Research Article

Comparative Influence of Green Manure (*Trifolium Alexandrinum* L.) and Conventional IPM on Population of Sucking Insect Pests of Cotton

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Abstract | Cotton crop is attacked by many insect pests and most of them have developed resistance against the synthetic pesticides. Therefore, this study was conducted to determine the influence of green manure (*Trifolium alexandrinum* L.) and conventional IPM on population of sucking insect pests of cotton during 2013. The population of sucking insect pests i.e., *Bemesia tabaci*, *Amrasca biguttula biguttula* and *Scirtothrips dorsalis* was recorded on weekly basis cotton grown with both green manure and IPM treatments. The green manure treatments suffered comparatively higher population of *B. tabaci* (0.83±0.09) and *S. dorsalis* (3.43±0.47) than IPM treatment with population of 0.46±0.05 whiteflies and 1.98±0.72 thrips, respectively. However, IPM cotton suffered higher *A. biguttula biguttula* population (1.01±0.10) than green manure treatment (0.49±0.07). Moreover, application of neem oil in green manure treatment and Spintoram in IPM treatment, lowered the population of sucking pests. Considering the results, further studies should be conducted with broader aspects and covering more green manure crops to evaluate their role in the pest management and fertility of the soil.

Received | March 19, 2018; **Accepted** |September 1, 2018; **Published** | September 21, 2017

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Citation | Sahito, J.G.M., T.S. Syed, G.H. Abro, I. Rajper. 2018. comparative influence of green manure (*Trifolium Alexandrinum* L.) and conventional IPM on population of sucking insect pests of cotton. *Pakistan Journal of Agricultural Research,* 31(3): 254-258.

DOI | http://dx.doi.org/10.17582/journal.pjar/2018/31.3.254.258

Keywords | Cotton, IPM, Green manure, Sucking pests, *Trifolium alexandrinum*

Introduction

Cotton is one of the most sensitive crop to pest attack, in Pakistan and farmers mostly rely heavily on pesticides for the control of insect pests in cotton crop (Poswal and Williamson, 1998). Hence, cotton is a chemically intensive crop among all field crops as it uses about 25% of all insecticides consumed in agriculture (ICAC, 1998). Despite the continued improvement in the performance of chemical control strategies, harvest losses remain very high in cotton (Deguine et al., 2009). The chemicals used in non-organic cotton production pollute air, surface waters and cause health hazards to people. It has been reported that more than seventy workers die every day due to the pesticide poisoning mostly during insecticides application (Tahir and Anwar, 2012; Khan et al., 2002; WHO, 2014).

A farming system, where the use of synthetic chemicals i.e., fertilizers and pesticides are prohibited is termed as organic agriculture. As no agrochemicals are used in organic farming, these systems mostly depend upon the rotation of crops, natural fixation of nitrogen due to the micro-organism, use of biologically active soil, use of recycled farm manure or crop residue, and

control of pests using biological, physical, mechanical or cultural practices (Swedish Control Association of Ecological Farming, 2003). Hence, such farming is more eco-friendly than conventional farming system that heavily depend upon the use of inorganic fertilizers and synthetic pesticides. Moreover, it has been known fact that practicing organic farming resulted in less leaching of nutrients and higher carbon storage (Drinkwater et al., 1995), less erosion (Reganold et al., 1987), and lower level of pesticides in water systems (Kreuger et al., 1999; Mader et al., 2002). An increased in the biodiversity, has been reported in the organic agriculture due to less disturbances to ecosystem stability (Paoletti et al., 1992, Ahnstrom, 2002) because modern agriculture practices have disturbed the balance of ecosystem and resulted in loss of biodiversity (Fuller et al., 1995; Stoate et al., 2001; Benton et al., 2002; 2003). Comparatively lower densities of insect pests have reported in the crops grown with organic farming due to the natural control of noxious insects because of the presence of their natural enemies that are severely affected by the agrochemicals in the conventional farming systems (Arancon et al., 2004; Blumberg et al., 1997; Culliney and Pimentel, 1986; Eigenbrode and Pimentel, 1988; Kajimura et al., 1993). However, the concept of organic cotton production and its associated benefit in reducing incidence of insect pests is not yet been highlighted generally in Pakistan and Sindh in particular. Therefore, this research was conducted to evaluate the influence of organic cotton production practices on the incidence of insect pests in comparison to conventional IPM practices that include the synthetic chemicals.

Materials and Methods

Study area and experimental design

The experiment was conducted at Research Farm of Sindh Agriculture University, Tando Jam during 2013-2014 for only one year. The experiment comprised of two treatments: organic and conventional IPM, arranged in a Randomized Complete Block Design and each treatment replicated four times. Size of each block was 40 x 60 meters and the size of each sub-plot was 40 x 10 meters. There were two treatments in the experiment was: **T1**= Conventional integrated pest management (IPM) and **T2**= Green manure, Berseem (*Trifolium alexandrinum* L.)

