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Effect of Trap Crops (Tomato, Carrot, Wheat) on the Population of Thrips on Onion Crop

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Abstract: *The experiment was conducted at Agriculture Research Institute Tandojam during the year 2018 to determine effect of trap crops (tomato, carrot, wheat) on the population of thrips on onion variety Phulkara, Wheat variety TD-1, tomato variety MAS-792 and carrot variety T-29 with plot size 6 m x 5 m (30 m^2) in a three replicated with randomized completely block design (RCBD). The treatments included T1= Sole onion at recommended row x plant spacing, T2= Perimeter trap cropping: 3 rows of onion bordered with 1 row of tomato, T3= Perimeter trap cropping: 3 rows of onion bordered with 1 row of carrot and T4= Perimeter trap cropping: 3 rows of onion bordered with 1 row of wheat. The data was recorded for the period of 12 weeks. The results of the present study indicated that onion thrips population per leaf in sole crop (T1) was recorded as 14.30±1.28 on 1st week, it was slightly increased from (14.90±1.32 to 17.90±1.68) during 2nd week to 8th week of observation, afterwards the population started decreasing from 16.10±2.50 to 14.84±1.10 during 9th week to 12th week of observation. The pest population in trap crop 'tomato' was recorded as 14.00±1.10 on 1st week and then started in decreasing trend from 13.48±1.30 to 05.10±0.10 during 2nd week to 12th week of observation. In next trap crop 'carrot' the pest population was recorded as 13.48±1.32 on 1st week and then started in decreasing trend from 12.10±1.10 to 03.67±0.52 during 2nd week to 12th week of observation. In wheat as trap crop the population per leaf of onion thrip was counted as 11.20±1.14 on 1st week, it was linearly decreases from 10.30±1.10 to 2.10±0.10 during 2nd week to 12th week of observation. Maximum population of onion thrips (15.94±0.31 per leaf) was recorded on sole crop 'onion' followed by trap crop 'tomato' (10.28±0.86 per leaf) and carrot (8.09±0.67 per leaf) and the minimum population (6.66±0.92 per leaf) was noted on trap crop 'wheat'. Statistical analysis of the obtained data indicates that there was significant (p<0.05) difference in population dynamics of onion thrips under different trap crops. It was concluded that the trap crops resulted in significant reduction in onion thrips population on onion. Wheat was the most effective trap crop, followed by carrot and tomato; while in sole onion crop, the insect pest infestation was significantly higher than the plots intercropped with wheat, carrot and tomato.*

Keywords: Effect of Trap Crops on the Population Of Thrip on Onion crop.

INTRODUCTION:

Onion (*Allium cepa* L.) is an essential item of food preparation in our daily diet. Onion is a thermal and photosensitive crop. In Pakistan, the onion is cultivated in almost all parts of the country. The area under onion cultivation in the country during 2016-2017 was 137.9 thousand hectares with production of 1833.2 thousand tons; while during the year 2017-2018, the area under onion cultivation in the country was 147.2 thousand hectares with the production of 1981.7 thousand tons. This indicates 8.1 percent increase in the production during 2017-2018 as compared to the onion production during 2016-2017 (GOP, 2018).

The onion crop is infested by many insect pests and diseases. Among insect pests, bollworms, aphid and thrips commonly infest onion plantation. However, thrips and bollworms are the most serious insect pests that devastate onion plantation more than any other insect pests occurring on this crop (Lanjar *et al.*, 2014). According to Mishra *et al.* (2014). The common onion insect pests are thrips, army worm,

maggots, crickets etc; while among natural enemies spiders, predatory ants, orius bugs, green lacewing and lady bird beetles are well recognized.

Planting of a field crop to prevent main cash from from several pests is known as trap cropping. Trap crop can be from different or same group of families than cash main crop. Two types of trap crops planting i.e. row and perimeter trap cropping. Border trap cropping (perimeter) is planting completely surrounding the main cash crop that prevent attack of the pest from all sides of field and it works best on field. Alternating rows within the main crop is the planting comes in row intercropping. The trap crop lessens the use of pesticide, by trapping insect pest population on them, preserves the indigenous natural enemies, improves the crop quality and helps to conserve the soil and the environment (Vaiyapuri *et al*., 2007).

For the purpose of pest management, the trap cropping framework is one of the best manipulation of an agroecosystem. Before introduction of synthetic modern insecticides for the control of insect pests, trap cropping was a common method for the control of pest in many system of cropping (Aluja *et al.*, 1997; Asman, 2002; Badenes *et al.*, 2005).

