Impact of Farmer Field Schools and Traditional Extension on Adoption of Crop Production Technological Packages in the Rahad Scheme

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مستخلص:

تقدم الدراسة المضمنة في هذه الورقة تحليلاً مقارناً لتأثير إستخدام منهج مدارس المزارعين الحقلية في الإرشاد الزراعي و نظام الإرشاد الإشرافي السلعي على معدلات تبني الحزم التقنية في إنتاج المحاصيل بواسطة مزارعي مشروع الرهد الزراعي بالسودان.

لقد تبين من البحث بأن المزارعين المنتمين لمدارس المزارعين الحقلية قد حققوا معدلات أعلى في تبني الحزم التقنية المرتبطة بإنتاج محصولي الذرة الرفيعة و الفول السوداني مقارنة بالمزارعين الذين يشملهم نظام الإرشاد الإشرافي السلعي تحت إدارة مفتشي الزراعة. أما معدل تبني مفردات الحزمة التقنية لإنتاج محصول القطن فقد كانت عالية نسبياً في المجموعتين. وهذا يعزى للاهتمام الأكبر الذي توليه إدارة المشروع تقليدياً لإنتاج وتسويق القطن كمحصول نقدي للصادر تدعمه الدولة.

ووضح من نتائج التحليل التراكمي بأن مجموعة المشاركين في مدارس المزارعين الحقلية تتفوق على مجموعة الإرشاد الإشرافي التقليدي في معدل تبني مكونات الحزم التقنية لإنتاج القطن والذرة الرفيعة والفول السوداني مجتمعين، وكذلك في معدل الحصول على المعلومات من المصادر الإرشادية المختلفة الذي تبين بأنه المؤثر المعنوي الوحيد على تبني الحزم التقنية، حيث أنه لا توجد فوارق معنوية بين مجموعتي المزارعين موضوع الدراسة في الصفات الديمغرافية و الإقتصادية الإجتماعية كالعمر و التعليم و الإرتباط بالمناطق الحضرية.

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INTRODUCTION

The Farmer Field School (FFS) participatory approach to Agricultural extension work was first experimented with and developed by the Food and Agriculture Organization of the United Nations (FAO) in Indonesia in 1989, as an innovative component in Integrated Pest Management (IPM) projects. Since then use of FFSs have spread all over the world. A global survey and review of FFS experiences[1] revealed that FFSs were used in 75 countries and that Sudan is among the first 5 countries that have adopted use of the FFS approach (see Table 1).

The first FFS in Sudan was established in 1993 as a component of an FAO/ARC IPM Project which was conducted primarily in the Gezira Scheme, followed by the establishment of the first Rural Women School (RWS) in the same project in 1995[2]. Gradually, however, use of FFSs in Sudan has evolved over the years into an all-inclusive participatory approach to agricultural extension work which is considered to constitute an effective means for enabling farmers to take right production decisions. The FFS approach is regarded to be comparatively advantageous because it engages participants in the planning and implementation of learner-centred, field-based learning activities that encourage observation, analysis, assessment, and experimentation. This constitutes an important feature in extension work, as it is generally recognized that the impacts of participatory activities are more sustainable.[3] The global evaluation studies, which were conducted in 25 countries, have revealed that FFSs have achieved sustained learning effects, the strengthening of social and political skills, and improvement of agro-ecosystem management [4]

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1 Braun, A.; Jiggins J.; Röling, N.; van den Berg, H. and Snijders, P. (2006). *A Global Survey and Review of Farmer Field School Experiences.* Report prepared for the International Livestock Research Institute (ILRI). Wageningen, The Netherlands.

2 Dabrowski, Z. T., Alsaffar, A. A. and Abdelrahman, A. A. (1997). The role of farmers' field schools in IPM implementation. *Arab Congress of Plant Protection*, Beirut (Lebanon), 27-31 Oct 1997.

3 Axin, H. (1988). Guide on Alternative Extension Approaches. FAO, Rome. Chambers, R. (1993) Challenging the Professions: Frontiers for Rural Development. Intermediate Technology Publications, London. Chambers, R. (1983). Rural development: Putting the Last First. Longman, London.

