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Assessment of Trap Crops for Management of Thrips, *T. tabaci* in Tomato

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ABSTRACT

The prospect of four trap crops viz., marigold, okra, sunflower and brinjal were evaluated for their efficiency against thrips, *T. tabaci* at SASRD, Medziphema, Nagaland University. The study was conducted in Split Plot Design with four treatments having three replications. Tomato was grown on two different planting geometries i.e. 90 x 70 cm (P1) and 60 x 60 cm (P2) and the treatments used as trap crops were indicated as marigold (T1), okra (T2), brinjal (T3) and sunflower (T4), while confining a ratio of main crop to trap crop at 4: 1.The trap crops were transplanted first following the pattern of sequential trap- cropping. Thrips infestations were recorded from the early vegetative stage of tomato and decline in population as the crop matured. All trap crops in the present study showed good performance in the management of *T. tabaci.* The planting geometry, P2 with okra as a trap crop was observed to be reasonably effective in curbing thrips population in the study period.

Keywords Tomato, Trap cropping, Thrips, Planting geometry.

INTRODUCTION

Tomato is cultivated globally and consumed in various forms from fresh raw fruits or cooked form and widely used in the preparation of soup, salad, puree and assorted cooking. It is also consumed in the form of various processed products like ketchup, mixed sauces,pickles. It forms an indispensable part of every meal. Considered as one of the most important crops agronomically as well as economically (Kimura and Sinha (2008). The present day agriculture has been the topic of discussion and concern for long because of the harmful societal and environmental effects of agriculture based on chemicals.There are a variety of factors, including biotic and abiotic stresses that limit tomato productivity of these, thrips is one of the major threats, as it also transmits tomato spotted wilt virus (TSWV) (Gupta *et al*. 2018) depleting tomato productivity worldwide. It is unavoidable that pesticides will be used in tomato production to reduce loss caused by resistant pests and diseases (Hossain *et al.* 2013),without considering the effects of the pesticides on environment or human health.

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It is imperative that as concerns grow worldwide to provide safer food products secure alternatives are required to produce them. In this study period, four trap crops have been grown to assess its efficiency in managing thrips without any chemical intervention.

MATERIALS AND METHODS

Data collection on incidence of tomato thrips: Total number of thrips population was counted from the leaves of five randomly selected plants per sub-plot at 7 days interval.

Effect of plant geometry on incidence of tomato thrips: To assess the effect of trap cropping system on activity of thrips on tomato, the experiment consisted of four treatments which were replicated thrice in split plot design. The treatments included four trap crops viz., marigold, okra, brinjal and sunflower. The trap crops marigold and sunflower were transplanted 20 days prior to the main crop and brinjal and okra were transplanted 30 and 7 days prior to tomato in the ratio of 4:1 combination (i.e. 4 tomato plants : 1 trap crop). Three random trap crop plants were selected per sub-plot and the total number of thrips incidence on the trap crops was recorded at 15 days interval. Incidence of thrips was recorded on the main crop on five randomly selected plants at 15 days interval. Observations were recorded and data was compared to tomato grown as monocrop.

RESULTS AND DISCUSSION

Incidence of *T. tabaci* and its correlation with abiotic factors

Incidence of *T. tabaci* in tomato crop on different plant geometry and its correlation with abiotic factors during April to August 2019 are presented in Tables 1-2 respectively. *T. tabaci* initially started on the 22nd standard week for both the plant geometries i.e. P1 (90 × 70) and P2 (60×60). Maximum and minimum number of thrips population on P1 was recorded at 25th and 27th standard week (13 and 4.67 thrips/ plant) respectively. While maximum and minimum number of thrips population on P2 was recorded at 26th and 28th standard week (15.33 and 3.67 thrips/ plant) sequentially. *T. tabaci* infestation was observed from 7 DAT till the early flowering stage of tomato i.e. 49 DAT. As the crop matured, it was observed that the population of thrips showed a drastic decrease in population.The observation above is in agreement with Jamuna *et al.* (2019) and Timmanna *et al.* (2020) who also observed that population of thrips was increased gradually from first week after transplanting to flowering and fruit development stage and later decreased as crop matured.The correlation coefficient (r), presented in Table 2 indicates that the incidence of thrips population has a negatively non-significant correlation with maximum and minimum temperature, minimum relative humidity and rainfall. However, maximum relative humidity had a negatively significant correlation with planting geometry P1. Subba and Ghosh (2016) found that temperature differences had significant positive influence on thrips while sig-

Table 1. Incidence of thrips (*Thrips tabaci)* in tomato from April to August 2019.

