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Comparative Incidence of Insect Pest Complex on Cotton Varieties Subjected to Organic and Synthetic Fertilizers

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ABSTRACT

In order to elaborate marked effect of organic fertilizer on insect pest population on cotton varieties grown in plots provided with synthetic and organic fertilizers, the comparative incidence of whitefly (*Bemisia tabaci*), jassid (*Amrasca davastans*) and thrips (*Thrips tabaci*) and per cent damage by spotted bollworms (*Earias* spp.) was observed on six cotton varieties viz., NIAB 98, FH-900, CIM–552, FH–901, NIAB 86 and NIAB Krishma. There was no significant difference of mean seasonal per leaf population of whitefly, jassid and thrips and per cent damage by spotted bollworms on each cotton variety when compared between organic and synthetic fertilizer treatments. A possible explanation of the relation between crop fertilization and insect pest incidence is described.

Key Words: Agro-ecology; Pest management; Sucking insects; *Earias* spp., Bollworms; Cotton

INTRODUCTION

The continuous and extensive use of fertilizers and pesticides for increasing per acre yield of cash crops of major importance, particularly cotton, has caused tremendous threats to agro-ecosystem. These threats include low soil organic matter, low soil biological activity, functional biodiversity and nutrient deficiency. Agro-ecology provides the guidelines to restore and enhance the resiliency, sustainability and health of ecosystems. Agro-ecologists contend that links between healthy soils and healthy plants is fundamental to ecologically based pest management. Hence, one of means of ecologically pest management is to improve plant health via improving and providing optimal physical, chemical and biological properties of soils (Altieri & Nicholls, 1999).

Many studies suggest that the physiological susceptibility of crops may be affected by form of fertilizer used (organic versus chemical fertilizers). High nitrogen fertilizers can stimulate outbreaks of Homopteran insects such as leafhoppers and aphids (Campbell, 1989; Leal *et al*., 1997; Morales *et al*., 1997; Myers & Stolon, 1999). Many evidences have been highlighted where comparison between conventional versus organic fertilizers have shown high number of herbivores insects on conventionally managed plots than organically farmed crops (Magdoff, 1992; Altieri, 1994). There is possibility of changing the preference of insects by optimal plant nutritional requirement via altering the fertilizer level of a soil (Hendrix *et al*., 1990; Phelan *et al*., 1996). Keeping in view the above, as a step forward towards sustainable healthy agro-ecosystem, the present project was proposed to compare the population level of sucking and chewing insect pest on cotton varieties sown in fields provided with organic (Farm Yard Manure) and synthetic fertilizers at recommended doses.

MATERIALS AND METHODS

The experiment on comparative incidence of insect pest on cotton varieties subjected to organic fertilizer and synthetic fertilizer was carried out at PARS, Jhang Road, Faisalabad, Pakistan.

The experiment was laid down according to Randomized Complete Block Design (RCBD) on six varieties viz., NIAB 98, FH-900, CIM-552, FH-901, NIAB 86 and NIAB Krishma with two treatments of nutrient inputs i.e., organic (Farm Yard Manure) and synthetic fertilizers at their recommended doses and there were three replication for each nutrient input.

Recommended dose of Farm Yard Manure was one tractor load per acre; whereas that of synthetic fertilizer was as follows:

i. Nitrogen 69 kg acre^{-1}, half at the time of sowing & half at the time of 1st irrigation
ii. Phosphorous 34 kg acre^{-1} at the time of 1st irrigation
iii. Potash 25 kg acre^{-1} at the time of sowing

Sucking insects, i.e., whitefly, jassid, thrips were counted as adult /nymph per leaf from 15 plants. The upper leaf of first plant, middle leaf of third plant and bottom leaf of fifth plant and in this way counting was done until 15 plants were observed. The spotted bollworms were counted on per cent infestation basis from randomly selected 15 plants.

The data of comparative incidence of sucking and chewing insect pests in both the treatments were subjected to one factor ANOVA.

RESULTS

The seasonal per leaf population of whitefly, jassid, thrips on cotton varieties in unsprayed plots is given in Table I. There was non-significant difference in the effect of two treatments i.e., organic vs. synthetic fertilizers on population of the above-mentioned insect species on all cotton varieties tested in the present studies. However, on few dates, the population was significantly high in the plots given synthetic fertilizer (data not shown). NIAB 86 showed significant difference in the number of jassid nymphs between organic and synthetic fertilizer treatment (Table I).

The considerable variation was also found in the number of the above-mentioned insects on different varieties. Foe example, the range of number of whitefly nymph on different varieties was from 3.23 to 12.5 leaf^{-1}, least and highest being on FH 901 and NIAB 98, respectively (Table I). No variety had consistent high number of one particular insect, which may suggest varietal potential to support lives of the insects.

