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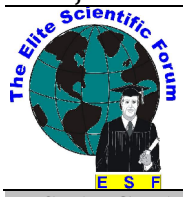


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RESEARCH ARTICLE

# Assessing the Impact of Integrated Pest Management Farmer Field Schools (IPM-FFSs) on Acquisition of Farmers' Knowledge Regarding Use of Pesticide, Nutrient Management and Confidence in Decision Making Process

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**ABSTRACT**

To encourage the environmentally friendly farming practices the National Integrated Pest Management Programme (Nat-IPM) for cotton was launched in Sindh province, Pakistan during 2001 to 2004, which sought to empower the farmer's community to take wise decisions at the field and new training methodology called Farmer Field School (FFS) was introduced. Integrated Pest Management Farmer Field School (IPM-FFS) training emphasized that the crops should be healthier with least use of pesticides which have bad impact on the nature and encouraged to the natural pest mechanism. The basic principle behind this new extension IPM-FFS training method was to enable farmers to be self sufficient, using efficient cultivation techniques and that are eco-friendly. To assess the impact of this new FFS training model in connection to agro-ecological sound IPM practices with special reference to cotton, study was conducted in four districts of Sindh province. The sample size comprised of 432 farmers in total, selecting 144 farmers from each category (Trained, Exposed and Controlled) and 108 farmers from each district (Hyderabad, Tando Allahyar, Matiari and Mirpurkhas). The results indicated that IPM-FFSs increased farmers' knowledge regarding use of pesticides, nutrient management and their confidence on decision making process regarding agro-eco-friendly farming.

## INTRODUCTION

Pakistan is recognized as an agricultural country in the world. About 60 percent of the Pakistan's population is associated with agricultural occupation. Being the principal sector in the development, agriculture contributes 21 percent to GDP, employs 45 percent of country's labor force and contributes substantially to export earnings (GOP, 2011). Pakistan is the world's 4th biggest cotton (*Gossypium hirsutum L.*) producing country after China, India, and USA, provides a livelihood to around 1.5 million farmers in rural areas. Cotton is a major source of export capital, accounting for 7.8 percent of value added in agriculture and 1.6 percent of GDP. The Pakistan's cotton production is projected at 13,595 thousand bales, during 2011-12 as against 11,460 thousand bales recorded in 2010-11, estimating an increase of 18.6 percent. Despite being one of the largest cotton growing countries, the cotton production in Pakistan is low as compared to other countries (GOP, 2011).

The low yields result from unfavorable weather, pests attack and limited awareness of pesticides and pest management options for improved cropping. Farmers' use a variety of pesticides in cotton to eliminate insects and weeds from their fields, but these pesticides can have the potential to harm human and environmental health. Excessive or mistimed use of pesticides can also disrupt the growth of cotton beneficial insects and provide opportunity for harmful pests to attack, pesticides use increases production costs to growers (FAO, 2004). To address these challenges, research efforts have taken to minimize dependence on pesticides through the implementation of IPM-FFSs (Wilson et al. 2004). Various studies regarding IPM programmes were agreed that FFS strengthens farmers'

ecological knowledge (Reddy and Suryamani, 2005; Tripp et al., 2005; Feder et al., 2004; Rola et al., 2002 Thiele et al., 2001). The information about understanding the crop ecosystem leads towards the reduction in the pesticides use and at the same time increases production and profit, for instance, in the cotton production systems (Khan and Muhammad, 2005; Godtland et al., 2004).

In developing country like Pakistan, disseminating knowledge and information to farmers effectively and timely is a critical challenge. To face the challenge, Sindh province of Pakistan had embraced IPM-FFSs during 2001 to 2004, as the dominant interface between facilitators of agriculture extension and farmers. It was assumed that through this new training method facilitators may change farmers' traditional role from passive learner to active learner. If significant diffusion of knowledge occurred then the value of the IPM-FFSs would be evident as a reliable extension training method to strengthen the agriculture information flow and dissemination of agricultural technologies among farmers, otherwise certain question raise on such type of IPM-FFS training programmes.

## MATERIALS AND METHODS

Data was collected from the four selected districts of Sindh Province i.e., Hyderabad, Tando Allahyar, Matiari and Mirpurkhas, where IPM-FFSs were conducted during 2001 to 2004 through Cotton-IPM programme. Present research study utilized a descriptive survey research approach. In descriptive survey research, the researcher selected a group of respondents, collected information and then analyzed the information to answer the research questions (McMillan, 2004).

