PERTANIAN

ADOPTION OF INTEGRATED PEST MANAGEMENT (IPM) TECHNOLOGY IN A RICE FARMING AT CHEDI HAK SUBDISTRICT, MUEANG RATCHABURI, THAILAND

Adopsi Teknologi Pengendalian Hama Terpadu (PHT) Pada Usahatani Beras Kasus di Kecamatan Chedi Hak, Kabupaten Mueang Ratchaburi, Thailand

Dian Galuh Pratita[1], Am-On Aungsuratana[2] , Rapee Dokmaithes[3] , Anik Suwandari[4] , Joni Murti Mulyo Aji[5,]

[1]Student on Agribusiness Study Program, Faculty of Agriculture, University of Jember
[2,3]Lecture on Agricultural Extension and Communication Department, Kasetsart University Kamphaeng Saen Campus
[4,5]Lecture on Agribusiness Study Program, Faculty of Agriculture, University of Jember
Jl. Kalimantan 37, Tegal Boto Campus, Jember 68121
email: aniksuwandari@gmail.com

ABSTRACT

Sustainable agriculture and food security are two main issues in agricultural development in developing countries including Thailand. As a developing country, pesticide consumption as agricultural input in Thailand is high and tends to increase annually. Therefore, adoption of the Integrated Pest Management (IPM) technology as the advanced technology for sustainable agriculture is tremendously important. Nonetheless, there are many factors that can affect the decision making of farmers to adopt or not to adopt IPM technologies, as the IPM technologies are relatively new, and therefore they are not clearly identified. A purposive sampling technique were used to select samples in this study including the progressive farmer, an extension officer, and stakeholders. Descriptive quantitative analysis was used to examine and analyze ecological condition, personal background, factors affecting adoption of IPM, and rate of KAP (knowledge, attitude, and practice) of IPM. The findings shows that the progressive farmer who has adopted the IPM technology for 6 (six) years, has high capability, acceptability, and practicality towards IPM technology model. Five items of the IPM technology including prevention, identification, monitoring, pest control action, and evaluation are practically 90 percent adopted. The only aspects not adopted by the farmers were those related to the use of chemical pesticides. Factor affecting adoption of IPM technology includes personal background, the use of inputs, physical factors, biological factors, social factors, economic factors, institutional factors, and psychological factors. Biological and institutional factors were found to be the most important factors influencing farmers' decision to adopt. While the main constraints in the IPM adoption including complexity of IPM technology, weak perception of IPM technology, labor intensive, easy access of pesticide, and lack awareness of pollution, the most important constraints related to the IPM adoption was the complexity of the technology.

Keywords: Sustainable Agriculture, Pesticide used, IPM

How to citate: Pratita, D.G. et al[1]. 2015. Adoption Of Integrated Pest Management (IPM) Technology In A Rice Farming At Chedi Hak Subdistrict, Mueang Ratchaburi, Thailand. *Berkala Ilmiah Pertanian* 1(1): xx-xx

INTRODUCTION

The challenges of increasing world food production are formidable. In spite of great agricultural advances, millions of people are in hunger or under threat of famine. Food production will have to be multiplied more than double in the year 2025 if the expected world population of up to 8 500 million is to be fed sufficiently. However, parallel with population growth is the impact of pollution and the degradation of natural resources that threaten to limit gains in production and imperil sustainable agriculture. Achieving sustainable agriculture and rural development (SARD) will not be easy. Most of the best agricultural land is already under cultivation. Future increases in production depend mainly on increasing the productivity of existing agricultural land and water resources (FAO, 2013).

Food and Agricultural Organization [FAO] (2013) and International Grain Council (2013) reported that rice is the biggest commodity in terms of production in the world. Asia have an important roles in world rice condition, because of 90% of world rice production comes from Asia. In 2009, total consumption of milled rice in Asia around of 397 million tons with 77 kg per capita. There was increasing on trend both of rice production and rice consumption in the world. Therefore, rice is considered as a "strategic " commodity in many countries both developed and developing countries and has consequently remained subject to a wide range of government controls and interventions.

