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EVALUATION OF FARMER FIELD SCHOOL ON INTEGRATED PEST MANAGEMENT OF RICE IN JEMBER DISTRICT, EAST JAVA - INDONESIA

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ABSTRACT

This research is aimed to explore the quality of the program implementation of the Integrated Pest Management Field Farmer School (IPMFFS) (in Indonesian language abbreviated as SLPHT, namely Sekolah Lapangan Pengendalian Hama Terpadu); to evaluate the effects of the IPMFFS program to the degree of the pesticide use and the production of farmer-efforts; and to describe the provision of the farmer-efforts, adoption process, innovation process and the change of knowledge and skills of the participants after to be actively involved in the IPMFFS program. The population of the research was 150 trainers (agricultural extension agent/PHP) and 22.240 farmers (grouped into 556 farmer groups engaged in the IPMFFS) in Jember district. The sample of this study consisted of 110 trainers (agricultural extension agent/PHP) and 400 farmers selected with the employment of an area random sampling technique. There is ten variables had been analyze that are : (1) the use of pesticide, (2) production quantity (3) participate agricultural extension, (4) remedial practice, (5) insight development, (6) motivation establishment, (7) the readiness of the participants, (8) the activeness of the participants, (9) planning program, and (10) coordination. Using path analysis as analytical tools, the result shows that variables of the process components which have a significant effect to the production quantity at 5 % significance level ($\propto$ = 0,05) are: (1) the use of pesticide, (2) participate agricultural extension, (3) motivation establishment, (4) insight development, (5) the readiness of the participants, (6) the activeness of the participants, (7) planning program, and (8) coordination. The variables which have a significant effect to the change of the use of the pesticide with the 5 % significance degree ($\propto$ = 0,05) include: (1) participate agricultural extension, (2) remedial practice, (3) motivation establishment, (4) insight development, (5) the readiness of the participants, (6) the activeness of the participants, and (7) planning program.

Key word: integrated pest management, farmer field school

INTRODUCTION

Based on the consideration that the application of pesticide economically not efficient and tend to make damage to the environment, Indonesia Government is pushed step by step to change the policy of pest controlling to the comprehensive approach. At November 5th 1986, Indonesia Government issued the President Instruction Number 3 year of 1986 (INPRES 3/86) which stated that Integrated Pest Management (IPM) (in Indonesia known as Pengendalian Hama Terpadu [PHT]) as a national policy which prohibit the application of 57 type of pesticide who has wide spectrum for rice plant. The policy of pesticide prohibit was followed by the decreasing of pesticide subsidy step by step then, and in the early of 1989 the pesticide subsidy was erased at all. As the follow up of President instruction (INPRES) 3/86, Indonesia government starts to hold

agricultural extension program and national IPM development which is managed by IPM National Program in Department of Agricultural.

The success of IPMFFS is expected to push the application of IPM in agriculture field. IPM applicator can be a IPM innovator through the effort to get information of IPM technology further and develop a new IPM tactic through its obtained information. Farmer who is trained is also expected to convince the other farmer about IPM usage. Further, those farmers is expected back to do the same study process although with the lower intensity level. All of IPMFFS process is expected to have a result in IPM application continuously by the standard quality which can be stand for last. Pest controlling approach by application IPMFFS has been a standard procedure in IPM concept implementation, even in Asia. In Jember district, IPMFFS had worked start from 1989 until 2003. The journey of IPMFFS change in three phases those are: (a) phase 1, between years of 1989 – 1992 IPMFFS in Jember district as agricultural extension phase. It has been trained as much as 16 chief of Agricultural Extension Board, 20 people of Pest Disease Observer, 131 people of Field Agricultural extension, and 143 farmers group or 4520 farmers; (b) phase 2, between years of 1992 -1993, as a transition phase and regarded as strategic momentum which by the exist human resources and East Java Province Government which is written in Governor Instruction Number 94/1992 about direction team and IPM work group in province level , and also circular letter of Domestic Minister Number 92/10/Bangda at the date of January 4th 1993 about IPM socialization and development, it is expected to create a suitable form of IPM program development through IPMFFS which obtain full support from District level Government ; and (c) phase 3, between the years of 1993 – 2003, as a field operation phase where all of farmer group in Jember District who has followed IPM are able to apply IPM concept in the field of themselves. The group of farmer in Jember District is as much as 2777 farmer groups, until 2003 there are 20 percent of farmer groups who had followed IPMFFS.