REVIEW OF LITERATURE:

Buckland *et al.* (2017) planted three trap crops, lacy phacelia *(Phacelia tanacetifolia* Benth.), buckwheat (*Fagopyrum esculentum* Moench.), and carrot (*Daucus carota* L.) in commercial onion fields during two growing seasons were evaluated for attractiveness to onion thrips. Abundance of thrips adults, larvae, and eggs were monitored on trap crops and onion plants, and dispersing adults were counted on aerial traps 0, 0.8, 6.4, and 12.8 m from trap crop rows. All trap crops when flowering or with lush vegetation supported all life stages of onion thrips during at least 1 of 2 years; trends in preference by onion thrips varied. Incidence of *Iris yellow spot virus* was low ranging from 6.6 to 8.2% in year 2; however, in late September of the second year, incidence was greater near trap crops than at farther distances. Trap crops were attractive to onion thrips adults in June and July which suggests promise for decreasing numbers of thrips on onion during critical periods of bulb sizing and spread of *Iris yellow spot virus*; however, the short distance of influence suggested need for larger plot sizes or better sampling methods. Potential for planting trap crops along field edges to attract migrating adult thrips early in the season is discussed.

Khaliq *et al.* (2016) evaluated the effect of plant spacing and intercropping in onion field. For this reason, they used 05 plant spacing i.e. 10 cm, 15 cm, 20 cm, 25 cm and 30 cm and 04 intercrops i.e. cotton, okra, tomato and chilli with onion. According to their findings, lowest density per plant of thrips were recorded in onion plots intercropped with cotton and high density per plant of thrips were recorded in control plot without intercropped. Crop yield was significantly better in plot in onion plots intercropped with cotton than control.

In recent years, pest management tool traditionally trap cropping has considerably increased due to inherent chracteristics as well as strategies associated with their deployment that encompasses the trap crop plant in trap cropping (Boucher *et al.*, 2003; Vaiyapuri *et al*., 2007; Shahabuddin *et al.*, 2015). They stated that there were significantly lower attack rate of pest in trap crop in comparison of without trap crop. Khaliq *et al.* (2016) stated that during the study period of two years, minimum population of thrips were recorded in plots grown under intercropped in comparison of control plot without intercropped (Buckland *et al.*, 2017). Planted lacy phacelia, buckwheat and carrot were used as trap crops in commercial onion fields for attractiveness to onion thrips. Abundance of thrips adults, larvae, and eggs were monitored on trap crops and onion plants, and trap crops were attractive to onion thrips adults in June and July.

The proposed study was conducted to investigate the effect of trap crops on the population of thrips in onion crop at Tandojam

Baloch (2015) conducted experiment at Mirpur Khas to analyse the effect of trap crop on pest and predator population in chilli agro-ecosystem. The trap crops managed as: T1 = Chilli + Maize, T2 = Chilli + Sunflower, T3 = Chilli + Pea and T4 = Control (Chilli). The data showed that the weekly jassid population on chillies accompanied by maize as trap crop was 1.634±0.235, aphid 0.207±0.030, thrips 3.729 ± 0.343, whilefly 0.955±0.044, mealy bug 3.623±0.456 and *H. armigera* was 0.274±0.006/ leaf; while in chillies where sunflower was used as trap crop the population of jassid was 1.748±0.090, aphid 0.222±0.041, thrips 3.990±0.292, whilefly 1.022±0.019, mealy bug 3.877±0.289 and *H. armigera* 0.294±0.004/leaf. In chillies where peas were sown as trap crop, the population of jassid was 1.846±0.101, aphid 0.234±0.032, thrips 4.214±0.416, whilefly 1.079±0.062, mealy bug 4.094±0.555 and *H. armigera* 0.310±0.001/leaf. In control plots (no trap crop), the population of jassid was 2.140±0.210, aphid 0.272 ± 0.073, thrips 4.885±0.156, whilefly 1.251±0.023, mealy bug 4.747±0.632 and *H. armigera* 0.359±0.011/leaf.

Shahabuddin *et al.* (2015) reported that in recent years, pest management tool traditionally trap cropping has considerably increased due to inherent chracteristics as well as strategies associated with their deployment that encompasses the trap crop plant in trap cropping. They stated that there were significantly lower attack rate of pest in trap crop in comparison of without trap crop.

