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Evaluation of Integrated Management Practices of South American Tomato Leaf Miner *Tuta absoluta* in Tomato

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ABSTRACT

Tomato is grown in an area of 36000 ha in Chittoor district of Andhra Pradesh. South American tomato leaf miner, *Tuta absoluta* has become major pest in tomato growing areas causing 50-60% damage. Even though pest damage starts from seedling stage, damage is not noticed by farmers till fruiting stage due to the pest feeding habit, and spraying chemicals repeatedly at this stage is of no use. Moreover, it causes environmental pollution and pesticide residual effects on consumers. Hence, an on-farm trial on integrated management of the *Tuta absoluta* was conducted during Rabi, 2020-21. The IPM practices included were installation of pheromone traps @ 25 per hectare; spraying neem oil @ 5 ml/l, twice @20 and 40 DAT and need based chemical sprays. In IPM plots, pest damage was low in crop grown under single row planting i.e., 9% followed by double row planting i.e., 12.6% whereas in farmers practice it was 21.5% and 24.3% in single row planting and double row planting respectively in crop planted during December, 2020. Crop planted during January suffered more than December planted cropi.e., in IPM plots it was 12.5% & 15.5% whereas in farmers practice it was 27.6 and 31.2% in single row planting and double row planting respectively. In December planted crop, Fruit yield of 54.2t/ha and 52.8t/ha was recorded in IPM and farmers practice respectively. In January planted crop it was 51t/ha and 49.5t/ha in IPM and farmers practice respectively. IPM along with planting of crop during December under single row method of planting found to be effective in managing the pest.

Key words : *Tomato, Tuta absoluta, Planting time, Planting method, IPM.*

Introduction

Tomato (*Lycopersicon esculentum* Mill.) is an important remunerative vegetable crop grown around the world and used as fresh produce and also for processing. It is the major vegetable crop grown in Chittoor district of Andhra Pradesh with an average area of 36,000 hectares. It is grown throughout the year in the district because of availability of marketing facilities in western part of the district. Crop is mainly affected by abiotic stresses like heavy rainfall from August to November months, biotic stresses like insects and diseases throughout the year. Insect pests *i.e., Helicoverpa armigera* and *Spodoptera litura* incidence on tomato is comparatively low in the district with yield losses ranges up to 3-5% only. But

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from the past few years, the South American Tomato leaf miner, *Tuta absoluta* (Meyrick) (Gelechiidae: Lepidoptera), a very harmful leaf mining moth with a strong preference for tomatoes causing 50-60% yield losses for the tomato growers. *Tuta absoluta* which isoriginated from South America was first detected outside South America in 2006 and it is now distributed in most tomato-growing areas in Europe, Africa and Asia.Since its detection, it has become the most serious pest causing severe yield losses in tomato in many areas (Germain *et al.,* 2009). However, this pest has not been reported in China, which is the largest tomato producing country worldwide (Han *et al.,* 2018). The fast spread of the pest may possibly be enhanced by trade, porous borders and fragile nature of the phytosanitary infrastructure coupled with inadequate implementation of quarantine measures (Tonnang *et al.,* 2015).

In India, the pest was first reported during 2014 in IIHR, Bangalore, Karnataka (Sridhar *et al.,* 2014) and subsequently in other tomato growing states of India like Gujarat, Andhra Pradesh, Telangana and Tamilnadu. The principal host plant was tomato, but also this pest attacked potato, eggplant, Jimson weed (*Datura stramonium* L.) and *S. dubium* Fresen in the family Solanaceae, and broad bean (*Vicia faba* L.) and alfalfa plant (*Medicago sativa* L.) in the family Fabaceae (Mohamed *et al.,* 2015). The pest with itshigh reproductive capability, short life cycle and multi voltine nature is known to cause damage throughout the entire growth period of tomatoes and becoming a serious threat to tomato production (Potting 2009). The tomato leaf miner can cause crop losses up to 100% and it is considered a key pest of greenhouse and open-field tomato (Arturo *et al.,* 2012).

