Sciences (SPSS), discussed interpreted using percentage, frequency distribution and chi-squire test at 0.05 significance level or less. Chi square is given by:

$$\chi^2 = \sum_{r=1}^{R}\sum_{c=1}^{C}(O_{rc} - E_{rc})^2 / E_{rc}$$

With degrees of freedom (v) given by (R-1) (C-1), where:

R: Rows of the contingency table

C: Columns of the contingency table

3. Results and discussion

3.1 Descriptive analysis of the data:

3.1.1 Selected socioeconomic characteristics of farmers:

Table (1) showed that the majority of FFS-participants and non- FFS participants (72%, 58%) were between 15- 60 years old respectively which can be seen as the productive age groups. The rest of FFS- participants and non- FFS participants (28%,26%) were 61 year old and above respectively .As known in the literature the age plays important role in farmer's adoption of new technologies.

Table 1.Percentage distribution of FF and non- FFS participants according to their ages

Age	FFS – Participants		Non-FFS-Participants	
	No	%	No	%
(10 – 14)	0	00	1	02
(15 - 30)	9	18	8	02
(31- 45)	14	28	17	34
(46- 60)	13	26	11	22
60<	14	28	13	26
Total	50	100	50	100

Table (2) revealed that the majority of FFS-Participants and non FFS- Participants (86%,86%) were literate respectively, while the rest of them (4%,10%) were illiterate respectively also. As known in the literature the education plays important role on farmer's adoption of new technologies.

Table 2. Percentage distribution of FFS and non-FFS- participants according to their education level

Education Level	FFS – participants		Non- FFS-participants	
	No	%	No	%
Illiterate	2	04	5	10
Khalwa	5	10	2	04
Primary	19	38	14	28
Secondary	20	40	26	52
University and above	4	08	3	06
Total	50	100	50	100

3.1.2 Participation in FFS activities per season:

Table (3) indicate that the majority of FFS-participants (62%) were participated in FFS activities in three seasons, because the activities of the school were attracted them to attend all training sessions throughout the three seasons.

Table 3 Percentage distribution of FFS and non- FFS- participants according to their participation in FFS activities per season

Participation	FFS Participants	
	No	%
Not Participant	0	00
One season	9	18
Two seasons	10	20
Three seasons and above	31	62
Total	50	100

3.1.3 Wheat production technical packages:

Table (4) revealed that:

1. The majority of FFS –participants and non- FFS -Participants (86%,68%) were prepared

their lands in the end of August and first of September as first land preparation respectively as recommended by the Agricultural Research Corporation (ARC) as suitable period for the first land preparation.

2. The majority of FFS and non- FFS -participants (74%, 70%) were prepared their lands in the second half of October as second land preparation respectively as recommended by the Agricultural Research Corporation (ARC) as suitable period for the second land preparation.

3. The majority of FFS -participants (92%) reported that they used the disc harrow in their land preparation compared to (42%) of non- FFS – participants.

4. The majority of FFS- participants (92%) reported that they cultivated Imam variety as recommended by the Agricultural Research Corporation (ARC) compared to (42%) of non- FFS participants who reported that they also cultivated this variety.

5. The majority of FFS participants (66%) reported that their seed rate is 50-60 kg/ fed as recommended by the Agricultural Research Corporation (ARC), while the majority of non -FFS participants (52%) reported that their seed rate is 40-50 kg/ fed.

6. The majority of FFS -participants and of non - FFS Participants (86%, 82%) reported that they treated their seeds with gaucho respectively as recommended by Agricultural Research Corporation (ARC).

7. The majority of FFS- participants (76%) reported that they sow their seeds between 12- 26 November as recommended by ARC compared to (70%) of non -FFS- participants reported that they sow their seeds in the first half of November.

8. The majority of FFS -participants (66%) and more than half of non - FFS- Participants (54%) reported that they added 40 kgm Super + 80kgm Urea/fed to their crop as recommended by the Agricultural Research Corporation (ARC).

9. The majority of FFS- participants (82%) reported that they irrigated their crops eight irrigations throughout the season as recommended by the Agricultural Research Corporation (ARC) compared to (66%) of non - FFS- Participants.

10. More than half of FFS -participants(52%) reported that they harvested their crop after two weeks after the drying of the crop as recommended by the Agricultural Research Corporation (ARC) compared to (26%) of non - FFS- Participants.

