Impact of Farmer Field Schools (FFS) in Coconut Crop in Kerala State: Gender Based Knowledge Analysis

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ABSTRACT

Farmer field schools is one the extension methods, which is field based group method, where learning attains prime importance. Many of the coconut technologies, especially plant protection aspects are knowledge intensive and experiential learning opportunities could provide sustainable skills to the FFS participants. The study was conducted on the FFS programme organized during the period 2013 to 2015 in Kerala state. It was found that the mean average knowledge index of the FFS farmers (51.31) was 65 per cent more than the non-FFS farmers (31.10). The difference in knowledge level of farmers of both gender was non significant indicating effectiveness of FFS methodology in improving knowledge regardless of the gender. The study also indicated non significant difference among FFS and Non FFS men and women farmers on all the knowledge items and a significant difference between FFS and Non FFS farmers of both the gender. Hence the gender aggregated knowledge index before and after the FFS indicated that FFS methodology is effective as an extension methodology for improvement of knowledge among both gender.

Key words: *Extension methodology; Rhinoceros beetle; Knowledge; Bio-management;*

Agriculture research, extension and development are vital in the progress and prosperity of a nation. Considering the diversity of soil, crops, cropping pattern, farming system, resource base and socio economic situation of farmers as well as the population to be covered by extension workers, transfer of technologies developed by research systems is a challenge to be addressed. The linear model of transfer of technology was replaced with several other models and processes to suit technology and situational specificities and crops. Farmer field school (FFS) is one of the extension methods, which is a field based group- method, where learning attains prime importance. The FFS was introduced in Central Java of Indonesia in 1989, with the assistance of Food and Agricultural Organization (FAO) for Integrated Pest Management (IPM) of rice. In simple terms it is a school without walls. *Dinpanah et al., (2010)* observed that FFS is a community based practically oriented field study program, involving a group of farmers facilitated by extension staff (public or private) or, increasingly, by other farmers. *Alam and Kamp (2007)* opined that this approach requires that fish farmers be recognized as experts in their own ponds. The aim of FFS is to have capacity building in analyzing their production systems, identify problems of testing solutions and eventually adoption of practices, skills, profits and yields.

Coconut is the major perennial crop of Kerala state and is being cultivated in 18 states and 3 Union territories in India, in a total area of 12.5 million hectares with production of 22680.03 million nuts production. The major constraints perceived by coconut farmers are in regard to plant protection aspects were high costs of inputs, low level of knowledge/ adoption of plant protection and management, unscientific use of chemicals, inadequate extension contact for information provision, lack of sufficient training at field level and high level of pest incidence.(*Anithakumari et al,. 2012*). The adoption of plant protection measures also found to be very low due to low level of knowledge, scarcity and high cost for engaging coconut climbers. Knowledge is a pre-requisite for understanding field problems, taking best possible decision for adoption and ensuring success. But the linear Transfer of Technology (ToT) methods could not result in expected performance of Agricultural Extension service, which is currently facing resource, logistical and methodological constraints (*Hagmann et al., 1998*). Hence Agricultural Extension has to change from an instructional, top down manner to more participatory ways of facilitation, communication and exchange of knowledge. (*Fliescher et al., 2002*). Methodology for FFS requires refinement for perennial crops like coconut considering the nature of crop and field problems. Hence the study was under taken with the objective to fine tune the FFS methodology for coconut, a perennial crop and to study the impact of FFS in terms of knowledge improvement with particular emphasis to gender aggregate impact of knowledge.

