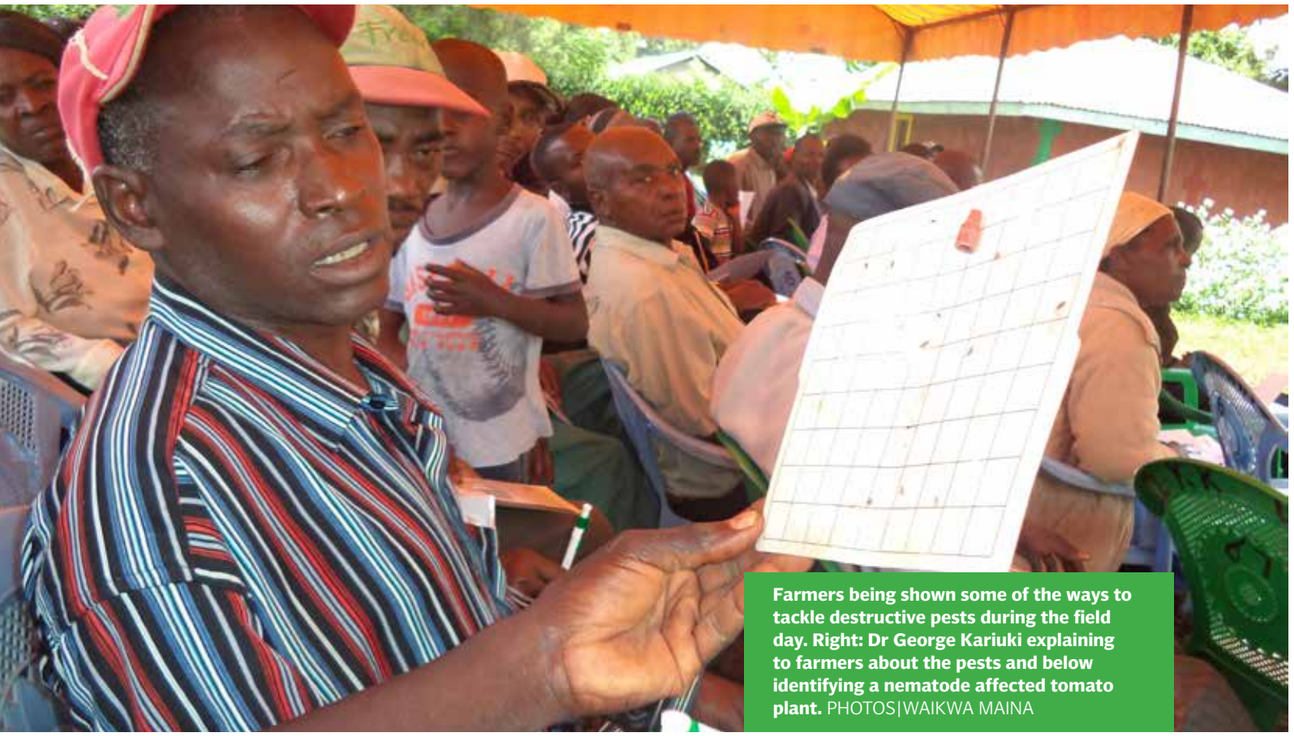
## Pest Management



Farmers being shown some of the ways to tackle destructive pests during the field day. Right: Dr George Kariuki explaining to farmers about the pests and below identifying a nematode affected tomato plant. PHOTOS|WAIKWA MAINA

# Crops need healthy roots, and a 'Trianum' boost is the answer

BY WAIKWA MAINA

For a long time now, Fusarium and other soil-borne pathogens such as Pythium, Rhizoctonia and Sclerotinia, have wreaked havoc on farms across the country, defying even the best pesticides, which largely work above the soil surface.

This has been the cause of failed harvests and heavy losses, as many unhappy farmers have watched their crops yellow, dry up and wither in the fields.

Lying at the foot of Mount Kenya, Kirinyaga County is the leading producer of the open-field tomato, accounting for 14 per cent of the crop's production in Kenya. However, farmers in the county have been having sleepless nights, thanks to the notorious crop pests that have been destroying the bulk of their crops.

That is why in April, during a field day organised by Koppert Biological Systems, a Dutch company, and Kenyatta University, the farmers, who came in droves, were more than eager to follow the events on Kariithi Farm in Kimbimbi Township, off the Mwea-Embu road.

They had come to learn about integrated pest management.

Last year, Koppert and Kenyatta University were awarded a Food and Business Applied Research Fund (ARF) grant for a project entitled, 'Development, Validation and Dissemination of Integrated Pest Management Packages for Tomato Leaf Miner (Tuta absoluta) and Fusarium wilt-root Knot Nematode Complex Affecting Tomato Production in Kenya'.

The three-year project, which started in August 2015, aims to introduce Integrated Pest Management (IPM) practices to smallholders through on-farm demonstration trials and Farmers' Field Schools (FFS).

"We have embarked on a programme to ensure that both large and small-scale farms are free from the pests, which are a real threat to farmers, with long-term environmental implications due to the overuse of chemicals to fight them," says Mr Evans Wafula, a researcher at Koppert.

Dr George Kariuki, a lecturer at Kenyatta University's School of Agriculture and Enterprise, and chairman of the University's Department of Agricultural Sciences and Technology, says fighting pests with only chemicals has not been successful and has adversely affected crop production. Besides, he adds, international markets are increasingly shunning crops nurtured on chemicals, preferring those grown on biological pest control methods.