Cultivation of berseem and cotton

Green manure crops Berseem Egyptian clover were sown in January 2013. Three months after the sowing of berseem, it was pulverized and mixed in the soil before the cultivation of cotton.

Cotton variety (Sindh-1) was sown on May 28, 2013 by dibbling method on furrows. The distance between plants to plant was 22.5 cm, and row to row was 75cms. All the agronomic practices were done as per standard.

The recommended doses of nitrogen, phosphorus and potassium @ 80, 40 and 60 kg/ acre were applied in the IPM treatment. Before sowing of cotton, 1 bag of urea along with 1 bag of DAP were applied, whereas, remaining fertilizer doses were applied during second and third irrigations. Depending upon the incidence of pest population, spray of Spintoram (Radient®) and neem oil were used in IPM and green manure treatments, respectively.

The collection of data on the presence of sucking insect pests of cotton was started forty days after the germination of cotton and continued till the harvesting at weekly intervals. Five plants were selected from each treatment and from each plant, five leaves (one from bottom and two each from middle and top) were observed to record presence of both adults and immatures of sucking insect pests. Data for sucking insect pests was recorded by counting both adults and immature stages of the pests. The collected data was analyzed using Analysis of Variance (ANOVA), whereas the Least Square Difference (LSD) was used to separate means with significant difference. All analysis was done using STATISTIX 8.1 software.

Results and Discussion

The results of the study indicated a significant difference among the population of sucking insect pests i.e., whitefly, *Bemisia tabaci* (Gennadus), jassids, *Amrasca biguttula biguttula* (Ishida) and thrips, *Scirtothrips dorsalis* (Hood) observed on green manure and IPM treatments.

Effect of IPM and green manure on incidence of cotton white fly Bemesia tabaci

The population of whitefly started to appear on the cotton during the first week of July, 2013 and fluctuated during the entire study period. However, a great variation in population buildup was recorded in the green manure treatment in comparison to IPM. Accordingly, the highest population of whitefly was recorded in green manure treatment (1.48±0.05) after

8th week of cotton cultivation, whereas, the highest population in IPM treatment (0.75±0.06) was observed on 18th week of cultivation (Figure 1). Overall, a highly significant difference (F = 42.53, p < 0.001) was recorded between green manure and IPM treatments for the population of *B. tabaci* as the overall the highest population was recorded in green manure (0.83±0.09), followed by IPM (0.46±0.05) Table 1.

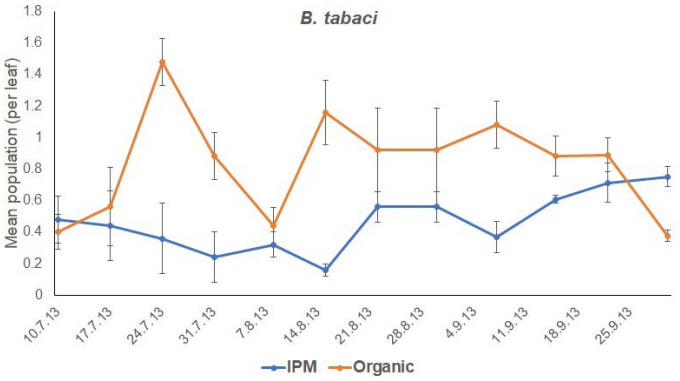

Figure 1: *Population incidence of B. tabaci on green manure and IPM cotton.*

Table 1: *Overall mean population of sucking insect pests in green manure and IPM treatments.*

	Green Manure	IPM
B. tabaci	0.83±0.09a	0.46±0.05b
A. biguttula biguttula	0.49±0.07b	1.01±0.10a
S. dorsalis	3.43±0.47a	1.98±0.72b

**Means followed by the same letters in a column are not significantly different at p: 0.05*

Effect of IPM and green manure on incidence of cotton Jassid Amrasca biguttula biguttula (Ishida)

In comparison to *B. tabaci,* comparatively higher population of *A. biguttula biguttula* was observed on IMP than green manure (Figure 2). Thus, the highest (1.24±0.29) population of *A. biguttula biguttula* was recorded in IPM at 8th of cultivation, whereas, the highest (1.00±0.30) population of *A. biguttula biguttula* suffered by green manure treatment was observed at 7th week of cultivation. According to Table 1, overall, the highest *A. biguttula biguttula* population was recorded in IPM (1.01±0.10) than green manure (0.49±0.07); hence, it indicated a highly significant difference (F = 11.74, p = 0.009).

Effect of IPM and green manure on incidence of cotton thrips Scirtothrips dorsalis (Hood)

Figure 3 showed the population of *S. dorsalis* on green manure and IPM cotton. Accordingly, the green manure treatment recorded higher densities of *S. dorsalis* than IPM treatment. The highest (9.68±1.65) population of *S. dorsalis* was recorded on IPM cotton at 6th week after cultivation, whereas, the highest (6.52±0.53) population on green manure cotton was recorded on 7th week of cultivation. Thus, overall a highly significant difference (F = 28.39, p < 0.001) was recorded in the population of *S. dorsalis* between green manure (3.43±0.47) and IPM treatments (1.98±0.72) Table 1.