Thailand milled rice production increased from 2000 until 2011. In 2000 Thailand rice milled production was around of 17.229,27 tons and increased 24.2 % in 2009 (21.410,73 tons). In addition, consumption of milled rice has increased to approximately 24.3 % in 2009. therefore, increasing in rice consumption and rice production become the factor of increasing in pesticides use in Thailand. Mostly pesticides in Thailand is imported product, and increased every year. Paneat (2012) pointed that total imported pesticides in Thailand increased every year. In 2000, quantity of pesticides import less of 40.000 tons, and increased to 120.000 ton in 2010. It can be seen that Thailand's pesticides imports was extremely increase.

Ratchaburi is located 80 kilometers west of Bangkok. Agriculture become the main important of income source in Ratchaburi, which 41,4% of household incomes from agriculture sector. Total land holding in Ratchaburi is currently 21.592.365 rai, of which 39,6% (8.541.412 rai) is rice area. Considering the use of pesticides, 75% reported using pesticides, of which 71,1 % used chemical pesticides, 5.3% using organic, and 1,3% using natural enemies (National Statistic Organization [NSO], 2003). Adoption in IPM technologies cannot spread clearly, many factors affect the decision making of farmers to adopt or not adopt of IPM technologies include in Chedi Hak Subdistrict, Mueang Ratchaburi District. Ratchaburi Province, Thailand.

The objectives of study including 1) to identify factors affecting farmer's adoption in IPM Technology namely; (a) to obtain and describe the study areas and its vicinity, (b) to obtain and describe basic personal and socio economic background of rice cultivator, (c) to determine rate of farmers knowledge, attitudes, and practices in IPM technology, (d) to investigate and determine factors affecting rice farmer's adoption in IPM

technology and 2) to assess constraints and recommendation in adoption in IPM technology in study area.

METHODOLOGY

The determination of sample was selected by purposive sampling technique (judgemental sampling). According to Malhotra (2007), judgemental sampling is a form of convenience sampling in which the population elements are selected based on the judgement of the researcher. The population of this investigation are one progressive rice farmer and extension officer in the study area. It was because the extreme condition of the area and respondent has high potential on giving the appropriate information of this research.

Data for the research study were obtained in crop year 2013/2014 from representative best practice farmers and stakeholders in IPM technology in rice cultivation. This research conduct in some survey items includes interviewing schedule, in depth interviewing schedule in terms of matrix form, and in depth interviewing schedule in terms of SWOT analysis.

Descriptive analytical methods have been employed to investigate the related constraint based on the objectives and nature of data gained as follows:

Ecological analysis of research site

In terms of ecological analysis, both descriptive and quantitative analytical methods were applied. The data related to study area such as history, location and accessibility, slope and topography, land suitability, soil profile, climate (average rainfall, temperature, and relative humidity), natural resources, irrigation system, land utilization and agricultural farming system have been gathered from key informant.

Descriptive analysis

Data collected will be analysis by descriptive analysis. This is aimed to analysis the personal background of farmers, factors affecting adoption of IPM technology, and the constraint that faced by farmers in the crop year 2013/2014.

RESULT AND DISCUSION

The Study Area and Its Vicinity

There are some surface water in Ratchaburi Province. Only one main stream that support agricultural sector in Ratchaburii Province called Mae Klong River. This area can provide the appropriate irrigation system for rice farming. Based on the Ratchaburi Province soil suitability, specific in Mueang Ratchaburi of the capital of district in this province has 68,679 acres of agricultural area which is 55.1% is very appropriate for rice farming or around 37,865 acres; 32.2% or 22,079 acres is moderate appropriate; and 12.7% or 8,728 acres is inappropriate for rice farming. while Chedihak Subdistrict has 7,093 acres of agricultural area which 13.1% or 929 acres is very appropriate for rice farming; 86.4% or 6,129 acres is moderate appropriate; and 0.5% or 64.042 acres is inappropriate in rice farming.

