Integrated Pest Management Training Workshop Report

Training of Bean Farmers and Village Extension Officers, Lushoto District Tanga Region, North eastern Tanzania

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Farmer group activity reports for the DFID Crop Protection Programme (CPP) Bean IPM Promotion Project in eastern and southern Africa

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For distribution to Village Information Centres (VICs) in bean growing areas in eastern, central and southern Africa.

Introduction

Lushoto district covers the western part of Tanzania's north-eastern Usambara mountains in Tanga region. The altitude for Lushoto ranges from 400 to 2200 metres above sea level, with undulating high slopes whose valley bottoms are at the lower altitude. The district is characterised by steep hillsides and high human population density. The soils are highly eroded and poor in plant nutrients. Farmers own small farm plots (0.2 - 0.4ha) and beans are one of the major legume food and cash crops that most farmers (particularly the rural women) grow. These farmers grow a variety of crops including temperate fruits, Irish potatoes, wheat, maize, beans, different vegetables, tea, coffee, bananas, sweet potato, cassava, rice, cotton and sisal.

Bean research activities have been going on with select farmers in the district for several years. When the IPM project started in 2001 with farmers in Hai district, a group of farmers were invited to the Hai bean farmer day. The Lushoto farmers exchanged knowledge and shared their experience with Hai farmers. During 2002, Lushoto farmers experimented with some of the technologies they had learned in Hai (zero grazing for

dairy cattle and collection of cow urine and cowshed slurry for use as pesticides in bean pest management and animal fertilizer on soils respectively). The 2002 bean farmer day was organised and hosted by Lushoto farmer groups who in turn demanded to be trained in IPM like the Hai farmers. In response to this, the bean IPM project scaled up the training in 2003 to include farmer group representatives in addition to the extension officers. This was the first training of its kind (experimental) in Hai and Lushoto districts because previous trainings were offered separately between farmers and extension officers or the extension officers would visit a farmers' field and only involve the farmer in the practical session.

Objective: The training aimed at building the capacity of farmer group representatives and village extension officers on the identification of major bean pests and natural enemies, appropriate management strategies and dissemination of IPM knowledge to the village communities.

Participants: Eleven farmers (5 women, 6 men), 4 village extension officers (2 women, 2 men), 3 district extension officers (all men) and 2 CIAT staff from Arusha.

Training: This was the first training that involved farmers, extension officers and researchers. During the training farmers were given the opportunity to contribute because of their knowledge and experience with problems in their production systems.

Areas of focus: The training covered: identification of major bean insect pests and their natural enemies, biology and ecology of the pests, available management strategies, monitoring population of pests (scouting), establishment of learning plots, field data record keeping and dissemination of bean IPM strategies.

1. Identification of major bean pests and their natural enemies

Trainer: H. Mbwambo, Ward Extension Officer, Ubiri Ward

Most farmers in Lushoto district recognise different crop pests and have local names for a number of the common insect pests. They however, were not aware of the types and role of common natural enemies and the type of damage caused by some of the pests. These farmers

are traditionally among the expert ethnic (Wasambaa) groups on traditional spices, botanical medicines and pesticides. The training started with farmers listing the common pests of beans at their locations:

Table 1: Major insect pests on beans according to Lushoto farmers including their local names

Species name	Common name	Kiswahili	Local name at Lushoto (Kisambaa)	Other local names
Ootheca spp.	Bean foliage beetle	Mbawakavu wa majani	Kiindi	Kirombosho (Kichaga), Nasheve (Kipare), Nadolukunya (Kimasai)
Ophiomyia spp.	Bean fly	Inzi wa Maharage		
Aphis spp.	Aphids	Vidukari	Kifizi	Kimamba (Kichaga)
Agrotis spp. *Spodoptera* spp.	Cutworms	Sota	Zukizi	
Acanthoscelides sp. and *Zabrotes* sp.	Bruchids	Vipekecha	Visaga	

Bean foliage beetle - BFB (*Ootheca* spp.) (Coleoptera: Chrysomelidae)

The adult bean foliage beetle is a small shiny insect with a brownish to black elytra and an orange to brown thorax and head. This pest commonly attack bean seedlings soon after germination and may continue until podding stage.

