

**MONITORING ON THE IMPACT OF PESTICIDES ON
AGRICULTURAL ENVIRONMENTS**

COMPOSED BY:

**GITA PERTIWI – CROP CLINIC OF AGRICULTURE FACULTY OF SEBELAS MARET
UNIVERSITY– PAN-AP**

GITA PERTIWI

JL. GRIYAN LAMA NO 20 BATURAN COLOMADU SURAKARTA, INDONESIA

TELP/FAX 0271-710465/71895

e-mail : gita@indo.net.id

INTRODUCTION

The module of "Monitoring the impacts of Pesticide to the agricultural environments" a documentation of the learning process conducted by Gita Pertiwi and farmers in Wonogiri district (vegetables) and Wonosobo district (potato). the learning process mostly implemented in the fields while the process of discussion were in the field and indoor with the model of adult education. Farmers are the source of information of knowledge based on their experiences on managing the field. The research was conducted in November to December 2007.

The module is to spread the impacts of pesticide, how the pesticide work to the insects and the impacts to human body and agricultural environment.

We hope that the experiences will give benefits to the farmer cadres to disseminate the impacts of pesticide and the use of pesticides in agriculture lands. The module may be implemented, modified according to the local situations.

We hope that the module will be able to become source of ideas and learning on the impacts of pesticide implementation to the field facilitators. So that we are able to develop sustainable agriculture and farmers will be able to practice it.

Surakarta, June 2008
Compiler team

CONTENT

page

Introduction

Content

- I. Introduction
 - A. Rationale
 - B. Objective
 - C. Module user

II. SURVEY METHOD ON THE IMPACTS OF PESTICIDE UTILIZATION TO ENVIRONMENT

- A. Rationale
- B. Objective
- C. Method
- D. Tool and Material
- E. Collecting water organism
- F. Collecting flying organism
- G. Collecting inside soil organism
- H. Collecting organism stick on crop

III. PRESERVING SPECIMENTS COLLECTED

- A. Rationale
- B. Objective
- C. Method
- D. Tool and Material
- E. Wet Preservation
- F. Dry Preservation

IV. ANALYSIS ON RESULT

- A. Rationale
- B. Objective
- C. Method
- D. Tool and Material
- E. Analysis

ATTACHMENTS

- 1. Observation table
- 2. Insect identification
- 3. Tool making
- 4. Bibliography

I. INTRODUCTION

A. RATIONALE

The utilizing of pesticides is increasing in developing countries while the harvest and quality of product is decreasing. There are also decreasing natural resources qualities because of the uncontrolled chemical pesticide implementations. The implementations will give impacts to the environment and the expose to human body as the increasing of chemical pesticide in agricultural production.

Pesticide is a hazardous chemical substance to kill pests. The pesticide will remain in the area after the spray conducted and it becoming a deposit and residue. The deposit is the temporary adhere on the surface of the target and surroundings and will wash away by the water or rain. The residue is the substance that exposes to the crops and it is difficult to eliminate instead of chemical and or biological treatments.

The impact of pesticide employing in agriculture would be:

1. Direct expose:
 - a. The deposit and residue of pesticide on crops will give affect to the organisms, pollinator, carnivore (natural pest enemy), cattle and human being.
 - b. The deposit and residue on the soil will expose the decomposer organism (termite, worms, Spring tail) and carnivore such as ants and spiders.
 - c. The deposit and residue in the water will kill water organisms such as larva of mosquito, dragonfly, insecticide on the water surface, fish, frog, crab etc.
2. Indirect expose:
 - a. The increasing of dosage and frequency of pesticide implementation is because the pest becoming more resistant to the chemical or the population of the natural opponent is decreasing.
 - b. The ratio of organic material (carbon) and the stud (C/N) indicate to the parallel quantity and quality of decomposer organisms, such as termite, earth worms and other soil organisms, such as Trichoderma. The organisms will decompose organic materials to make the soil fertile. The score of C/N will rapidly decrease when there are many organisms and the score of C/N increase if there is no organisms.

