

Full Length Research Paper

Effect of integrated pest management farmer field school (IPMFFS) on farmers' knowledge, farmers groups' ability, process of adoption and diffusion of IPM in Jember district

Rizal Rustam

State Polytechnic of Jember, Indonesia. E-mail: rizal2001@yahoo.com.

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This research aims to explore the effect of the integrated pest management farmer field school (IPMFFS) on farmers' knowledge, farmers groups' ability, and process of adoption and diffusion of IPM in Jember District. The population of the research was 556 groups of farmers, with 22.240 farmers who are engaged in the IPMFFS in Jember District. The sample of this research consisted of 400 farmers selected with stratified area random sampling technique. Area or region will be used as basis for sub-district: from 31 sub-districts will be taken 8 sub districts by random, and each sub-district will be represented by 2 farmer groups. It means 16 farmers group can act as sample and 400 farmers as sample taken proportionally. The conclusion is rationalized with the following points: (1) the IPMFFS has significant effect on farmers' knowledge, (2) the IPMFFS improves three aspects of farmer groups' ability, that is the ability to plan activity for improving agribusiness productivity, to implement and obey agreement with other institution and to apply technology, information and team work, (3) The IPMFFS has the ability to improve the adoption of Integrated Pest Management (IPM) by the farmers, and (4) the IPMFFS has the ability to improve diffusion of IPM by the farmers to other farmers.

Key words: Integrated pest management, farmers' knowledge, farmer group ability, adoption, diffusion.

INTRODUCTION

The economically and technologically use of pesticide has not been efficient and is harmful (Kasumbogo, 1993). In this case, Indonesian Government has been motivated to have more comprehensive pest control policy. On November 5th, 1986, Indonesian Government issued President Instruction No. 3 1986 (INPRES 3/86). It stated that Integrated Pest Management (IPM) as National Policy forbids the use of 57 kinds of wide spectrum pesticide for rice plant. Then, this policy was followed by reducing subsidy of pesticide gradually and in the beginning of 1989, the subsidy was totally removed. As the following up of INPRES 3/86, Government has been implementing Training and Developing Program of National Integrated Pest Management managed by National Integrated Pest Management under the responsibility of National Development Planning Agency (BAPPENAS).

The implementation of Integrated Pest Management on farmers' level depends on training system of the Integrated Pest Management Farmer Field School

(IPMFFS). IPMFFS is a training activity for one season, has a good method in developing human resources (farmers) and motivates farmers in creating activities, creativities and independence for solving problems during planting season. Extension program through IPMFFS program is one of alternative extension program to change the farmers' habit and attitude so that they can be experts of integrated pest management. Farmers' training through IPMFFS method is a bottom up training program and avoids top down training program (Kasumbogo, 1993).

In the implementation of IPMFFS, the farmers attended the meeting once a week for one season (three months), conducted an experiment about pest improvement and discussed ways of solving problems. The farmers learned to observe situation in the field, make an initial analysis of agro ecosystem and take the action and keep controlling it. Conservation, the use of local and natural enemy and other methods, has important role in controlling the pest. There are four main principals in implementing IPMFFS

(Kasumbogo, 1993); they are: (1) healthy plant cultivation, (2) controlling every week, (3) the use of natural enemy, (4) farmers understanding ecology on their plants. Then, the farmers were trained to implement Integrated Pest Management (IPM) and the prestigious farmers were chosen as trainers for the next IPMFFS. The success of IPMFFS could motivate the implementation of IPM in the agribusiness farm. IPM practitioner could be an innovator of IPM by trying to get information of advance IPM technology and developing new tactic of IPM based on the available information. The trained farmers were able to assure other farmers about the advantages of IPM, and then they were expected to do the same learning process despite relatively low intensity.