In Indonesia, IPM is a government base policy in doing plant protection program. The base of regulations in applying plant protection program is Constitution Number 12 Year of 1992 about Plant Cultivation System, Government Rules Number 6 Year of 1995 about Plant Protection, and Agriculture Minister Decision Number 887/Kpts/OT/9/1997 about Guidance of Plant Intruder Organism Controlling (OPT). Operationally, in its implementation especially the one which has an involvement with Local Autonomy is adjusted with assignment conducting, function, and authority based on Constitution Number 22 Year of 1999 about Local Authority, and Government Rules Number 25 Year of 1999 about local autonomy conducting.

There are 4 (four) IPM application principles, those are: (1) good plant cultivation; (2) natural enemy application and conservation ; (3) regular weekly observation; and (4) farmer who is able to do and IPM expert (Director General of Horticultural Protection, 2003). The IPM Field School is an example model of adult education through agricultural extension and farmer agricultural extension. According to Kusnadi (1986) the approach which is used in a agricultural extension better best through the adult education (Andragogy) through Experimental Learning Cycle and Learning by doing. It is because of the agricultural extension contestant commonly is adult who has experience and has experienced many things. Based on guidance book of IPMFFS program, there are seven education principal for adult those are: a) adult can study better if he/she takes role in activity, b) adult can study better if it attracts him/her and has an involvement with daily life, c) adult can study as better as possible if they study a science

who bring benefit and simple, d) emboldening and repeating continuously will help someone to study better, e) adult can study as better as possible if they have a chance use their knowledge, ability, and totally in enough time, f) study process is effect by past experiences, and thinking ability of student, and g) understand each other which suitable with the main characteristic of adult to reach the aim of study.

The main goal of IPM Field Farmer School (IPMFFS) is to reduce pesticide usage and increase production farm management either from quantity or quality of its result. Based on it, farmer is given agricultural extension so that they become IPM field expert and able to apply IPM principal, at least in their field. To make someone who expert in IPM, basic skill which is need to be obtained from IPMFFS according to Kasumbogo (1993) are: (1) natural enemy controlling, pest, and attack model. The ability to identify natural enemy, pest and attack model can be learned through ecosystem analysis, and (2) the way to make decision.

METHODOLOGY

This research was carried out January until June 2005. The research took place in some area in Jember District. Research determination area was determined by sampling random area method based on consideration of the existed IPMFFS program which had been done by member of farmer group. This research population is a group of farmer and Agricultural extension agent/PHP (Pest Disease Observer) in Jember District, East Java Province. Population determination is based on the consideration that IPMFFS program has been done in Jember District since 1989. Because of that, this program is regarded to have spread either in farmer people or Agricultural extension agent/PHP.

Jember District is consist of 31 Region and have 150 people of Agricultural extension agent/PHP, and 2.777 farmer group which have followed IPMFFS as much as 556 farmer group which have members as much as 22.240. Agricultural extension agent/PHP who becomes sample (respondent) are 110 people by simple random sampling technique from Agricultural extension /PHP in Jember District as much as 150 people. The Likert scale have used in the instrument research (questionnaire). The questionnaire have five (5) answers choice in an interval scale, there are: (1) very often or very agree; (2) often or agree; (3) sometimes or doubt; (4) seldom or disagree; and (5) never or very disagree. The highest score is 5 (five) and the lowest score is 1 (one).

In order to analyze how big the effect of process variable to the farm management production and level of pesticide application, path analysis is used by using *LISREL* program. The data which is obtained is analyzed so that it will be obtained regression coefficient which can predict how big the effect of each variable and if the effect has a significant meaning statistically. To analyze the variables which effect IPMFFS program conducting, it is used path analysis. Based on hypothesis, it is formulated that process variable of IPMFFS program has an effect to the level of farm management production and level of pesticide used.

Path analysis is used to analyze process variable of IPMFFS program because it can estimate program variables quantitatively especially estimation of those variables effect to the aim of program. The relative contribution of every variable can be stated in path coefficient analysis. Path analysis also can be used to describe how significant the effect of independent variable to dependent variable. Besides that, this analysis can test statistically the relation between those variables, and perform the result simply so that it is easy to understand. If the expected relation doesn't happen in its process, the program

