

## **Promoting Participatory Technology Development Approach in Integrated Crop Protection Among Tomato Farmers in Anyima in the Kintapo District of Brong Ahafo Region, Ghana**

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### **Abstract**

*The Ghanaian public and government have come to realise that the use of chemical pesticides by vegetable farmers to control pests and diseases in the country is increasing and if agricultural production is to be sustainable and safe to humans and the environment, then intensive farming systems should become less dependent on chemical pesticides. The top-down approach characterizes most of the interventions that have attempted to address this production constraint of vegetable farmers in Ghana. The farmers have not been fully involved in the process of developing technological options which can help produce healthy vegetables at the same time sustaining the environment. The research was a collaboration between the Department of Agricultural Economics and Extension of the University of Cape Coast and GTZ/Ministry of Food and Agriculture (MOFA) Project. It was an Action Research, which experimented on Integrated Crop Protection (ICP) strategies using participatory approaches among farmers in Anyima in the Brong Ahafo Region of Ghana. The concern is that agriculture is becoming more and more complex and any intervention aimed at assisting farmers to manage crops efficiently must be holistic in nature. It should integrate the major cultural practices of farmers. Vegetable farmers in Anyima are aware of the practices of ICP but their knowledge and skills in the practice are limited. The farmers accepted the Participatory Technology Development (PTD) and ICP concept introduced by GTZ/MOFA Project and are prepared to continue. However, they will need regular assistance from agricultural extension agents in learning the basic principles underlying PTD and ICP. The vegetable farmers came to the conclusion that 'neem leaf extract' can be used alongside the chemical pesticides in controlling destructive caterpillars on tomato farms. Evaluation of farmers' responses to PTD in ICP indicated that the process facilitates group work, encourages the use of local resources, reduces the over-dependence on chemical pesticides and gives farmers the skills to research into their production problems.*

### Introduction

Many of the interventions that are geared towards addressing the production constraints of vegetable farmers in Ghana are characterized by the top down approach. The farmers have not been fully involved in the process of developing technological options which can help produce healthy vegetables at the same time sustaining the environment. Over the last decade, the Ghanaian public and government have come to realise that the use of chemical pesticides by farmers to control pests and diseases in the country is increasing (Gerken, Suglo and Braun, 2000). In order to make agricultural production sustainable and to protect humans and the environment, intensive farming systems should become less dependent on chemical pesticides. However, the supply and use of pesticides do not seem to follow any regulations and direction (Larbi, 1997).

The farmers over-rely on the use of chemical pesticides (Okorley and Kwarteng, 2002). Excessive application of pesticides on crops renders them toxic and unfit for human consumption. The World Health Organization estimates that some 200,000 people die each year from pesticides poisoning, and at least three million suffer acute health effects (FAO, 1998). The cost of agrochemicals is high and consequently increases production cost of vegetables. In an attempt to address this over-reliance on chemical pesticides in crop health management and high cost pesticides to farmers in Ghana, the GTZ/MOFA Project is experimenting with Integrated Crop Protection (ICP) strategies using participatory approaches among farmers in the Brong-Ahafo Region of Ghana. The concern is that agriculture is becoming more and more complex and any intervention aimed at assisting farmers to manage crops efficiently must be holistic in nature. It should integrate the major cultural practices of the farmer.

The study was a collaboration between GTZ/MOFA Project and the University of Cape Coast, Ghana to introduce Integrated Crop Protection (ICP) using Participatory Technology Development (PTD) approach among farmers at Anyima in the Kintampo District of Brong Ahafo Region of Ghana. The University of Cape Coast designed and implemented the research whereas GTZ/MOFA Project was the financier and co-supervisor of the study.

### Specific Objectives

The specific objectives were:

1. To create awareness on Integrated Crop Protection (ICP) using Participatory Technology Development approach amongst vegetable farmers in Brong-Ahafo Region.
2. To conduct needs assessment of tomato farmers in ICP using participatory approach.
3. To facilitate formation of tomato farmers into groups using participatory approach.
4. To introduce PTD in ICP to the farmers for adoption.
5. To test at least one technological option on a farmers' field.
6. To assess the responses of farmers to PTD in ICP.

### MOFA/GTZ Working Operations: PTD Extension Approach in ICP

The MOFA/GTZ Integrated Crop Protection (ICP) in extension projects works with farmer groups with typical cropping systems for vegetables (okra, tomato), pulses (cowpea) and plantain. Farmer groups are facilitated by the Agricultural Extension Agents (AEAs) who are supervised by District Agricultural Development Officers (DADO) and supported by specialists of the Plant Protection and Regulatory Services Division (PPRS) of MOFA. The

GTZ gives financial and technical support in the form of specialist advice and training of personnel involved in the project.