The impacts of pesticide utilization to the environment are to “select” pests that resistant, demolition of useful insects, increasing new pests, disappearing of pollinators and contamination to food cycles. It will threat to the sustainability of agricultural environment.

There are many researches conducted by universities and research institutions in Indonesia, however the results are only scientific notes. Farmers who work directly to the agricultural fields are seldom to make research, the module will help to conduct simple observation on pesticide utilization in their areas.

B. OBJECTIVE OF MODULE

1. To give simple guidelines to farmer cadres , field facilitators and environmental observers to conduct modesty research on the impacts of pesticide to the environment.
2. The module will help to identify the impacts of pesticide on environment (water, air, soil and crops)
3. The module will help to appraise the quality of the environment.

4. The result of observation could be one of the fundamental aspects to improve the environmental quality.

C. MODULE USER

The module would be useful to:

1. Farmers, field facilitators, environmental observer who already attended a Integrated pest Management field school training for at least one planting season.
2. They are able to identify and understand the difference of the harm and advantage among natural pests
3. They are able to understand the basic knowledge on pesticide issues (history, classification and the politics)

II. SURVEY METHOD ON THE IMPACTS OF PESTICIDE UTILIZATION TO ENVIRONMENT

A. RATIONALE

One of the impacts of pesticide usage is that it kills organisms that are not the target of the pesticide implementation. It could be in the air, water and soil and crops. The organisms may be useful for the crops that we do not know the advantages in the cycle of ecosystem yet. There are some indicators of good environmental, such as:

1. There are pre-mature dragonflies flying on the water near to the agricultural lands.
2. There are pre mature firefly at the evening flying above the crops
3. Increasing quality and quantity of insects in the area

The quantity indicates the number of insects and the quality indicates the diversity of insect in one area. The collection of insects in one ecosystem will help to indicate the impacts of pesticide. We count the number and identify of insects collected to recognize the role of each insect.

Generally we can find the organism in the area of food they use to consume or in their environments. There are some specific tools to collect insect according to the behaviors of the insect, such as hand waving net, aspirator, funnel bottle, pitfall cup trap, sticky trap etc. the tools are useful to catch specific insect according to the model. For example the hand waving net is useful to catch flying insects that fly around the crop's canopy, the funnel bottle would be useful to trap insects into a container, the pitfall cup trap is for insects that run on a flat surface, the sticky trap is useful to catch flying insects, and the aspirator is useful to collect insects on crops, while to collect insects in the water we can use water dipper. We are also able to catch insects with our hands or other tools available.

B. OBJECTIVE:

To identify the species, population and characteristic of micro and macro organisms that intensively related to the pesticide utilization in agricultural areas.

C. MATERIAL AND TOOL

1. Tool to collect flying insects: Yellow sticky trap (YST) and hand waving net
2. Tool to collect insect in and surface of soil
 - Inside of soil: Hoe, sickle and spade.
 - On soil surface: pitfall cup trap
 - Dead insect in the container: Funnel bottle
 - In water: water dipper and bucket
3. We can use container or small bottles to collect the insects after we trap them.
5. Additional material: alcohol 70%

D. METHOD

- a. Absolute (direct counting)
- b. Proportionate (the product or nest of the insects)
- c. Relative method (with tool)

E. COLLECTING INSECT (ORGANISM) IN THE WATER

Steps:

1. Take water with water dipper, take two water dippers from two different places.
2. Put the water into two different containers
3. Bring the water to the laboratory
4. Watch closely the organism in the water, indicate and calculate each organism



Picture of water sampling

F. COLLECTING FLYING INSECTS

To collect flying insects we can use the hand waving net.

1. Use the hand waving net
2. Wave the net surrounding the crop canopy, wave it for 10 times
3. Take the insect trapped and put into the bottle to kill.
4. Please do the same thing in different areas near by or a little bit far from the first trap taken
5. Bring the insects to the laboratory to identify the number, species and the roles.