The pest cause damage from seedling stage to harvesting stage. After emergence the larvae mines the leaves producing large galleries and both caterpillars & their black fross can be seen in the mines of the leaves. Fruits infested by larvae will have pinholes especially at calyx. Even though damage is seen throughout the year it is more prominent during *rabi* season. Farmers failed to observe the damage up to fruiting stage because of its feeding habit and they often confuse the leaf damage symptoms with late blight disease, as late blight disease is also a major disease during *rabi* season. Farmers are able to observe fruit damage and subsequently adopting chemical control measures to manage the pest but, by that time the pest is causing substantial yield losses to the growers. However, insecticides are also partially successful because of endophytic behavior of larvae (Silva *et al.,* 2011). Integrated Pest management is an effective management option and is vital to global crop protection, sustainable agriculture and improved public health (IRAC, 2014).

Prophylactic tools are effective and ecofriendly and there is a need to reduce the use of insecticides (Cherif *et al.,* 2013). In this connection, a trial was conducted to create awareness about the pest in the district and to assessthe impact of integrated management practices in managing the pest below ETL.

Materials and Methods

T1: Integrated pest management includes

- Installation of pheromone traps @25 per hectare
- Spraying of azadirachtin 10000ppm @2 ml/l of water
- Spraying of spinoteram 11.7SC @0.8 ml or spinosad 45% SC @0.3 ml/ l of water

T2: Farmers practice (Spraying of insecticides)

Trial was conducted in KVK, Kalikiri operational area during *Rabi*, 2020-21 in 10 locations. An area of one acre considered as unit at each location and data on pest incidence was recorded from seedling to harvesting stage. Five sampling units were selected in one acre field. In each sampling unit randomly five plants were selected and data on number of leaves infested and total number ofleaves in each plant was recorded. Similarly, on each planttotal number of fruits and number of fruits infested with tomato leaf miner were recorded. Data on pest incidence was recorded in crop planted during 2nd week of December and 2nd week of January in two types of planting *i.e.,* double row method of planting and single row method of planting.

Pheromone traps @ 25 per hectare were kept on the day of planting to monitor the pest incidence. Traps adjusted to 30cm above canopy height and ¾ of the trap was filled with water and insecticide to arrest escape of trapped moth. Lures were changed at 45days interval and data on no. of moth catches per trap was recorded till harvesting.

Results and Discussion

The data from Table 1 revealed that the pest damage was started from seedling stage and continued till harvest in IPM and farmers practice. There is signifi-

cant difference between IPM and farmers practice in both double row planting and single row planting. IPM with single row planting recorded much lesser damage (9.0%) than other practices. Damage was higher at fruiting stage in both IPM and farmers practice and it was lower during seedling stage. Highest damage of 32.9% was recorded in farmers practice during fruiting stage followed by vegetative stage (32.1%) in double row planting. The damage was higher in farmers practice with double row planting (24.3%) followed by farmers practice with single row planting (21.5%). Mateus *et al.,* 2021 reported that *Tuta absoluta* life cycle extended at low temperatures and females are also fertile at very low temperature of 4 ºC. Nayana *et al.,* 2018 reported higher incidence of the pest during *Rabi* than *Kharif* and management should be initiated in the early stage of the crop to avoid buildup of the pest in the later growth stages. Karut *et al.,* 2011 reported slow increase of the pest from seedling to fruiting stage. Shiberu and Getu 2018 reported that use of botanical extracts of neem or *Allium sativum* L. caused more than 70% of *T. absoluta* larval mortality.

From Table 2 it is revealed that crop suffered more during seedling stage in both IPM and farmers practice. There is significant difference between IPM and farmers practice in both double row planting and single row planting. Highest damage was recorded in farmers practice with double row planting (31.2%) followed by single row planting (27.6%). Lowest damage was recorded IPM under single row planting (12.15%). High plant population in double row planting might be created congenial climate for build-up of the pest leading to more damage than single row planting.