Integrated Crop Protection (ICP) is a concept with a systems perspective, comprising the pest/beneficial complex of the crop and the environment on one side, and the farmers (socio-economic as well as the economic condition and legal framework of the country) on the other side. It stresses the principle of prevention over cure, with the aim of growing a healthy crop, which need as little direct pest control as possible. The concept employs systematic combination of all appropriate cultural, physical, hygienic, sanitary, chemical and biological control measures in order to reduce pest damage in the wider sense under an economic threshold. It gives preference to ecologically friendly, economically sound and easily applicable methods to farmers.

The Participatory Technology Development (PTD) approach to technology development assists farmers to choose from alternate options the ones that help produce healthy crops and at the same time sustain the environment. It is the practical process of bringing together the knowledge and research capacity of the local farming communities with that of the commercial and scientific institutions in an interactive way. The approach in this project is supposed to give farmers knowledge about the relationships between crop plants and their environment and the need to create the right balance for proper crop growth and management. Integrated Crop Protection technology is cost effective and ecologically friendly. There is minimal use of pesticides and agrochemicals in general. Toxic-free vegetables can be produced for export. The approach ensures complete farmer participation and has the following components: Awareness creation, selection of farmer participants, formation of farmer groups, assessment of group needs in ICP and introduction of PTD in ICP.

### **Methodology**

The study was an action research. Action (intervention to bring about change within an organization or community), and research (to increase understanding on the part of the researcher and/or the client(s) (Zinnah, 1998). The methodology used was essentially to involve the farmers in participatory assessment of their production needs in terms of disease and pest control in tomato cultivation. The target group for the Participatory Rural Appraisal (PRA) sessions was tomato farmers at Anyima community, in the Brong-Ahafo Region of Ghana. The farmers were involved in the planning and evaluation of the project. Initial diagnostic survey was carried out using 40 vegetable farmers selected at random out of an estimated 200 vegetable farmers in the Anyima community. Through informal discussion with the farmers, background information was collected and used as the awareness creation, selection of participants for the main research and group formation activities.

#### **Awareness Creation in ICP**

Group discussions and informal conversations were used to create awareness about the need for Integrated Crop Protection.

#### **Selection of Farmers for the Research**

The farmers were granted equal opportunities to participate in the PTD sessions. The project started with 80 farmers who showed interest to be part of the research project after the awareness creation exercise. Group discussions started with the 80 farmers. After four group

discussion sessions on the aims, objective, demands and planning of the project, the number of farmers was reduced to 40 individuals. Focused Group Discussion approach was used to find reasons why some farmers left and others remained.

#### Formation of Farmer Group

To ensure the sustainability of the project, purposive sampling was used to select twenty participating farmers and organized them into a group. Personal interest and commitment were used as the basis for the selection. The farmers themselves did the selection. The farmers selected were prepared to participate in all group activities, especially meetings, and were also prepared to make available part of their farm for experimentation. Farmers who for some reasons were not selected for the project on the basis of limited resources and ease of project management were permitted and encouraged to attend the group meetings. The farmers were left to select and form their own group. The researchers facilitated the process by organizing a one-day training for the farmers on Group Formation and Processes. The farmers were also assisted to:

1. develop group mission and objectives
2. formulate guiding principles for group activities
3. get support from GTZ/MOFA Project (Seasonal loans for their farming business)

#### Assessment of Farmer Group Needs

The needs of the tomatoes farmers were assessed through discussions and consensus building. The researchers facilitated the discussion process. Farmers were asked to recall all their production problems. The identified problems were listed and prioritised to determine the most important needs and the intervention needs to address them.

#### *Introduction of PTD in ICP to Farmers*

Farmers were introduced to ICP in a group discussion. A resource person from MOFA explained the importance of PRA in Participatory Technology Development (PTD) to farmers. The benefits of working in groups for crop health management were also stressed. The farmers were guided on how to carry out simple mapping, scoring, ranking, drawing of seasonal calendars and direct observations and measurement. The farmers discussed the possible interventions or options that can be used to solve their pest problems (caterpillars and nematodes).

#### Testing of Technological Options (Neem Leaf Extract Versus Karate + Kocide)

A result demonstration was set up in a volunteer farmer's field to test the efficacy of neem leaf extract and a mixture of Karate and Kocide (usual practice) to control caterpillars in tomato farm. Farmers were taken through method demonstrations by a plant protection expert from the Plant Protection and Regulatory Services Division (PPRSD) of MOFA in the preparation of neem extract for spraying as insecticide. An average of one hour was spent to prepare 15 litres of the solution using the leaves. Tender leaves without the flowers are most ideal. Six kilograms of well-pounded leaves of the neem leaves were sifted and used in the preparation of 15 litres of extract. For effective action, the extract (pesticide) was sprayed in the evenings.