SMW	Date of observation	Mean number per plant P1	P2
22	30th May	9.00	8.00
23	6th June	12.33	13.67
24	13th June	10.33	11.67
25	20th June	13.00	14.00
26	27th June	12.33	15.33
27	4th July	4.67	8.00
28	11th July	6.33	3.67
29	18th July	0.00	0.00
30	25th July	0.00	0.00
31	1st August	0.00	0.00
32	8th August	0.00	0.00
33	15th august	0.00	0.00
Total mean		**5.67**	**6.19**

Note: Mean total of five plants.SMW: Standard mean week.

Table 2. Correlation coefficient (r) of *Thrips tabaci* with abioticfactors in tomato at different plant geometries during April to August 2019.

Plant geometry	Pearson's correlation coefficient: Temperature (°C) Max	Min	Relative humidity (%) Max	Min	Rainfall (mm)
P1	-0.176	-0.338	-0.635*	-0.021	-0.356
P2	-0.081	-0.243	-0.533	-0.002	-0.376

Note: df=(12-2)=10.r0.05=0.576. r0.01= 0.708
*= Significant at 5%level of significance.
**= Significant at 1%level of significance.

Table 3. Effect of different trap crops and plant geometries against thrips in tomato during May to August 2019.

Treatments	Crop stage of tomato: Vegetative		Flowering		Fruiting		Mean
	7th June	22nd June (30)	7th July	22nd July	6th August (75)	21st August (90)	
Planting geometries							
90 ×70 (P1)	7.67	8.60	2.53	0.67	0	0	**4.87**
	(2.86)	(3.02)	(1.74)	(1.08)	(0.00)	(0.00)	
60 × 60 (P2)	7.87	11.00	1.93	0.60	0	0	**5.35**
	(2.89)	(3.39)	(1.56)	(1.05)	(0.00)	(0.00)	
SEm±	0.34	0.34	0.21	0.09	-	-	-
CD (p=0.05)	1.03 (NS)	1.02 (NS)	0.62 (NS)	0.26 (NS)	-	-	-
Trap crops							
Untreated control: (T0)	12.33	13.50	3.67	2.00	0	0	**7.88**
	(3.58)	(3.74)	(2.04)	(1.58)	(0.00)	(0.00)	
Marigold, Pusa Narangi (T1)	5.67	8.50	1.83	0.17	0	0	**4.04**
	(2.48)	(3.00)	(1.53)	(0.82)	(0.00)	(0.00)	
Okra, Arka Anamika (T2)	7.17	8.83	2.33	0.83	0	0	**4.79**
	(2.77)	(3.05)	(1.68)	(1.15)	(0.00)	(0.00)	
Brinjal, Pusa Shymla (T3)	7.67	9.67	1.17	0.17	0	0	**4.67**
	(2.86)	(3.19)	(1.29)	(0.82)	(0.00)	(0.00)	
Sunflower, DRSH-1 (T4)	6.00	8.50	2.17	0.00	0	0	**4.17**
	(2.55)	(3.00)	(1.63)	(0.00)	(0.00)	(0.00)	
SEm±	**0.46**	**0.45**	**0.28**	**0.12**	**-**	**-**	**-**
CD (p=0.05)	**1.37***	**1.36***	**0.83 (NS)**	**0.35 (NS)**	-	-	-

Note: Figures in the table are mean values and those in parenthesis are transformed values.
*=Significant at 5 % level of probability.
NS= Non- significant at 5 % level of significance.

nificant negative correlationwith temperature (Minimum and average), relative humidity (minimum and average) and weekly total rainfall. The dissimilarity may result due to geographical location of the studied area and abiotic factors.