arrangement must be repaired and maybe for some activity need to be increased or added with other activity. In this path analysis, there are some assumptions that have to be fulfilled. Among the important assumptions which have to be fulfilled those are: (1) between the observe unit must be freely (independent data), (2) data doesn't contain *outliers*, (3) to forecast the parameter by Maximum Possibility Method, the minimum samples are 100, and (4) data must normally spread. In this path analysis, there are two variables which become dependent variable that is farm management production and changing in pesticide application that is regarded to be the main aim of IPMFFS program, and also become a product variable of IPMFFS program. The reason which become the base of why this must be done is because the main aim of IPMFFS program is pest controlling by integrated way and as possible as avoid pesticide application. Besides that, IPMFFS is an agricultural extension program which has an aim to teach how the right way to manage farm to the contestant so that there is a development in farm management productivity. This research is also analyze the relation between variable dependent (pesticide application and farm management productivity), because it is prejudiced that the relation has a meaning theoretically. Besides because of the productivity, it is effect by many factors, either internal or external factor. The relation between dependent variables is also involved in IPMFFS program itself, remembering that the product of a program is an effect or impact after IPMFFS program had been conducted. It is important to give attention to the effect of independent variables which is a conducting process variable that can be increased or manipulated if it is approved to have a significant effect to the dependent variables by the analysis. In this path analysis, development of path model procedure is as possible as based on the theory. It means that in model specification (any variable which must be included) must be support by theory to avoid bias of specification or specification mistake. It is suitable with Gujarati (1990) stated who suggested the development of a model must use the help that is supplied by theory, and tried to modify the model based on the gained result

RESULTS AND DISCUSSION

All 27 indicators by Confirmatory Factor Analysis (CFA) shows that all indicators are valid at significant level 5%. The SEM (structural Equation Model) using LISREL will be produce output that's standardized for latent variable, except if one of the latent variable have already value. In this analysis unit of analysis (scale of analysis) have been used is the same, so the result will be meaningful in order to decide unit of analysis that will be use. It will be easy to compare the effect of variable X to variable Y.

The Output of the Structural Equation shows that there is two structural equation. The two structural equation have significant relations. The output shows that farm production quantity significantly effect by (1) the use of pesticide, (2) participate agricultural extension, (3) motivation establishment, (4) insight development, (5) the readiness of the participants, (6) the activeness of the participants, (7) planning program, and (8) coordination. The variables which have a significant effect to the change of the use of pesticide with the 5 % significant degree ($\propto = 0{,}05$) is: (1) participate agricultural extension, (2) remedial practice, (3) motivation establishment, (4) insight development, (5) the readiness of the participants, (6) the activeness of the participants, and (7) planning program.

The structural equation model analysis describe below (variable has significant effect is sign with *):

1. Prod = -1.15*Pest + 1.11*Part - 0.14 Remedial + 0.17*Insight +0.79*Motivation
(0.23) (0.19) (0.09) (0.05) (0.24)
4.96 5.90 -1.55 3.41 3.29

+0.42 Readiness + 1,03*Activeness + 0.25*Planning + 0,23* Coordination,
(0.12) (0.24) (0.09) (0,11)
3.50 4.29 2.82 2,09

2. Pest = - 1.08*Part - 0.22*Remedial - 1.06*Insight - 0.27*Motivation - 0.72*Readiness
(0.20) (0.09) (0.13) (0.08) (0.22)
-5.45 -2.41 -8.22 -3.48 -3.27
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- 0.97*Activeness - 0.75*Planning + 0.22 Coordination.
(0.16) (0.16) (0.15)
-6.02 4.68 1.46

The meaning :

(ή1) Pest	= the use of pesticide
(ή2) Prod	= production quantity
(ξ1) Part	= participate agricultural extension
(ξ2) Remedial	= remedial practice
(ξ3) Insight	= insight development
(ξ4) Motivation	= motivation establishment
(ξ5) Readiness	= the readiness of the participants
(ξ6) Activeness	= the activeness of the participants
(ξ7) Planning	= planning program
(ξ8) Coordination	= Coordination

The interesting findings from the result is significant effect of the application pesticides to form production. It is prove that decreasing application of pesticides has not negative effect to farm production, on the contrary the farm production will be increase. This prove can be stimulate the farmer to avoid application pesticide. Avoiding the application of pesticide is prove just the technical mater that have not direct impact to farm production.