4 Van den Berg, Henk (2004). IPM Farmer Field Schools: A synthesis of 25 impact evaluations. Wageningen University, The Netherlands, January 2004. Prepared for the Global IPM Facility. http://www.fao.org/docrep/006/ad487e/ad487e00.HTM.

Thus, unlike many of the traditional approaches to extension, the FFS is meant to achieve capacity development and empowerment goals rather than merely the achievement of technology transfer objectives. The central element of the FFS participatory approach to extension is the formation of farmer groups founded around activities designed to satisfy the priority needs of the intended participants[1]. The second element is the facilitation of experiential learning coupled with sustained interaction between farmers, extension workers and researchers.

Studies on the impact of FFSs in the Gezira Scheme[2], have concluded that FFS training had produced long-term behavioural change effects. Farmers participating in FFSs were found to have continued to follow the IPM recommendations more than the non-participating farmers who were subjected to the traditional inspectorate technology transfer extension system.

The FFS school approach to extension work was adopted by the Rahad Agricultural Scheme relatively recently. Its implementation started in 1993 as a component of an IPM project supported by FAO in parts of the scheme under the supervision of full-time field extension personnel belonging to the scheme's Extension Department. The first FFS was established in the 1993/94 season at Village 39 where 35 farmers were trained. In the 1994/95 season, the second FFS was established in Village 37. In the 1995/96 season, 6 schools were established and constituted a part of the extension activities. By 1997, the number of FFSs in the scheme gradually increased to 18 and provided for training of 600 farmers.

The traditional extension approach which continued to be implemented in the Rahad Scheme since 1977 is essentially a commodity development information and service delivery system in which farmers are closely supervised by field inspectors who perform extension education functions in addition to their principally regulatory and managerial duties. Local field assistants (*Samads*), and members of the scheme's local production

1 Mohamed, Shadia A. (2001). Assessment of the Impact of Different Systems of Extension Work on Adoption of Technological Packages by Farmers in the Rahad Scheme. Ph. D. (Agric.) thesis, University of Khartoum, Sudan.

2 Khalid, A. (2002). Assessing the long-term impact of ipm farmer field schools on farmers' knowledge, attitudes and practices: a case study from Gezira Scheme, Sudan. Paper presented in *The International Learning Workshop on Farmer Field Schools: Emerging Issues and Challenges.* 21 – 25 October 2002, Yogyakarta, Indonesia. Sid-Ahmed, B. H. (2004). *Assessment of the Impact of Farmer Field Schools on Adoption of Innovations in the Gezira Scheme.* M. Sc. thesis. University of Khartoum, Sudan.

committees, work with the field inspectors as intermediaries. This approach has been criticized for its top-down nature and lack of participation of the targeted farmers in the identification and solution of production problems.

The objective of this paper is to compare FFS and the traditional inspectorate technology transfer approaches to extension work in the Rahad Agricultural Scheme in terms of their impact on rate of adoption of the technological packages recommended to the tenant farmers for use in the production of three principal crops, namely cotton, sorghum and groundnuts. Each of the recommended technological packages was composed of nine components, including sowing date, sowing rate, thinning, weed control, use of fertilizers, irrigation, use of pesticides and crop harvest method. The rates of adoption of these components by farmers exposed to the two distinct approaches to extension in selected Blocks of the Rahad Agricultural Scheme constitute the focus for comparative analysis. Because of the homogeneity of the farmers who were exposed to the two extension systems in the Rahad Scheme, the study was based on the teaching or extension communication methods impact approach to research on adoption of innovations which views adoption behaviour as the outcome of learning processes facilitated by exposure to effective extension communication methods or approaches (Albrecht, 1965; Saeed, 1989).[1]

METHODOLOGY

The methodology of the study involved use of a multi-stage stratified random sampling procedure for selection of a representative sample of farmers exposed to FFS extension training, and one for farmers operating under the traditional supervisory extension system in the Rahad Agricultural Scheme. In the first stage of the sampling procedure, two of the three administrative Groups of the scheme (the Southern, Central and Northern Groups) were randomly selected. These turned to be the Central and Southern Groups. The second stage of sampling involved random selection of one Block from each of the selected Groups. The blocks thus selected were Block 6 from the Central Group and Block 3 from the Southern Group. The third stage of sampling involved random selection of three villages from each of the two selected Blocks. The 6 villages selected that way were

