SAMPLING AND MONITORING OF PESTS AND DISEASES

Beyond Cotton | WFP World Food Programme Centre of Excellence against Hunger | IBA Brazilian Cotton Institute | ABC Brazilian Cooperation Agency | Ministry of Foreign Affairs | Brazilian Government Brasil Uniting and Rebuilding

Alternatives for the Disposal of Cotton By-Products and Accessory Crops in Africa
Beyond Cotton Project (Project-Country: Tanzania)

SAMPLING AND MONITORING OF PESTS AND DISEASES

Technical Data Sheet

Brazilian Institutions
Brazilian Cooperation Agency (ABC) of the Ministry of Foreign Affairs - Coordinator
Federal University of Campina Grande (UFCG) - Implementer
Brazilian Cotton Institute (IBA) - Financier

Tanzanian partner institutions
Ministry of Agriculture (MoA)
Tanzania Agricultural Research Institute (TARI)
Tanzania Cotton Board (TCB)

International partner organization
World Food Programme (WFP) in Tanzania
World Food Programme (WFP) Centre of Excellence against Hunger Brazil

Project Coordinator
Cecília Malaguti do Prado
Brazilian Cooperation Agency (ABC) of the Ministry of Foreign Affairs

Albaneide Maria Lima Peixinho
World Food Programme (WFP) Centre of Excellence against Hunger Brazil

Text preparation
Luderlândio Andrade Silva

Textual Revision and Supervision
Albaneide Peixinho
Cecilia Malaguti do Prado
Eliene Souza
Janaina Plessmann
Joélcio Carvalho
Milena Lopes
Paola Barbieri
Plinio de Assis Pereira
Riffat Iqbal
Thaynara T. Dias Guimarães

Graphic Design and Layout
Caroline Melo
World Food Programme (WFP) Centre of Excellence against Hunger Brazil

Translation
Erik Mwanyika (UNV)
Diogo Teixeira (UNV)

Edition/Year
1ª. 2024

PEST MONITORING: ESSENTIAL FOR DECISION-MAKING

Pests are primarily caterpillars, beetles, flies, aphids, mites, scale insects, and slugs. They suck or eat parts of the plants. Pests can also transmit diseases from one plant to another. Mites are very small pests, and scale insects, also small, are pests with scale, half-ball, or flour-like shapes.

Pest monitoring is the practice of determining the status of pests in a crop, assessing the damage and losses that may be occurring, and defining the optimal timing and type of pest control to be implemented in the field. Thus, monitoring is the foundation of any integrated pest management program. The practice should be routine and carried out throughout the crop's entire cycle.

PEST MONITORING: WHEN AND HOW TO CONDUCT

Pest monitoring should begin before planting. The following factors can negatively impact the crop from the outset:

- Presence of caterpillars in residues from previous plantings.
- Presence of pests in the developmental stage in the soil.
- Depleted soils with few nutrients, which occurs when the same crop is planted in the same location consistently without crop rotation.

After the crop is established, monitoring continues to be crucial for decision-making regarding pest control. First, sampling is conducted, followed by pest identification, and finally, the decision-making process for control measures. Follow each one below.

SAMPLING

Sampling is conducted to assess the quantity of pests and natural enemies in the fields. It can be carried out:

Natural enemies are predators that feed on insects and mites that are harmful to crops. This group includes beetles, flies, bedbugs, scissors, wasps, ants, praying mantises, mites and spiders. Natural enemies can also be considered parasitoids, such as wasps, micro wasps and flies which, by parasitising other insects, cause the death of their host.

- Quickly, taking a maximum of one hour per plot.
- Easily obtained, executed with simplicity.
- At a low cost, without representing a significant increase in production costs.

It is recommended to obtain a zigzag or perimeter sampling, where 20 consecutive plants should be sampled, at least 30 meters away from the field entrance (border). This sampling should be performed at least in five different points across the field, totalling 100 plants.

ZIGZAG SAMPLING

PERIMETER SAMPLING

During sampling, traps are utilized. There are various types of traps that can vary in colours, shapes, and materials. Among the main types of traps, we can mention:

- **PHEROMONE TRAPS:** Traps attract insects and the pheromones are substances produced by insects, specific to each species, with the aim of promoting communication among them.

- **LIGHT TRAPS:** These are light devices designed to attract and capture insects that are active during the night and are drawn to the light between 7 p.m. and 5 a.m. This leads to the interruption of the insect's life cycle due to their capture.

- **ADHESIVE TRAPS:** These are adhesive cards made of resin and wax, which trap the insect upon contact. They are typically available in blue and yellow colours and have squared sides to facilitate insect counting.

TYPES OF SAMPLING

BEFORE CROP INSTALLATION

To assess the presence of pests in the soil before sowing, soil sampling should be conducted. Sampling points should be 1m in width and 1m in length (1 m^2) and 5 cm in depth, well-distributed in the area.

If the presence of more than one caterpillar (armyworm, cutworm, fall armyworm), and/or soil weevil longer than 1.5 cm is observed in the 1m^2 area, it is recommended to wait ten days before sowing, a period during which the caterpillars pupate.

FROM EMERGENCE TO THE THREE TO FOUR TRIFOLIATE LEAF STAGE

Mark 2m on the planting line per sampling point and monitor dead plants, pests, and damages, recording on a sheet the survey of pests and natural enemies with the following data:

- Number of dead plants (soil pests).
- Number of insects or symptoms of attack on plants at the sampling point (upper and lower leaf surfaces should be turned slowly to avoid dispersing insects).
- Number of live leaf-mining larvae in ten trifoliate leaves at the sampling point (do not consider the attack on primary leaves).
- Level of defoliation caused by beetles and caterpillars (visually observe an area with a radius of 5m centred on the sampling point).