According to Food Agricultural Agency District of Jember (FAADJ, 2004), In Jember District, IPMFFS had been working from 1989 to 2003. IPMFFS had changed in three phases: (a) phase 1: from 1989 to 1992 IPMFFS had been as training phase. It had trained 16 heads of Agricultural Extension Center, 20 Pest Observers, 131 Agricultural Counselors, 27 ex-Agricultural Counselors and 143 farmer groups or 4520 farmers; (b) phase 2, from 1992 to 1993, IPMFFS had been a transition phase and considered as a good moment when the existing human resources and the policy of East Java Government were declared into Governor Instruction No. 94/1992, which was about director team and work group of IPM on Province level, and the letter of Internal Minister No 92/10/Bangda on January 4th, 1993 about socialization and development of IPM. Therefore, it was expected that there would be appropriate development of IPM activities completely supported by Regional Government of District, and (c) phase 3: from 1993 up to 2003, IPMFFS had been as a phase of field operation. In this way all of farmer groups in Jember who had joined IPMFFS could implement the concept of IPM on their own farm land. There were 20% of 2777 existing farmers groups in Jember who had joined IPMFFS.

In Indonesia, IPM is a principal government policy in implementing plant conservation activities based on Constitution No.12 1992 about Plant Cultivation System; Government Regulation No. 6 1995 about Plant Conservation and; Declaration of Agriculture Minister No. 887/Kpts/ OT/9/1997 about Plant Pest Organism Control. The duty, function and authority of IPM are based on Constitution No. 22 1999 about Regional Autonomy; and Regional Regulation No. 25 1999 about the implementation of regional autonomy. IPM uses a system approach to reduce the damage caused by pests and their harmful level by using biological control, cultivation control, varieties resistance, and selectively necessary pesticides so that they do not contaminate environment and human health (DGHRI, 2003).

The implementation of IPM program entirely on agricultural system consists of the following basic elements: (1) dedicated researcher and Agricultural Extension Board who can provide information of cultivation, biology and

management control, (2) the program that can monitor the existence of pest and natural enemy for one season, (3) the limit of control action toward pest existence and level. Control action must be taken to protect plants from economical disadvantages and it is really unexpected thing, (4) IPM tactic consists of natural enemy spectrum used to reduce pest population, (5) the leader of farmer group who implements IPM program in the field or farm land and (6) the willingness and cooperation of farmers.

They are very important because farmers, Extension Board and researcher try not to depend on pesticide anymore. It is very irony: IPM theory has been well understood and introduced to the public, but it has not been implemented in the field (Oka, 1990).

IPMFFS was one of excellent agricultural extension and training models. It has conducted training of members of farmers a great deal. The objective of IPMFFS was to train farmers to be expert on IPM in the field. Therefore, they can implement principal of IPM at least on their farm land and around it. The farmer will be expert on IPM if he has the basic skills. According to Kasumbogo (1993), they are: (1) natural enemy and pest control and its method of attack control. The skill of identifying natural enemy, pest and its attack method can be learned through eco system analysis, and (2) making decision. Based on analysis arranged, the farmer can make the best decision on pest control so that the he can invest on his farm land efficiently.

METHODOLOGY

This research was conducted in Jember District, East Java Province, Indonesia. The research population was farmers in Jember District, based on the consideration that IPMFFS program had been implemented since 1989 to 2003 in Jember. It means this program has been well known and understood by the farmers and Agricultural Extension Board.

Jember District consists of 31 sub-districts and has 150 agricultural counselors and 2.777 farmer groups, but only 556 farmer groups have joined IPMFFS with 22.240 members. There were 400 farmers who had joined IPMFFS as the respondents from 22.240 farmers.

To take respondents of the farmers who had joined IPMFFS, the researcher used sampling technique "stratified area random sampling". The area used was sub-district and only 8 sub-districts were randomly taken from 31 sub-districts. Each sub-district had 2 farmer groups' representatives. Therefore, there would be 16 farmer groups or 400 farmers involved as respondents on this research. This research objective is aimed to explore the effect of the IPMFFS on farmers' knowledge, farmer groups' ability, process of adoption and diffusion of IPM in Jember District.