METHODOLOGY

The study was conducted during 2013 to 2015 in Alappuzha district of Kerala state. The intervention panchayaths selected and 10 FFS groups formed. Coconut farmers of different categories of both gender who are voluntarily willing to participate in the FFS-coconut was selected. ICAR-CPCRI scientists functioned as facilitators for the FFS. The active participation and facilitation of extension officials also ensured for the sustainability and continuity. In all the FFS sessions, field visits and Agro Ecosystem Analysis (AESA) was conducted. The FFS methodology as per the general procedure was adopted, initially. On consultation with participants, experts and extension officials, finer refinements were made. The curriculum was prepared as per the recommendations of work shop on curriculum development for farmer field schools of CFC/DFID/APCC/FAO project during 3-5, February, 2005, Kochi (*Singh and Arancon Jr., 2007)*. The refinement made, was regarding the 'ballot box exercise' for assessing the pre FFS knowledge level of farmers, considering the high literacy rate of the state. The exercise was done in farmers homesteads. Convenient size of plastic containers prepared with the ballot box questions (in local language- Malayalam) pasted legibly on the lids. The FFS farmers were asked to choose the correct answers and put the answer - ballot with the option written, into the container. The correct and incorrect answers were then tabulated and presented to the participants and knowledge gain analyzed. Another refinement is that, unlike in annual crops all the growth stages of coconut could not be examined physically and easily in coconut, due to the tall structure of the palm crop. Hence for observation and physical examination coconut seedlings up to 6-7 years old were selected for the farmer field schools. Participant farmers were equipped with skills in observing the details in adult bearing palms also. The curriculum was finalized based as discussion with experts, extension officials and participating farmers, based as their needs, level of knowledge and adoption of practices. A total of 240 farmers, 120 each from FFS and non-FFS farmers were selected randomly, from Devikulangara, Kandalloor and Krishnapuram panchayths. Data were subjected to descriptive statistics such as per centage, mean, standard deviation and 't' test. The knowledge index was calculated for each farmer (FFS and non-FFS) by multiplying the actual knowledge score by 100 and dividing with maximum potential score for an individual. Similarly for each knowledge items also the scores were indexed. To measure the knowledge of biomanagement of rhinoceros beetle of coconut, a knowledge test was developed. Forty six knowledge items were selected on the direct and indirect items on management of rhinoceros beetle. The items were finalized with the help of experts. The items were selected, so as to discriminate the well knowledgeable and the poorly knowledgeable respondent farmers. Thought provoking questions also included. All the selected items were administered to randomly select non sample farmers and elicited their response. Item analysis included calculation of index of item difficulty and index of item discrimination. The items falling in the difficulty index of 0.40 to 0.60 and discrimination index above 0.40 were considered for inclusion in the final knowledge test. Thus the final knowledge test on management of rhinoceros beetle of coconut consisted of 34 items.

RESULTS AND DISCUSSION

The results of the study are given in terms of the knowledge difference between FFS and non-FFS farmers in general and in terms of gender aggregated format. The knowledge was analyzed in terms of the average knowledge score of the participant and non participant farmers as well as in terms of the average knowledge score obtained for each of the knowledge items. The results are presented as follows:

Categorization of participant and non-participant farmers : Enhancing farmers' knowledge is expected to be the first and the immediate impact of the FFS program intervention on the outcome indicators. Hence it is logical to assess the impact on the knowledge improvement among participants and non participant farmers. The data presented in Table 1 indicated that the overall knowledge level of the FFS participants are higher than the non - participant farmers (NFFS Farmermer).

Table 1. Overall knowledge level of participants on biomanagement on Rhinoceros Beetle (n=240)

Knowledge level	FFS farmers	N FFS farmers
Low	20.00	76.25
Medium	62.50	22.50
High	17.50	1.25

The mean of the average knowledge score of the FFS farmers was 51.31 and standard deviation of 15.68, where as the mean of the non – FFS farmers was 31.10 with standard deviation of 11.56 indicative of the high knowledge level of FFS participants. ie., 65 per cent knowledge gap between FFS participants and non participants. The categorization of the farmers based on the knowledge level also indicated that only 1.25 per cent of the non – FFS farmers were categorized in the high knowledge level compared to the scores of FFS farmers, with 22.5 in medium and 76.25 in low knowledge level category. The knowledge categories among the non FFS farmers were 15 per cent in high, 75 in medium and 10 in low respectively, which shows the knowledge up-gradation due to FFS methodology.