This study intended to collect information on acquisition of knowledge by farmers' regarding pesticide use, nutrient management and their confidence in decision making process. The target population of this study was categorized into three categories i.e. trained farmers (FFS participants), exposed farmers (non-FFS participants, but live in FFS village), control farmers (who neither participated in FFS nor living in FFS village). List of the farmers (FFS participants) were obtained from Nat-IPM programme coordinator, Director General, Agricultural Extension Wing, Hyderabad, Sindh. The total 144 sample of farmers (trained) were randomly selected and included in the research study. Similarly, the sample of 144 farmers (exposed) selected from villages where IPM-FFS training had occurred and 144 farmers (control) selected from the villages at least 15 kilometers away from IPM-FFS villages and with radius about 20 kilometers, assumed enough distance to possible dissemination of IPM knowledge; where sufficient cotton growing farmers were available to obtain cross-sectional data. Within each of the farmer categories considering the matching characteristics such as age, education and landholding were established. Thus, the sample size comprised of 432 farmers in total, selecting 144 farmers from each category (Trained, Exposed and Controlled) and 108 farmers from each district (Hyderabad, Tando Allahyar, Matiari and Mirpurkhas). The sample was determined using "Table for determining random sample size from a given population" at 95% confidence level and 5% (+ or -) margin of sampling error rate (Wunsch, 1986).

Detailed questionnaire was developed in consultation with the local and foreign subject specialists and following review of available literature. The concepts/ideas were predominantly measured through different statements on a continuum ranging from negative to positive. A data coding sheet was developed and all the data were analyzed using appropriate statistical analysis techniques. Frequency, mean, percentage, and standard deviation were calculated. For the comparison among groups Analysis of Variance (ANOVA) was performed and Duncan Multiple Range Test (DMRT) was applied to rank the means using computer software IBM-SPSS version-19. The survey for this study was conducted during the period March to September 2009.

## RESULTS AND DISCUSSION

### Demographic Information:

The demographic characteristics of the sampled farmers are presented in table-1, it shows that most of the trained farmers were falling in the age group of 21-30 years, exposed farmers were in the age group of less than 20 years and control farmers were in the age up to 30 years. Majority of trained farmers (27.4%) were educated up to primary level; exposed (24.4%) and control (25.9%) famers were illiterate with slight difference. While 11.1%, 8.9%, and 10.4% of the trained, exposed and control farmers were found graduate respectively. Majority of trained, exposed and control farmers were tenants. Most of the trained and exposed farmers were owners of 11 to 20 acres and control farmers were owner of 21 to 30 acres of land. Large number of all categories of farmers had farming experience in the range of 11 to 20 years followed by the farmers had less than 10 years of experience. Majority of the trained farmers had their yearly farm income more than 100,000 (pak rupees) while most of the exposed and control farmers received their yearly income between the range of 21,000 to 40,000 (pak rupees) followed by yearly farm income in the range of 41,000 to 60,000 by trained and exposed farmers while control farmers had their yearly farm income more than 100,000 (PKR).