"Overuse of chemicals has had a negative impact on food production. We have registered decreased production in many crops as a result of pollinators being killed by the chemicals. This has also affected our international markets," says Dr Kariuki.

In the three-year programme dubbed, 'Salvaging Tomato Production in Kenya Through Sustainable Management of Pests and Disease, Koppert will use a combination of natural methods of controlling pests called the Integrated Pest Management (IPM), which includes the use of bio chemicals, pest predators and traps.

This method involves the use of simple biological approaches that are neither harmful to the soils nor the environment.





### Understanding Nematodes and Fusarium Wilt

If plants were human beings, then their mouths would be their roots and the soil their dinner table. Water and nutrients would be their food. Imagine someone covering your mouth for days, giving you little or no chance to eat or drink! You would die of starvation and thirst.

This is what happens when soil-borne pathogens such as Fusarium – notorious fungi often confused with Root Knot Nematodes, attack a plant from the root and rapidly move up, clogging water-conducting tissues in the stem before starving the plant to death. The result is a ruined crop of Fusarium-prone plants such as tomato, potato, pepper, and eggplant.

Many farmers confuse soil-borne pathogens such as Fusarium with nematodes. But according to Dr Kariuki, they are different but interlinked. Nematodes weaken the roots, making them more vulnerable to other soil-borne pathogens such as Fusarium.

"Nematodes attack and eat plant roots, weakening the plant. Fusarium and other soil-borne pathogens are more vicious and destructive when a farm is already infested with nematodes. The weakened plants allow the harmful fungi to spread easily and faster," says Dr Kariuki.

### Nematodes

- They can't be seen with the naked eye. They are microscopic roundworms that live in dirt and attack and eat the roots of plants, causing damage and death or reduced production. The knots prevent water and nutrients from getting to the leaves and fruits.
- They can be spread through ground irrigation. If a farmer in the upper part of the irrigation system or water tributary fails to address the problem, it ends up spreading downstream, Dr Kariuki warns.
- In tomatoes, they survive by feeding directly off nutrients pumped through the roots, forming galls that can reach up to an inch wide. They hide here and reproduce and can attack right from the nursery or after transplant.
- They appear in soils where tomatoes and other host plants have been grown in the last three to five years, and their populations increase the longer an area is used.
- **Symptoms:** Include withering of plants, fewer plant roots than normal, stunted growth, yellowing leaves, thinning plants, damage in patches and premature wilting.
- With any suspicion of infection, soil testing should be done. Before applying any chemicals or pesticides, farmers should first be sure about what they are treating.

### Prevention

- Soil solarisation reduces nematode populations and eliminates weeds. Lay a transparent plastic sheet over moist soil in the planting bed. Then anchor the sheeting with bricks or boards. Leave for six to 12 weeks.
- Rotate crops of a similar variety. For example, since tomatoes are nightshades, others such as pepper and eggplant must be rotated.
- Plant clean materials sourced from qualified seed and seedlings breeders.
- Destroy all plant debris after harvest.
- Destroy infected plants as soon detected.
- Plants should be well-fed and irrigated.
- Add organic matter to the soil to make the water and nutrients more available to the plants. Healthier plants will tolerate more nematode damage.
- Weed control also helps to control nematodes.

### Fusarium Wilt

- A disease caused by a fungus that lives in the soil.
- The fungus moves up through the plant roots, clogging water-conducting tissue in the stem.
- Affected plants produce very few tomatoes, before dying.
- **Symptoms:** yellowing and wilting on one side of the plant, a leaf, single shoot, branch, or several branches.
- Yellowing moves up the plant as the fungus spreads, leading to drying and dropping of immature leaves. The interior of the main stem when split shows discoloured streaks from plugged water-conducting tissue.
- Attacks at any stage in a tomato plant's growth, but symptoms are most common right after tomato blossoms appear.

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- Best in temperatures between 70º-90ºF and wet weather, which allows it to spread more easily.
- Plants in poorly drained soils are more susceptible to infection. Wet soils allow the fungus to multiply and move up through the tomato plant's water-conducting tissue.
- According to Dr Kariuki, there is no chemical treatment for the disease.

### Prevention

- Destroy infected plants once discovered.
- To slow down the disease, farmers must retain a soil pH of between 6.5 and 7.0.
- Practise crop rotation and ensure that tomatoes are planted not more than once every four years in the same spot. Fusarium can survive indefinitely in the soil.
- Do not plant other solanaceous crops such as potato, pepper, and eggplant in the same area, since they are also prone to fusarium attacks.
- Choose disease resistant tomato seed varieties, or source for clean planting materials or seedlings.
- Plant tomatoes in well-drained soils.

### Prevention with Trianum, the effective biological weapon

Trianum, a trade name of Koppert's hybrid strain of Trichoderma Harzianum, is a bio-friendly fungus that is best suited to counter disease-causing soil-borne fungi.

When the fungus is applied; its vegetative part grows, creating a protective cover over to keep out soil-borne pathogens such as Fusarium.

"Following the application of Trianum, it develops mycelia, which grow aggressively along with the developing root system," says Ms Purity Kabura of Koppert.

Trianum starves pathogens by quickly absorbing what attracts them to the roots – any fluids or cells that seep out. The fungus produces enzymes that break down the pathogen's cells.

"A healthy plant starts with a healthy root system. Once Trichoderma spores in Trianum quickly establish themselves in the roots, ensuring that harmful fungi have no chance to establish themselves," says Dr Kariuki.