Table 4. Descriptive analysis of the data and test of significance using chi-squares test

Wheat production technical packages	FFS Participants %	Non- FFS- Participants %	Number of participation in FFS activities			Sig.
			One season	Two seasons	Three seasons	
1-Date of first land preparation	86	68	09	10	31	.010
2-Date of second land preparation	74	70				.076
3- Method of land preparation	92	42				.000
4- Cultivation of recommended wheat varieties	92	42				.000
5- Seed rate kg/fed	66	18				.000
6- Seed treatment with gaucho	86	82				.475
7- sowing date	76	12				.179
8- Fertilizers rate kg/fed.	66	54				.014
9- Number of irrigations	82	66				.048
10- Harvesting time	52	26				.000

Significance level 0.05

Table 5. Percentage distribution of FFS and non- FFS participants according to their production

Number of participation in FFS activities	Production (Sac)					Total	sig
	1-6	7-12	13-18	19-25	25<		
Did not participate	9	26	10	5	0	50	
One season	1	1	3	2	2	9	
Two season	0	2	3	4	1	10	.000
Three and more	0	3	2	14	12	31	
Total	10	32	18	25	15	100	

3.2 Test of significance using chi-squares test:

To test the association between participation in FFS activities per season and adoption of wheat production technical packages:

Table (4) showed that:

1. There was significant association between number of participation in FFS activities and adoption of recommended date of first land preparation.
2. That there was no significant association between number of participation in FFS and adoption of recommended date of second land preparation. This may due to the high percentage of non- FFS – participants (70%) that were also adopted the recommended date of second land preparation.
3. There was significant association between number of participation in FFS activities and the adoption of recommended method of land preparation.
4. There was significant association between number of participation in FFS and adoption of cultivation of recommended wheat varieties.
5. There was significantassociation between number of participation in FFS activities and adoption of seed rate.
6. There was no significant association between number of participation in FFS activities and adoption of seed treatment with gaucho. This may due to the high percentage of non- FFS –participants (82%) that were also adopted the recommendation of seed treatment with gaucho.
7. There was no significant association between number of participation in FFS activities and sowing date. This may due to the high percentage of non- FFS –participants (70%) that were also adopted the recommended sowing date.
8. That there was significant association between number of participation in FFS activities and adoption of fertilizers rate.
9. There was significant association between number of participation in FFS activities and adoption of recommend number of irrigations.
10. There was significant association between number of participation in FFS activities and adoption of recommended harvesting time.
11. Table (5) revealed that there was significant association between number of participation in FFS activities and Farmer‘s production.

Table (5) showed that the majority of FFS - participants (70%) reported that their production ranging between 19- 25, 26 and above sac compared to (52%) of non - FFS -participants reported that their production ranging between 7- 12 sac.

4 Conclusion and recommendations

As in other African countries the important factor affecting wheat production of Sudan according to climate change is the intense heat during its growing season which limiting the crop performance and yield. The national yield average for wheat is only 2 tons per hectare (t/ha) or may lower than this as in Nigeria where similar conditions prevail (ICARDA, 2016).Many studies pointed out that Sudan currently produces only 30% of wheat it consumes and relies on imports of some 1.5 million tons of wheat each year. Regarding the growing population, the imports of wheat will increase year after year, exposing the country to the vagaries of global increased prices. The government of Sudan has been encouraging solutions to increase domestic wheat production to progressively reduce import dependence. Therefore the gap between potential yield and farmers' yields needs to be closed. The national strategy aims to exploit the potential gains from improved wheat production technologies developed by the Agricultural Research Corporation (ARC) in collaboration with International Centre for Agricultural Research in the Dry Areas (ICARDA).These production technologies were disseminated to wheat farmers starting from 2012 through the Farmer Field Schools in collaboration with The Gezira Scheme extension services.

The participatory approach assumes that effective agricultural extension cannot be achieved without the active participation of farmers as well as of research and related services, that there is a

reinforcing effect in group learning and group action and that agricultural extension efficiency is gained by focusing on important points based on expressed needs of farmers and by reaching more small scale farmers through their groups/organizations instead of through individualized approach. Therefore participation in FFS activities throughout the growing season plays important role on farmer's adoption of new technologies.

Extension services can play a key role in dissemination of information by transferring technology, facilitating interaction, building capacity among farmers, and encouraging farmers to form their own networks. Extension services that specifically address climate-change adaptation include disseminating local cultivars of drought-resistant crop varieties; teaching improved management systems; and gathering information to facilitate national research work (Hellin et al, 2012). Results of a study conducted by the Agricultural Research Corporation (ARC) revealed that the new wheat varieties were demonstrated a yield increase of up to 70% on fields of participant farmers over non-participant farmers (ICARDA, 2015). Mussei et al (2001) showed that a higher percentage of adopters of improved wheat technologies in Tanzania participated in on-farm demonstrations than the percentage of non-adopters.

From this study it can be concluded that:

1-The FFS are very effective agricultural extension approach that can be adopted to transfer knowledge and recommended cultural practices of agricultural crops to farmers. This consequently can increase the income of farmers through their participation in various FSS activities.

2- FFS have indirect impact on non-FFS participants as a result of the horizontal communication between FFS participants and non-FFS participants which can be considered as one of the FFS objectives.

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