**Table 1: Demographic information of farmers**

| Characteristics | Category | Trained Farmers | | Exposed Farmers | | Control Farmers | |
|---|---|---|---|---|---|---|---|
| | | No. | % | No. | % | No. | % |
| Age (years) | Less than 20 | 25 | 18.5 | 33 | 24.4 | 36 | 26.7 |
| | 21 to 30 | 38 | 28.1 | 31 | 23.0 | 36 | 26.7 |
| | 31 to 40 | 30 | 22.2 | 32 | 23.7 | 34 | 25.2 |
| | 41 to 50 | 23 | 17.0 | 26 | 19.3 | 18 | 13.3 |
| | 51 & above | 19 | 14.1 | 13 | 9.6 | 11 | 8.1 |
| Educational Level | Illiterate | 26 | 19.3 | 33 | 24.4 | 35 | 25.9 |
| | Primary | 37 | 27.4 | 32 | 23.7 | 31 | 23.0 |
| | Middle | 24 | 17.8 | 22 | 16.3 | 21 | 15.6 |
| | Matriculate | 11 | 8.1 | 16 | 11.9 | 13 | 9.6 |
| | Intermediate | 13 | 9.6 | 13 | 9.6 | 17 | 12.6 |
| | Graduate | 15 | 11.1 | 12 | 8.9 | 14 | 10.4 |
| | Post Graduate | 9 | 6.7 | 7 | 5.2 | 4 | 3.0 |
| Status | Land Lord | 26 | 19.3 | 16 | 11.9 | 19 | 14.1 |
| | Tenant | 65 | 48.1 | 76 | 56.3 | 71 | 52.6 |
| | Lease Holder | 10 | 7.4 | 12 | 8.9 | 16 | 11.9 |
| | Owner-Cultivator | 34 | 25.2 | 31 | 23.0 | 29 | 21.5 |
| Farm Size (acres) | Less than 10 | 27 | 20.0 | 31 | 23.0 | 28 | 20.7 |
| | 11 to 20 | 37 | 27.4 | 32 | 23.7 | 29 | 21.5 |
| | 21 to 30 | 30 | 22.2 | 28 | 20.7 | 33 | 24.4 |
| | 31 to 40 | 21 | 15.6 | 29 | 21.5 | 22 | 16.3 |
| | 41 & above | 20 | 14.8 | 15 | 11.1 | 23 | 17.0 |
| Farming Experience (years) | Less than 10 | 40 | 29.6 | 47 | 34.8 | 37 | 27.4 |
| | 11 to 20 | 49 | 36.3 | 54 | 40.0 | 44 | 32.6 |
| | 21 to 30 | 23 | 17.0 | 20 | 14.8 | 32 | 23.7 |
| | 31 to 40 | 15 | 11.1 | 10 | 7.4 | 11 | 8.1 |
| | 41 & above | 8 | 5.9 | 4 | 3.0 | 11 | 8.1 |
| Farm Yearly Income (rupees) | Up to 20,000 | 7 | 5.2 | 12 | 8.9 | 10 | 7.4 |
| | 21,000 to 40,000 | 27 | 20.0 | 33 | 24.4 | 34 | 25.2 |
| | 41,000 to 60,000 | 31 | 23.0 | 27 | 20.0 | 19 | 14.1 |
| | 61,000 to 80,000 | 15 | 11.1 | 23 | 17.0 | 22 | 16.3 |
| | 81,000 to 100,000 | 20 | 14.8 | 15 | 11.1 | 19 | 14.1 |
| | 100,000 & above | 35 | 25.9 | 25 | 18.5 | 31 | 23.0 |

**Farmers' Perception about Use of Pesticides:**

The effectiveness of IPM-FFS training was studied by knowing the perception of the respondent farmers on a set of 13 statements related to the knowledge about the pesticide use in cotton. The five points Likert scale (e.g. 1=Strongly disagree, 2=Disagree, 3=Undecided, 4=Agree, 5=Strongly agree) was used to assess the perception of the farmers, the results were formed and presented in table 2. The data showed that the perception of the respondent farmers were significantly ($P<0.01$) varied for almost all the statement regarding knowledge about pesticides.

The responses of trained, exposed and control farmers were significantly different and Likert scale showed that exposed and control farmers were agreed, while trained farmers showed undecided attitude. The respondents when invited to perceive on that pesticides kill only harmful insect pests and not effects on beneficial and all the respondent of three categories (trained, exposed, controlled) either disagreed or kept calm over this, but differences were significant. All the respondent categories remained undecided that expensive pesticides effectively control insect pests, but showing highly significant difference in farmers' response.

The categories of farmers were asked to tell about the effectiveness of pesticides. The all three categories of farmers were undecided that mixing of pesticides increases their effectiveness and showed significant differences in responses of trained, exposed and control farmers. Similarly, trained and exposed farmers were agreed that cleaning of spray equipment in tank or water stream is unsafe, but control farmers were undecided and differences among respondents were significant. The trained farmers were agreed that one can sick from pesticide spraying if not take protective measures and undecided by the exposed and control farmers, variation among respondents was significant while trained, exposed and control farmers did not agree (undecided) that pesticides sold in the market are safe and differences were significant. Tripp et al. (2005)