Huluka and Negatu (2016) reported that knowledge test index of those FFS graduate farmers is higher than the non-FFS graduate farmers and this finding is statistically significant. The result is also consistent with other previous studies. Thus, it can be concluded that participation in the FFS training significantly enhances agricultural knowledge of the participants.

Impact of the FFS on knowledge level of rhinoceros beetle bio-management (About the rhinoceros beetle, symptoms of the pest attack, integrated nutrient management and biomanagement practices) was brought out in terms of gender aggregated improvement. This was presented in Table 2. as the difference in knowledge level between the FFS and Non FFS farmers in terms of average knowledge index of individual farmers. The data indicated that the difference in knowledge level among the men and women FFS and Non FFS farmers was highest in case of differentiating male and female rhinoceros beetle, non suitability of *Metarhizum* for leaf axil filling (79.19), duration of life cycle of rhinoceros beetle (66.40%), details of life stages of .5%), weed plant used in rhinoceros beetle management (59.22%), frequency of naphthalene balls placement (59.12%).Where as the knowledge difference among the FFS and Non FFS women farmers was highest with regards to identification of *Metarhizium* infected grub (79.91%), life stage of rhinoceros beetle (73.7%), differentiating male and female rhinoceros beetle (65.47%). Reason for not using *Metarhizium* for prophylactic leaf axil filling (63.84%) and weed plant used in rhinoceros beetle management (59.17%).The traditional knowledge and practices for rhinoceros beetle and its management as well as integrated nutrient management of coconut indicated low level of knowledge gap among FFS and Non FFS farmers of both genders, but knowledge gap on bio-management of rhinoceros beetle was comparatively higher *ie.,* 44.62 to 48.06 per cent among women and men farmers respectively. The data also revealed that the participation in FFS helped them in improving the overall knowledge on various knowledge items. It could also be seen that the knowledge of FFS farmers of majority of item was 60 per cent and above for both genders, where as the variability of knowledge level among the non FFS farmers ranged from 1.78 to 99.1 per cent and 0 to 96 per cent among the men and women sample respondents respectively. *Manoj and Vijayaragavan (2014)* also found similar results in their study among FFS and non- FFS paddy farmers. Similar findings were reported *by Rustam (2010), Gopala et al.,2012* and *Nirmaladevi and Manoharan (1997). Anithakumari et al., (2007)* reported 51 to 100 per cent in knowledge of FFS coconut farmers in regard to IPM of rhinoceros beetle. Herath *et al.,* (2007) also reported an average of 40 per cent increase in knowledge on IPM of coconut, 30 per cent in production and utilization of GMF in field level as well as 45 per cent improvement in farmer extension linkage. *Huynhpaul et al., (2011)* reported 57.6 per cent to 80 per cent improvement in chilli farmers' knowledge among the FFS farmers in Vietnam. *Mariyono et al. (2013)*