1 Albrecht, Hartmut (1965). *Theoretical Approaches of American Adoption Research. A Critical Analysis for the Orientation of Extension Research.* Institut fur Auslandische Landwirtschaft an der Universitat Gottingen. Saeed, Awadalla M. (1989). *Socio-Economic Models of Adoption of Agricultural Innovations in the Sudan and Their Implications for Agricultural Development Programs.* Ph. D. thesis. Cornell University, Ithaca, New York, USA.

villages 12, 13, 14, 26, 27 and 28 (the villages in the scheme are known by their assigned numbers). The fourth stage of the sampling procedure involved the preparation of separate sampling frames listing farmer trained in FFSs and those operating under the traditional system in each of the selected villages for the purpose of drawing sub-samples of farmers randomly to represent each of the two groups (up to 20 farmers from each group if available). The number of farmers selected that way amounted to 156, of whom 66 were FFS participants and 90 were farmers operating under the traditional inspectorate extension system (see Table 2).

Data collection involved use of structured schedules and individual interviews with the selected farmers to get and record responses relating to the rate of adoption of the different components of the technological packages recommended by the Rahad Scheme for use in the production of three principal crops, namely cotton, sorghum and groundnuts. Background demographic and socio-economic data and information on other related variables were also collected.

Data analysis involved use of the Statistical Package for the Social Sciences (SPSS) to generate frequencies and t-test statistics for comparative analysis and determination of the significance of the observed differences between the two farmer-groups in the rate of adoption of the recommended crop production technological packages.

RESULTS AND DISCUSSION

The rates of adoption of the different components of the technological packages recommended for use by tenant farmers in production of cotton, sorghum and groundnuts were found to be generally high. A larger proportion of the farmers who received FFS training, as well as the farmers operating under the traditional inspectorate extension system, reported high levels of adoption of the recommended seed rates and weed control methods in production of the three crops. The practices which scored the highest levels of adoption on the whole included the recommended weed control practice, seed rates, plant thinning methods and use of improved seeds. On the other hand, the components of the recommended technological packages least adopted were use of pesticides, use of fertilizers, sowing dates and crop harvest methods. For all of the three crops, the rate of adoption of the recommended technological packages was found to be higher among the farmers participating in FFSs (see Table 3).

The rates of adoption of the different components of the cotton packages by all farmers in the sample, shown in Table 4, indicate high rates of adoption of the recommended weed control method, seed rate, plant

thinning method, use of improved seeds and use of fertilizers, followed by use of the recommended crop harvest method, pesticides and irrigation intervals. The rate of adoption of each of the components of the technological package for cotton production was found to be higher among the farmers participating in FFSs, except for use of pesticides and the recommended sowing date. The average rate of adoption of the cotton package components among the farmers participating in FFSs was 87.4%, while the average rate of adoption of the same components by the farmers exposed the to traditional extension method was 85.5%. However, the results of the t-test analysis displayed in Table 5 suggest that the differences between the farmers trained in FFSs and those who were subjected to the traditional inspectorate extension system, in terms of adoption of the components of the recommended technological package for cotton production were not significant.

The analysis results for the sorghum crop (see Table 6) indicate the presence of slight differences between farmers trained in FFSs and the farmers subjected to the traditional extension approach with respect to the level of adoption of the components of the recommended sorghum production package. The rate of adoption was high among farmers in the two groups, especially with respect to the recommended weed control method which achieved 100% rate of adoption, followed by the recommended seed rate (98.7%). The overall average rate of adoption of the sorghum package among the farmers participating in FFSs was found to be 86.7 %, while that among the farmers exposed to the traditional extension system was a little lower, being 81.1 %. Table 7 shows t-test analysis statistics based on composite scores on adoption of the recommended technological package for sorghum. The statistics reveal a significant difference (at the .09 level) between the two farmer groups in their rates of adoption of the technological package for sorghum production in favour of the farmers trained in FFSs.