Maharjan *et al.* (2013) conducted study on hemipteran bugs on mungbean in Nepal. A trap crop of a variety preferred by the bugs was planted along with the main crop. The tests were performed using a selection of six of the most preferred

mungbean varieties [VC6173A, VC6153B-20G, VC3960 A-88, Kalyan, Pratikchha and Saptari local (as the control)] relative to the Saptari local variety. Significant differences were recorded in the number of bugs among the six varieties, with a maximum number of bugs in VC6173A (3.25 bugs/plant) showing the lowest yield. Three different trap crop designs were employed in the field. There was a significant difference between variety Pratikchha as the main crop and variety VC6173A used as the trap crop in two of the designs. The data suggested that VC6173A is a probable trap crop and that those two designs can be employed in the field in Nepal.

Buckland *et al.* (2011) planted lacy phacelia, buckwheat and carrot were used as trap crops in commercial onion fields for attractiveness to onion thrips. Abundance of thrips adults, larvae, and eggs were monitored on trap crops and onion plants, and trap crops were attractive to onion thrips adults in June and July.

Majumdar (2010) reviewed trap cropping as a IPM tool for controlling insect pests and concluded that trap crops can be arranged in various spatial patterns and the choice of design will depend on target pest, pest pressures, and garden or farm size. Extremely mobile insects such as cucumber beetles are more difficult to manage with trap cropping than the slow moving insects, e.g., Colorado potato beetle.

Adler and Hazzard (2009) stated that an effective IPM tool such as perimeter trap cropping that is more attractive to pests are successful method for the prevention of insect pest attack on the main crop in field. The use of perimeter trap cropping in onion field were found better in terms of controlling / preventing the attack of pests and enhancement of crop yield in field condition.

Hormchan *et al.* (2009) compared the row intercropping and perimeter trap cropping with castor bean and okra with sunflower. According to their result of study, it was observed that significantly minimum number of leafhopper were observed in plot sown under intercropped in comparison of control plot. Significantly maximum yield of the crop were obtained from the plot sown under intercropped and minimum yield were noticed under control plot without intercropping.

Memon (2008) investigated the effect of trap crops on the population dynamics of sucking insect pests of cotton; and trapped with four different crops viz. soybean, sunflower, okra and mungbean and compared with cotton alone. Each treatment of plot replicated four times, thus there were twenty plots. The experiment was laid out in a Randomized Complete Block Design. All the recommended cultural practices were adopted throughout the cotton growing season, however, sprays of many kinds of insecticide pesticide was avoided. For recording observations on sucking insect pest i.e. Thrips, Whitefly, Aphids, Jassids and Mealy bug per five plants both from cotton as well as trap crops were selected randomly and tagged.

Vaiyapuri *et al.* (2007) reported that two types of trap crops planting i.e. row and perimeter trap cropping. Border trap cropping (perimeter) is planting completely surrounding the main cash crop that prevent attack of the pest from all sides of field and it works best on field. Alternating rows within the main crop is the planting comes in row intercropping. The trap crop lessens the use of pesticide, by trapping insect pest population on them, preserves the indigenous natural enemies, improves the crop quality and helps to conserve the soil and the environment

MATERIALS AND METHODS:

The experiment was conducted at Agriculture Research Institute Tandojam during the year 2018 to effect of trap crops (tomato, carrot, wheat) on the population of thrips on onion variety Phulkara, Wheat variety TD-1, tomato variety MAS-792 and carrot variety T-29 with plot size 6 m x 5 m (30 m^2) in a three replicated with Randomized Completely Block Design (RCBD). The sowing of seeds was done on 20th August, 2018. The data was recorded for the period of 12 weeks.

T1= Sole onion at recommended row x plant spacing

T2= Perimeter trap cropping: 3 rows of onion bordered with 1 row of tomato

T3= Perimeter trap cropping: 3 rows of onion bordered with 1 row of carrot

T4= Perimeter trap cropping: 3 rows of onion bordered with 1 row of wheat

The weekly observations on population dynamics of onion thrips was recorded in all the plots, using randomly selected leaves/plants. The onion yield differences between treatments were also determined. The data thus obtained was statistically analysed following Gomez and Gomez (1984).