The seasonal per cent damage by the spotted bollworms on cotton varieties in unsprayed plots is given in Table II. There was non-significant difference in the effect of two treatments i.e., organic vs. synthetic fertilizers related to per cent damage by spotted bollworms on all cotton varieties.

All the varieties had similar trend of spotted bollworms' infestation. The difference of 2.64% was the result of lowest (13.40%) and highest (16.04%) spotted bollworms, infestation on bolls in organic fertilizer treatment while difference of 5.62% was found in synthetic fertilizer treatment (Table II).

DISCUSSION

The present studies were undertaken to elaborate the influence of organic and synthetic fertilizers on sucking and chewing insect pests on cotton varieties with the following questions in mind (i) was there any difference in population of insect pest complex in the two fertilizer regimes (ii) can this difference be exploited as tool for pest management or at least to reduce the pesticide load on cotton crop. In fact already 7-8 sprays of the insecticides are being done in cotton growing areas of the Punjab, Pakistan, which speaks

Table I. Comparison of seasonal mean per leaf population of whitefly (adult and nymph), jassid (adult and nymph), and thrips (adult) on cotton varieties, subjected to organic (FYM) and synthetic fertilizer treatments

		Fertilizer			
Insect	***Variety***	**Organic**	**Synthetic**	***p-value***	
Whitefly (adult)	NIAB 98	3.93 ±0.4	4.12±0.4	0.20	n.s.
	FH-900	3.55±0.3	4.58±0.4	0.06	n.s.
	CIM-552	4.32±1.0	4.02±1.3	0.60	n.s.
	FH-901	3.88±1.1	2.66±0.9	0.40	n.s.
	NIAB 86	6.55±1.2	6.62±1.2	0.97	n.s.
	NIAB Krishma	6.45±1.2	6.47±1.2	0.99	n.s.
Whitefly (nymph)	NIAB 98	12.5±1.8	13.5±1.8	0.70	n.s.
	FH-900	11.1±1.7	12.0±1.9	0.75	n.s.
	CIM-552	4.30±1.43	4.04±1.14	0.73	n.s.
	FH-901	3.23±1.51	2.79±1.10	0.44	n.s.
	NIAB 86	6.15±0.90	6.29±0.89	0.91	n.s.
	NIAB Krishma	5.97±0.91	6.11±0.89	0.91	n.s.
Jassid (adult)	NIAB 98	0.99±0.12	1.10±0.11	0.21	n.s.
	FH-900	0.81±0.10	0.99±0.07	0.16	n.s.
	CIM-552	2.14±0.75	2.40±0.45	0.21	n.s.
	FH-901	1.98±1.00	1.86±1.86	0.70	n.s.
	NIAB 86	2.85±0.18	2.90±0.19	0.87	n.s.
	NIAB Krishma	2.64±0.18	2.73±0.18	0.73	n.s.
Jassid (nymph)	NIAB 98	1.58±0.12	1.90±0.11	0.05	n.s.
	FH-900	1.32±0.13	2.17±0.52	0.12	n.s.
	CIM-552	1.80±0.75	1.27±0.68	0.10	n.s.
	FH-901	1.71±0.23	1.25±0.71	0.18	n.s.
	NIAB 86	1.36±0.09	1.73±0.12	0.02	*
	NIAB Krishma	1.57±0.69	1.57±0.60	0.92	n.s.
Thrips	NIAB 98	0.50±0.07	0.59±0.08	0.45	n.s.
	FH-900	0.40±0.07	0.50±0.08	0.38	n.s.
	CIM-552	1.57±0.26	1.57±0.15	0.99	n.s.
	FH-901	1.48±0.32	2.00±0.22	0.29	n.s.
	NIAB 86	1.65±0.28	1.69±0.32	0.56	n.s.
	NIAB Krishma	1.84±0.65	1.79±0.65	0.63	n.s.

Values are mean±S.E. and were compared by one way ANOVA (Minitab 11). P-values <0.05 show significant difference between organic and synthetic fertilizer treatments

Table II. Comparison of seasonal per cent damage of spotted bollworms on cotton varieties subjected to organic (FYM) and synthetic fertilizer treatments

Spotted bollworms	*variety*	*Fertilizer* organic	synthetic	*p- value*	
on bolls		per cent damage			
	NIAB 98	13.51±0.88	15.01±0.86	0.22	n.s.
	FH-900	14.55±0.58	15.33±0.89	0.45	n.s.
	CIM-552	15.79±1.25	14.51±1.23	0.45	n.s.
	FH-901	16.04±2.32	19.05±2.49	0.05	n.s.
	NIAB 86	13.40±0.84	13.42±0.92	0.11	n.s.
	NIAB Krishma	13.82±1.0	14.98±0.91	0.40	n.s.
on squares	NIAB 98	3.26±0.51	4.01±0.52	0.31	n.s.
	FH-900	2.92±0.49	3.64±0.50	0.30	n.s.
	CIM-552	9.56 ±3.90	8.80±3.22	0.46	n.s.
	FH-901	8.21±1.77	9.84±1.13	0.11	n.s.
	NIAB 86	9.44±2.34	10.96±2.50	0.15	n.s.
	NIAB Krishma	8.05±1.16	7.31±1.02	0.44	n.s.

