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RESEARCH ARTICLE :

Farmer field school : An approach beyond technology transfer

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SUMMARY : Farmer field school is an innovative extension approach, emerged in rice crop and gradually diversified to vegetables, cotton, livestock and other crops. FFS originated from Indonesia, is presently being conducted in many countries with local adaptations and institutionalization. FFS is a group-based learning process that includes hands-on training methods, carried out through field observations, agro-ecosystem analysis at subgroup level, agro-ecosystem analysis at school level and special topics. Participants of farmer field schools are made to learn through direct real-life experiences to maximize retention of farm information. During the period 1994-2013, total 14,617 FFS were organized to train 58,422 agricultural extension officers and 4,39,508 farmers in the country. Evaluation studies reported that the FFS approach has empowered farmers in knowledge acquisition, analytical skills, critical thinking, problem-solving skills and reflecting an increase in yield, reduction in pesticide use and farm-level returns. Sustained diffusion from field school graduates to neighboring farmers still lacks convincing evidences. Effective FFS essentially require backstopping by experienced facilitators, appropriate fund release mechanism, proper logistics, regular monitoring and participation of farmers.

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BACKGROUND AND OBJECTIVES

Public agricultural extension system is one of the largest information dissemination institution in the country. The use of innovative extension approaches to reach the unreach is, therefore, a concern for all involved in agriculture extension and advisory services. In the future, the farmer participatory approaches, farmers' co-operatives, social media, involvement of NGOs being emphasized for more efficient and helpful agricultural extension system. Farmers found to be showing keen interest in localite communication approach and receive the views of fellow farmer more quickly than any other method of technology sharing (Kaur and Kaur, 2018). The theory of Jurgen Habermas played an importantly critical role in the formation of the initial FFS educational strategy (Habermas, 1984). His theoretical model presented analysis and learning as a communicative process among freely speaking adults who respect and support each other. The critical theory analysis of Habermas elaborates on why adults are motivated to learn

in three domains *i.e.* technical, practical and empowerment, in turn distinguishing three areas of social existence:work, social interaction and power (FAO,2016). Farmer field school is an innovative extension approach based on farmer to farmer communication. This approach to farmer training emerged in Indonesia called the 'Farmer field school' (FFS) by the end of 1980's. The term "Farmer field school" came from the Indonesian expression *Sekolah lapangan* meaning just field school (Van de Fliert, 1993 and Pontius *et al.,* 2002).

The first field school was established in 1989 in Central java during a pilot season by 50 plant protection officers to test and develop field-training methods as part of their IPM Training of Trainers' course. The name field school was created to reflect the educational goals of the course based on real field problems being observed and analysed from crop planting to harvest (Braun and Duveskog, 2008). Farmer field school on integrated pest management (IPM) was developed to help farmers alter their practices to diverse and dynamic ecological conditions. Policy-makers and donors were impressed with the results of farmer' field school and the programme rapidly expanded (Gwary *et al.,* 2015) . Eventually, IPM framer field school programmes for rice were carried out in the twelve Asian countries and gradually branched out to vegetables, cotton, livestock and other crops. From the mid- nineties onwards, the experience generated in Asia was used to help initiate IPM farmer field school programmes in other parts world. New commodities were added and local adaptation and institutionalization of these programmes were encouraged. At present, IPM farmer field school programmes, at various levels of development, are being conducted in over 30 countries worldwide (Soedijo, 2016).

Status of famer field school implementation:

Farmer field schools have been introduced to at least 90 countries worldwide and it is estimated that somewhere in the range of 400,000 to 475,000 farmer field schools has been organized, producing 10-15 million field school graduates by 2008. They are largely funded by multilateral development agencies and implemented by developing country governments and non-governmental organisations (Waddington *et al.,* 2014). In India, farmer field school (FFS) training model for disseminating IPM technology was introduced in 1993 through Central Integrated Pest Management Centers (CIPMC) in rice, cotton and vegetable crops. During the period 1994-2013, total 14617 FFS were established in India (Table 2). At the national level on an average 58,422 agricultural extension officers had trained and 4,39,508 farmers was trained during this period. In Punjab, 334 FFS had been organized and 1904 AEOs and 11530 farmers were trained during 1995-2000.