**Table 2: Farmers' perception regarding use of pesticides in cotton**

| Knowledge About Pesticides | Trained Farmers | | Exposed Farmers | | Control Farmers | | F. Value | Sig. |
|---|---|---|---|---|---|---|---|---|
| | M | SD | M | SD | M | SD | | |
| Pesticides applications are necessary to protect the cotton crop. | $2.72_a$ | 1.22 | $3.16_b$ | 1.24 | $3.47_c$ | 1.04 | 14.14 | 0.001** |
| Pesticides kill only harmful insects and not effect on beneficial insects. | $2.27_a$ | 0.91 | $2.65_b$ | 1.20 | $2.94_c$ | 1.26 | 11.64 | 0.001** |
| It's true that the pesticide induces resistance to pest population. | $3.76_b$ | 0.93 | $3.40_a$ | 1.02 | $3.21_a$ | 1.04 | 10.71 | 0.001** |
| Repeated application of pesticides increases the pest population. | $3.85_c$ | 0.84 | $3.61_b$ | 0.99 | $3.21_a$ | 1.07 | 15.06 | 0.001** |
| Indiscriminate use of pesticides leads new pest problems in cotton. | $3.86_c$ | 0.81 | $3.47_b$ | 0.94 | $3.11_a$ | 1.08 | 20.79 | 0.001** |
| Expensive pesticides help farmers to control pests and diseases. | $2.28_a$ | 0.95 | $2.62_b$ | 1.09 | $3.02_c$ | 1.20 | 15.54 | 0.001** |
| The mixing of two or more pesticides may increase its effectiveness. | $2.38_a$ | 1.05 | $2.63_a$ | 1.13 | $2.94_b$ | 1.15 | 8.61 | 0.001** |
| It is good to use a little more pesticide than recommended dose. | $2.23_a$ | 0.91 | $2.42_a$ | 1.00 | $2.89_b$ | 1.18 | 14.29 | 0.001** |
| Pesticide applications contaminate the air, water, soil, and food. | $3.76_b$ | 0.89 | $3.50_a$ | 1.02 | $3.33_a$ | 1.07 | 6.52 | 0.002** |
| No matter, if animals run around the fields while spraying pesticides. | $2.37_a$ | 0.99 | $2.61_a$ | 1.01 | $2.88_b$ | 1.12 | 8.07 | 0.001** |
| It is not safe to clean spray equipment in tanks or stream of water. | $3.79_b$ | 0.77 | $3.64_b$ | 0.80 | $3.30_a$ | 1.04 | 10.49 | 0.001** |
| One can sick from pesticide spraying if not take protective measures. | $4.06_b$ | 0.83 | $3.90_{ab}$ | 0.90 | $3.72_a$ | 1.00 | 4.67 | 0.010* |
| It is correct that pesticide is sold in the market means it is safe. | $2.13_a$ | 0.88 | $2.37_a$ | 1.10 | $2.80_b$ | 1.25 | 12.94 | 0.001** |

1 = Strongly Disagree, 2 = Disagree, 3 = Undecided, 4 = Agree, 5 = Strongly Agree; $^{NS}$ = Non-significant, * = Significant at 0.05 level of significance, ** = Significant at 0.01 level of significance; Values in a column with different superscript letters are significantly different (P<0.05), as assessed by ANOVA and Duncan's Multiple Range Test (DMRT)

**Table 3: Farmers' perception of nutrient management in cotton**

| Knowledge About Nutrient Management | Trained Farmers | | Exposed Farmers | | Control Farmers | | F. Value | Sig. |
|---|---|---|---|---|---|---|---|---|
| | M | SD | M | SD | M | SD | | |
| NPK are necessary required fertilizers for growing cotton. | $3.93^a$ | 1.04 | $3.84^a$ | 1.00 | $3.84^a$ | 0.96 | 0.38 | $0.682^{NS}$ |
| All required nutrients exist in soil, but the percentage varies. | $3.65^b$ | 0.94 | $3.49^b$ | 1.09 | $3.17^a$ | 1.20 | 6.87 | $0.001^{**}$ |
| Excess of nitrogen application helps to promote the insect pest. | $3.69^b$ | 1.14 | $3.28^a$ | 1.04 | $3.20^a$ | 0.90 | 8.62 | $0.001^{**}$ |
| Nitrogen element can be obtained from soil organic matter. | $3.60^b$ | 0.96 | $3.36^a$ | 0.98 | $3.39^{ab}$ | 0.91 | 2.62 | $0.073^{NS}$ |
| Balanced nutrient application ensures improvement in yield. | $4.04^b$ | 0.82 | $3.82^a$ | 0.85 | $3.91^{ab}$ | 0.70 | 2.47 | $0.085^{NS}$ |
| Balanced nutrient application maintains soil fertility. | $3.97^a$ | 0.78 | $3.79^a$ | 0.95 | $3.94^a$ | 0.74 | 1.93 | $0.146^{NS}$ |
| Balanced use of fertilizer ensure optimum yield. | $4.21^b$ | 0.81 | $4.00^a$ | 0.78 | $4.03^{ab}$ | 0.77 | 2.93 | $0.054^{NS}$ |
| Farm Yard Manure (FYM) contains a large quantity of plant nutrients. | $4.05^a$ | 0.82 | $3.94^a$ | 0.87 | $3.87^a$ | 0.88 | 1.47 | $0.230^{NS}$ |
| FYM also improves efficiency of applied fertilizers. | $4.16^a$ | 0.86 | $3.73^a$ | 0.81 | $3.63^b$ | 0.99 | 13.58 | $0.001^{**}$ |
| FYM increases soil water holding capacity and makes it porous. | $3.93^b$ | 0.84 | $3.68^{ab}$ | 1.13 | $3.53^a$ | 1.09 | 5.15 | $0.006^{**}$ |