The rates of adoption of the different components of the groundnuts production package are provided in Table 8. From the data included in the table, the highest rate of adoption was scored by the weed control method, followed by the recommended seed rate, plant thinning method and use of improved seeds. The rate of adoption of the individual components of the groundnuts technological package was found to be higher among farmers participating in FFSs. The average rate of adoption of the different components of the groundnuts package among the farmers participating in FFSs was 77.9%, while that among the farmers exposed to traditional

extension system the average rate adoption of the individual components of the same package was 75.4%.

As reflected in Table 9, the results of t-test analysis for adoption of the groundnuts technological package show a very significant difference (at .03 level) between the farmers participating in FFSs and those who were exposed to traditional extension system in favour of the former group.

Further t-test analysis involving the composite scores received by farmers in the two groups in the adoption of the components the three technological packages (for cotton, sorghum and groundnuts) taken together indicate a significant difference (at .057 level) in favour of the farmers participating in FFSs (see Table 10). This result suggests that the FFS participatory approach to extension work in the Rahad Scheme had achieved a greater positive impact on adoption of the recommended crop production technological packages than the traditional top-down extension system that had been put to use for decades.

The relatively better performance of the farmers trained in FFSs in adoption of the recommended crop production practices, as suggested by the analysis results shown in Tables 11 and 12, is attributed to their higher level of access to agricultural extension information and experiential training. The differences between the FFS participants and non-participants in the sample in relation to other socio-economic and demographic variables were found to be insignificant.

CONCLUSIONS

The findings of the present study indicate the presence of significant differences in the rates of adoption of the recommended technological packages for production of cotton, sorghum and groundnuts in the Rahad Scheme between the farmers who received FFS training and those who operated under the traditional supervisory extension system.

From the data analysis results, it can be concluded that adoption rates of the technological package for production of cotton was significantly higher among all farmers, compared to the adoption rates of the recommended production packages for sorghum and groundnuts. That may be attributed to the more regular support services which are provided by the scheme to farmers in the cotton fields and to the closer supervision of cotton production operations by the field inspectors. Also farmers in the Rahad Scheme have acquired long experience in cotton production practices.

The production of sorghum and groundnuts, as the principal private food and cash crops in the Rahad Scheme, was found to have been constrained by

several limiting factors. Some of the recommended technological packages for production of sorghum and groundnuts were not adopted by the farmers. The main limiting factors which resulted in low rates of adoption of some of the components of the sorghum and groundnuts technological packages were identified by the farmers in the sample. The low rate of adoption of the recommended sowing date for groundnuts, for example, was attributed by farmers in both groups to irrigation problems (supply of irrigation water in the groundnuts fields is often delayed beyond the scheduled time). The same reason is also behind the very low rate of adoption of the recommended groundnuts harvest practices among farmers in the two groups.

Differences in the levels of exposure to extension sources proved to be the major factor that explains the significant differences which existed between farmers participating in FFSs and the non-participants in relation to adoption rates of the different components of the recommended crop production practices. The factors limiting adoption of some of the recommended practices are more of less common for farmers in both groups, but significant differences exist with regard to level of engagement in extension activities. The analysis has revealed that farmers participating in FFSs had more access to extension personnel. Both of the FFS approach and traditional extension system do not involve use of mass communication media, the exposure to which was found to be equally very low for both groups.

One of the factors limiting adoption of some of the recommended practices, especially for sorghum and groundnuts, was found to be the low economic return from production of the crops. The incomes reported by farmers are very low, and that was attributed to limited access to land and services, and the high production costs. In this connection it should be mentioned that the rapid increases in the cost of production have resulted from the new economic policies (production inputs price subsidies are no longer provided to farmers by the scheme management). The increases in crop yields and farm prices do not compensate for the ever increasing production costs, a situation which discouraged adoption of some of the recommended crop production practices. The continued failure to achieve substantial increases in crop yields and prices has eroded farmers' incentive to remain in the farming business, especially with respect to the cotton crop. The land parcel operated by the tenant farmers in the Rahad project were too small to allow for obtaining decent incomes by the participating tenants.