Table 1: Year wise progression of farmer field school approach in different countries

Year	List of countries adopting Farmers' Field School approach
1989	Indonesia
1992	Vietnam
1993	China, Philippine, Sudan
1994	Bangladesh, India
1995	Sri Lanka
1996	Cambodia, Egypt, Ghana, Kenya
1997	Laos PDR, Mali, Pakistan, Peru, Tanzania, Zimbabwe
1998	Nepal, Thailand
1999	Brazil , Bolivia, Ecuador, Ethiopia, Uganda, Zambia
2000	Colombia, El Salvador, Honduras, Nicaragua, Senegal
2001	Benin, Burkina Faso, Malawi, Mexico, Mozambique, Niger, Nigeria
2002	Dominica, Dominican Republic ,DR Congo, Haiti, Jamaica, Suriname, Trinidad and Tobago
2003	Bosnia-Herzegovina, Bulgaria, Cameroon, Croatia, Guyana, Hungary, Iran, Kyrgyzstan, Romania, Serbia and Montenegro, Sierra Leone, Slovak, Republic, Syria, Turkey
2004	Algeria, Armenia, Bhutan, Gambia, Guatemala, Jordan, Lebanon, Morocco, Namibia, Palestine Territory, Togo, Tunisia, Uzbekistan
2005	Angola, Rwanda, USA

FAO (2016) and Khisa (2004)

Principles of FFS:

Farmer field school brings together a group of farmers to engage in a process of hands-on field-based learning over a season/production cycle. The four principles of the FFS approach is mainly identified in the literature (Khisa , 2004 and FAO, 2010) and are as under:

– Grow a healthy crop

– Observe fields regularly

– Conserve natural enemies

– Understand the ecology and become experts in the field.

Characteristics of the farmer field school approach:

Farmer field schools prominently encompasses the characteristics of adult and non-formal education with the aim to manage more complex problems arising in their local community agro-ecosystems. The distinguished characteristics of FFS approach includes:

The field is the learning place:

Learning takes place in the field. It is usually on a host farm where an FFS is established. Participants observe and learn from the field work rather from textbooks and lectures of extension workers. Farmers' preferences, local ecological and socio-economic conditions must be considered while promoting improved farm practices.

Facilitation, not teaching:

The role of the facilitator is crucial for successful learning and empowerment because FFS does not focus on teaching but on guiding FFS members through the learning process. To foster the learner centered process, the facilitator remains in the background, listening attentively and reflectively, asking questions and encouraging participants to explore more in the field and present their ideas. The facilitator must stimulate FFS members to think, observe, analyze and discover answers by themselves.

Hands-on and discovery-based learning:

The process of learning adheres to principles of adult education and "learning by doing". Adults tend not to learn and change behaviour by passive listening, but as a consequence of experience. Through learning by doing in a discovery-based manner, group members cherish

Table 2: Implementation status of farmer fieldschools in India

Year	FFSs (No)	AEOs trained	Farmers trained
1994-95	944	4335	28151
1995-96	1844	8615	57137
1996-97	1506	6501	40679
1997-98	694	3116	22421
1998-99	714	2581	23295
1999-00	520	1621	15600
2000-01	511	1690	15749
2001-02	520	1802	15990
2002-03	504	1807	15123
2003-04	652	2151	19815
2004-05	674	2874	20357
2005-06	621	2600	18397
2006-07	638	2764	19063
2007-08	698	3264	20940
2008-09	751	3632	22395
2009-10	750	3633	22136
2010-11	734	3595	22000
2011-12	716	1408	21480
2012-13	626	460	18780
Grand Total	14617	58422	439508

Source: Ministry of Agriculture (2012)

ownership over their knowledge and gain confidence in what they have learned.

The farmer as expert:

The FFS approach recognizes community members as the experts within their particular contexts and considers indigenous and local knowledge an important source of information to be used within the FFS learning process. Through the process, FFS members learn how to improve their own abilities to observe and analyses problems and to develop practical and relevant solutions. The approach inspires members to learn continuously by exploring and educating themselves on issues and topics that affect their livelihoods.

Equity and no hierarchy:

An FFS is designed for all to participate on an equal basis. FFS supports no hierarchy between farmers and facilitators, group leaders and ordinary members, diploma holders and those who do not read and write. All are equal partners in the FFS learning experience.

Integrated and learner-defined curriculum:

The FFS curriculum is defined by the learners and is unique for each group, though much of learning enterprises are pre designed under the mandate of FFS implementing agencies. The basic principle for any FFS is that all topics must be related to what is important to the group members and aim to fill their particular gaps in knowledge.

Comparative experiments:

Knowledge is gained through practical experiments where different options are compared with each other. The trials are regularly observed and analyzed. Issues are discussed as they occur in reality.

Team building and social animation:

Aspects of team building, group dynamics and social animation are important components of learning sessions. Through song, dance and drama people share knowledge and culture, build cohesion and learn communication and leadership skills.

Participatory monitoring and evaluation:

While preparing the FFS curriculum, participants develop a plan for monitoring and evaluating progress to later assess whether they are achieving the agreed objectives.