In IPM plots two sprayings were done to manage the pest based on pheromone trap catches and pest incidence whereas it was five in farmers practice during entire crop growth period. Pheromone trap catches revealed peak incidence of the pest from November to January months and thereafter trap catches were reduced and subsequently pest dam-

Table 1. Percent damage by the pest in crop planted during December, 2020

Crop stage	IPM		Farmers practice	
	Double row planting	Single row planting	Double row planting	Single row planting
Seedling stage	8.9	5.9	7.3	11.2
Vegetative stage	10.9	8.3	32.1	23.2
Flowering stage	14.3	11.4	24.9	21.4
Fruiting stage	17.9	10.5	32.9	30.3
Mean	12.6	9.0	24.3	21.5
SD	3.76	2.45	11.89	7.88
't' value	1.255*	1.881*		
'p' value	0.004	0.0023		

*Significant at 5% level

Table 2. Percent damage by the pest in crop planted during January, 2021

Crop stage	IPM		Farmers practice	
	Double row planting	Single row planting	Double row planting	Single row planting
January planted crop				
Seedling stage	20.5	15.8	45.6	33.2
Vegetative stage	22.9	18.3	35.9	32.6
Flowering stage	12.6	9.2	22.3	20.4
Fruiting stage	6.2	5.3	19.3	16.3
Mean	15.55	12.15	31.2	27.6
SD	7.63	3.95	8.67	8.56
't' value	2.111*	1.804*		
'p' value	0.007	0.003		

*Significant at 5% level

age was also reduced. Taha *et al.,* 2013 reported that fruit damage was significantly reduced after mass trapping of males with water traps. El-Aassar *et al.,* 2015 reported that spinosad found to be effective in controlling the larvae and reduced leaf and fruit damage effectively. Retta and Berhe 2015 suggested that pheromone traps of *Tuta absoluta* not only used for monitoring but also to control the population through mating disruption and male annihilation techniques. In contrary to above, Nayana *et al.,* 2018 reported that *Tuta absoluta* density increased with the age of crop.

Table 3. Economics of December planted crop

S. No	Character	IPM	Farmers practice
1	Cost of cultivation (Rs/ha)	235000	242000
2	Yield (t/ha)	54.2	52.8
3	Gross income (Rs/ha)	433600	422400
4	Net income (Rs/ha)	198600	180400
5	B:C ratio	1.84	1.74

From Table 3 it is revealed that in December planted crop, IPM plot recorded higher yield of 54.2t/ha whereas farmers practice recorded 52.8t/ha. High B:C ratio of 1.84:1 was also recorded in demo plot than farmers practice, *i.e.,* 1.74:1. Abdelmaksoud *et al.,* 2020 reported that pheromone traps and insecticides sequential application was more effective in reducing pest damage and recorded higher yield, net profits than control.

Table 4. Economics of January planted crop

S. No .	Character	IPM	Farmers practice
1	Cost of cultivation (Rs/ha)	2,40,000	2,47,875
2	Yield (t/ha)	51.0	49.5
3	Gross income (Rs/ha)	4,08,000	3,96,000
4	Net income (Rs/ha)	1,68,000	1,48,125
5	B:C ratio	1.7	1.59

Table 4 indicates that IPM plot recorded higher yield than farmers practice (49.5t/ha). Net income of Rs.1,68,000/- and B:C ratio of 1.7:1 was recorded in IPM plot whichwas higher than farmers practice *i.e.* Rs.1,48,125 per hectare and 1.59:1 respectively.

It can be summarized that crop planted during December recorded higher yield than January planted crop. In both the times of planting IPM plot recorded higher yield than farmers practice. Ahammad *et al*., 2013 indicated that crop planted during December performed better with respect to yield and showed potential fruiting capability than February planting. Even though double row planting is economical but it is not suitable during winter season as it increases pest and diseases incidence which in turn increases cost of cultivation to the farmers. May and Valencia 1990 reported that hybrids with high yield potential planted in single row method yielded as equal to double row planting.

Conclusion

Integrated pest management found to be effective in managing the pest and it is the best option to manage the pest as chemical control alone is not effective because of its feeding habit. Awareness has to be created among farming community about the pest damage and its management by capacity building programmes and field demonstrations. Pest damage was low in single row method of planting than double row method both in IPM and farmers practice and it can be included as one of the IPM practice to control the pest.

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