Data were collected through primary sources as structured questionnaires, personal interview and observation were used to obtain information from the respondents. Four hundred questionnaires were administered to the respondents. Data analysis was based on the four hundred retrieved questionnaires. The secondary sources of data include seminar papers, workshop papers, journals, published books, note of agricultural counselor, (by the use of percentages, mean and t-test) were used in documentation of IPMFFS in sub-district and village office and materials were also got from electronic media. Descriptive statistics analysis of the data. The framework model and interaction between the variables are

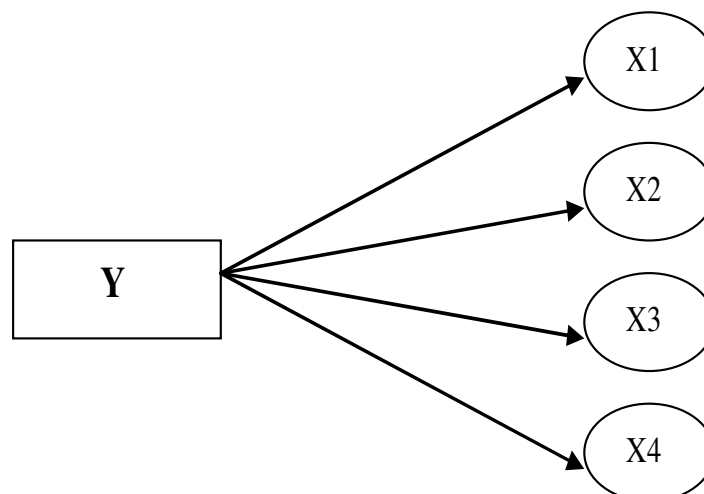


Figure 1. The framework model effect of IPMFFS program to the group knowledge, group ability, adoption and diffusion process of integrated pest management farmer field school (IPMFFS); X1 = Farmer group knowledge; X2 = Farmer group ability; X3 = The process of adoption IPM; X4 = The process of diffusion IPM.

Table 1. The result of ballot box test, pre-test (before IPMFFS) and post-test (after IPMFFS) (n=400).

| Score (0-100 scale) | Pre-test (%) | Post-test (%) |
|---------------------|--------------|---------------|
| 81 – Over | - | 14 |
| 71 – 80 | - | 20 |
| 61 – 70 | 7 | 28 |
| 51 – 60 | 10 | 20 |
| 41 – 50 | 13 | 10 |
| 31 – 40 | 17 | 8 |
| 30 – Lower | 53 | - |
| Total | 100 | 100 |

Source: Field study, 2008.

presented in Figure 1.

RESULTS AND DISCUSSION

The changing of farmers' knowledge after joining IPMFFS

In implementation of IPMFFS, every participant must follow a test "Ballot Box" that is useful to assess farmer's diagnostic skill and the progress after joining IPMFFS program. Besides, the "Ballot Box" test is also as a based line of IPM adopted by participants. This test is conducted in the early and the last week of IPMFFS program. Ballot Box is one of evaluation efforts for participants through pre-test and post-test to assess the progress of participant's knowledge and skill.

The pre-test is the test that is given to the farmers before taking the IPMFS and the post test is the test that is given to the farmers after the IPMFS is finished. The questions of Ballot Box test are based on the local field situation concerning the function of field ecology, and not the names of insect. Both pre-test and post-test must assess the same level of skill and knowledge. The result of Ballot Box test is used for supporting study and activity evaluation. Table 1 represents the data of ballot box test result.

The data of Table 1 indicate that there is a progress of knowledge and skill, the percentage of farmers, and that score on post test is higher than pre-test. The t-test shows differences between pre-test and post-test, as presented in the table.

Based on the statistical test, mean frequent of pre-test was 31.400 while post-test was 66.200. The t – value of

Table 2. T-test showing differences between pre-test and post-test.

| Variable | Mean | Std. deviation | Score -t | Remark |
|-----------|--------|----------------|----------|-------------|
| Pre-test | 31.400 | 14.990 | 5.146* | Significant |
| Post-test | 66.200 | 12.862 | | |

*Significant on α 0.05.

Table 3. The IPMFFS influence on five aspects of ability progress of farmer group (n=400).

| No | Aspect of ability | Improve (%) | Not improve (%) |
|----|---|-------------|-----------------|
| 1 | The ability to plan activity for improving agribusiness | 87 | 13 |
| 2 | productivity | 65 | 35 |
| 3 | The ability to implement and obey agreement with other institution | 50 | 50 |
| 4 | The ability to increase investment and income; the ability to develop institutional relationship between farmer group and cooperative unit in village (KUD) | 50 | 50 |
| 5 | The ability to apply technology and information, and team work. | 93 | 7 |
| | Average | 69 | 31 |

Source : Field study, 2008.