Picture: Observation on the result of insect catching with hand wave trap tool

How to collect insects with Yellow sticky trap

1. Take the Yellow sticky trap prepared
2. Attach 10 Yellow Sticky Trap to the field with a little bit far from each other at the height of 10 centimeters above the crops
3. Put the Yellow Sticky Trap on the field for 24 hours
4. Put the insects that stick on the trap and put in a film container that already filled with alcohol. Each Yellow Sticky Trap (YST) put into one film container.
5. Observe the insects collected, identify the number, species and the roles



Picture: Yellow Sticky Trap on eggplant

G. SOIL ORGANISM

G.1. How to collect organism from soil

1. Prepare the tools
2. Determine 10 places in agricultural land as samples for collecting organism from soil.
3. Dig the soil in 25 centimeters square with 20 centimeters deep (humus).
4. Collect all organism within the square deep soil done.
5. Identify all organisms in each area of digging the number, species and the roles



Picture: the observation of soil organisms

G.2. How to catch organism/insects on the soil surface with pitfall cup

1. Take 10 pitfall cups
2. Determine where to put the pitfall cups in the agricultural area with enough distance one to each other
3. Dig the soil as deep as the cup of pitfall
4. Fill the cup with soap water about 2 centimeters under the top of the cup
5. Put the cup into the soil and make the surface of cup flat to the soil surface
6. Put shade to avoid rain water
7. Let the trap stay for 24 hours
8. Take the cups and bring them to the laboratory
9. Observe the insects trapped, identify all organisms in each area of cup the number, species and the roles



Picture: Pitfall cup installation

G.3. Organism in the bottom of container (funnel cup)

1. prepare funnel bottle complete with other tools
2. Take humus in the area with spade (about 3 spades)
3. Put humus into plastic container.
4. Repeat the same process above in different location
5. Bring the humus to the laboratory
6. In the mean time, put soap water into a cup
7. Put the humus into the funnel bottle and make it hot (with an electric lamp of about 25 watts above the funnel). Do not make it too hot as it will kill the insects, on the other hand do not make it cold as the insects will not go down.
8. Let it for 24 hours

9. Put the cup and start to identify the insects collected
10. Make observation, the number, species, function of the organism trapped.



Picture: Funnel cup with humus inside and electric lamp of 25 watts

H. Organisms on crop

The observation and catching insects could be done without any tools, we can do it with hands if we can catch them while they fly, or rest.

How to observe and catch insects with no tools

1. Determine location of observation and take 10 crops as samples.
2. Observe carefully the insects and organism stick on the crops
3. You may use with your hands directly or with the help of plastic container
4. Collect the insects and put into the bottle that already filled with alcohol.
5. Identify all organisms the number, species and the roles



Picture: Insects observation on crops

III. PRESERVING SPECIMENTS COLLECTED

A. RATIONALE

There are many organisms and insects could be found in agricultural areas, they live on crops, soil surface and inside. There are many that we know the name and function to the crop growth and some that we still do not know, there is difficulty to identify the species and their roles in the environment. The pesticide usage has decreased the number of species of insects. The effort to make insectariums will help to recognize the insects when they already gone or to learn for people who do not know the kinds of insect. The insect preserving is a media to study for farmers on the danger of pesticides to organisms that actually useful for agricultural process.

We have to kill the insect before we preserve them. We can put into alcohol 70%, the alcohol is useful to kill micro organism in insect body and to preserve it. The weakness of alcohol is the color of insect becoming brighter. The alcohol is to preserve soft body insects. Put wet cotton (with alcohol) in a container and then put the insect inside. Whereas to hard-body insects, it would be better to make a dry preservation (butterfly, grasshopper, cricket etc.)

B. OBJECTIVE:

1. The participants understand how to preserve wet and dried insects
2. The participants are able to preserve the result of field research as insectariums to become a learning process for farmers.