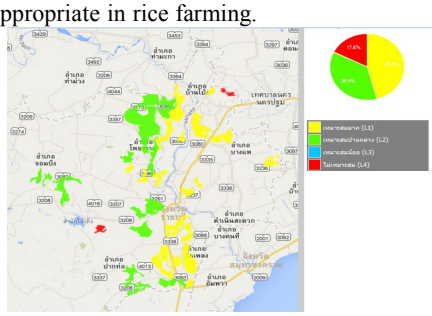

Figure 1. Soil Suitability of Rice in Ratchaburi Province, 2014
Source: Rice Department (2014)

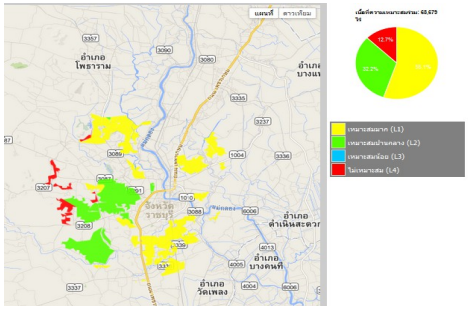

Figure 2. Soil suitability of rice in Chedi Hak

Source: Rice Department of Thailand (2014)

Personal Background and Socio Characteristic

Respondent in this study was progressive rice farmer. He is 56 years old. He work as full time farmer. He has experienced in rice cultivation more than 20years. His rice farm around 23 rais which is rented area. He has 5 household member which all of them was farm labor in the rice cultivation. IPM is one kind of advanced technology which was adopted by the farmers. There are two source of media perception in terms of IPM technology that received by farmer including personal media and interactive media. Personal media was provided by the government officer while interactive media was training program in IPM technology.

In terms of input used, farmer in the study area can produce the good quality of seeds. There are two kinds of seeds which used by farmer including Chainat and Suphan cultivar. Those seeds will be sold around 20 THB per kilogram seeds and needs 20 kilograms of seed per rai. Suphan variety is appropriate in Chedi Hak than another variety, this variety also tolerant with BPH. In terms of fertilizer, farmer used chemicals and organic fertilizer. In addition, respondent did not used chemicals in pest control. He only used biological control to manage their farm. Trichoderma is the best way to prevent pest in the rice cultivation. In terms of institutional support, there are some institutional that support the farmer including Department of Agriculture Staff, Department of Agricultural Extension, and University staff. The respondent was belonging in some group including cooperatives, BAAC, and Farmer's group.

Rate of Knowledge, Attitude, and Practice

According to Aungsuratana (2007) in Hasim (2013), pointed out that to analyze the level's of farmer capability based on their scores on question given. Based on the Table below, respondent knowledge in prevention is 60% correct while 40% was not correct. The respondent know well in cultural practices on prevention including tillage the soil and using the herbs to prevent the pest surrounding the rice area. Meanwhile the respondent used different time on the fertilizer application including when in the 3 days after transplant and 20 days after transplant, and respondent did not used rotation system. He cultivated rice two crops in one year and the harvest method was not close to ground. On the identification items, respondent know well of the three sub items including identification pest, identify beneficial organism, and identify pest damage. Respondent also well known in the monitoring items which include five sub item; monitoring of pest, monitoring of beneficial organism, recognizing early symptom, action threshold, and written record.

Table 1. Distribution of knowledge towards IPM technology

No	Items	Correct		Wrong		Total	
		No	%	No	%	No	%
1	Prevention	6	60	4	40	10	100
2	Identification	3	100	-	-	3	100
3	Monitoring	5	100	-	-	5	100
4	Pest control action	7	87.5	1	12.5	8	100
5	Evaluation	2	100	-	-	2	100

Source: Primary data (2014)

In the prevention items, respondent was agree for 50% of total sub items including proper sanitation (tillage the soil), proper varieties (tolerant on pest), proper water management, balancing in fertilizer application, and using herbs to protect the area. The respondent was not decided about appropriate spacing and harvest to the ground technique. While respondent disagree with the appropriate time for fertilizer application. In the identification items, monitoring items, and evaluation items, respondent was agree on all of the sub items. While in the pest control action, respondent agree for 6 sub items including hand picking, barriers, trapping, release natural enemies, pesticide use based on monitoring and ETL, and the criteria of appropriate pesticide.

