Productivity and Growth in Organic Value Chains (ProGrOV)

Management of the tomato leaf miner T. absoluta – alternatives to insecticides

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Delta Pheromone Traps with a sticky liner: T. absoluta monitoring.

Netting materials used.

Introduction

Insect pest are heavily affecting agriculture production and productivity, management of the pests varies from chemical, physical, mechanical to biological. Studies report a reliance on synthetic pesticides application on pest management by the majority of small scale farmers. Like other farmers in developing countries, tomato farmers in Tanzania heavily rely on the routine application of pesticides to manage pests and diseases in tomatoes, other horticultural crops and cereals. Farmers use various pesticides as a quick control measure. Many synthetic chemicals are effective and fast acting, when properly used. But inappropriate use and lack of approved insecticides lead to resistance development in T. absoluta, pest resurgences, secondary pest occurrences and elimination of natural enemies. Furthermore, pesticide reliance and overuse results in health risk to the farmer handling the pesticide, pesticide residues on crop, increased production costs, as well as risk for the environment. Tomato is the main source of income for farmers to sustain their living in tomato growing areas in Tanzania. However, increasing tomato yield losses due to T. absoluta could threaten tomato farmers' livelihoods, and already now some farmers are beginning to replace tomatoes with other crops.

This study involved two parts, interviews and questionnaire surveys on tomato production practices and a field experiment testing the efficacy of the management practices on tomato productivity. The aim of this study was to contribute to the understanding of the pest problems caused by T. absoluta and to provide solutions to minimize the losses caused by the pest on tomato productivity amongst smallholders testing the environmental friendly methods that will reduce the use of synthetic pesticides in tomato production.

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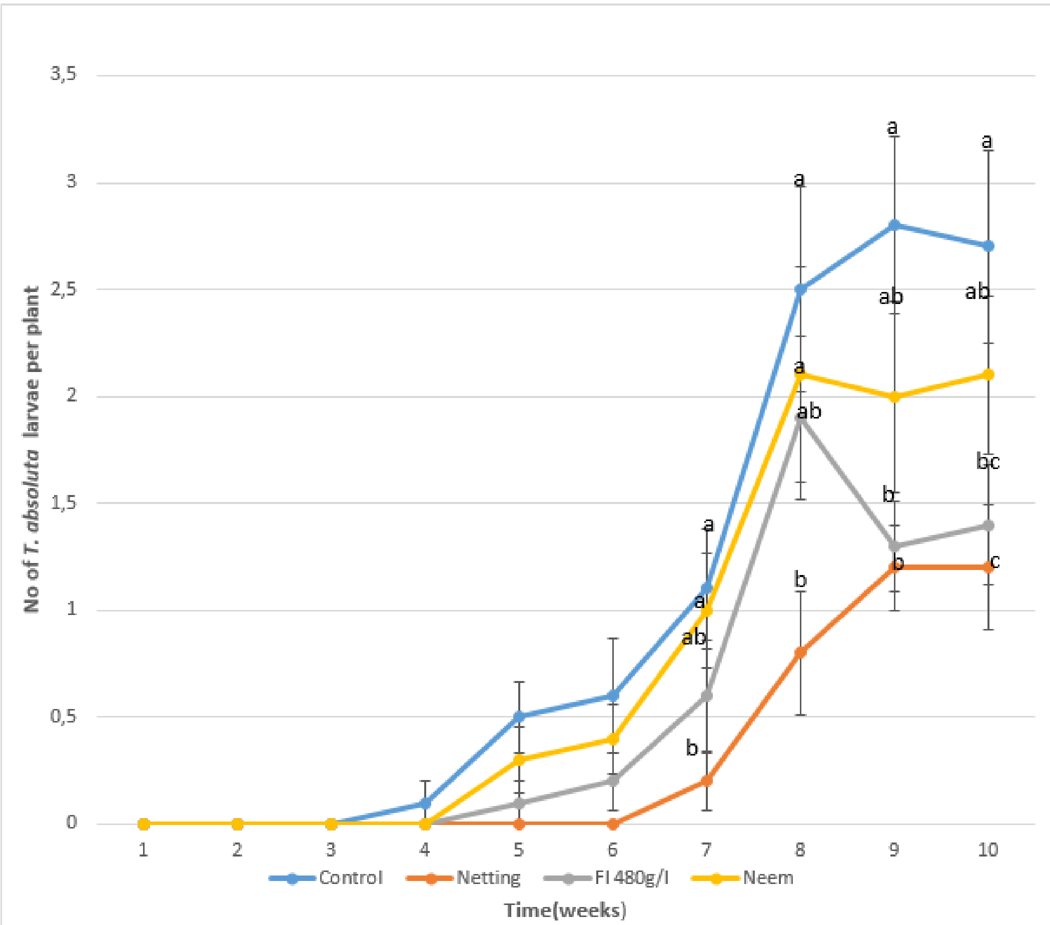
Study setup

This study involved 75 questionnaires from 25 respondents in each of the three study areas Doma, Wami-Dakawa and Kipera respectively at Mvomero district to assess farmers' perception and knowledge of T. absoluta as a tomato pest. The field experiment was a randomised complete block design (RCBD) with four treatments, neem extract, netting, an insecticide flubendiamine 480g/l and a no treatment control with five replications. The experiment included two sites (Kipera and Wami-Dakawa) at Mvomero District in Morogoro region Tanzania aiming to quantify losses associated with Tuta absoluta on tomato and evaluate the effectiveness of selected management techniques against Tuta absoluta and other pests of tomatoes. Sampling and collecting the pests were done weekly after transplanting by scrutinizing ten plants from the middle two rows of each plot from the 20 experimental plots. Harvesting of the tomatoes was done during the pink stage. Fruits were harvested plot by plot and the fruits number per plant were recorded in a labelled polyethene bags, weighed and assessed as marketable or non-marketable based on surface blemishes, insects and diseases damages displayed.