5.146 was significant at 0.05 level.

This suggests that there is significant difference between pre-test and post-test. It means we can take the conclusion that the differences of farmer's pre-test and post-test indicates that knowledge and also skills are gained by joining IPMFFS (Table 2).

The changing of the farmers as the participants of IPMFFS program has been analyzed only on the real application on the field particularly knowledge, attitude, and skill related to IPM technology. In other words, the skill analyzed is the real action from the farmers in implementing IPM on their plant after obtaining IPM training.

Based on observation, the real application is a better quality on five farm technology package (FFTP declare by the government) implementation, that is: 1) using quality seed; 2) using suitable fertilizer; 3) control the pest and disease; 4) good harvest implementation; and 5) good post harvest implementation. After participating in IPMFFS, the farmers are more intensive to implement the technology package recommendation (FFTP). Although they have known technology package for long time, they have not implemented FFTP yet. They have just implemented it intensively after they had got IPMFFS because the basic concept of IPM is concentrated on Technology Package of FFTP.

The changing of farmer groups' ability after joining IPMFFS

The Declaration of Agriculture Minister No: 41Kpts/OT.210/1/1992 states that to measure the quality

of farmer group is based on the five abilities that the farmer group must have: 1) the ability to plan activity for improving agribusiness productivity; 2) the ability to implement and obey agreement with other institution; 3) the ability to increase investment and income; 4) the ability to develop institutional relationship between farmer group and cooperative unit in village (KUD); and 5) the ability to apply technology, information and team work. These five aspects of ability must become basic standard to measure the quality of farmer group.

The influence of IPMFFS on five aspects of farmer group is presented on Table 3. Table 3 indicates that there are three aspects of ability of farmer group that are improving according to a respondent after joining IPMFFS program; they are: (1) the ability to plan activity for improving agribusiness productivity (87%), (2) the ability to implement and obey agreement with other institutions (65%), and (3) the ability to apply technology, information and team work (93%), while the two other aspects based on the interview improve the ability of the respondents (50%), but do not improve the ability of the rest respondents (50%). From the data above, it indicates that there are two aspects that have not improved yet. This is good enough because the two aspects are not really related to IPMFFS program.

In this case, IPMFFS program is good enough in developing farmer groups' ability. This can be indicated from the progress of the three ability aspects, especially the ability to apply technology, information and team work. The improvement of this farmer group's ability is a capital for developing farmer group in order to apply IPM principal on their agribusiness, to make them experts of IPM as final objective of IPMFFS program.

Table 4. Opinion of Farmers about the Adoption of IPM after finished IPMFFS (n=400).

| No | Statement | Percentage |
|--------------|---|------------|
| 1 | I am always implementing every aspect of IPM on my plant. | 30 |
| 2 | I often implement every aspect of IPM on my plant. | 37 |
| 3 | I do often implement every aspect of IPM on my plant. | 25 |
| 4 | I do not often implement every aspect of IPM on my plant. | 8 |
| 5 | I never implement every aspect of IPM on my plant. | 0 |
| Total | | 100 |

Source : Field study, 2008.

Table 5. Opinion of Farmers about The Diffusion of IPM After Finished IPMFFS (n=400).

| No | Statement | Percentage |
|--------------|--|------------|
| 1 | I am always teaching other farmers that do not know about IPM. | 31 |
| 2 | I do often teach other farmers that do not know about IPM | 30 |
| 3 | I often teach other farmers that do not know about IPM | 22 |
| 4 | I do not often teach other farmers that do not know about IPM | 11 |
| 5 | I never teach other farmers that do not know about IPM | 6 |
| Total | | 100 |

Source : Field study, 2008.

This condition is suitable with the result of Bagus research (1996) that most IPMFFS farmer groups are distributed on high level of IPMFFS farmer group ability up to 50% and generally if IPMFFS farmer groups have high level ability, they will have high level too on IPM innovations adoption, which is about 66%.