C. METHOD:

To make wet and dried insect preservation

D. TOOL AND MATERIAL

1. WET COLLECTION

- Clear glass bottle with the lid according to the size of the insect that will enter to the bottle.
- Alcohol 70 %, soft insect or organism (pre mature) and hot water

2. DRIED COLLECTION

- Knob needle, container with lather on the foundation, paper glue, paper and dryer (could be sun shining or electric lamp)
- Mature insect collected form the field and mothballs

E. WET PRESERVATION

Steps:

1. Prepare the tools and materials needed
2. Select soft insect or organism
3. Put the insect or organism into the hot water until the insect or organism becoming stiff.
4. Put alcohol of 70% into the water
5. Put same organism or insect into one bottle
6. Give label on each bottle
7. There are some mature insects that may be preserved in bottle.

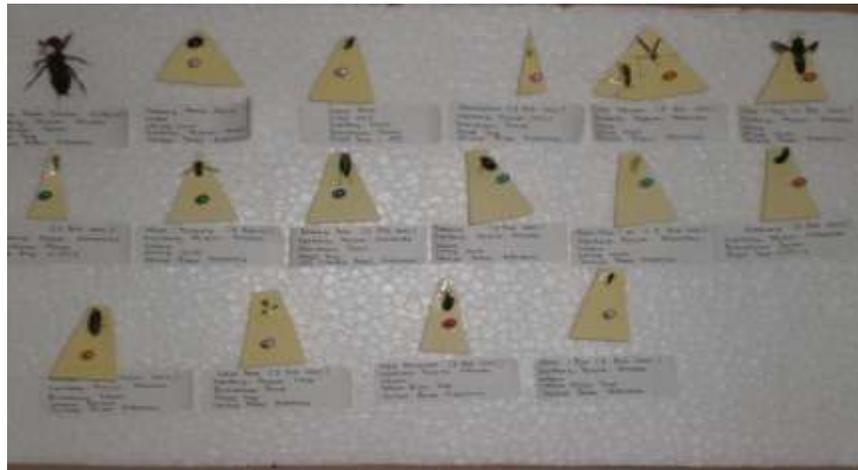


Picture: Collection of wet preservation insects

F. DRIED PRESERVATION

Steps:

1. Prepare the tools and material needed
2. Select mature insects (butterfly, grasshopper, cricket, dragonfly)
3. Dry them under the sun or with an electric lamp until them becoming really dried.
4. Stick the insects on the Styrofoam board with knob needle
5. when we found small insect, then we can use triangle cutting paper that we put glue on all corners and then put the small insect with knob needle.
6. We put mothballs to avoid ants
7. Give the label of each insect collected



Picture: Collection of dried insects

There should be a label of description of each insect

1. Name of insect
2. Date of collection
3. Location (name of area)
4. Spot of collection
5. How to collect
6. Collector

Example:

Name of insect	Beetle
Date of collection	25 th November 2007
Location (name of area)	Surakarta
Spot of collection	Grass
How to collect	Pitfall cup
Collector	Mr. Karto

IV. ANALYSIS ON RESEARCH RESULT

A. RATIONALE

The data sampling collection in agricultural lands using “absolute” (direct counting), “proportionate” (the product or nest of the insects), “relative method” (with tool) according to the habitat of the insects. The places where the insect live or gather are the choice to determine the location of collecting and observing insects. Insects live in different environments according to the species; they are on the air, water, soil and fly among crops.

The methods should be implemented to get better result of the observation to collect insects and other organisms identified in relation to the research. There are other aspects that should be considered instead of collecting insects, other aspects that influence to the insect life cycle are the climate, planting system, pesticide utilization of farmers.

B. OBJECTIVE

1. The participants understand the importance of data to support analysis
2. The participants understand what kinds of supporting data to make analysis
3. The participants are able to analyze the observation result and to make conclusion and action plan.