On-farm learning and Dale's Cone of Experience:

In 1946, Edgar Dale, introduced the Cone of Experience which shows the progression of experiences from the most concrete (at the bottom of the cone) to the most abstract (at the top of the cone). The cone of experience signifies how much people remember based on their method of receiving information. According to Dale's Cone of Experience (1946), the base of the cone is characterized by more concrete experiences, such as direct experiences (real-life experiences), contrived experiences (interactive models) and dramatic participation (role plays). A direct purposeful experience represent reality or the closet things to real, everyday life. The common theme among these levels is learners are "doing". The middle of the cone is slightly more abstract and is characterized by learners realistically "observing" the experience. These levels are differentiated from the lower levels of the cone because students do not interact directly with the phenomenon. Levels in this section of the cone include demonstrations, field trips, exhibits, motion pictures, and audio recordings or still pictures. The peak of the cone is the most abstract where the experiences are represented non-realistically by symbols, either visual or verbal *i.e.* listening to the spoken world.

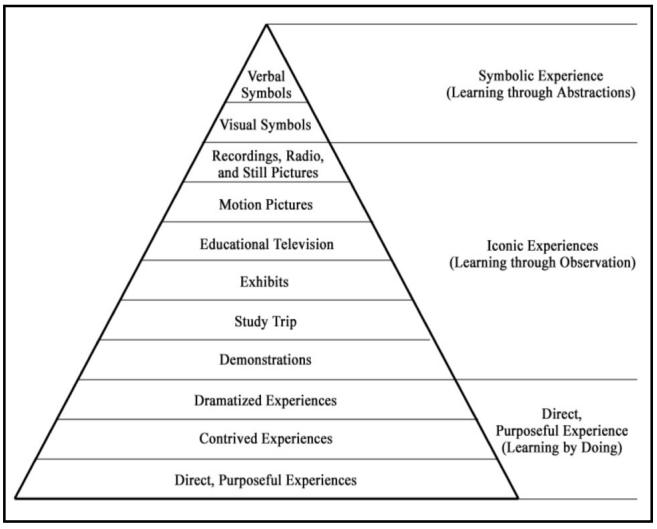

Fig. 1: Dale's cone of experiences

The cone charts the average information retention rate for various methods of teaching. The further you progress down the cone, the greater the learning and the

more information is likely to be retained. It also suggests that when choosing an instructional method, it is important to remember that involving trainees in the process strengthens knowledge retention. It reveals that "action-learning" techniques result in upto 90 per cent retention. People learn best when they use perceptual learning styles. Participants of farm field school (FFS) are exposed to direct real-life experiences and hence, maximum retention of farm information can be predicted.

Activites of farmer field school (FFS):

The field school offers farmers an opportunity to learn by doing, by being involved in experimentation, discussion and decision-making. This strengthens the role of farmers in the research-extension-farmer chain. (Van de Fliert, 1993 and Pontius *et al.*, 2002). It also improves the sense of ownership of technological packages and new knowledge and skills. The prominent activities (Khisa, 2004) that constitutes the farmers field school are:

Field observations:

The main activity and first in the morning is to step into the demonstration plots in groups of five and observe crop, usually chosen at random along a diagonal across the field. Notes are taken considering crop development, environmental factors, pest and natural enemies occurrence and damage symptoms etc.

Agro ecosystem analysis at subgroup level:

Following the field observation, the farmers make the drawings of what they have just observed in the fields. Using large sheets of paper and coloured crayon, farmers draw crop at its present growth stage with pests and natural enemies of the moment. A leaflet with pictures of insect pests and natural enemies is distributed to each subgroup for reference material. A conclusion about the status of the crop is drawn by the five members together and noted down on the paper.

Agro ecosystem analysis at school level:

Agro ecosystem analysis reports prepared by each other subgroup is then presented to whole field school group. The conclusions drawn from the field observation with respect to pest control are discussed in the entire group. After this brief presentation of results, the floor is open for question and discussion.

Special topics:

During each session, special topics are introduced. These topics are generally related to locally occurring field problems or providing opportunities to discover processes such as effect of pesticides on natural enemies.

Group dynamics:

Group exercise is performed from time to time. These exercises develop cohesiveness and collaboration in the group and create a strong sense of belongingness to the school.

Field day:

Results of farmer field school are presented to the whole community on the field day, which is organized at the end of the crop season. Village and sub district heads are also invited in order to obtain (financial) support for follow-up activities of the school (Van de Fliert, 1993).