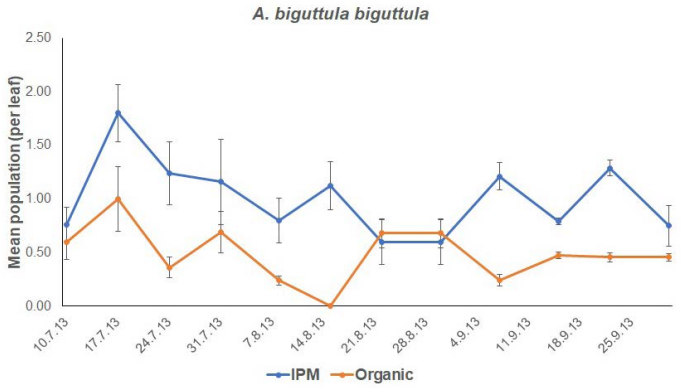

Figure 2: *Population incidence of A. biguttula biguttula on green manure and IPM cotton.*

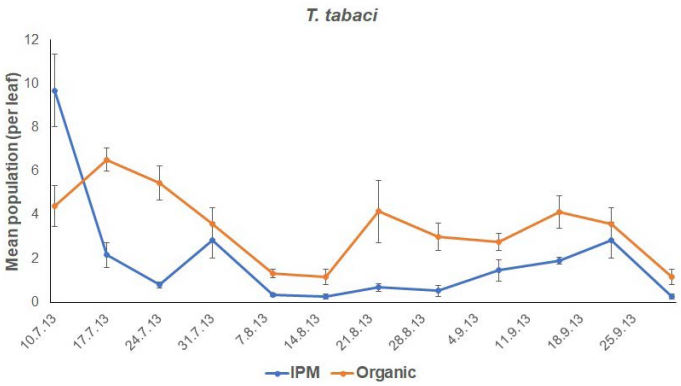

Figure 3: *Population incidence of S. dorsalis on green manure and IPM cotton.*

In this study, it was observed that population *B. tabaci, A. biguttula biguttula* and *S. dorsalis* appeared on cotton grown with green manure and IPM treatments early in July and then fluctuated throughout the study period, comparatively, higher populations of pests was recorded in the initial period of growth of cotton than the latter growth period. Green manure cotton recorded comparatively higher populations of *B. tabaci* and *S. dorsalis*, whereas, IPM cotton exhibited higher population of *A. biguttula biguttula.* Many previous studies have mentioned the similar trend regarding the appearance of sucking insect pests i.e., *B. tabaci, A. biguttula biguttula* and *T. tabaci* started appearing on cotton early in the month of June. Moreover, population of whitefly has been reported to appear

during the mid of June and the highest population was recorded in the month of August (Abro et al., 2004; Hanumantharaya et al., 2008). Solangi et al. (2008) reported that the maximum population of *A. biguttula biguttula* in cotton at the end of August. The study of Soni and Dhakad (2016) also confirmed that population of *A. biguttula biguttula* remained active throughout the cotton growth season, however, its peak populations were observed during the months of September and October. Nagendra (2015) studies also confirmed that cotton is attacked by the key sucking pests such as aphids, jassids and thrips, where their peak populations recorded during the last week of August and mid-September.

Due to the application of neem oil in green manure cotton and Spintoram in IPM cotton, comparatively lower population was recorded during the later developmental period of cotton in both the treatments. Gahukar, (2006) studied the potential of botanical products made from kernels and leaves *Azadirachta indica* and mentioned that these products are getting popularity in various plant protection programs due to their specific toxicity and less hazardous to beneficial insects, hence, lowering the use of synthetic chemicals as they possess many undesirable effects to humans and their environment. Moreover, Mamoon-ur-Rashid et al. (2012) also carried out the management experiments for the cotton pests using *A. indcia* and found that it showed very specific and effective control against the targeted pests at different doses. Hence, various concentrations of neem significantly lowered the popualations of whitefly, jassids and thrips for a considerable period after the spray.

Conclusions

Appearance of sucking insect pests i.e., *B. tabaci, A. biguttula biguttula* and *S. dorsalis* was recorded on cotton grown with both green manure and IPM treatments. However, comparatively higher population of *B. tabaci* and *S. dorsalis* was recorded on green manure treatment, whereas, IPM cotton suffered higher *A. biguttula biguttula* population. Moreover, application of neem oil in green manure treatment and Spintoram in IPM treatment, lowered the population of sucking pests. Considering the results, further studies should be conducted with broader aspects and covering more green manure crops to evaluate their role in the pest management and fertility of the soil.

Author's Contributions

J.G.M. Sahito perceived the idea data collection and overall supervision of the article and data analysis, T.S Syed technical input preparing the manuscript, G.H. Abro review manuscript. I. Rajper handled plagiarism and reviewing the article.

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