Table 2. Distribution of respondent attitude on the IPM

No	Items	Agree		Undecided		Disagree		Total	
		No	%	No	%	No	%	No	%
1	Prevention	5	50	2	20	3	30	10	100
2	Identification	3	100	-	-	-	-	3	100
3	Monitoring	5	100	-	-	-	-	5	100
4	Pest control action	6	75	2	25	-	-	8	100
5	Evaluation	2	100	-	-	-	-	2	100

Source: Primary data (2014)

According to the interview, respondent was adopt the 6 sub items of prevention, 3 items in identification, 5 sub items in monitoring, 5 sub items in pest control action, and 2 sub items in evaluation. According to the Table below, the respondent as progressive farmer was adopt 19 sub items from 28 sub items in the IPM technology;

Table 3. Distribution of practices on IPM technology

No	Items	Anytime		Sometimes		Never		Total	
		No	%	No	%	No	%	No	%
1	Prevention	6	60	-	-	4	40	10	100
2	Identification	2	66.7	1	33.3	-	-	3	100
3	Monitoring	5	100	-	-	-	-	5	100
4	Pest control action	5	62.5	1	12.5	2	25	8	100
5	Evaluation	2	100	-	-	-	-	2	100

Source: Primary data (2014)

Table 4. Comparison between knowledge and practice in IPM technology

Item	Sub item	K	P
Prevention	Proper sanitation	√	√
	Using tolerant varieties	√	√
	Proper spacing	√	√
	Balancing fertilizer application	√	√
	Proper water management	√	√
	Using herbs to protect the area	√	√
Identification	Identification pest	√	√
	Identification beneficial organism	√	√
	Identification pest damage	√	√
Monitoring	Monitoring of pest	√	√
	Monitoring of beneficial organism	√	√
	Recognizing early symptom	√	√
	Action threshold	√	√
	Written record	√	√
Pest control action	Physical practices		
	Hand picking	√	√
	Using barriers	√	√
	Trapping	√	√
	Biological practices		
	Create habitat for beneficial organism	√	√
	Release natural enemies	√	√
	Protecting the beneficial organism	√	√
	Chemical practices		
	Using pesticide based monitoring, ETL	√	x
	Using selective pesticide	√	x
Evaluation	Evaluate the strategy	√	√
	Write record	√	√

Note:√ refers to either correct knowledge or practice

x Refers to either not correct knowledge or not practice

Source: Primary data (2014)

Factors Affecting Adoption of IPM Technology in Chedi Hak Sub District

Based on the interviewed, factors affecting adoption of IPM technology in the study area including personal background, input used factors, physical factors, biological factors, social factors, economic factors, institutional factors, and psychological factors as follows. Personal background consist of age, education, experienced, and number of media perception. Input used factors consist of biological control availability and chemical substances availability. Physical factors include water resources and rice soil suitability. Biological factors include pest,disease, and weed problem in the field. Social factors include IPM training and number of group belonging. Economic factors defined as farm income. Institutional factors include number of extension service and quality of service by extension officer. The last is psychological factors that consist of knowledge, attitude, and practice. Those description has been shown in Table 5 as follows;

Table 5. Factors affecting rice farmers adoption of IPM technology

Factor	Variables
Personal Background	Age
	Education
	Experienced
	Number of media perception
Input used	Biological control availability
	Chemicals substance availability
Physical	Water resources
	Rice soil suitability
Biological	Pest
	Disease
	Weed
Social	IPM training
	Number of group belonging
Economic	Farm income
Institutional	Number of extension contact
	Quality of service
Psychological	Knowledge
	Attitude
	Practices

Source: Primary data (2014)