Table 1. The countries that have adopted the farmer field school approach (1989 – 2005)

Year	Number of countries that use the approach.	Cumulative Number of countries that use the approach	Countries
1989	1	1	Indonesia
1990	0	1	
1991	0	1	
1992	1	2	Vietnam
1993	3	5	China; Philippines; Sudan
1994	2	7	Bangladesh; India
1995	1	8	Sri Lanka
1996	4	12	Cambodia; Egypt; Ghana; Kenya
1997	6	18	Laos PDR; Mali; Pakistan; Peru; Tanzania; Zimbabwe
1998	2	20	Nepal; Thailand
1999	6	26	Brazil; Bolivia; Ecuador; Ethiopia; Uganda; Zambia
2000	5	31	Colombia; El Salvador; Honduras; Nicaragua; Senegal
2001	7	38	Benin; Burkina Faso; Malawi; Mexico; Mozambique; Niger; Nigeria
2002	7	45	Dominica; Dominican Republic; DR Congo; Haiti; Jamaica; Suriname; Trinidad and Tobago
2003	15	60	Bosnia-Herzegovina; Bulgaria; Cameroon; Croatia; Guyana; Hungary; Iran; Kyrgyzstan; Romania; Serbia and Montenegro; Sierra Leone; Slovak Republic; Syria; Turkey
2004	12	72	Algeria, Armenia; Bhutan; Gambia; Guatemala; Jordan; Lebanon; Morocco; Namibia; Palestine Territory; Togo; Tunisia; Uzbekistan
2005	3	75	Angola; Rwanda; USA

Source: Braun, A.; Jiggins J.; Röling, N.; van den Berg, H. and Snijders, P. (2006). *A Global Survey and Review of Farmer Field School Experiences.* Report prepared for the International Livestock Research Institute (ILRI). Wageningen, The Netherlands.

Table 2. Distribution of the farmers in the sample by farmer group and village

Farmer group	Name of Rahad Scheme Village Included in the Sample						Total Number of farmers interviewed
	Village 12	Village 13	Village 14	Village 26	Village 27	Village 28	
Farmers participating in FFSs	15	8	7	12	12	12	66
farmers exposed to traditional extension system	13	15	15	15	17	15	90
Total	28	23	22	27	29	27	156

Table 3. Extent of adoption of the component practices of the technological packages for Production of cotton, sorghum and groundnuts

Item in the recommended Technological package	Rate of adoption among farmers participating in FFSs by crops (%) N=66			Rate of adoption among farmers exposed to traditional extension system by crops (%) N=90		
	Cotton	Sorghum	Groundnuts	Cotton	Sorghum	Groundnuts
Improved seeds	100	97	93.9	94.4	83	84.6
Sowing date	37.9	72.7	54.5	45.6	65.6	51.9
Seed rate	100	100	100	98.9	96.7	98.7
Thinning	98.5	97	97	97.8	95.6	96.2
Weed control	100	100	100	100	100	100
Use of fertilizers	97	78.8	-----	85.6	66.7	-----
Irrigation	78.8	78.8	80.3	75.6	75.6	77.6
Pesticide	81.8	-----	-----	85.6	-----	-----
Harvesting	92.4	69.9	19.7	85.6	65.6	18.6
Mean rate of adoption of package	87.4	86.8	77.9	85.5	81.1	75.4

Table 4. Rates of adoption of components of the technological package for production of cotton among farmers in the sample

Items of the technological package	Rate of adoption among farmers participating in FFSs N = 66	Rate of adoption among farmers exposed to traditional extension system N = 90	Rate of adoption among all Farmers in the sample N = 156
	%	%	%
Improved seeds	100	94.4	96.8
Sowing date	37.9	45.6	42.3
Seed rate	100	98.9	99.4
Thinning	98.5	97.8	98.1
Weed control	100	100	100
Use of fertilizers	97	85.6	90.4
Irrigation	78.8	75.6	77.0
Pesticide	81.8	85.6	84.0
Harvesting	92.4	85.6	88.5
Mean rate of adoption of package	87.4	85.5	86.3

Table 5. Results of t-test analysis of scores on adoption of the components of the technological package for cotton production received by farmers trained in FFSs and those exposed to the traditional extension system

Farmer groups	Mean Score out of 9 points	Standard deviation	Mean difference	Standard error	t value	Significance
Farmers trained in FFSs	7.8030	1.1796	.2076	.2435	.852	.395
Farmers exposed to traditional extension	7.5955	1.6971				