Biology and Ecology: Adult beetles emerge with early rains (March/April in Lushoto) although a few were observed feeding on bean leaves during the September/October short rain season. Females lay eggs in the soil and when eggs hatch, the newly emerged larvae feed on bean and other legume plant roots. Pupation occurs in the soil. The teneral adults remain in the soil until the onset of rains. The life cycle of the insect takes one year.

Damage: Adult *Ootheca* feed on bean leaves and causes extensive defoliation. The larvae feed on leguminous plant roots including beans, causing stunted growth and premature senescence of bean plants.

Management strategies: - Farmers in Lushoto traditionally use botanical herbs as a source of pesticides to control crop pests, as well as in animal and human health. The following botanicals and other locally available materials have been experimented with for the control of bean foliage beetles.

Table 2: Traditional materials tested for bean pest management by Lushoto farmers

Botanical spp./Other materials	Common name	Other local names
Vernonia spp.		Muhasha (Kiswahili) Mhasha (Kisambaa) Tughutu (Kisambaa)
Pycnostachys spp.		Donondo (Kisambaa)
Tithonia sp.	Wild sunflower	Alizeti pori (Kiswahili and Kisambaa)
Tetradenia spp.		Aake Luli Zaake (Kisambaa)
Euphobia spp.		Mnyaa (Kiswahili) Muui (Kisambaa) Mwasa or Maasa (Kichaga) and Mwasi (Kipare)
Wood ash		Majivu (Kiswahili)
Neem oil/powder		Mwarobaini (Kiswahili)
Cow urine		Mkojo wa ng'ombe (Kiswahili)

- Timely planting to avoid pest population peaks is a common practice. Through the project farmers have acquired and judiciously used conventional insecticides at high population densities.
- Crop rotation with non-host plants e.g. maize
- Post-harvest tillage to expose larvae to natural enemies.

Bean stem maggot - BSM (*Ophiomyia* spp.) (Diptera: Agromyzidae)

Adult bean stem maggot is a small, black fly with clear wings that reflect metallic blue in bright sunlight. The wings do not fold over but form a 'V' shape when the fly is settled. There are two common species of beanfly, *Ophiomyia phaseoli* and *O. spencerella*. The two species can be differentiated by the colour of the pupa. *O. phaseoli* pupa is brown while that of *O. spencerella* is black.

Biology and Ecology: Adult bean fly oviposits in tender bean leaves (*O. phaseoli*) or in the hypocotyl (*O. spencerella*). The female pierces the leaf tissue with ovipositor and feeds on the exuding sap, resulting in characteristic stripes on the leaves. The emerging larvae (maggots) mine through a leaf vein and petiole to reach the stem. They tunnel under the epidermis down the stem to feed close to the soil surface. Such feeding on stems causes visible mining trucks. Pupation takes place in the stem near the soil surface and adults emerge from the pupae to start feeding on soft leaves.

Damage: The symptoms on seedlings are leaf yellowing and desiccation of the first leaves. The external tissue at the base of the stem detaches and ruptures causing a characteristic thickening of the collar, wilting and drying of the plants. Plants produce adventitious roots if there is sufficient moisture. Damage is more serious when infestation occurs at an early stage of crop development and during prolonged dry periods. Plants may continue to grow in case of low infestations but severe attacks can substantially reduce yields (yield losses ranging from 30 to 100% have been attributed to bean fly infestations).

Management strategies:

- Use of tolerant bean genotypes/cultivars e.g. EXL 52, EXL 158 and G 21153
- Timely planting to escape peak populations
- Earthing up (ridging)
- Intercropping with non host plants e.g. maize
- Use of organic and inorganic fertilizers to improve plant vigour
- Use of mulch to conserve soil moisture
- Farmers are experimenting with various botanicals and other traditional materials
- Integration of several control strategies.