Treatments impacts on insect pests populations

Netting treatment significantly recorded the smallest population of tomato leaf miner larvae, T. absoluta (figure 1) and there were no significant differences between netting and other treatments to the pests, whiteflies, aphids and noctuids. Though netting recorded the highest populations of spidermites.

Figure 1: Average number of T. absoluta larvae recorded per plant in different treatments



Mean (±S.E) number of T. absoluta larvae recorded per week in different treatments, means followed by the same letter are not significantly different according to Duncan's new multiple range test (DMRT, P=0.05) (F (27, 355) = 2.068, p=1.68e-3).

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Impacts of treatments on yield and yield attributes

Netting recorded the highest average fruit weight and significantly different to neem and not significantly different to flubendiamine 480g/l. Though there was a significantly few number of total fruits per plant in netting as compared to other treatments (table 1).

Table 1: The mean weight (± S.E) of total fruits, marketable fruits, average fruit weight and the means numbers (± S.E) of total fruits per plant and number of marketable fruits harvested to treatment impacts; % total loss represents a total number of of fruits per plant with any damage.

	Dependent variable: yield						
	Av. fruit weight (g/fruit)	Total fruit weight (g/plant)	Marketable fruit weight (g/plant)	Total fruits per plant	No of marketable fruits per plant	Total % Loss	% Loss by *T. absoluta*
Netting	61.08^{a} (1.40)	1673.32^{a} (126.00)	991.39^{a} (96.94)	27.40^{b} (1.92)	17.20^{b} (1.56)	37	7
Flubendiamine 480g/l	57.28^{ab} (1.29)	1971.36^{a} (153.59)	1254.24^{a} (125.64)	34.40^{a} (2.36)	21.90^{ab} (2.11)	36	12
Neem	56.09^{b} (1.36)	2006.41^{a} (104.60)	1327.48^{a} (70.08)	35.60^{a} (1.58)	23.60^{a} (1.03)	33	15
Control	49.54^{c} (1.71)	1139.65^{b} (65.20)	465.92^{b} (26.25)	23.10^{b} (1.26)	9.40^{c} (0.40)	60	24
$F_{(3,38)}$	24.01	6.05	8.60	4.35	5.39		
P-value	1.82e-05	0.02	0.006	0.04	0.03		

Note: Means followed by the same letter in the column are not significantly different according to Duncan's new multiple range test(DMRT, P=0.05)

Treatments cost effectiveness

Among the treatments, netting showed less return as compared to other methods (table 2).
Since the netting materials can be used for more than one season, the production cost will become less in the preceding production seasons.

Table 2: Estimates of the cost used by selected methods per one acre

Control method	$Cost (acre)	$yield	$Cost differential
Netting	3900000 TZS (1770$)	5600000 TZS (2545$)	1700000 TZS (770$)
Flubendiamine 480g/l	4100000 TZS (1863$)	6200000 TZS (2818$)	2100000 TZS (950$)
Neem	3200000 TZS (1454$)	6500000 TZS (2954$)	3300000 TZS (1500$)
Control	1600000 TZS (680$)	2700000 TZS (1231$)	1100000 TZS (500$)

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Conclusions:

- The netting material 0.9 mm mesh size was effective in reducing the population of tomato leaf miner 'T. absoluta'
- The selected management strategies of netting and neem both significantly increased tomato yield in comparison to the no treatment control and were not significantly different from the insecticide treatment
- The cost differential of neem is greater than insecticides, and the netting would come to overcome the insecticide in the preceding season, and the treatments are less harmful to environment and posing less risk to farmers health than insecticide.

Recommendations:

- To effectively manage T. absoluta, detection of the presence and monitoring of the pest population by pheromone traps is important for early warning and making a judicious decision of the use of the pest control.
- Small scale tomato farmer shoulder consider using the netting materials as part of the management strategy as an environmentally friendly method to control the pests and enhance yield and quality products. But they need to find a method to allow pollinators for example by removing netting parts of the day or during main flowering, or by inclusion of pollinators under the net.
- To improve the efficacy, the netting materials may be treated with an insecticide which could check the populations of pests and other species like spider mites that are not controlled by physical exclusion, but this would require further study.
- If the netting materials are occasionally opened at certain points of the day to allow pollination, the crop may be treated by eco-friendly means such as the use of neem extract to prevent pest infestation.
- Further studies/researches are needed in different agro ecological zones using different net mesh sizes including both insecticide treated nets and untreated nets to check the impacts on managing the pests of tomato and possibly their influences on pollinators and natural enemies.

Partners

Aarhus University, Denmark
University of Copenhagen,
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Makerere University, Uganda
University of Nairobi, Kenya
Sokoine University of Agriculture, Tanzania
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Associated partners

National Organic Movement of Uganda (NOGAMU)
Kenya Organic Agriculture Network (KOAN)
Tanzania Organic Agriculture Movement (TOAM) Project

Further reading

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For more information, please visit

http://icrofs.dk/en/research/international-research/progrov/

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