RESULTS:

Population of onion thrips (per leaf) on different trap crops

Results (Table-1) indicated that onion thrips population per leaf in sole crop (T1) was recorded as

14.30±1.28 on 1st week, it was slightly increased from (14.90±1.32 to 17.90±1.68) during 2nd week to 8th week of observation, afterwards the population started decreasing from 16.10±2.50 to 14.84±1.10 during 9th week to 12th week of observation. The pest population in trap crop tomato was recorded as 14.00±1.10 on 1st week and then started in decreasing trend from 13.48±1.30 to 05.10±0.10 during 2nd week to 12th week of observation. In next trap crop carrot the pest population was recorded as 13.48±1.32 on 1st week and then started in decreasing trend from 12.10±1.10 to 03.67±0.52 during 2nd week to 12th week of observation. In wheat as trap crop the population per leaf of onion thrip was counted as 11.20±1.14 on 1st week, it was linearly decreases from 10.30±1.10 to 2.10±0.10 during 2nd week to 12th week of observation. Maximum population of onion thrips (15.94±0.31 per leaf) was recorded on sole crop onion followed by trap crop tomato (10.28±0.86 per leaf) and carrot (8.09±0.67 per leaf) and the minimum population (6.66±0.92 per leaf) was noted on trap crop wheat. Statistical analysis of the obtained data indicates that there was significant (*P<0.05*) difference in population dynamics of onion thrips under different trap crops

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Table 1. Population of onion thrips (per leaf) on different traps crop.

Observation dates	T1	T2	T3	T4
1st week	14.30±1.28	14.00±1.10	13.48±1.32	11.20±1.14
2nd week	14.90±1.32	13.48±1.30	12.10±1.10	10.30±1.10
3rd week	15.30±1.84	13.10±1.50	10.40±1.30	10.00±1.03
4th week	15.84±1.20	13.00±1.21	10.00±1.11	9.40±0.92
5th week	16.23±1.34	12.88±2.10	08.40±1.32	8.10±0.68
6th week	16.85±1.60	10.50±1.30	08.10±1.10	7.30±0.52
7th week	17.30±1.50	09.40±1.10	07.83±0.58	6.00±0.30
8th week	17.90±1.68	09.00±1.03	07.24±0.40	5.22±0.24
9th week	16.10±2.50	08.55±0.84	06.14±0.29	5.00±0.14
10th week	16.68±2.62	08.10±0.32	05.38±0.48	3.18±0.10
11th week	15.10±1.50	06.30±0.25	04.42±0.17	2.23±0.13
12th week	14.84±1.10	05.10±0.10	03.67±0.52	2.10±0.10
Overall Mean±SE	**15.94±0.31 a**	**10.28±0.86 b**	**8.09±0.67 c**	**6.66±0.92 d**

SE± = 1.1083
LSD 0.05 = 2.2337
P<0.05 = 0.0000**
** highly significant

T1= Sole onion at recommended row x plant spacing
T2= Perimeter trap cropping: 3 rows of onion bordered with 1 row of tomato
T3= Perimeter trap cropping: 3 rows of onion bordered with 1 row of carrot
T4= Perimeter trap cropping: 3 rows of onion bordered with 1 row of wheat

Yield kg/plot

The maximum yield was recorded 10.60 kg /plot under treatment T4= Perimeter trap cropping: 3 rows of onion bordered with 1 row of wheat, followed by T3= Perimeter trap cropping: 3 rows of onion bordered with 1 row of carrot and T2= Perimeter trap cropping: 3 rows of onion bordered with 1 row of tomato resulted 8.93 and 6.84 kg/plot, respectively. While the minimum yield was recorded 4.22 when crop treated with T1= Sole onion at recommended row x plant spacing, respectively.

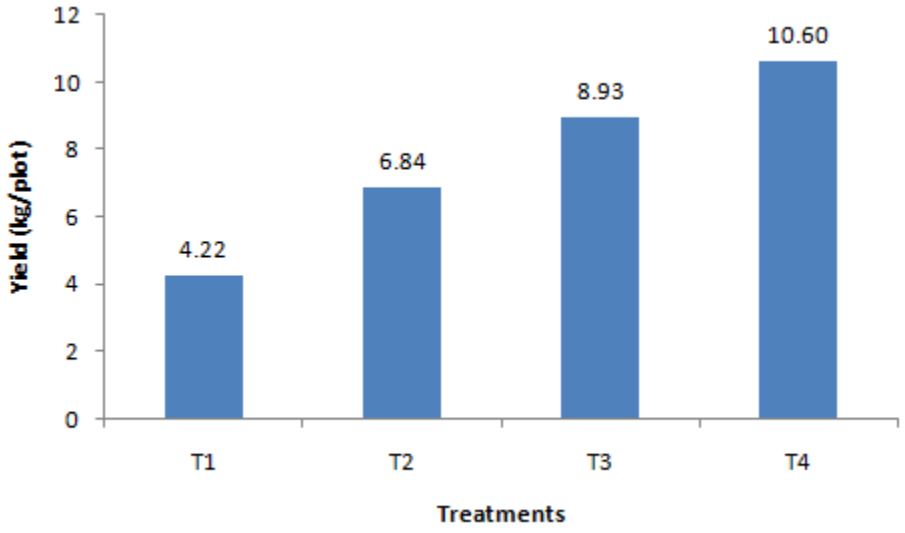

Figure 1. Effect of different trap crop on onion yield (kg/plot)