## **Major Findings**

### **Awareness of ICP**

The average age of the farmers that constituted the group was 35 years and the majority of them (80%) had basic education. Almost all the farmers were aware of the practices of ICP but are not using the principles in their crop health management practices. The farmers mostly used chemical pesticides in controlling crop pests. Okorley and Kwarteng (2002) also saw this, where vegetable farmer in the Central Region of Ghana rely almost entirely on chemical pesticides. Agro-Ecosystem Analysis (AESAs) was done indeliberately on their fields. They were aware of the presence of natural enemies of crop pests in the field but knowledge about the significance of these beneficial insects to crop and their environment was lacking.

### **Group Formation**

The farmers formed a group with a membership of 20 individuals. The farmers met once every week at the beginning of the research project to draw plans and organize their activities. After the first month the farmers decided to schedule their meetings fortnightly to compare notes and share ideas on their activities towards the realization of the research objectives. Group meeting attendance within the project period was always more than 80%. There were instances where meeting attendance was 100%. As a way of consolidating the group, the farmers took the following actions:

1. They developed a group mission, objectives and guiding principles for group activities
2. They formally registered with the GTZ/MOFA Project to qualify them for seasonal loans and technical support for their farming business.
3. They registered with the District Assembly to be recognized as vegetable farmers' group in the district so that they could access support from government as recognized group.

### **Assessed Needs of Tomato Farmers in ICP**

The production problems of the farmers in decreasing order of importance were expressed as follows:

1. Lack of market for produce due to absence of buyers and consequently extremely low prices for tomatoes offered by middlemen at farm gate.
2. High pest infestation and high cost of pesticides.
3. High costs in land preparation.
4. High labour costs.
5. Difficulty in acquiring improved seeds for planting.

The farmers decided to tackle their second most important problem, pest infestation which is the focus of the project. The most important crop health management constraints identified by the farmers in their deliberations were the wilt disease, caterpillar infestation, damping-off, grasshopper infestation and nematodes in that order of importance. The group realized that pests and diseases attack on tomato are most prevalent during the dry season between November to March and also during the early stages of fruiting. This implies that any technology aimed at reducing the adverse effect of pests and diseases in tomato must start by November and Agro-Ecosystem Analysis (AESAs) should be intensified during the onset of fruiting of the crop in the community.

### Technological Options (Neem Leaf Extract Versus Karate + Kocide)

The results show slightly higher percentage of flower drop in tomatoes sprayed with neem extract than tomatoes sprayed with synthetic pesticide. However, there was lower percentage of leaf and fruit damage in tomatoes sprayed with neem extract compared to the synthetic pesticide. At the end of the experiment farmers realized that yields from the crops sprayed with the neem extract were better than those sprayed with chemical pesticides. However, they did not see the difference in the yields of the two treatments as significant. After assessing and comparing the two types of pesticides over the period of the research, the farmers concluded that the neem extract is equally effective and can conveniently be combine with the synthetic pesticides for better economic and environmental benefits.

**Table1. Growth and Yield Responses Neem Extract and Synthetic pesticides**

Growth Characteristics	<b>Karate + Kocide (Mean Values)</b>	<u>Neem Leaf Extract</u> <b>(Mean Values)</b>
Plant Height	35.33 cm	37.00cm
No. of Whole Leaves/plant	216	214
No. of Flowers /plant	10	11
No. of Fruits/plant	7	7
Percentage Leaf Damage	0.8%	0.7%
Percentage Flower Drop	2.4%	2.8%
Percentage Fruit Damage	2.7%	1.4%

### Project Evaluation

The farmers and the stakeholders in the research observed the following benefits of the Participatory Technology Development approach in Integrated Crop Protection.

1. It helped to produce healthy and wholesome crops.
2. It encouraged the use of available local resources (e.g. neem leaves) for crop health management.
3. It facilitated group work.
4. It gave farmers conscious research skills to solving their production problems.

The farmers were of the opinion that there is drudgery in the preparation of the neem extracts. However, their interest and willingness to continue with the innovation was high.

### Conclusions

Vegetable farmers in Anyima in the Brong-Ahafo Region in Ghana are aware of the practices of ICP but their knowledge and skills in the practice is lacking.

The participated farmers accepted the PTD and ICP concept but the desired impact can be achieved if farmers are assisted by agricultural extension agents to understand the basic principles underlying what they know and what they are to learn in the process on regular basis.

The tomato farmers came to the conclusion that Neem Leave Extract (NLE) can substitute or be combined with synthetic agro-chemicals (Karate + Kocide) in the control of caterpillars. Evaluation of farmers responses to PTD in ICP indicated that Technology Development (PTD):

- Facilitates group work.
- Encourages the use of available local resources for crop health management
- Helps farmers to research into their production problems.
- Helps to produce wholesome crops for local and export market.

### **Educational Importance**

An educational programme which involves the affected people from the start has a better chance of succeeding. Collaboration, participation and group work among the University of Cape Coast, GTZ, MOFA and the farmers accounted for the success of the research project and therefore should be encouraged in the dissemination of agricultural technologies. This approach will ensure better use of local resources and help develop farmers' skills in handling their own production problems.

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