**1** = Strongly Disagree, **2** = Disagree, **3** = Undecided, **4** = Agree, **5** = Strongly Agree; $^{NS}$ = Non-significant, * = Significant at 0.05 level of significance, ** = Significant at 0.01 level of significance; Values in a column with different superscript letters are significantly different (P<0.05), as assessed by ANOVA and Duncan's Multiple Range Test (DMRT)

conducted a survey about the FFS and the IPM practices in the Southern Sri Lanka and found that the farmers initially applied some IPM practices that reduced insecticides by 81% but later on they gave up further practices and did not share that information to the other farmers. He has called for further assessment of the IPM-FFS programmes and held insufficient assessment as a part of the problem. The IPM practices have covered just 1 to 5 % of the entire farmers. The complete research displays the impact and efficiency of communication elements as well (Berg and Jiggins, 2007; Godtland et al., 2004).

**Perception of Farmers Regarding Nutrients Management**

The perception of the respondent farmers on a set of 10 statements regarding nutrient management knowledge in cotton invited and the data is presented in table 3. The data indicates that the perception of the trained, exposed and control farmers differed significantly (P<0.01) in relation to nutrient management knowledge.

According to the respondents fertilizers are necessarily required for growing cotton, trained, exposed and control farmers equally agreed and the differences in perception of farmer categories were non-significant. The

**Table 4: Farmers' confidence in pest management decision making method/source**

| Decision Making Methods/Sources | Trained Farmers | | Exposed Farmers | | Control Farmers | | F. Value | Sig. |
|---|---|---|---|---|---|---|---|---|
| | M | SD | M | SD | M | SD | | |
| Cotton Eco-System Analysis (CESA) | $3.87^{c}$ | 0.86 | $3.10^{b}$ | 0.83 | $2.81^{a}$ | 0.53 | 70.03 | $0.001^{**}$ |
| Economic Threshold Level (ETL) | $3.19^{a}$ | 1.06 | $3.30^{a}$ | 0.99 | $3.70^{b}$ | 1.23 | 7.84 | $0.001^{**}$ |
| Discussion with other farmers | $3.91^{b}$ | 1.01 | $3.51^{a}$ | 1.11 | $3.50^{a}$ | 1.10 | 6.26 | $0.002^{**}$ |
| Consultations with family members | $3.68^{b}$ | 0.97 | $3.39^{a}$ | 1.19 | $3.62^{ab}$ | 1.09 | 2.63 | $0.073^{NS}$ |
| Follow neighborer practices | $2.61^{a}$ | 0.96 | $3.07^{b}$ | 1.17 | $3.48^{c}$ | 1.09 | 21.66 | $0.001^{**}$ |
| Making decisions on calendar basis | $2.36^{a}$ | 1.09 | $2.70^{b}$ | 1.14 | $3.58^{c}$ | 1.14 | 41.75 | $0.001^{**}$ |
| Recommendation by extension worker | $3.90^{b}$ | 0.86 | $3.92^{b}$ | 0.99 | $3.67^{a}$ | 1.04 | 2.86 | $0.058^{NS}$ |
| Recommendation by dealers/traders | $2.36^{a}$ | 1.21 | $2.64^{b}$ | 1.06 | $3.17^{c}$ | 1.16 | 17.49 | $0.001^{**}$ |
| Instruction by farm manager/land lord | $3.03^{a}$ | 1.02 | $3.33^{b}$ | 1.06 | $3.34^{b}$ | 1.31 | 3.26 | $0.039^{*}$ |
| Follow NGOs/FOs advice | $2.90^{a}$ | 0.89 | $2.92^{a}$ | 0.83 | $2.71^{a}$ | 1.00 | 2.15 | $0.118^{NS}$ |
| Media (TV, Radio, Newspaper) | $3.90^{b}$ | 0.78 | $3.60^{a}$ | 1.02 | $3.64^{a}$ | 0.98 | 4.15 | $0.016^{*}$ |