Process of IPM adoption

Adoption is someone's attitude changing from the first time; he is aware of innovations, then he receives and applies that innovations. The steps of IPM adoption analyzed in this research are based on five steps: (1) awareness, (2) interest, (3) assessment, (4) experiment and (5) acceptance.

The influence of IPMFFS on the process of IPM adoption is presented in Table 4. Table 4 indicates that IPMFFS has good influence on the adoption of IPM. It shows that 92% of farmers, after they have finished the IPMFFS, state that they always, or very often implement every aspect of IPM on their plant. Only 8% of farmers state that, they never, not, very often implement every aspect of IPM on they plant.

Three important factors found from the observation in this research which influences IPM adoption, namely: IPM innovations, farmers as participants of IPMFFS and IPMFFS factor. These three factors can be described in detail:

IPM innovations factor

Integrated Pest Management is an innovation for the participating farmers of IPMFFS, which has some interesting characters of innovation that the farmers can adopt. The characters are written below:

- a. IPM technique aspect can be learned and practiced on the farm of agribusiness. It means that the basic principles can be learned so that the farmers can apply them easy without any difficulty.
- b. IPM has economical advantage. In this case, the farmers can save the cost because they do not spend money for insecticide for spraying pest.
- c. IPM is not contrary to the social-culture of farmers. The application of IPM new technique does not disturb social life of farmers, is not contrary to the tradition of religious application related to agribusiness, and does not change farmers' hierarchy and role in their organizational life.

The participating farmers of IPMFFS

Based on the observation, there are intrinsic factors found from farmers that support them to adopt the IPM; they are:

- a. The need for new method of pest control. It is very urgent for farmers because they always fail in controlling pest with existing applied technique. Thus, they welcome

the existence of new IPM warmly.

b. They have skill to apply new technique. By conducting training, the farmers have skill, knowledge and positive attitude to IPM new technique so that they are ready to receive and apply the innovation and even the innovation is relatively simple.

IPMFFS factor

The administrator of IPMFFS really supports IPM innovation received by farmers because in this training the farmers discuss intensively the IPM innovation. IPMFFS as non-formal education system is designed with many supporting aspects that can adopt IPM; they are:

a. The participants of IPMFFS are selected farmers that can read and write; they are regarded as the modern farmers in their regions. The objective is they can join this program well and can share or diffuse IPM innovation to other farmers. In this way, they have great responsibility to run their mission trusted by the group.

b. The training is based on the adult education system: this is based on learning by applying or doing. It means the farmers are more active when they put training materials to work, while the counselor directs them only. In this case, the participants are sure that they can learn with the materials because they try to utilize them on their own, and can prove the result. Therefore, it is really appropriate that IPM innovation is adopted.

Process of IPM diffusion

In this research diffusion means that IPM is diffused to other farmers who have not joined IPMFFS. Integrated Pest Management diffusion is analyzing the effort or ability of respondents' farmers in diffusing IPM and what kind of media used to diffuse IPM to other farmers.

The Influence of IPMFFS on the process of IPM diffusion is presented in the Tables. Although Table 5 indicates that IPMFFS influence on the diffusion is not too good compared to its influence on the adoption, it shows that the percentage (83%) of farmers, who have finished the IPMFFS that state that they always, or very often teach other farmers that do not know about IPM, is still high. Only 17% of other farmers state that they never or not very often teach other farmers that do not know about IPM.

The interview and observation also indicate that the effort of sample farmers in diffusing IPM to other farmers is good enough. It means the mission of IPMFFS to diffuse IPM skill starts working, although it is not optimal yet. The farmers face some obstacles in diffusing IPM. They are: the limited time, the less skill in influencing farmer's image that IPM is not better than chemical control.

Generally the media used by sample farmers in diffusing IPM are either formal or non formal meetings. The formal meeting is the scheduled meeting of IPMFFS alumnae community while non formal meeting is unscheduled and unplanned meeting between sample farmers and other farmers in certain places; in food and beverage hut, cafe, field, custom activity center and etc.