There are some strength point on adoption of IPM technology in study area include soil suitability, biological control access, experienced in farm, water resources condition, and awareness in the chemicals substance. Weakness point that makes farmer did not want to adopt this technology are chemical substance availability, complexity of IPM procedures, less reliable information, labor intensive, age, and education of farmer. Opportunity on increasing adoption of IPM technology among rice farmer in the study area are Thailand Agricultural Standards that makes their product more easy to sell, good agricultural practices, extension service, and FFS training every year. Threat on adoption of IPM technology in the study area including pest, disease, disaster, and low price of product. Those description has been shown in the figure below;

Strength Point	**Weakness Point**
Soil suitability	Chemical substance availability
Biological control access	Complexity of IPM procedures
Experienced in farm	Less reliable information
Water resources	Labor intensive
Awareness in the chemicals substance	Age
	Education
	Awareness on pollution
Opportunity	**Threat**
TAS	Pest
GAP	Disease
Extension service	Disaster
FFS training	Price

Constraint and Recommendation of Adoption in IPM Technology

There are some constraint in adoption IPM technology. Complexity of IPM technology become the first rank of constraint. It was because IPM has a lot of procedures that makes farmer did not want to accept all of the items. Weak perception of IPM technology that IPM can not increase the price continuously also become major problem. All of the items of IPM makes labor intensive in the field that makes high production cost. In the study area was very easy to get pesticide, it makes farmer prefer choose used pesticide than do IPM. Lack awareness of pollution from pesticide used also one of the problem on adoption of IPM. Based on that problem there are some recommendation in terms of policy and implementation oriented. Those description has been shown in table 6 and 7 below;

Table 6. Constraint on adoption IPM technology

Constraints	Rank
Complexity of IPM technology	1
Weak perception of IPM technology	2
Labor intensive	3
Easy access of pesticide	4
Lack awareness of pollution	5
Weed problem	6

Source: Primary data (2014)

Table 7. Recommendation on IPM technology dissemination

Dimension	Recommendation
Policy oriented	Enhance the FFS training
	Provide periodical training for farmers
	Provide training for extension agent
	Increasing promotion of IPM practices in mass media
Implementation oriented	Increase the extension officer
	Increase the frequency of meeting
	Increase coordination between farmers and extensionist
	Increasing young farmer participation
	Stakeholders should stimulate adoption of IPM

Source: Primary data (2014)

ACKNOWLEDGEMENT

1. Bureau of Indonesian International Affairs as the financial sponsor (Beasiswa Unggulan)
2. Assist. Prof.Chatchai Keosontai as The Head Department of Agricultural Extension and Communication, Kasetsart University Kamphaeng Saen Campus
3. Ebban Bagus Kuntadi, S.P., M.Sc and Dr. Triana Dewi Hapsari, S.P., M.P. As the examination committee in Agribusiness Study Program, Faculty of Agriculture, University of Jember.

CONCLUSION

1. Ratchaburi province covered by mountain, forest that has height 200-300 meters above sea level, and supported with Mae Klong river (irrigation system). Chedi Hak Sub district has 7,093 acres of agricultural area which 13.1% is very appropriate for rice cultivation, while 86.4% was moderately appropriate for rice farming.
2. This study was describe mainly based on a progressive farmer experience in adopting IPM in this study. The farmer was 56 years old and more than 20 years in rice farming. Respondent used Trichoderma as biological control. Machinery was used in the land preparation, planting stage, and harvesting. He was belonging on cooperatives, BAAC, and farmer's group.
3. The progressive farmer who has adopted the IPM technology for 6 (six) years, has high capability, acceptability, and practicality towards IPM technology model. Five items of the IPM technology including prevention, identification, monitoring, pest control action, and evaluation were practically 90 percent adopted
4. There were some factors affecting in adoption of IPM technology including personal background (age, education, experienced, and number of group belonging), input used factor (biological control availability, and chemicals substance availability), physical factors (water resources and soil suitability for rice), biological factors (pest, disease, and weed), social factor (IPM training and number of group belonging), economic factor (farm income), institutional factor(number of extension service and quality of service), and psychological factor (knowledges, attitudes, and practices). Biological and institutional factors were found to be the most important factors influencing farmers' decision to adopt
5. There were some main constraint in adoption of IPM technology including complexity of IPM technology, weak perception of IPM technology, labor intensive, easy access of pesticide, lack awareness of pollution, and weed problem. The most important constraints related to the IPM adoption was the complexity of the technology.