Effect of different trap crops against of thrips, *T. tabaci* population in tomato

It can be noted from Table 3 that thrips infestation was observed on all the trap crops employed viz. marigold, okra, brinjal and sunflower. The untreated plot where tomato was mono cropped attracted the highest number of thrips on all observation dates. The highest and the lowest total mean of trapping were observed in okra and marigold with 4.79 and 4.04 thrips / plant respectively. It may be noted that all the trap crops viz. marigold, okra, brinjal and sunflower performed similarly as the total mean values differed only faintly. This may be due to its host plant feeding preference of young leaves and flowers (Gill *et al.* 2015 and Marullo 2009).

Interaction effect of different trap crops and planting geometries against thrips, *T. tabaci.*

The combined interaction of the planting geometries and trap crops against the population of thrips are presented in Table 4. The findings showed that all the treatment combinations were found effective in trapping thrips in all dates of observations. Infestation of thrips on tomato began from the early stages of the crop and the highest infestation was recorded on sole tomato (P2T0) with 14.00 thrips / plant. Among the trap crops, the highest infestation of thrips was registered in P2 (intercropped with marigold) with13.33 thrips/plant contrastingly as the crop maturity P2 (intercropped with marigold) with a record of 0.33 thrips / plant at 60 DAT registered the lowest infestation along with P1(Marigold) and P2 (Sunflower). The highest total mean infestation 6.67 thrips/ plant was observed on sole tomato (P2T0) and the lowest

Table 4. Interaction effect of different planting geometries and trap crops against thrips on tomato during May to August 2019.

Treatments	7th June (15 DAT)	22nd June (30 DAT)	7th July (45 DAT)	22nd July (60 DAT)	Mean
P1T0 (Sole tomato)	12.33 (3.58)	13.00 (3.67)	3.67 (2.04)	1.67 (1.47)	7.67
P1T1(Tomato+ marigold)	6.67 (2.68)	9.33 (3.14)	2.67 (1.78)	0.33 (0.91)	4.75
P1T2 (Tomato+okra)	5.00 (2.35)	6.00 (2.55)	3.00 (1.87)	0.00 (0.00)	3.5
P1T3 (Tomato+brinjal)	7.67 (2.86)	6.00 (2.55)	1.00 (1.22)	0.00 (0.00)	3.67
P1T4 (Tomato+ sunflower)	6.67 (2.68)	8.67 (3.03)	2.33 (1.68)	1.33 (1.35)	4.75
P2T0 (Sole tomato)	12.33 (3.58)	14.00 (3.81)	3.67 (2.04)	2.33 (1.68)	8.08
P2T1 (Tomato+ marigold)	7.67 (2.86)	13.33 (3.72)	1.33 (1.35)	0.33 (0.91)	5.67
P2T2 (Tomato+ okra)	4.67 (2.27)	7.67 (2.86)	1.00 (1.22)	0.00 (0.00)	3.34
P2T3 (Tomato+ brinjal)	4.67 (2.27)	11.00 (3.39)	1.33 (1.35)	0.00 (0.00)	4.11
P2T4 (Tomato+ sunflower)	7.67 (2.86)	9.00 (3.08)	2.33 (1.68)	0.33 (0.91)	4.83
SEm±	**0.91**	**0.91**	**0.55**	**0.24**	-
CD (p=0.05)	**2.74**	**2.72**	**1.65**	**0.71**	-

Note: Figures in the table are mean values and those in parenthesis are transformed value.
DAT: Days after transplanting, P1= 90 ×70, P2= 60 × 60.

total mean infestation of thrips 3.34 thrips/ plant was observed on tomato planted with okra (P2T2). It may be observed that tomato crop planted as sole attracted the highest number of thrips population in both the plant geometries and tomato planted with okra showed lesser infestation as compared to all the other trap crops followed by tomato planted with brinjal, sunflower and marigold. A similar study was done by Chandio *et al.* (2020) on trapping *T. tabaci* in onion crop using marigold, fennel, carrot and coriander along with control. In their result, marigold and fennel proved to be the most effective for trapping thrips. The present study coincides with the effective use of marigold for trapping thrips.

CONCLUSION

The results of the present study demonstrate that trap cropping can be a suitable strategy in management of tomato thrips. Additional studies could not be found to supplement the overall observations of other trap crops and more intense study on crops attractive to thrips can be initiated for the future course.

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