Table 3: Comparison between farmer field school and transfer of technology approach

Sr. No.	Parameter	Farmer field school	Transfer of technology approach
1.	Learning method	Participating and experimenting, discovering	Listening (experimenting and discovering usually absent)
2.	Training venue	Subject of learning (field, crop, animal etc.)	Training halls or community centers
3.	Duration	Complete crop period (Season long cycle)	Varying from one day to months
4.	Extension agent and their role	Facilitators, helps in problem solving	Spends most of their time trying to convince farmers
5.	Farmer' role	Participator, contributor, decision maker	Listener and advisories usually prescribed
6.	Programme planning	Done and agreed upon by/with farmers. Extension agent commits themselves	Normally at higher level and top to down approach based
7.	Evaluation and adoption	Together with farmers and adoption is the choice of the farmer	By officials and adoption of technology is usually persuasive

Source: Modified after Khisa (2004)

Impact of farmer field schools:

Peshin (1997) concluded that farmers trained under IPM-FFS had knowledge about natural enemies and were conscious of the fact that pesticide application destroys natural enemies present in the field, as such IPM trained farmers had gone for lesser number of pesticides expenditure. Thirteen IPM trained farmers had not at all applied any insecticide without adversely affecting the yields. Another study conducted by Vijayalakshmi *et al.* (2003) assessed the experiences of FFS's in the Tamil Nadu state and concluded that FFS approach is considered the most successful among various agricultural extension methods. However, the adoption of the technologies disseminated through FFS largely depends on the initiative and interest shown by the individual farmers. Siddiqui (2012) also indicated that FFS training was a favorable process in increasing knowledge and skills of cotton growing farmers regarding ecologically sound farming practices. Manoj (2013) in Andhra Pradesh revealed that a high level of over-dose of chemical fertilizers which was reduced to recommended level through the intervention of FFS methodology among FFS farmers. Therefore, FFS methodology was found to be an effective extension tool to enhance farmers' knowledge and adoption related to complex crop management practices in paddy. The results found FFS as a justifiable investment.

Khatam and Khan (2013) reported that FFS helped in protecting the environment through reduced use of pesticides and fertilizers. Furthermore, FFS promoted local recipes for controlling insect/pests which helped a lot in protecting the environment from pollution. The study concluded that FFS had a positive impact on protection of environment. Butt *et al.* (2015) concluded from the study that FFS proves highly beneficial to the farming community due to its capacity building functions. Sharma and Peshin (2015) conducted a field study to evaluate the impact of vegetable Integrated Pest Management-farmer Field School (IPM-FFS) Programme in the sub-tropical Jammu region. The results reflected that much needs to be done with improving the quality of IPM trainings conducted by different extension agencies to achieve the goals of IPM programme in educating farmers and reducing pesticide use and adverse environmental impact. There should be institutionalization of evaluation research to quantify the outcomes /impacts of agricultural research and development programmes for generating empirical feedback.

Sarthi *et al.* (2015) concluded that farmer field school programme is playing a vital role in enhancing the socio-economic status of farmers with adoption of IPM practices, which can improve the skills of insect pest management and enhances the crop production also. Mariyono *et al.* (2018) assessed the impact of farmer field schools (FFS) on the productivity of vegetable farming in vegetable-producing areas of East Java and Bali, Indonesia. The results indicate that FFS were successful for enhancing farmers' capability in vegetable farming. Farmers who participated in FFS have higher productivity than those who did not. Farmers also could adapt and adopt the knowledge gained from FFS as they underwent a process of learning by doing. The impacts of the increase in farmers' capacity can be more evident if weaknesses during the FFS preparation and implementation can be overcome, to ensure more participation, flexibility to fit different conditions/needs and continuous learning. Akila and Bharathi (2020) found that 24 programmes in eight blocks were conducted in one year and evaluation results revealed that conduct of FFS in one year improved the adoption behaviour of scientific practices among the livestock farmers of Karur district. Aravind and Rakhesh (2006) also reported about enhancement of social competence and confidence in farmers to speak and argue in the public.