Where:

T1= Sole onion at recommended row x plant spacing.
T2= Perimeter trap cropping: 3 rows of onion bordered with 1 row of tomato.
T3= Perimeter trap cropping: 3 rows of onion bordered with 1 row of carrot.
T4= Perimeter trap cropping: 3 rows of onion bordered with 1 row of wheat.

Discussion:

Trap cropping is the planting of a trap crop to protect the main cash crop from a certain pest or several pests. The trap crop can be from the same or different family group, than that of the main crop, as long as it is more attractive to the pest. The trap crop lessens the use of pesticide, by trapping insect pest population on them, preserves the indigenous natural enemies, improves the crop quality and helps to conserve the soil and the environment (Vaiyapuri *et al*., 2007). The concept of trap cropping fits into the ecological framework of habitat manipulation of an agro-ecosystem for the purpose of pest management. Many different methods alter the habitat as part of an IPM strategy, and such manipulation can occur at the landscape level. Prior to the introduction of modern synthetic insecticides, trap cropping was a common method of pest control for several cropping systems.

The findings of the present study indicates that maximum population of onion thrips (15.94±0.31/leaf) was recorded on sole crop onion followed by trap crop tomato (10.28±0.86/leaf) and carrot (8.09±0.67/leaf) and the minimum population (6.66±0.92/leaf) was noted on trap crop wheat. These results are parallel with the findings of Gary (2000) that used maize as trap crop with various vegetable crops and found that trap cropping resulted in decline in insect pest infestation on the main crop. Potvin (2001) compared the effect of border variety, pesticide, and pollination treatments on herbivory, pollination, and yield in the maincrop and suggests that reduced herbivory caused by pesticides did not protect these plants from wilt, but the border crops resulted in decreased insect infestation on the main crop. Boucher *et al*. (2003) concluded that the use of the perimeter trap crop technique as part of an IPM or organic program can help improve crop quality and overall farm profitability, while reducing pesticide use and the possibility of secondary pest outbreaks. Tillman and Mullinix (2004) concluded that grain sorghum could serve as an affective trap crop for corn

earworm in cotton. Virk *et al*. (2004) reported that trap crops cultivated on the borders of the cotton caused reduction in insect pest population. Duraimurugan and Regupathy (2005) assessed the effects of push-pull strategy with trap crops in cotton and showed *H. armigera* showed resistance against insecticides; while under trap cropping system, the *H. armigera* reduced on cotton and this insect showed preference on other minor crops. Clifton and Duphily (2006) reported that insect pest showed disturbance with the cultivation of trap crops such as corn, beans, sunflower, pigeon pea and cowpea; where it was observed that the losses in main crop due to insect pest reduced considerably due to trap cropping as compared to control. Vaiyapuri *et al*. (2007) argued that trap cropping is the planting of a trap crop to protect the main cash crop from a certain pest or several pests. The trap crop can be from the same or different family group, than that of the main crop, as long as it is more attractive to the pest. The trap crop lesser the use of pesticide, lowers the pesticide cost, preserves the indigenous natural enemies, improves the crop's quality and helps conserve the soil and the environment. The studies of Memon (2008) showed that the sucking insect pests, mealy bug and *H. armigera* population was checked by trapped with four different crops viz. soybean, sunflower, okra and mungbean and compared with cotton alone. Thrips, Whitefly, Aphids, Jassids and Mealy bug per five plants both from cotton an well as trap crops were selected randomly and tagged. Majumdar (2010) reviewed trap cropping as a IPM tool for controlling insect pests and concluded that trap crops can be arranged in various spatial patterns and the choice of design will depend on target pest, pest pressures, and garden or farm size. Extremely mobile insects such as cucumber beetles are more difficult to manage with trap cropping than the slow moving insects, e.g., Colorado potato beetle. Maharjan *et al*. (2013) found that the insect pests on chillies may be reduced by using trap crop on the borders or at the alternate rows.

Conclusion

The trap crops resulted is significant reduction in thrips population on onion. Wheat was the most effective trap crop, followed by carrot and tomato; while in sole onion crop, the insect pest infestation was significantly higher than the plots intercropped with wheat, carrot and tomato.

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