C. METHOD

1. Group discussion

D. TOOL AND MATERIAL

Tools: Wide paper size, adhesive tape and marker

Materials:

1. Observation documentation
2. Planting history documentation
3. Pesticide usage history documentation

E. DATA ANALYSIS

Collect the raw documentation of the result of observation

1. Identify the species, number and the role of the insects collected.
 - a. Classify the insects and organism that have similar role (pest, parachute, predator, or natural enemy)
 - b. Identify which dominant insect or organism (in number and role)
 - c. Create graphic from every finding after we calculate the amount (pest, parachute, predator, or natural enemy)
2. Participants may consider the planting system, planting season and pesticide usage to make the observation complete.
3. Ask the participants if there is any differences because of climate (summer, fall, winter)
4. Establish group discussion to analyze the data according to the number, species, and role of the organisms or insects and the relationship to the surrounding situations, climate, kind of crop, soil condition, and farmer's treatment using pesticide.
5. Make the action plan based on the result of the data analysis of the observation

Attachment 2

INSECT IDENTIFICATION

1. Water insects

There are some organisms that often to find in water such as fish, tadpole, golden snail, fresh water crab, pre mature dragonfly, mosquito larva, etc. the fish and tadpole are easy to identify.

- a. **Golden snail:** The snail has golden brownish hard cover body. The mature snail will have about 4 centimeters wide. The eggs have pink color that we can find at the top of water surface that stick on the body of crops. They usually in young paddy field where the water still high.
- b. **Anggang-anggang (local name).** This organism is a group of insect of Hemipterae order. It has long slim body the middle and back legs very close separated from the front legs. It stays on the surface of water, the front legs are to catch foods while the back legs to walk on the water. We can find them on calm flow water, this insect is a predator.
- c. **Fresh water crab.** The crab categorized as in Hemipterae. order Oval body, slim with the body size about 2.5 - 5.0 cm, brown color, the front legs to catch foods, the flat back legs and have hairs to swim. Predator
- d. **Pre mature dragonfly.** Dragonfly is an insect. The pre mature dragonfly has long mouth and it will fold under the chest if it is not used. The body color is brownish. A predator
- e. **Mosquito larva.** Mosquito is an insect in the order of dipterae. The larva is in water in the family of culicidae, for examples are Anopheles and Aedes sp. The insect is a disease vector. The larva very small without legs, color brown or red.

2. Organism in humus (with funnel bottle)

There are many organism found in humus such as Spring tail, "cecopet", ants, termite, beetle, cockroach and spider

- a. Spider: this insect is easily to differentiate as it can be found in many places. It has 4 legs, no wings the body divided into two cephalothorax and abdomen.
- b. Spring tail (Ekor Pegas). Is an insect in collembolla order, small body no wings internodes body, the tail is like a spring to jump from one place to another. This insect has capability as a decomposer.
- c. "Cecopet". This insect has flat body, short front wings and the back wings looks like furs. The body is like a tweezers with dark brown color. They live under a wood and sometime we can find them in humus.
- d. Termite is an insect, it categorized as a worker to in a big group to collect foods for their queen. Termite may change to flying ant. It has small body with a big head.
- e. Beetle is in the order of Coleoptera. It lives in humus, generally has small size body and has a role to decompose materials. It is a predator. Beetle has hard front wings and soft back wings.
- f. Cricket is the member of Orthoptera order. This insect has brown to black color, it has soft long antenna in front. It is a predator
- g. Cockroach is in the order of Orthoptera. The cockroach may found in humus. It has small size oval body with slippery brown color,

3. Organism on the top of soil (pitfall cup trap)

The organisms that live on soil surface that are trapped with pitfall cup usually are spring tail, ants, cricket, beetle, grasshopper, termite, spider and pre mature Lepidoptera (caterpillar), pre mature beetle (lundi), and “cecopet”. The organisms trapped in pitfall cup more or less are the same as when we use the funnel cup.

- a. Grasshopper is in the order of Orthoptera. It has shot antennas, the back legs are longer than front legs, long wings. Most of grasshoppers are pests.
- b. Caterpillar is general name of pre mature Lepidoptera that will becoming butterfly and moth. The caterpillar has 3 pairs of legs in front and some under abdomen. Most of caterpillars trapped are soil caterpillar or caterpillar that are moving from one place to another. The caterpillar is a pest.
- c. Lundi/uret is local name for pre mature beetle; Lundi has 3 pairs of legs under the abdomen.

4. Flying organism (Yellow sticky trap)

Most of the organisms trapped with yellow sticky are insects, in the order of Orthoptera (cricket).