Bean aphids (*Aphis fabae* and *A. craccivora*) (Homoptera: Aphididae)

The black bean aphid (*Aphis fabae*) and the groundnut aphid (*A. craccivora)* (Homoptera: Aphididae) are important pests of beans in Lushoto. The nymphs and adults suck sap from the tender parts of the plant. Both aphid species are black and usually found in colonies on the tender growing tips of the plants.

Biology and Ecology: Female aphids reproduce parthenogenetically (asexual reproduction). The nymphs are wingless and dark in colour.

Damage: Aphids colonize bean plants and suck sap from the stem and growing points, leaf petioles and young leaves. Seedlings wilt and die. Older plants become stunted. Direct damage caused by aphids may not be as economically important as their ability to transmit bean common mosaic virus (BCMV). Plants infected by the virus do not produce viable seed. Aphid infestations are important during dry periods in the growing season.

Management strategies:

- Timely planting to escape peak populations
- Use of botanical and other traditional insecticides e.g. *Vernonia spp*, *Tithonia spp*, *Tetradenia spp*, *Pycnostachys spp*, cow urine and neem oil/powder
- Judicious use of conventional insecticides
- Integration of several control strategies.

Cutworms

These are larvae of various moths belonging to the genera *Agrotis* and *Spodoptera* (Lepidoptera: Noctuidae). They are cosmopolitan, reported to attack seedlings of most crops including beans.

Biology and Ecology: The adult moths lay eggs on stems of weeds, crop seedlings or on the soil. Larvae live in the soil and they vary in colour from grey, greenish grey, greenish brown to brown or black. They feed on roots during the day and at night move up to the soil surface and attack seedling stems or leaves. Stems or leaves will be cut or partly chewed and the larva burrows into the soil nearby the point of damage. The larva can be located by slowly excavating the soil around the damaged seedlings to a depth of 4 cm and 4 - 6 cm around the stem. Pupation takes place in the soil.

Management strategies:

- Seed dressing will reduce the initial cutworm population in the soil
- Farmers have experimented with traditional herbs

applied soon after seed germination, e.g. the use of extracts from *Euphobia* species by the Wasambaa in Lushoto

- Judicious use of conventional soil insecticides.

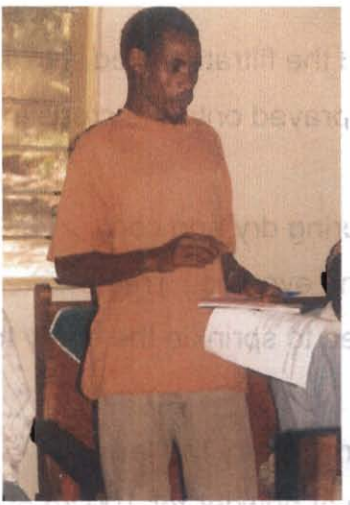
Contribution from farmers: Traditional methods for preparing botanicals for use in insect pest management and soil fertility amendment. Example: *Vernonia* or *Tithonia* spp.

- Farmers take 1 kg of leaves of the selected herb and pound it
- The pounded leaves are soaked in 3 litres of water for 10 - 12 hours
- The mixture is filtered and the filtrate mixed with 10 gm of powder soap and sprayed onto the crops in the field
- Spraying is carried out during dry and cool conditions preferably in the evening. Tree branches or twigs are used to sprinkle the spray to the crops.
- In storage pest control farmers dry the leaves, pound them and use 1 kg of powder for 100 kg of grain. For seed they add chillies to the leaf powder

- In cases of use as fertilizer, the leaves are chopped and used as green manure (a hand full per planting hole). Alternatively, the leaves are pounded and fermented for 10-14 days (3 kg leaves pounded/chopped and mixed with 10 litres of water). A cupful (≈ 150 ml) of the fermented mixture is applied to a planting hole.
- Chemical analysis (data from ARI Mlingano, Tanga) on the leaves from *Vernonia* sp. and *Tithonia* sp. showed that they contain substantial amounts of N, P and K as follows:

nutrient content

Plant	Percentage ~~control~~ of		
	N	P	K
Vernonia	3.6	0.25	4.7
Tithonia	3.2	0.23	4.4



Farmers - D. Wilson and T. Musa contributing their knowledge on traditional pesticides and fertilizers

2. Field population monitoring of insect pests and natural enemies (scouting)

Trainer: G.A. Matosho, Field Officer, Lushoto district

Scouting is a constant monitoring process that involves the inspection of a crop for insect pests, diseases, nutritional disorders and general plant health. It is carried out on a regular basis to gather and record information that enhances the process of making appropriate crop management decisions.

