Feed the Future Tanzania Kilimo Tija Activity

Technical Bulletin: Integrated Pest Management

INTRODUCTION

Pest damage continues to undermine crop yields and food security for many smallholder farmers in Tanzania. While pesticides provide temporary relief, their excessive use can negatively impact health, the environment, and pest resistance over time. Integrated Pest Management (IPM) offers a more sustainable solution.

IPM combines different approaches to prevent and monitor pests, reducing reliance on chemicals. It uses cultural practices, mechanical techniques, biological control, and responsible pesticide application to keep pest levels below significant thresholds. This protects crops while preserving biodiversity and natural pest control systems.

This bulletin offers practical guidance for smallholder farmers to implement IPM strategies tailored to key crops. It covers IPM techniques, their benefits, and proven practices to optimize adoption at the field level. The aim is to improve farmer skills in ecological pest management as a means to sustainably increase productivity and profitability, while minimizing environmental impact.

Figure 1: A farmer in Morogoro inspects his tomato crop for signs of pests or disease.
Photo: Fintrac Global Inc.

BENEFITS OF INTEGRATED PEST MANAGEMENT

Transitioning to IPM can provide multiple benefits for smallholder farmers:

- **Minimized Pesticide Use:** IPM curtails blanket pesticide application through techniques tailored to actual need, reducing associated health risks and environmental pollution.
- **Enhanced Biodiversity:** Conservative biological control and reduced chemical usage preserves natural enemy populations and overall agroecosystem diversity.

- **Improved Resilience:** The diversified strategy of IPM equips farmers to better manage pests under changing climatic conditions and anomalies.
- **Lower Costs:** Though IPM has some upfront costs, the total economic burden is often reduced in the long-term compared to sole reliance on chemicals.
- **Increased Know-how:** The data-driven approach of IPM improves farmers' understanding of pest ecology for more informed decision making.
- **Food Safety:** Prudent pesticide use ensures agricultural produce meets stringent maximum residue levels, which results in safer food and more marketable produce for higher prices.
- **Sustainability:** IPM principles and practices pave the path to resilient and economically viable crop production for the future.

KEY COMPONENTS OF IPM

Integrated pest management incorporates the following control techniques:

Biological Control – Is the use of natural enemies, predators, parasites, and pathogens, to control pests, including:

- Introducing natural predators and parasites to attack target pests.
- Releasing sterile insects to disrupt pest mating and reproduction. Effective for flies and moths.
- Applying microbial biopesticides like Bacillus thuringiensis to suppress pest larvae.
- Protecting natural enemy habitats like hedgerows and flowering plants that provide food sources.

Figure 2: Cultural practices can be used to control meal bugs, pictured here on papaya.
Photo: Fintrac Global Inc.

Specific examples of ***biological control*** include:

- Releasing parasitic wasps to control leafminer flies in vegetables like spinach and beets.
- Introducing predatory mites to manage spider mites on eggplant and tomatoes.
- Applying entomopathogenic nematodes to suppress soil-dwelling pests like cabbage maggot.
- Encouraging lacewing populations to prey on aphids in cole crops by providing flowering plants.

Cultural Practices – Make the environment less hospitable to pests by adjusting farming practices:

- Crop rotation and intercropping to disrupt pest cycles and enhance biodiversity.
- Adjusting planting date to avoid peak pest infestations. Early or late planting can evade damage.
- Cultivating and weeding to remove alternate pest hosts and destroy egg masses.
- Pruning and destroying infested plant parts or fallen fruit to prevent spread.
- Using pest-resistant and tolerant varieties adapted to local conditions.

Specific examples of ***cultural practices*** include:

- Use reflective mulches to deter aphids from lettuce and other leafy greens.
- Prune and discard diseased papaya branches to prevent the spread of anthracnose.

- Rotate tomato fields with cereals to disrupt nematode and wilt disease cycles.
- Time sweet pepper planting to avoid peak potato tuber moth damage.

Chemical Control – Is the judicial use of pesticides to control pests, but only as a last resort and in minimal quantities. Activities include:

- Applying biorational pesticides derived from natural materials as an alternative to synthetics.
- Spot treating affected parts instead of blanket application to minimize quantity.
- Alternating chemical modes of action to prevent resistance.
- Using lower toxicity products approved for organic farming.

Specific examples of ***chemical control*** include:

- Spot spray horticultural oils and soaps on cucurbit downy mildew infections.
- Apply granular bacillus-based biopesticide for beetle larvae control in onions.
- Use pheromones for mating disruption of tomato pinworm moths.

Figure 3: Pheromone traps can help trap fruit flies and other pests.
Photo: Fintrac Global Inc.

Monitoring – The routine surveillance of pest populations to determine whether action is required.

- Scouting fields weekly to assess pest numbers and natural enemy prevalence.
- Setting up pheromone traps for early detection of insect pests.
- Tracking pest development stages to determine optimal intervention timing.
- Recording data to estimate damage levels versus established thresholds.