- a. Plant flea (Homoptera)
- b. Fly and mosquito (Diptera)
- c. Moth (Lepidoptera) thrips (Hemiptera)
- d. Beetle (Coleoptera)
- e. “Tabuhan” (Hymenoptera).

5. Flying organism (hand wave net)

- a. Plant flea (Homoptera)
- b. Fly and mosquito (Diptera)
- c. Moth (Lepidoptera) moth
- d. Thrips (Hemiptera)
- d. Beetle (Coleoptera)
- e. “Tabuhan” (Hymenoptera).
- f. Grasshopper
- g. Dragonfly (Odonata)



Attachment 3 TOOL MAKING



1. Hand wave net

Tools:

- Needle
- Scissor
- Metal wire of 0,8 millimeter diameter with 1 meter long, (we can use bamboo stick).
- Long wood stick as a handle (1 meter)

Material:

- Plastic or fabric net one meter square
- Threads
- Elastic wire 92 meters)

How to make:

- a. Prepare the tools and materials
- b. Make circle of about 40 centimeter diameter of metal wire (0,8 ml) and tight it with elastic wire.
- c. Sew the plastic or fabric net with threads in triangle model.
- d. Assemble the net on the wire circle and sew it.
- e. Join the long wood stick (one meter) as a handle.

2. Yellow sticky trap

Tools:

- a. Metal scissor
- b. Paint brush
- c. Hammer

Materials:

- a. Metal flat (one meter square)
- b. Yellow color paint
- c. Transparent plastic
- d. Nails
- e. One meter stick (wood or bamboo)
- f. Used motor oli or vasselin

How to make Yellow Sticky Trap

- a. Prepare the tools and materials
- b. Cut the flat metal of 20 X 20 cm square for one sticky trap.
- c. Join the flat metal and the wood stick with nails
- d. Paint the metal with yellow color and let it dry
- e. Put the transparent plastic on the metal
- f. Brush the used motor oil or Vaseline on the plastic

3. Pitfall cup trap

Tools:

- a. Knife
- b. Metal scissor

Materials:

- a. Used plastic bottle with 6.5 wide diameter and height 10 centimeters
- b. Thin flat metal 1 m X 1 m
- c. Water
- d. Soap

How to make:

- a. Prepare the tools and materials
- b. Cut the plastic bottle at the mouth of the bottle
- c. Make a cover with thin flat metal 20 X 20 cm and the buffer

4. Funnel cup trap

Tools:

- a. Metal saw, concrete wire 0.8 ml with 2 meters length
- b. scissors
- c. Weld
- d. Screw driver
- e. Screen wire (mesh)

Materials:

- a. Wire 0,8 ml diameter, 2 meters length
- b. Flat metal 100 cm X 200 cm (to make funnel)
- c. Mesh 0.3 cm
- d. Plastic cup or used plastic bottle 10 cm height
- e. Electric cable 2 meters
- f. Electric connector

- g. Lamp 25 W.
- h. Water
- i. Soap

How to make

- a. Prepare tools and materials
- b. Make funnel with 20 cm diameter below and 15 cm height
- c. Make a knob to cover the funnel (metal flat) 24 cm with 15 cm height, make a hole to put the lamp inside
- d. Install the lamp and electric cable
- e. Make buffer legs with metal concrete wire 0,8 cm with a circle above of 15 cm and the height of legs are 25 cm.
- f. Plastic cup or used plastic bottle cut 10 cm height



Picture: Funnel cup, complete

BIBLIOGRAPHY

Minister of Agriculture Indonesia, SK No 434.1/Kpts/TP.270/7/2001, How to submit pesticide registration, 2001

PAN-AP, A Guide for The Training of Facilitators on Community-Based Pesticide Action Monitoring (CPAM),2005

PAN-AP, Seeking Out The Poison: A Guide To Community-Based Monitoring, 2005

Heertz N, Priyono Hery,dkk, Neoliberalisme, Cidelaras Pustaka Rakyat Cerdas, 2003

Jhamtani Hira, WTO and third world colonialism, INSIST Press,2005