Waddington *et al.* (2014) conducted a systematic review to examine the effectiveness of farmer field schools in improving intermediate outcomes (such as knowledge and pesticide use) and final outcomes (such as agricultural yields, incomes and empowerment) in lowand middleincome countries (LMICs), as well as implementation factors associated with programme's success and failure. A large number of FFS evaluation studies has been generated. Researchers has screened the titles and abstracts of over 28,000 papers, the majority of which were irrelevant to the topic. On further screening by two authors, 134 quasi experimental studies comprising 92 distinct evaluations were considered for the review. The review also includes 20 qualitative evaluations and a portfolio review of 337 project documents. The results suggested that farmer field schools have positive impact on intermediate and final outcomes for participating farmers in the short to medium term. There was a significant increase of 0.21 standard deviations on knowledge about beneficial practices among farmer field school participants over comparison farmers. There was a significant reduction in pesticide use by 23 per cent for

IPM and IPPM FFS participants over comparison farmers. Effects on pesticide use were particularly large and consistent for cotton IPM projects in Asia. There was a significant increase in indices of adoption of other beneficial practices by 0.22 standard deviations over comparison farmers. A significant increase in agricultural yields was estimated among FFS participants, by 13 per cent over comparison farmers. A significant increase in profits (net revenues) was estimated, by 19 per cent among FFS participants over comparison farmers. The increase in profits was higher for FFS projects which also included complementary interventions involving input or marketing support. There was a 39 per cent reduction in estimated environmental impact quotient (EIQ) score as a result of reduced pesticide use among FFS farmers over comparison farmers.

It can be inferred that majority of studies measured the immediate impact of training through aggregated data, and reported substantial and consistent reductions in pesticide use attributable to the effect of training (Pananurak, 2006 and Sharma *et al.,*2015). In a number of cases, there was also a convincing increase in yield due to training. Most studies focused on rice. Pesticide reduction and farm-level returns were higher in non-rice crops (vegetables and cotton) than in rice. However, there is no convincing evidence that IPM field schools offer sustained diffusion to neighboring farmers who live in the same community as field school graduates. This lack of diffusion is an important weakness of FFS implementation approach (Waddington *et al.,* 2014).

Merits of FFS:

– Strengthening observation capability of farmers and increasing knowledge enhancement through discovery-based learning.

– Building self-confidence and enhancing decision-making capacity.

– Minimizing risks in experimenting with new practices.

– Changing deep-rooted beliefs and practices.

– Developing problem-solving capabilities.

– Sharpening the farmers' ability to make critical and informed decisions.

– Helping farmers learn how to organize themselves and their communities (Khisa, 2004 and Hussain *et al.*, 2017).

Limitations and barriers in FFS:

There are several key planning and managerial issues in implementing FFS. While planning, the most important point to be taken care of is to visualize the need of FFS in particular situation. Moreover, FSS is not a universal panacea. It supports an educational approach that emphasizing experiential learning, action research and critical thinking (Braun and Duveskog, 2008). Clearly the FFS is not the best instrument for achieving quick and application of standardized recommendations. In later cases non-FFS methods like campaign, mass media, ICT are often more appropriate (Gwary *et al.,*2015). Another critical consideration is to ensure appropriate fund release mechanism and effective logistics. FFS is carried out according to the crop cycle and must start according to the planting season. An FFS programme must be carefully planned to ensure that study material and inputs for the particular FFS activities can be delivered in a timely manner. An appropriate fund release mechanism is also essential to enable timely procurement and delivery of materials and inputs (Singh and Kaur, 2005 and Sharma and Peshin, 2015).

FFS are vulnerable to loss of quality, particularly in terms of poor or inappropriate curriculum design. Experience shows that FFS must be implemented according to its key principles and cannot be applied simply on the basis of knowledge of extension methods. FFS facilitators must have at least two weeks of intensive FFS facilitation training delivered by experienced FFS master trainers, which must be followed up with continuous backstopping to maintain the quality of FFS during field application by the trained facilitators. The approach often loses its effectiveness when the fundamental principles and components are overlooked. FFS needs to be implemented as a complete package to achieve desired results (Gwary *et al.,* 2015).

FFS are usually considered as more costly method. The major costs involved in implementing FFS are facilitating training, training materials, transport and supervision. The cost per FFS varies according to the duration of the crop cycle, accessibility of FFS sites and the allowances paid to facilitators. Inadequate follow-up of trained farmers shows unwillingness to continue practicing IPM and the evidence for the benefits remains weak. In addition, experience in implementing FFS shows that a monthly meeting with facilitators, experience sharing workshops and exposure of facilitators to new technologies are essential to maintain a dynamic

relationship between the project management, facilitators and FFS members. Such activities are important to successful FFS outcomes. At the end, results depend upon farmers participation and concentration with which one takes part in FFS activities.

Conclusion:

The FFS approach is an innovative, participatory and interactive learning approach that emphasizes problem solving and discovery-based learning. The FFS approach helps farmers in enhancing their knowledge level, confidence level, individual analytical skills, critical thinking, creativity and capacity for independent problem solving. Thus, the Field School was a school without walls that taught basic agro-ecology and management skills. FFS requires effective backstopping by experienced FFS facilitators, appropriate fund release mechanism, proper logistics, regular monitoring and participation of farmers.

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