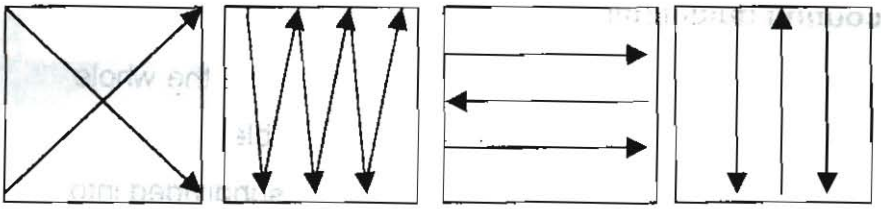
Objective: To enable a farmer or practitioner make appropriate decisions on management actions for a specified problem at different stages of crop growth.

Problem diagnosis: For proper management, it is important for the farmer to know how a healthy crop looks like, he/she should be familiar with normal crop growth changes and recognise the major pests of the crop at various stages of development and typical damage caused by a specific pest. It is important for a farmer to be able to differentiate pest damage symptoms from nutritional, physiological disorders, and damage from chemicals and adverse weather conditions which are sometimes referred to as non-parasitic disorders.

Therefore the ability to diagnose the problem enhances a farmer's decision-making process that leads to reduced production costs by minimising costly and unnecessary management options.

Scouting procedure: Observations involve a thorough inspection of the whole plant from the soil and roots to the top of the newest shoot, with a careful check of both upper and lower leaf surfaces, flowers and pods. On each visit to the field, the farmer walks through the crop area to get an overview of the major problems and/or crop condition. This also helps the farmer to develop a record sheet for the day. The farmer will then inspect the crop, picking plants at random on pre-determined stations. Monitoring methods can include (but not limited to) plant sampling, insect traps and indicator plants. Regular crop inspection helps to reduce scheduled crop protection practices and inputs that could be used unnecessarily. It also helps to save a crop by timely application of the appropriate management options.

Random sampling: There is no fixed approach or protocol that is suitable for all crops and field size or shape. However, for guidance, a farmer could try one of the following and select the most suitable scouting pathway for his field or crop.



Determination of sample size: The farmer should also decide on the number of stations (sampling sites) on each stretch. The sample size (number of plants to be inspected or number of insect to count/collect) at each station will depend on the size of the plant, the crop, spacing, type and stage of insect pest/disease/weed, time, manpower and costs.

Once the field has been inspected, a farmer has to decide on the appropriate action. The following should be considered depending on the prevailing conditions: Pest population and damage levels, beneficial organisms, prevailing weather conditions, type of crop, stage of growth and yield potential, previous field records and results of options already implemented, and potential management options available.

Scouting guidelines:

It is advisable to conduct a quick inspection of the whole field to get an overview of the prevailing problems.

- If there are no plots, large fields can be subdivided into plots and blocks
- More attention should be paid to critical stages of crop development depending on the kind of problem, e.g. pests at the reproductive phase
- Rank problems and scout the major ones in detail for immediate actions
- Determine the sample size and maintain it throughout the crop cycle
- Scouting can be conducted to determine:
    - **Incidence:** count the number of sampled plants, determine number of infested/infected plants and calculate the percent damage
    - **Severity:** count number of insects per plant, number of leaves or fruits damaged and develop a simple scale of severity
- While sampling, plants should be selected at random to avoid bias

- Consideration should be made on factors that could influence the pest problem and keep records on:
  - Beneficial organisms (type, abundance and effectiveness)
  - Crop growth stage
  - Prevailing weather conditions and any other factor that may influence the pest or disease
  - Expected harvest
  - The costs of inputs to be used

3. Establishment of learning/demonstration plots

Trainer: A.R. Kiluwa, Subject Matter Specialist (SMS) Crops, Lushoto District

Learning/demonstration plot:

A learning and/or demonstration plot is a reasonably small and carefully planned and managed plot owned by a farmer, a small group of farmers or a school classroom/student groups. It is a central site where many farmers and the surrounding community can visit to learn about certain new technologies (e.g. bean IPM strategies).