Table 2. Difference in knowledge of FFS and non-FFS farmers – gender aggregated

Knowledge Items	Knowledge of Men farmers (%)			Knowledge of Women farmers (%)		
	FFS	NFFS	Difference	FFS	NFFS	Difference
About the Pest- Rhinoceros beetle (RB) of coconut						
Common name of RB	99.10	99.10	0.0	96.00	96.00	0.00
Colour of rhinoceros beetle	98.34	94.72	3.62	84.00	70.83	13.17
Symptoms of RB infestation	83.63	57.14	26.49	88.00	66.66	21.34
Life stages of rhinoceros beetle.	85.45	20.40	65.05	84.00	10.30	73.70
Damage causing life stage of RB	85.45	76.78	8.67	88.00	75.00	13.00
Natural enemies of RB	65.45	28.57	36.88	60.00	58.33	1.67
Difference male and female of RB	84.54	5.35	79.19	68.00	2.53	65.47
Duration of RB life cycle.	78.18	11.78	66.40	46.00	8.30	37.70
Mean	86.02	49.23	35.79	76.25	48.49	28.25
INM practices of Coconut						
Mulching coconut	80.00	44.64	35.36	80.00	50.00	30.00
Coconut basin management	58.18	25	33.18	68.00	29.16	38.84
Organic Manures for coconut	98.18	87.5	10.68	100.00	95.83	4.17
Chemical fertilizer application	65.45	30.35	35.1	76.00	41.66	34.34
Organic Manuring schedule	80.00	62.5	17.5	84.00	75.00	9.00
Quantity of chemical ferti. required for coconut palm/year	56.36	32.14	24.22	44.00	25.00	19.00
Irrigation schedule for coconut	47.27	42.85	4.42	44.00	25.00	19.00
Mean	69.34	46.42	22.92	70.85	48.80	22.05
Symptoms of pest attack and related factors						
Pest causing spindle breakage /drooping.	83.63	39.28	44.35	76.00	54.16	21.84
RB infestation -season	71.81	28.92	42.89	72.00	18.33	53.67
Month of high incidence of RB	75.45	35.71	39.74	80.00	54.16	25.84
Damage causing stage of RB	91.81	70.00	21.81	84.00	70.83	13.17
Fatal pest of coconut	98.18	82.14	16.04	96.04	84.00	12.04
Breeding sites of RB	91.81	40.35	51.46	88.00	50.00	38.00
Mean	85.44	49.40	36.04	82.67	55.24	27.42
Bio management practices						
What is *Metarhizium?*	94.54	51.78	42.76	90.00	38.33	51.67
Schedule of GMF treatment	88.18	35.35	52.83	82.83	40.30	42.53
Prophylactic measures -RB	96	72.14	23.86	86.00	62.50	23.50
Pesticide for leaf axil filling.	66.36	17.14	49.22	58.00	18.33	39.67
Bio agent of RB other than GMF	52.72	1.78	50.94	44.00	2.50	41.50
Identification *Metarhizium* infected grub	93.40	21.20	72.2	90.31	10.40	79.91
Can *Metarhizium* used prophylactic leaf axil filling	94.54	15.35	79.19	68.00	4.16	63.84
Traditional RB management	98.18	94.07	4.11	94.00	90.3	3.70
Weed plant used for RB management	86.36	27.14	59.22	80.00	20.83	59.17
Frq. for naphthalene ball appli. in coconut leaf axils	90.90	31.78	59.12	76.00	0.00	76.00
Oil cake used for repelling RB	72.72	37.5	35.22	76.00	66.66	9.34
Mean	*84.90*	*36.83*	*48.06*	*76.83*	*32.21*	*44.62*

showed that farmers' knowledge on agricultural practices increased significantly due to FFS. FFS improved farmer cohesiveness and information sharing. Farmers' knowledge of insect pests, diseases and natural enemies increased considerably, as did their awareness of pesticide-related hazards. In sum, FFS successfully delivered improved technology and enhanced knowledge to enable farmers to grow chilli with sustainable practices and higher profits.

The data provided in Table 2. supported by the views of *Dinpanah et al., (2010)* that educational approach needed, in biological control as tropical small holder farmers is highly dependent on local context, it often calls for farmers analytical skills and expertise. Improving farmer expertise in these fields requires hands-on education.

As per Table 2. the average knowledge difference between FFS and non- FFS men farmers was 22.92 to 48.06, whereas women farmers 22.05 to 49.62. The maximum knowledge gap of 44.62 to 48.06 per cent between FFS and non-FFS women and men farmers respectively was on the major topic of FFS, ie., biomanagement of rhinoceros beetle of coconut. This is also indicative of the effects of FFS methodology in reducing knowledge gap. Another interesting point noted was the rate of reduction of knowledge gap between FFS and non-FFS women farmers compared to their counterparts. This may be due to the active SHGs among women in the state, with regular meetings and activities, which requires further studies. This could be utilized for planning and framing strategies for horizontal dissemination among women farmers.