In formal meeting the farmers or participants have special time to convey materials related to IPM and this opportunity is given after the discussion of main program, while non-formal meeting engages in different varieties. Basically, diffusion process is the same as adoption process. The difference is that someone who brings innovation is out of the social system in adoption process, while in diffusion process someone who brings innovation is from the social system that has adopted the innovation before.

The diffusion process of IPM technique in evaluated region starts from neighbor farmers or IPMFFS graduates and then it diffuses to other farmers around them. The farmers who have diffused IPM can be divided into two groups based on the nearness with the farmers of IPMFFS graduates. The first group is the farmers whose farm land is near with the farmers of IPMFFS graduate and the second group is the farmers who have family relationship to the farmers of IPMFFS graduate.

The diffusion process takes place within their neighborhood. For instance, the first group, almost every time they contact or meet with the farmers of IPMFFS graduate so that the chance to see, ask, imitate and discuss materials related to IPM is pretty big. This is the main factor which causes them to adopt IPM. While IPM diffusion process is really possible on the second group because they are as family or native family who always keep in touch, know, or take care of each other. For instance, if a member of a family knows or applies a more beneficial innovation, he must inform or diffuse it to the other members of family and vice versa, the entire family must adapt so that they can receive and apply IPM technology together. The concept described by Florencia et al. (2002) is a social capital concept. It means this concept can be used to transfer technology efficiently. There are many definitions stated by the experts about social capital concept, one of them is stated by Schuller et al. (2000): a) it is more focused on relationship method between social unit and its institution, b) it is more focused on the theme about building the belief and believing each other, sense of belonging, and team work, c) discussing about policy directly taken based on society attitude assumption.

Consequently, capital social concept directly disagrees with economy analysis concept which depends on the effort of profit and efficiency that provide the basis for human behaviors. Capital social concept takes place on many kinds of levels in village area especially on daily life and their agribusiness practice. For instance: lending money, food and exchanging food and services. One of

the forms of social capital that has become a custom for farmers is sharing technology monopolized by the farmers. The research result of Florencia et al. (2002) in Philippines indicates that the farmers who have been trained by IPM share the knowledge of IPM to their family more than to non member of their family. Furthermore, the result of that research shows that the farmers who have not been trained by IPM learn more IPM directly in the field than in other places.

The skill of IPMFFS graduate farmers in diffusing IPM is still relatively limited; it is extremely different when they get or adopt IPM at IPMFFS. Thus, IPM aspect absorbed by the other farmers is operational technique only, namely practical method in implementing IPM but they do not obtain its philosophy or scientific argumentation. In this diffusion process, other farmers just imitate what the farmers of IPMFFS graduate have done related to IPM. Although they are not critical to ask some questions or analyze something related to IPM but they are persistent enough to join and have a positive response and complete belief in what the farmers of IPMFFS graduate have done. However, this condition is very good in diffusion process of IPM since the main objective is how IPM can be diffused to the farmers as much as possible in several times. The paramount thing is IPM concept and technique can be received and applied by the farmers in reality because the philosophy and scientific argumentation are not too essential on the farmer level.

Conclusion

The conclusion is rationalized with the following points: (1) the IPMFFS has significant effect on farmers knowledge; (2) the IPMFFS improves three aspects of the ability of farmer groups that is the ability to plan activity for improving agribusiness productivity, to implement and obey agreement with other institution, and to apply technology and information, and team work; (3) The IPMFFS has good influence to improve the adoption of Integrated Pest Management (IPM) by the farmers; and (4) the IPMFFS has good influence to improve diffusion of IPM by the farmers to other farmers.

RECOMMENDATIONS

As long as we know, social and economical research of farmer in applying IPM has not got good attention. Generally, it is like innovation, IPM adoption is determined by farmer willingness to apply it. The perception of farmer's attitude can change through forcing them and it can kill their creativity and it is not humanism. IPM researchers and other researchers need to think about simply IPM technology application process so that it can be adopted easily by the farmers. Social research relevant with IPM is expected to be able to give input for improving IPM aspect. Farmer as the actor in applying IPM is necessary to analyze in relation to his accuracy and speed of application. This research still expresses many respondents' opinions and to complete this research requires further research to express fact in the field.

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