Specific ***monitoring*** examples include:

- Scout melon fields weekly for signs of fungal diseases and insect egg masses.
- Monitor orchards for fruit fly populations using traps baited with food attractants.
- Check underside of brassica leaves for eggs of diamondback moths.
- Inspect passion fruit vines for scale insect colonies and natural enemies present.

PRE-PLANTING IPM PRACTICES

A strong IPM foundation is established before crops even enter the ground through a combination of the following techniques:

Site Preparation

- Deep plow fields to disrupt pest habitat, expose larvae and pathogens to sunlight, and improve drainage.
- Construct raised beds and maintain drainage channels to mitigate flooding that spreads soilborne diseases.
- Remove or burn crop debris and weeds to eliminate sources of pest and disease carryover.

Resistant Varieties

- Select disease-tolerant, heat-adapted and pest-resistant seed hybrids and seed varieties suited for target regions.
- For perennials, graft desirable scions onto vigorous, resistant rootstocks to protect fruits.

Crop Rotation

- Rotate between botanically unrelated crops to break pest and disease cycles.
- Include pest-suppressing cover crops like legumes in the rotation.
- Practice long rotations of 3+ years for persistent pests and pathogens.

Barriers

- Install physical barriers like trenches or metal sheets to prevent entry of crawling insects.
- Use plastic mulch as a barrier against aphids and other flying pests.
- Maintain guard rows of pest-repellent plants around fields to intercept pests.

Seedling Protection

- Cover nurseries with fine insect netting to exclude virus-transmitting vectors.
- Apply biological treatments like Bacillus thuringiensis to control larvae.
- Weed-out diseased seedlings to avoid transplanting sources of inoculum.

Figure 4: Fall army worms are a prevalent pest in Tanzania that can be controlled with IPM techniques.
Photo: Fintrac Global Inc.

POST-PLANTING IPM PRACTICES

Diligent monitoring and timely interventions after crop establishment are critical elements of IPM. A combination of the following practices should be used for best results:

Scouting and Monitoring

- Scout fields frequently (2x/week) to identify pests and diseases for targeted control.
- Install pheromone/food traps for early detection of insect pests like fruit flies.
- Track soil moisture levels and drain excess water to avoid fungal/bacterial diseases.

Rapid Disease Management

- Immediately remove and destroy virus-infected plants to prevent further spread.
- Prune diseased branches and foliage to restrict spread of fungal/bacterial pathogens.

Selective Pest Control

- Release parasitoid wasps or predatory mites for biological pest suppression.
- Apply biorational pesticides like neem oil to avoid pre-harvest chemical residues.
- Handpick and destroy large visible larvae and adult insect pests.

Pre-Harvest Protection

- Wrap/bag individual fruits to create physical barrier against pests.
- Use kaolin clay sprays to deter pests and sunburn on maturing fruits.
- Rotate between pesticide modes of action to mitigate resistance.

Postharvest Sanitation

- Eliminate crop debris immediately after harvest to remove pest refuge sites.
- Adjust soil pH in planting holes using lime/ash to suppress soilborne pathogens.

ACCESSING IPM RESOURCES

The following institutions and service providers serve as invaluable repositories of IPM knowledge, products, and applications for smallholder farmers:

- **Agricultural Extension** – Government extension officers provide localized training, materials, and field support on IPM principles and practices.
- **Research Institutes** - Leading centers like the International Institute of Tropical Agriculture (IITA), national agricultural research systems and local universities conduct studies on IPM and extensions.
- **NGOs** - International and local non-profits (e.g., CropLife, Farm Africa) offer training, demo plots, input materials, and guides.
- **Input Suppliers** - Agrodealers trained in IPM can provide pest monitoring tools, biopesticides, and advice on proper use.
- **Cooperatives & Associations** - Farmer groups involved in IPM production and peer learning are accessible sources of knowledge.
- **Private Sector** - Agricultural companies can provide IPM technical support and resources as part of service packages.
- **Online Resources** - Credible websites offer free manuals, case studies and e-learning on various IPM approaches.

Figure 5: This picture shows damage done by Thrips to an African Eggplant leaf. Thrips can be controlled naturally through biological control measures, such as use of predatory insects.
Photo: Fintrac Global Inc.

CONCLUSION

Transitioning to IPM represents an important shift away from reliance on pesticides alone toward more proactive, integrated approaches that strengthen the farm's natural defenses. IPM considers the whole system - productivity, profitability, health, environment - for well-rounded sustainability. The range of techniques allows flexibility based on local conditions and needs. Progress requires collaboration among farmers, government, researchers, and partners to realize IPM's potential. With proper training and support, IPM can be broadly adopted with a goal of widespread implementation that will lead to more sustainable agriculture practices across Tanzania.