Figure 1 - Monitoring from emergence to the three to four trifoliate leaf stage.

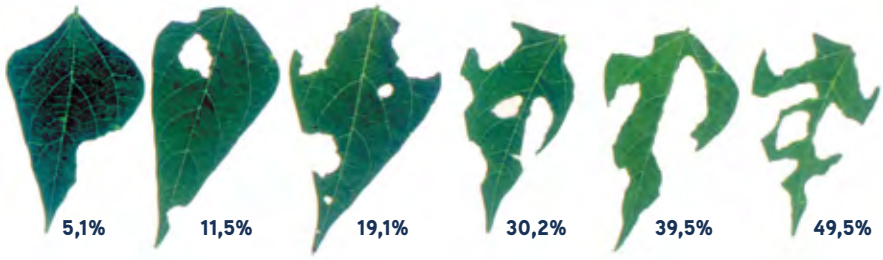

Figure 2 - Different levels of defoliation in the bean crop.

AFTER THE THREE TO FOUR LEAF STAGE

At this stage of plant development, samplings should be conducted using a white beating cloth, 1 m in length and 0.5 m in width, with lateral supports. Carefully insert the cloth between two rows of beans to avoid disturbing insects and natural enemies, then vigorously beat the plants onto the cloth to displace them. Record in the pests and predators survey spreadsheet the number of insects fallen on the cloth.

Figure 3 - Sampling method for pests in bean crops using the beating cloth.

Some pests do not fall on the beating cloth. In this case, move away the plants in the area of the beating cloth, observing the presence of pests or attacked plants as described below, and record the number in the spreadsheet:

- Observe their presence on terminal buds and new leaves.
- Caterpillars - observe their presence on leaves.
- Whiteflies - observe the number of adults near each sampling point on ten trifoliate leaves from the upper third of the plants (slowly turn the lower leaf surface to avoid dispersing the adults).
- At this stage, also note the levels of defoliation, the number of beetles, slugs, and leaf-mining larvae.

Figure 4 - Visual sampling of pods to check for the presence of pests or symptoms of attack.

FLOWERING AND POD FORMATION STAGE/TWINING/FLORAL BUDS

At this stage, samplings should be mainly focused on flowers. Beetles, bugs, and caterpillars that attack the pods, following this sequence:

- Insert the beating cloth between two rows of plants and vigorously beat the plants onto it for the counting of insects and natural enemies.
- Without beating the beating cloth, check the number of plants with symptoms of attack on the upper part of the leaves in the area.
- Without beating the beating cloth, also check the number of plants with symptoms of attack in the middle part of the plants.
- Check for beetles, leaf-feeding caterpillars, and leaf-mining larvae, as well as defoliation levels, as described earlier.
- Check for caterpillars and/or damage caused.

REGISTRATION OF SAMPLING AND ACTION THRESHOLD FOR BEAN PEST CONTROL

PEST OR DAMAGE	ACTION THRESHOLD
Aphis fabae – black bean aphid or bean aphid	Four plants with symptoms and/or presence of mites in 2 m of row.
Stink bugs (various species)	Two stink bugs per cloth and/or five in ten sweeps.
Leaf-rolling caterpillar (Omiodes indicata)	5-10% of attacked plants.
Ootheca bennig and Bean leaf beetles (Diabrotica speciosa; Cerotoma arcuata)	Twenty insects per cloth (2 m of row) or defoliation of: 50% of primary leaves; 30% before flowering; and 15% after flowering.
Seed, seedling, and root pests (reducing plant stand)	Two plants cut or showing wilting symptoms in 2 m of row.
Bean fly larva - Ophiomyia phaseoli	Monitor seedlings twice a week, inspecting stems and leaves for the following aspects: oviposition marks on leaves; mines made by larvae on leaves, petioles, and stems; swelling and cracking in the stem, particularly at the base; presence of adult flies. Control measures should be applied when 5-10% of the plant population is infested.

RECORDING OF SAMPLINGS AND ACTION THRESHOLD FOR COTTON PEST CONTROL

PEST OR DAMAGE	ACTION THRESHOLD
Aphis fabae – Aphid	Presence of 5 to 15% of plants with colonies
Armyworm	10% of plants attacked
Apple Worm	13% of plants attacked
Stink Bugs	20% of plants with attacked buds
Helicoverpa Caterpillar	11% of plants attacked

RECORDING SAMPLINGS AND ACTION THRESHOLD FOR MAIZE PEST CONTROL

PEST OR DAMAGE	ACTION THRESHOLD
Helicoverpa Caterpillar	2 caterpillars per meter traversed in the field measuring less than 8mm, or 1 caterpillar per meter traversed in the field measuring more than 8mm.
Cutworm Caterpillar (Agrotis ipsilon)	10% of plants attacked.
Corn Stem Borer (Bussoela fusca)	11% of plants attacked.

HOW TO CONTROL CROP DISEASES WITH GOOD PRACTICES

It is important to adopt various control strategies to increase management efficiency. Below are some measures to be employed in disease management in crops:

- Avoid successive planting of the same crop in the same area.
- Plant and harvest at appropriate times.
- Use seeds with good physiological and sanitary quality.
- Use treated seeds whenever possible.
- Implement frequent crop rotation.
- Control invasive plants.
- Implement alternative pest control with biopesticides.
- Apply proper fertilization and maintain well-nourished plants.

Beyond Cotton | WFP World Food Programme Centre of Excellence against Hunger | IBA Brazilian Cotton Institute | ABC Brazilian Cooperation Agency | Ministry of Foreign Affairs | Brazilian Government Brasil Uniting and Rebuilding