The gap in farmers adoption of known technologies was the lowest in leaf axil filling (traditional method) against rhinoceros beetle/red palm weevil, organic manure and chemical fertilizer application, ie., 0.5 to 5 per cent as reported by *Anithakumari et al., (2012)*. The data in Table2. also show that the gap in knowledge in integrated nutrient management, about the pest and infestation was below 30 per cent between FFS and non FFS farmers of both genders, pointing to the need for integration of various appropriate extension methodologies. While preparing the FFS curriculum more emphasis could be given for technologies/ practices having wider knowledge and adoption gaps.

Table 3. clearly indicated that the overall knowledge level of the FFS and Non-FFS farmers show statistically significant difference, indicating the effectiveness of FFS methodology in improving the knowledge of participating farmers. Hence it could be inferred that, FFS is an appropriate extension methodology for improving knowledge based decision making in technology adoption.

Table 3. provided the difference in the average knowledge score of FFS and Non-FFS participants of both genders. The data indicate that there is non significant difference among the FFS and non-FFS farmers of both genders regarding the knowledge level.

Table 3. Comparison of knowledge level between FFS and non-FFS farmers (N=240)

Category of farmers		Mean	SD	‘t’ value
FFS		51.76	17.75	9.369**
Non-FFS		31.35	12.75	
FFS	Men	51.25	14.82	0.135 NS
	Women	50.11	17.73	
Non – FFS	Men	28.39	10.14	3.303 NS
	Women	36.49	12.48	

Significant at p <0.01 level

Table 4. Comparison of average scores of knowledge about *Biomanagement aspects of rhinoceros beetle of coconut* items between FFS participants and non-participants

Categories		Mean	SD	‘t’ value
FFS	Men	60.95	22.14	-0.255
	Women	62.26	21.83	
Non-FFS	Men	28.63	24.55	0.108
	Women	36.66	29.06	
FFS	Men	60.95	22.14	9.636**
Non-FFS	Men	28.63	24.55	
FFS	Women	62.26	21.83	9.161**
Non-FFS	Women	36.66	29.06	

Significant at p <0.01 level

This is also an indication of the effectiveness of FFS methodology in improving knowledge regardless of the gender. The data in Table 3. points to the non significant difference among coconut farmers regardless of gender differences and the effectiveness of FFS as an extension methodology in improving knowledge of farmers. *Feder et al., (2004)* stated that effectiveness of the diffusion process is of great practical importance in the design of farmer knowledge enhancement strategies through FFS approach, as it affects the cost effectiveness and financial sustainability of publicly funded farmer information services such as extension and adult education. *Dinpanah et al. (2010), Tripp et al. (20015), Bunyatta et al. (2008)* and *Palis (1998)* also reported significant difference in knowledge on biological control of pests, between the participant and non participant rice farmers.

Table 4. presented the impact of FFS as an extension methodology in significantly improving the knowledge level on biomanagement of rhinoceros beetle, the major pest of coconut and integrated nutrient management practices, among FFS and Non FFS farmers of both genders. Table 4. also showed non

significant difference among FFS and Non FFS men and women farmers on all the knowledge items and a significant difference between FFS and Non FFS farmers of both the genders. Hence it could be concluded that overall improvement in case of average knowledge score of participant farmers as well as knowledge of each of the component items significantly improved/ enhanced due to the FFS methodology. *Davis et.al.,(2012)* stated that FFSs were shown to have positive impact on production and income among women, low-literacy, and medium land size farmers. Participation in FFS increased income by 61 per cent. Participation in FFS improved agricultural income and crop productivity overall. They also stated that, farmer field schools are a useful approach to increase production and income of small-scale farmers in East Africa, and that the approach can be used to target women and producers with limited literacy.