**1** = Extremely Unconfident, **2** = Unconfident, **3** = Neutral or Unsure, **4** = Somewhat Confident, **5** = Extremely Confident; $^{NS}$ = Non-significant, ***** = Significant at 0.05 level of significance, ****** = Significant at 0.01 level of significance; Values in a column with different superscript letters are significantly different ($P<0.05$), as assessed by ANOVA and Duncan's Multiple Range Test (DMRT)

perception of farmer respondents on nitrogen obtaining from soil organic matter was non-significant, however, trained farmers agreed whereas exposed and control farmers did not. The three categories of farmers were asked to tell about the nutrient application. All farmer respondents of three categories equally agreed that balanced nutrient application improve yield and quality of crop and difference amongst them were non-significant. Similarly, all the farmer categories agreed that farmyard manure increases soil water holding capacity and makes soil porous but differences between respondent categories were significant. The results of present study are also in line with those reported by Bajwa et al. (2010) who found that facilitators provided information to the farmers regarding fertilizer requirement and effectiveness. The extent of provision and effectiveness of information ranged between 2.75 to 3.18 and 2.77 to 3.53 respectively and there was consistency in responses.

**Farmers' Confidence on Pest Management Decision Making Method:**

The respondent farmers were asked to disclose about their confidence level regarding pest management decision making process/methods/sources. Various decision making methods applied by the farmers were identified and their responses were recorded. The results are presented in table 4. The data shows that for pest management decision making, the trained farmers were somewhat confident on Cotton Eco-System Analysis (CESA), while exposed and control farmers were unsure for this method but the differences in respondent categories were significant. The responses of farmers on discussion with other farmers were different significantly and all the farmer categories were somewhat confident, while variation among farmer categories was non-significant and trained or control farmers were somewhat confident on decision by discussion with other family members and exposed farmers were unsure. Trained farmers were unconfident over pest management decision on calendar basis, and exposed or control farmers were unsure, while pest management decision by extension workers were commented positively as somewhat confident by all the farmer categories. The trained farmers had no confidence on dealers' recommendation but exposed control farmers remained neutral or unsure. However, decision through farm manager for pest management was slightly favored by all the farmers' categories and was neutral or unsure, while all the farmer categories were also neutral or unsure for pest management decision by NGO/FO advice. Farmers were also asked to tell about the pest management decision making method or source. The all categories of farmers (trained, exposed, controlled) were positively favored and somewhat confident on media (TV, Radio, Newspaper). In a study previously conducted by Wandji et al. (2007) reported that the farmers trained through IPM-FFS training methods are well trained to identify the cotton insect pests and diseases, while untrained farmers are entirely unaware of these problems. Moreover, the trained farmers use correct method of controlling the insect pests and diseases; while the untrained farmers rely on the decisions of pesticide dealers, seed companies and neighboring farmers.

**Conclusion**

Knowledge and information about agricultural technologies plays an important role to empower the farmers. Various extension approaches have been experienced to diffuse agricultural knowledge and uplift farmers' confidence. The results of this study indicated that IPM-FFS training method was a favorable process in increasing farmers' knowledge about the use of pesticides, nutrient management and building their

confidence in decision making process. It appeared that effects of FFS training exist even after seven years of the termination of the cotton IPM programme. However, the results further indicated that the IPM-FFS participants shared/transferred little knowledge to non-IPM-FFS farmers. It was suggested that IPM-FFS participants may be a good source for transferring the knowledge to the other farmers, regarding this agriculture extension should be utilized to persuade IPM-FFS participants to spread the obtained knowledge of agro-eco-friendly farming practices.

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