Experimental Analysis of Ecomomic Action Level of Tomato Leafminer, *Tuta absoluta* Meyrick (Lepidoptera: Gelechiidae) on Tomato Plant under Open Field

Tadele Shiberu* and Emana Getu

Department of Zoological Sciences, College of Natural and Computational Sciences, Addis Ababa University, Ethiopia

***Corresponding author:** Tadele Shiberu, Department of Zoological Sciences, College of Natural and Computational Sciences, Addis Ababa University, Ethiopia, Tel: +251920839476; E-mail: tshiberu@yahoo.com

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Abstract

Tomato leafminer, *Tuta absoluta* (Meyrick) is considered to be one of the major pests of tomato crop in Ethiopia. In tomato, economic impact is caused by larval which feeding leaves and fruits. Information on tomato leafminer economic injury levels (EILs) and economic thresholds (ETs) is relatively limited. Studies were conducted during 2015 to 2017 to determine EILs and ETs on open field is required for more effective management. The results from the current studies significant ($P<0.05$) differences were observed among the treatments during the study periods. *T. absoluta* was highly infested the untreated control as compared with protected treatment. The mean value of marketable yield loss to the cost of insecticide application at one larva/plant was 3.61% and from untreated control was obtained 77.91% during 2015/16. Similarly, during 2016/17 at one larva/plant and untreated control marketable yield loss were observed 5.57% and 81.61%, respectively. The highest yield loss was observed at unsprayed control absoluta

Benefit cost ratio (BCR) was worked out as the ratio of the value of yield saved to the cost of insecticidal application. Standard chemical

Figure 2: Relationship between larval densities of *T. absoluta*/plant and yield loss in percent correlation coe f cient during 2015-2017 on f eld condition.

Economic threshold and economic injury level

A linear relationship between tomato yield and larvae of *T. absoluta* per plant was detected on f eld during 2015-2017. T ere was a signif cant linear relationship between larval infestation and marketable yield loss when tomato fruit and leaf were infested in larvae (Figures 2 and 3). T e correlation between the observed and predicted values of marketable fruit weight was calculated for each data set to assess the f t of the model. However, the economic injury level (EIL) is o f en expressed mathematically by the following formula:

$$EIL = \frac{C \times N}{V \times I}$$

Where:

"C" is the unit cost of controlling the pest (Birr/plant)

"N" is the number of pests injuring the commodity unit (number of pest/plant)

"V" is the unit value of the commodity (Birr/plant)

"I" is the percentage of the commodity unit injured (% loss)/plant

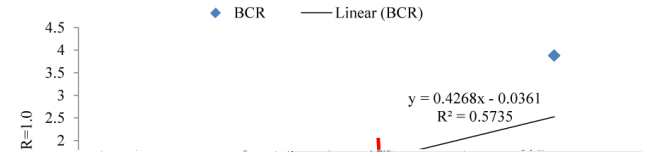

Figure 3: Relationship between larval densities and BCR under open f eld during 2015-2017.

From the above equations the EILs of *T. absoluta* larvae determined as three larvae during 2015-2017 (Figure 3). On the basis of means of two years, the EIL value was 3.82 larvae per plant under f eld conditions. T erefore, the economic threshold level was determined as 2.87 larvae per plant.

Data presented on Table 2 indicated that marketable yields per hectare were statistically signif cant P<0.05) di erent, a population density of one larva per plant caused 394.57 U.S dollar during 2015/16 which indicated 1,134.4 kg/ha yield losses. In 2016/17, one larva caused 569.45 U.S dollar which showed 1,637.16 kg/ha yield losses. T e control (unsprayed) treatments were caused 8,548.81 U.S dollar during 2015/16 which showed 24,577.84 kg/ha yield losses and 9,249.77 U.S dollar lost in 2016/17 which showed that 26,593.08 kg/ha yield losses were observed. T e criterion of selection of slope for economic injury level calculation was based on the worst-case scenario of yield loss per insect, i.e., the control unsprayed treatment (Table 3).

	Year I (2015/16)				Year II (2016/17)			
Treatments	**Marketable yield**	**Marketable yield loses**			**Marketable yield**	**Marketable yield loses**		
	(kg/ha)	**(kg/ha)**	**%**	**(US $/ha)**	**(kg/ha)**	**(kg/ha)**	**%**	**(US $/ha)**
T1	31,384.0a	---	---	---	32,643.0a	---	---	---
T2	30,249.6ab	1,134.40	3.61	394.57	31,005.84ab	1,637.16	5.75	569.45
T3	29,115.24abc	2,268.76	7.23	789.13	29,871.48abc	2,771.52	9.2	964.01

Treatments	Mean marketable yield	Mean yield loss		Value of yield loss (US$/ha)	Mean cost of insecticide (US$)	Mean labor charges (US$)	Other production cost (e.g. Fertilizer, land rent, transport, cost of marketing and distribution) (US$)	Total production cost (US$)	Total income (US$)	Net income (US$)	BCR
		(kg/ha)	(%)								
T1	32,013.50	-	-	-	1,552.17	1,865.65	6,803.91	10,221.74	11,135.13	913.39	-
T2	30,627.42	1,386.09	4.68	481.23	1,004.35	1,865.65	6,803.91	9,673.91	10,653.12	979.21	0.91
T3	29,493.36	2,520.14	8.22	876.57	821.74	1,865.65	6,803.91	9,491.30	10,258.56	767.26	0.93
T4	28,548.06	3,465.44	10.81	1,205.37	821.74	1,865.65	6,803.91	9,491.30	9,929.76	438.46	0.96
T5	27,035.44	4,978.06	15.51	1,731.50	730.43	1,865.18	6,803.91	9,400.00	9,403.63	3.63	1.00
T6	26,090.28	5,923.22	18.5	2,060.25	639.13	1,865.65	6,803.91	9,308.70	9,074.88	-233.82	1.03
T7	6,428.04	25,585.46	79.76	8,899.29	0.00	1,865.65	6,803.91	8,669.57	2,235.84	-6,433.73	3.88

T4	8**	8**
T5	7*	7*
T6	5	7
T7	0	0