Adoption of bio-management practices : The adoption of treatment of rhinoceros breeding sites with *Metarhizium* was 43.2 per cent in Devikulangara panchayath during 2015-16 due to the implementation of biomanagement programme by the local panchayath among potential coconut farmers. Incorporation of *Clerodendron infortunatum* (weed plant) in the breeding sites of rhinoceros beetle was adopted by 36.01 per cent of farmers. (Project records of *Krishibhavan, Devikulangara, 2016*). This is an impact of the FFS programme implemented in the panchayath and a sure way to disseminate the technology components in an area wide scale. FFS learning experiences by the critical adopters who were having the farm yard manure pits / compost/ coir pith heaps which are the primary breeding sites of the pest, enabled the benefit of the technology dissemination to other farmers of the locality. The facilitation of technology dissemination through project components was provided by ICAR-CPCRI scientists. In this process the area wide adoption managed through coconut producers' societies (CPS) of the locality, wherein FFS participants are also represented. *Braun et al., (2006)* opined that FFS participants can become part of the farmer networks which was reflected in this study through the coconut producer's societies. This shift in paradigm enabled the results to be disseminated to the coconut farming community of the location (panchayath) equitably through the area wide extension approach, thus overcoming the challenges of fragmented holdings and individual resource base for managing the wide spread incidence of the rhinoceros beetle. Hence a paradigm shift obtained, combining decision making and logistics for critical inputs by farmers groups and field level adoption by individual farmers. The FFS graduates can act as motivators and take proactive roles in reaching out to fellow farmers for wider adoption of technologies. The financial requirement for up-scaling and sustaining the process could also be mobilized by local governments.

CONCLUSION

This paper assessed the impacts of Farmer Field School (FFS) on knowledge and technology adoption two years after the launch of the program, with focus on biomanagement of rhinoceros beetle, the major pest of coconut. To view the impact we have compared the FFS participating farmers and non-participating farmers with baseline similarities as well as gender based impact, since coconut is the major crop of homestead farming in which women play a major role. Farmer field schools are usually practiced among paddy farmers throughout the world, initially. The FFS methodology adaptive in duration, curriculum and scheduling in coconut since the crop stand is up to 70-80 years and congenial presence of the crop in contiguous area favoring pests or diseases. Homestead based coconut systems, was found to have effective results through area wide pest management decisions and actions. This study adapted the FFS methodology for coconut and proved that FFS is an appropriate extension approach for improving knowledge level of both gender. The gender aggregated analysis attains importance in FFS of perennial crops like coconut since the decision making for the technology adoption or discontinuance; changes are being made by the family members, as coconut is base crop of homestead farming systems. The farmer to farmer extension of knowledge through developing master farmers is a continuation activity, which requires knowledge/ skill empowerment in related areas of system based farming and ICAR-CPCRI is in the process of evolving a participatory farmer lead mechanism for reaching out to coconut communities for making research more useful and purposeful. In case of FFS-coconut, the master trainers/ FFS participants were integrated with coconut producers' societies (CPS), the coconut community based local organizations for rapid technology dissemination and community level adoption.

REFERENCES

Alam, R. and K. Kamp. (2007). A farmer field school for Aquaculture. (On- line), Available on the www: *url: http:// www.wis.cgiar.org/* rwc/shared/asp/practices /PraOverview.asp?Practice ID=528

Anithakumari, P.; K.Muralidharan , S. Kalavathi and S. Remabhai. (2014). Constraints in adoption of integrated management for root (wilt) disease affected coconut area- An analysis of Alleppey district, *J. of Plantation Crops*. **40** (1): 9-15

Anithakumari, P; C.P.R. Nair; P. Rajan and Chandrika Mohan. (2007). In final technical report, CFC/DFID/APCC/FAO. Project on Coconut IPM, Jakarta, Indonesia

Braun, A.; J. Jiggins.; N. Röling; H. van den Berg and P. Snijders. (2006). A global survey and review of farmer field school experiences. Report prepared for the International Livestock Research Institute (ILRI). Pp. 91

Bunyatta, D.K.; J.G., Muriethi., C.A. Anyango and F.U. Ngesa. (2006). Farmer field schools effectiveness for soil and crop management technologies in Kenya. *J. of Intl. Agril.and Ext. Edu.*, **13**(3): 47-64.