LITERATURE CITED

Bonobana, J. and Wabbi. 2002. *Assessing Factors Affecting Adoption of Agricultural Technologies: The Case of Integrated Pest Management (IPM) in Kumi District, Eastern Uganda*. M.S. Thesis, Virginia Polytechnic Institute.

Environment Protection Agency (EPA). 2012. *Integrated Pest Management* (Online). Available: http://www.epa.gov/oecaagct/tipm.html.

Food and Agriculture Organization (FAO). 2013. *World Annual Growth(2000-2012)* (Online)**.** Available: http://faostat3.fao.org/wds/rest/table/excel.

Govind, S. And G. Perumal. 2004. Constraints Encountered in The Adoption of IPM Technologies. *Journal of Agricultural Science* 17(4): 741-746, (Online). Available: http://14.139.155.167/test5/index.php/kjas/article/viewFile

Kumar, P. and S. Mital. 2006. Agricultural Productivity Trend in India: Sustainability Issues. *Agricultural Economics Research Review* 19: 71-88, (Online). Available: http://ageconsearch.umn.edu/bitstream/57779/2/DrP-Kumar.pdf

Kumari, G. 2012. Constraints in Adoption of Integrated Pest Management Practices by Rice Growing Farmers of Jammu Division**.** *Indian Research Journal of Extension Education* 2: 15-17, (Online). Available: http://www.seea.org.in/special_issue/vol2/04.pdf

Malhotra, et all.2007**.** *Marketing Research*. Third Edition : Pearson Education.

National Statistic Organization (NSO). 2013. *Central Plain Agricultural Census* (Online). Available: http://www.nso.go.th

Nelleman, C. et al. 2009. *The environmental Food Crisis; The environment's Role in Future Food Crisis*. Northway: Bikkerland Tlykkert.

Panayotou, T. 1993. *Green Markets; The Economics of Sustainable Development.* California: Institute for Contemporary Studies.

Panuwet, P. 2012. Agricultural Pesticide Management in Thailand: Situation and Population Health Risk. *Environmental Science Policy* 17: 72–81, (Online). Available: http://www.ncbi.nlm.nih.gov/pubmed/22308095

Ping, X. *Environmental Problems and Green Lifestyle in Thailand. Thailand*: Asumption University.

Rahman, M. M.. 2012. Problems and Suggestions for Farmers Adoption of IPM Practices in Rice Cultivation. *Bangladesh J. Agr. Res*. 37(1): 121-128, (Online). Available: www.banglajol.info/index.php/BJAR/article/download/11183/8169

Rogers, E.M. 2003. *Diffusion of Innovations*. 5th ed.. New York: Free Press.

SAI. 2010. *Sustainable Agriculture* (Online). Available: http://www.saiplatform.org/sustainable-agriculture/definition.

Singh, A., A.K. Vasiht, R. Kumar, and D.K. Das . 2008. Adoption of Integrated pest Management Practices in Paddy and Cotton: A case Study in Haryana and Punjab. *Agr. Econ. Research Review* 21: 221-226, (Online). Available: http://ageconsearch.umn.edu/bitstream/47675/2/7-Alka

Singh.pdf

Tapintha, A. 1998. *Pesticide Use and Residual Occurrence In Thailand*. Available: http://link.springer.com/content/pdf/10.1023/A:1006156313253

United State Department of Agriculture (USDA). 1999. *Sustainable Agriculture; Definition and Terms* (Online). Available: http://www.nal.usda.gov/afsic/pubs/terms/srb9902.shtml.

Veisi, H. 2012. Exploring the Determsinants of Adoption Behaviour of Clean Technologies in Agriculture a Case of Integrated Pest Management. *Asian J. of Technology Innovation* 20(1): 67–80, (Online). Available: http://www.tandfonline.com/doi/pdf/10.1080/19761597.2012.68143