Values are mean ± S.E. and were compared by one way ANOVA (Minitab 11). P-values <0.05 show significant difference between organic and synthetic fertilizer treatments

of an environment exposed to insecticide hazards and there must be some mechanism to reduce insecticide burden on environment.

These results mentioned above were not in agreement with the findings of Kowalski and Visser (1979), Palti (1981), Campbell (1989), Hendrix *et al*. (1990), Magdoff (1992), Altieri (1994), Phelan *et al*. (1996), Morales *et al*. (1997), Leal *et al*. (1997) and Myers and Stolton (1999). These authors have reported that population of sucking and Lepidopteran insect pests were significantly high on crops grown with synthetic / or inorganic fertilizer. The contrast of the results can be envisaged due to difference of crop, insect pest, and fluctuation of environmental conditions. Morales *et al*. (2001) have reported that maize in fields given organic fertilizer applied for consecutive two years hosted fewer aphid (*Rhopalosiphum maidis*) than maize grown with synthetic fertilizers. In the light of this report it can be exhibited to get good results if 2-3 years continuous use of organic fertilizers could be carried out. While the present experiment was first change in agro-ecology of the research area. Another possible explanation of difference in results is in the fertility levels of field because gram was grown in the previous season on plots of cotton varieties. Else where reported findings (Altieri, 1994; Phelan *et al*., 1996; Morales *et al*., 1997) of fewer insects on organically managed fields could forestall total reliance on it for pest control.

On the basis of above discussion it was concluded that the marked effect of organic fertilizer on insect pest population was not evident on cotton varieties grown in plots provided with synthetic and organic fertilizers. However, there is need to carry out further studies on the same aspects on short duration crops particularly vegetables, which harbor the sucking insect pest of cotton before cotton crop.

REFERENCES

Altieri, M.A., 1994. Biodiversity and Pest Management. *Agroecosystem*, p.185. Howarth Press, NY

Altieri, M.A. and C.I. Nicholls, 1999. Biodiversity, Ecosystem function and Insect Pest Management in Agricultural System. *Agroecosystem*, p: 28–32. CRS Press, Boca Raton

Campbell, R., 1989. *Biological Control of Microbial Plant Pathogens*, p. 199. Cambridge Univ. Press, Cambridge, UK

Hendrix, P.H., D.A. Crossley Jr. and D.C. Coleman, 1990. Soil biota as components of sustainable agro-ecosystem. *Sustainable Agric. Sys.*, pp: 637–54. Soil Water Cons. Soc., IA. USA

Kowalski, R. and P.E. Visser, 1979. Nitrogen in a crop-pest interaction: Cereal aphid. *Nitrogen as an Ecological Parameter*, pp: 16–7. Blackwell Sci. Pub., Oxford. UK

Leal, E.J., R. Chac and G. Sanchez, 1997. The effect of organic soil amendments on soil pests and crop nutrition of broccoli. IPM CRSP, 4th Ann. Rept., Office Intl. Res. Develop., Virginia Tech. Blacksburg, 24061-0334

Magdoff, F.R., 1992. Building soil for better crops: *Organic Matter Management*, p. 176. Univ. Nebraska Press, Lincoln, USA

Morales, H., R. Williams, I. Perfecto and R. Perez, 1997. Pest control and soil management in the Guatemalan Highlands. *CAR News*, 4: 1–2

Morales, H., I. Perfecto and B. Ferguson, 2001. Traditional fertilization and its effect on corn insect population in the Quatemalan highlands. *Agric. Ecosys. Environ*., 34: 145–55

Myers, D. and S. Stolton, 1999. *Organic Cotton-From field to Final Production*, p. 250. Intermed. Technol. Publication, NY

Palti, J., 1981. *Cultural Practices and Infectious Crop Diseases*, p. 243. Springier, NY

Phelan, P.L., K.H. Norris and J.F. Mason, 1996. Soil management history and host preference by *Ostrinia nubilalis*: Evidence for plant mineral balance mediating insect-plant interaction. *Environ. Entomol*., 25: 1329–36

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