Davis, K.; E. Nkonya and E. Kato (2012). Impact of farmer field schools on agricultural productivity and poverty in East Africa. *World Development*. **40**(2): 402-413.

Dinpanah, G.; M. Mirdamadi, A. Badragheh, J. M. Sinaki and F. Aboeye. (2010). Analysis of effect of farmer field school approach on adoption of biological control of rice producers characteristics in Iran. *American- Eurasian J. of Agri. and Envi. Sci.*, **7** (3): 247-254

Feder, G.; R. Murgai, and J.B. Quizon. (2004). The acquisition and diffusion of knowledge: The case of pest management training in farmer field schools, *Indonesia, J. of Agricultural Economics,* **55**(2): 221-243

Fleischer, G. H. Waibel and G. Walter Echols (2002). Transforming top down agricultural extension to a participatory system: A study of costs and prospective benefit in Egypt. *Public Administration and Development,* **22**: 309-322.

Gopala, Y.M.B.; K.P. Krishnamurthy; K. Raghuprasad; K. Nagabhushanam and Shivaramu. (2012). Impact of farmers' participation in farmer field schools. *J.of Rural Development*. **31** (1): 85-94.

Hagmann, J.; E. Chuma.; M. Connolly and K. Murwira. (1998). "Client-driven change and institutional reform in agricultural extension: an action learning experience from Zimbabwe". ODI Agricultural Research & Extension Network AgREN. Network Paper No. 78. pp. 2-13

Herath, C.S.; L.K. Weersinghe; T. Bandaranayake; M.M.N. Nuwanthilake; A. Irshad Ahamed and R.D. Samathapala. (2007). In final technical report, CFC/DFID/APCC/FAO, Project on Coconut IPM, Jakarta, Indonesia

Huluka, A. T. and W. Negatu. (2016). The impacts of farmer field school training on knowledge and farm technology adoption: Evidence from smallholder maize farmers in Oromia, Ethiopia. *J.of Eco. and Public Finance* (Online). **2** (1): 1-21

HuynhPaul, Q.T.N.; C.Struik; Lisa L. Price; Nguyer P. Tuyen; P. Nguyen Hoan; and Heleen Bos. (2011). Increase in farmers knowledge through farmer seed production schools in vietnam as assessed in the basis of ex-ante and ex- post tests. *The J.of Agri. Edu. and Ext*, **16** (3): 229-247.

Manoj, A. and K. Vijayaragavan. (2014). Impact of farmers' field school on farmer knowledge of integrated crop management practices in paddy. *Indian Res.J.Ext. Edu.*, , **14** (1): 35-10

Mariyono, J.; G. C. Luther; M. Bhattarai; M. Ferizal; R. Jaya. and N. Fitriana (2013). Farmer field schools on chilli peppers in aceh, Indonesia: Activities and Impacts. *Agroecology and Sustainable Food Systems,* **37** (9): 1063-1077

Nirmaladevi and M. Manoharan. (1997). Adoption level of guava cultivation and analytical study. *Indian J. of Ext. Edu.*, **8** (2): 2723-2726.

Palis, F.G.; (1998). "Changing farmers' perceptions and practices: the case of insect pest control in central Luzon, Philippines". *Crop Protection*, **17**: 599-607.

Rustam, R. (2010). Effect of integrated pest management farmers field school (IPM FFS) on farmers' knowledge, farmers group's ability, process of adoption and diffusion of IPM in Jember district. *J. of Agril. Ext. and Rural Devel,*. **2** (2): 029-035

Singh, S.P. and Romulo N. Arancon Jr. (2007). Farmer field schools in IPM of coconut pests. APCC-IPM Publication. No.3. CFC/ DFID/ FAO project as Coconut Integrated Pest Management, Asian and Pacific Coconut Community, Jakarta

Tripp, R.; M. Wijertne and V.H. Piyadasa. (2005). What should we expect from farmer field schools? A Sri Lanka case study. *World Development*, **33** (10) : 1705-1720

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