Table 6. Rates of adoption of components of the technological package for production of sorghum among farmers in the sample

Items of the technological package	Rate of adoption among farmers participating in FFSs N = 66	Rate of adoption among farmers exposed to traditional extension system N = 90	Rate of adoption among all Farmers in the sample N = 156
	%	%	%
Improved seeds	97	83.3	94
Sowing date	72.7	65.6	68.6
Seed rate	100	96.7	98.7
Thinning	97	95.6	96.2
Weed control	100	100	100
Use of fertilizers	78.8	66.7	71.8
Irrigation	78.8	75.6	76.9
Pesticide			
Harvesting	69.9	65.6	67.3
Mean rate of adoption of package	86.8	81.1	84.2

Table 7. Results of t-test analysis of scores on adoption of the components of the technological package for sorghum production received by farmers trained in FFSs and those exposed to the traditional extension system

Farmer groups	Mean Score out of 9 points	Standard deviation	Mean difference	Standard error	t value	Probability
Farmers trained in FFSs	6.9091	1.466	.3698	.2435	1.684	.094
Farmers exposed to traditional extension	6.5393	1.4852				

Table 8. Rates of adoption of components of the technological package for production of groundnuts among farmers in the sample

Items of the technological package	Rate of adoption among farmers participating in FFSs N = 66	Rate of adoption among farmers exposed to traditional extension system N = 90	Rate of adoption among all Farmers in the sample N = 156
	%	%	%
Improved seeds	93.9	84.6	88.5
Sowing date	54.5	51.9	53.2
Seed rate	100	98.7	99.4
Thinning	97	96.2	96.8
Weed control	100	100	100
Use of fertilizers	-----	-----	-----
Irrigation	80.3	77.6	78.8
Pesticide	-----	-----	-----
Harvesting	19.7	18.6	19.2
Mean rate of adoption	77.9	75.4	76.6

Table 9. Results of t-test analysis of scores on adoption of the components of the technological package for groundnuts production received by farmers trained in FFSs and those exposed to the traditional extension system

Farmer groups	Mean Score out of 9 points	Standard deviation	Mean difference	Standard error	t value	Significance
Farmers trained in FFSs	5.4394	.8966	.3945	.1830	2.156	.033
Farmers exposed to traditional extension	5.0449	1.295				

Table 10. Results of t-test analysis of the composite scores on adoption of the components of the technological packages recommended for production of the three crops (cotton, sorghum and groundnuts) obtained by farmers in FFSs and those exposed to the traditional extension system

Farmer groups	Mean Score out of 27 points	Standard deviation	Mean difference	Standard error	t value	Significance
Farmers trained in FFSs	20.151	2.3088	.9717	.5065	1.918	.057
Farmers exposed to traditional extension	19.178	1.8				

Table 11. Distribution of farmers trained in FFSs and those exposed to the traditional extension by level of exposure to extension information sources

Level of exposure to extension information sources	Farmers participating in FFSs N = 66 %	Farmers exposed to traditional extension system N = 90 %	All Farmers in the sample N = 156 %
No exposure	27.3	42.2	35.90
Less than once a month	0.0	1.1	0.64
Once a month	6.0	4.4	5.13
Once in every two weeks	19.7	16.7	17.95
Once a weak	47.0	35.6	40.38
Total	100.0	100.0	100.0

Table 12. Results of t-test analysis of scores on extent of exposure to extension information sources and other selected variables by farmers trained in FFSs and those exposed to the traditional extension system

Variable	Farmer group*	Mean Score	Standard deviation	Mean difference	Standard error	t value	Sig.
Extent of exposure to extension information sources	1	7.1818	4.9081	3.2596	.5936	5.491	.001
	2	3.9222	2.3713				
Age in years	1	49.7	11.14	3.87	2.08	1.858	.065
	2	53.6	13.98				
Years of Education	1	2.79	3.59	.89	.58	1.543	.125
	2	1.90	3.52				
Cosmo-politeness (Urban contact)	1	.98	1.06	.12	.18	.672	.503
	2	.87	1.10				

* Group 1 = Farmers trained in Farmer Field Schools
Group 2 = Farmers exposed to the traditional extension system