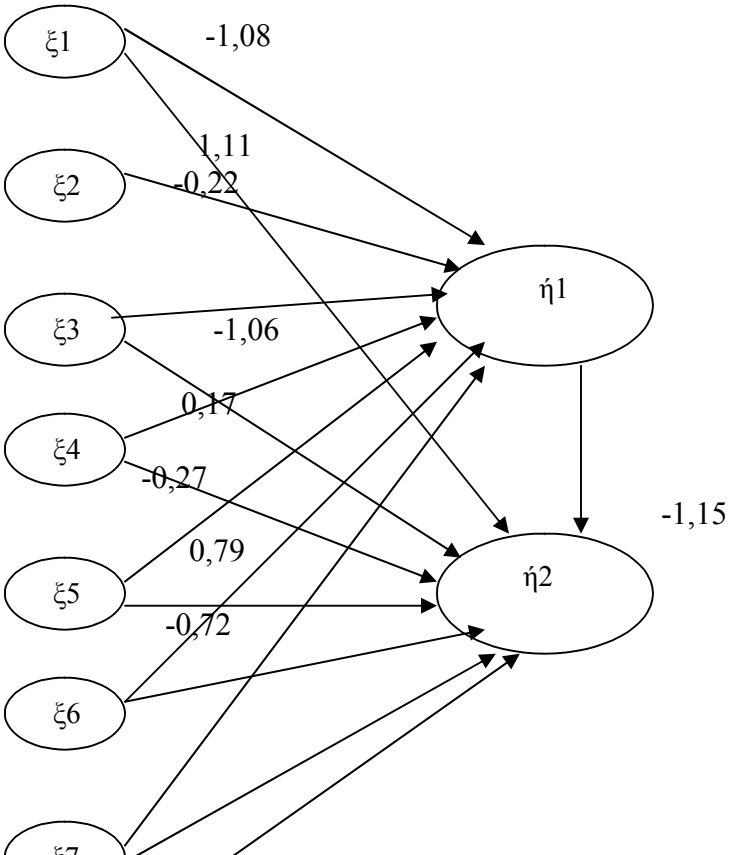
The other aspect that need attention from the path analysis that is significant effect of the participate agricultural extension. The variable of participative agricultural extension have significant effect to other variable because all agricultural extension agent declare they have been done the method, this prove that the variable have significant effect to farm production of the farmer who participate the IPMFFS program. The research result same with the research that have been done by Ison (1995), Chambers (1994), and Sinha (1998), that indicate participative extension method as agricultural extension is a bottom up approach agricultural extension process that can stimulate the farmer to develop their knowledge of their condition and how to improve their condition to better condition. Beside that it can be stimulate social and economic changes too by increasing their farm productivity.

With path analysis coefficient the result shows that coefficient range is 0,14 to 1,15. from 9 variables only one variable that have negative coefficient. It means most of the variables (8 variables) have significant effect to increasing the production. This condition is consider good, which means most of the variables have significant and positive effect, this also means that IPMFFS program is consider good.

The equation also shows that seven variables of process have significant effect wit level of significant 5% ($\propto$= 0,05) to the change of pesticide application that is:: (1) participate agricultural extension, (2) remedial practice, (3) motivation establishment, (4) insight development, (5) the readiness of the participants, (6) the activeness of the participants, and (7) planning program.

The important findings from the result is coordination variable that have not significant effect to application of the pesticides. This result did not mean that coordination variable did not have meaning function to agricultural extension process. Coordination variable have not significant effect because just the IPMFFS program did not need to much coordination among other institution. Like the analysis effect of the process variable to quantity of farm production, the important findings from path analysis is significant effect of the participative agricultural extension to the application of pesticides. This aspect is important because participative agricultural extension in the IPMFFS program is the most important things and become the ultimate principle in the IPMFFS program. The significant effect of variable participative agricultural extension also means this variable always important in the IPMFFS program. From observation that have been done to the participate agricultural extension in the IPMFFS program at the Jember District, the IPMFFS program have been done in a good way even though there is still a few weakness because the role of the agricultural extension agent is still strong on the discussion session among farmer. This problem difficult to avoid because this pattern (participate agricultural extension) is something new among farmer who followed the program.