A bean IPM learning/demonstration plot should have the following characteristics:

- Established at an easily visible and accessible site (most preferably near the main roads/ pathways, churches, mosques, schools, etc.) where most people can reach and learn even on their own
- Properly designed and laid out
- Appropriately planted at recommended spacing
- Carefully managed
- Properly labelled.

Sites for learning/demonstration plots:

- It is advisable to set these plots away from the shaded areas
- Choose an area with fairly uniform topography
  Avoid setting such plots very near to residential premises
- Such plots should be of reasonable size for appropriate result interpretation.

A.R. Kiluwa and G.A. Matosho (facing the flip chart) during presentation

4. Field data record keeping

Trainer: H. A. Mziray, Research assistant, CIAT-Arusha

Proper data recording and storage is very important. A written logbook or record sheet should be kept for each site. It should include, name of location, problem being addressed, incidence levels of problem, weather and soil conditions, agronomic practices (in the case of crops), types of inputs, crop development, dates for pest management activities and any other disorder/solution

observed/implemented. It is therefore important for the farmer to know what he/she intends to observe and keep records. A record of all other remedial observations should also be maintained. These records assist the farmer to decide on the timing and choices of appropriate management strategies. Such records will also be of benefit in the long run because most pests and diseases tend to appear about the same time each year or they may change depending on various environmental factors.

5. Dissemination of IPM strategies

Trainer: T.M. Kizuguto, District Agriculture and Livestock Development Officer (DALDO), Lushoto

Most farmers have their own pathways for disseminating information among themselves and their neighbours. Some of the traditional and improved tools commonly used include: Family/friendly visits and meetings, formal and informal training workshops and seminars, farmer field days, farmer meetings/conferences (formal and informal), cross village and cross site visits, learning and demonstration plots, drama, poems, choir, radio, TV, leaflets, posters, newsletters and field manuals.

T.M. Kizuguto (DALDO Lushoto) taking lead in discussions on dissemination of IPM strategies

List of Participants

No.	Name of participant	Title	Village/Location
1	Mr Yusufu Kingazi	Farmer/Ward Leader	Ubiri
2	Ms Zakati Salimu	Farmer	Ubiri
3	Ms Mwanaisha Ramadhani	Farmer	Ubiri
4	Ms Batuli Omari	Farmer	Soni
5	Ms Tatu Musa	Farmer	Soni
6	Mr Bakari Gembe	Farmer	Mombo
7	Mr Daniel Willson	Farmer	Kwalei

8	Mr Bakari Iddi	Farmer	Mombo
9	Mr Shekibughe Omari	Farmer	Mombo
10	Ms Mary Msangula	Farmer	Mbuzii
11	Mr Ahamadi Y	Farmer	Mbuzii
12	Mr Kimboi R H R	Ward Extension Officer	Nyasa
13	Mr Yona M D	Village Extension Officer	Lushoto
14	Mr Urassa B R	Divisional Extension Officer	Soni
15	Ms Happiness Mbwambo	Ward Extension Officer	Ubiri
16	Mr Godfrey A Matosho	Field Officer	Lushoto District
17	Mr M Sellungato	Ward Extension Officer	Kwalei
18	Mr A R Kiluwa	Subject Matter Specialist - Crops (SMS)	Lushoto District
19	Mr T M Kizuguto	District Agriculture and Livestock Development Officer (DALDO)	Lushoto District
20	Mr Hendry A Mziray	Research Assistant	CIAT-Arusha
21	Dr Eliaineny Minja	Entomologist, CIAT Bean IPM Project	CIAT-Arusha

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