The effect of the variables is describe below in the empirical model as a Structural Equation Model :



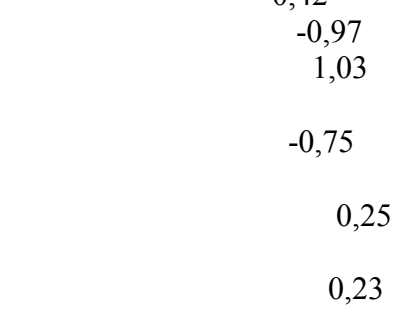


Figure 1. Empirical Model Effect Of The Variable Process Of The IPMFFS Program To The Farm Production And The Level Of Pesticides Application

The meaning :

(ή1) Pest = the use of pesticide
(ή2) Prod = production quantity
(ξ1) Part = participate agricultural extension
(ξ2) Remedial = remedial practice
(ξ3) Insight = insight development
(ξ4) Motivation = motivation establishment
(ξ5) Readiness = the readiness of the participants
(ξ6) Activeness = the activeness of the participants
(ξ7) Planning = planning program
(ξ8) Coordination = Coordination

After doing a model analysis, it is important to decide that the model is really precisely estimate the effect of the variables and to know how the relations among the variables. There is some indicators can be used to judge that the model is fit. In this research the model fit is base on the indicator below:

Table 1. Indicator Model Fit

No	Indicator	Value
1.	*Minimum Fit Function Chi-Square*	877.32 (p=0.06)
2.	*Root Mean Square Error of Approximation (RMSEA)*	(0.02)
3.	*90 Percent Confidence Interval for RMSEA*	(0,00; 0.01)
4.	*Expected Cross-Validation Index (ECVI)*	(5,39)
5.	*ECVI for Saturated Model*	(6.94)
6.	*ECVI for Independence Model*	(12.12)
7.	*Chi-Square for Independence Model 351 Degrees of*	(1266.83)
8.	*Freedom*	(1320.83)
9.	*Independence AIC*	(614.99)
10.	*Model AIC*	(756.00)
11.	*Saturated AIC*	(1420.74)
12.	*Independence CAIC*	(1262.84)
13.	*Model CAIC*	(2154.78)
14.	*Saturated CAIC*	(0.54)
15.	*Root Mean Square Residual (RMR)*	(0.54)

16.	*Standardized RMR*	(0.92)
17.	*Goodness of Fit Index (GFI)*	(0.66)
18.	*Adjusted Goodness of Fit Index (AGFI)*	(0.68)
	Parsimony Goodness of Fit Index (PGFI)	

The Table above shows that RMSEA value is 0.02, this value is measure deviation of parameter at the model with covarians population matrix (Browne and Cudeck, 1993) . Even though this fit parameter has been long to introduce, but only lately become a indicator parameter for model fit. The analysis shows that RMSEA indicate there is a model fit because the value is lower than 0,5. This is same as Byrne (1998) that conclude the model that have RMSEA value below 0,05 have estimate error as reasonable. For RMSEA confident interval the value must be lower that indicate RMSEA have a good precisely. The same thing is the value of probability about the nearly to the model fit. Joreskog (1996) say the P-value must be bigger than 0,5. From the Table ECVI for Saturated Model have confident interval around 0,00 to 0,01, so RMSEA have a good precisely.

The value of Goodness of Fit Index (GFI) is the parameter about the model precisely to produce observed matrix covarians. The value of the GFI must be around 0 to 1. The value of GFI upper 0,9 shows that the model have good model fit. Adjusted Goodness of Fit Index (AGFI) same with the GFI, this parameter have been adjust with the effect of degree of freedom in the model. The parameter that almost same with the GFI and PGFI is the Parsimony Goodness of Fit Index (PGFI), the interpretation of PGFI must be follow with other parameter model fit. The good model must be have value of PGFI upper 0,6 (Byrne, 1998) . Table above show the value of GFI (0,92) and PGFI (0,68), this result shows that the value of GFI and PGFI is good.

CONCLUSION AND RECOMMENDATIONS

Base on the analysis and discussion above, it can be drawn some conclusions that are:

The variables of Integrated Pest Management Field Farmer School (IPMFFS) which have a significant effect to the production quantity with the 5 % significance level ($\propto$ = 0,05) are: (1) the use of pesticide, (2) participate agricultural extension, (3) motivation establishment, (4) insight development, (5) the readiness of the participants, (6) the activeness of the participants, (7) planning program, and (8) coordination.

The variables of Integrated Pest Management Field Farmer School (IPMFFS) which have a significant effect to the change pesticide used with the 5 % significance level ($\propto$ = 0,05) are: (1) participate agricultural extension, (2) remedial practice, (3) motivation establishment, (4) insight development, (5) the readiness of the participants, (6) the activeness of the participants, and (7) planning program.

Development of the IPMFFS program is create to avoid the negative impact of pesticide application. The way to control the pest is to combine several technique that fulfill the economic and environment precondition. The IPMFFS become the most important way to control the pest and to protect environment. The research about IPMFFS must be solved the problem about pest and disease, and the production system that influence pest biology and pest population.

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