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Comparative Effect of Organic and Synthetic Fertilizers on the Infestation of Sucking and Bollworms Insect Pest Complex on Different Varieties of Cotton (*Gossypium hirsutum* L.)

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Abstract: To evaluate the comparative effect of organic and synthetic fertilizers on the infestation of sucking insect pests viz, Whitefly (*Bemisia tabaci*) Jassid (*Amrasca davastans*) Thrips (*Thrips tabaci*) and percent damage by spotted bollworms (*Earias spp.*) and American bollworms (*Helicoverpa armigera*) on six cotton varieties viz, NIAB-98, FH-900, CIM-552, FH-901, NIAB-86 and NIAB-Krishma, it was revealed that there was no significant difference of mean seasonal per leaf population of sucking insect pests and bollworms on each cotton variety when compared between organic and synthetic fertilizer treatments. However the crop grown in organic fertilizer harbour lesser number of insect pests. Use of organic fertilizer can be integrated with rational/judicious use of pesticides and use of synthetic fertilizers/pesticides may be minimized.

Key words: Sucking insects, cotton, Bollworms, organic fertilizers, synthetic fertilizers

INTRODUCTION

Cotton (*Gossypium hirsutum L.*) is very important economy oriented, fiber and cash crop of Pakistan sown over an area of 2983.1 thousand hectares with production of 11.24 million bales (Anonymous 2001) but per acre yield of cotton in Pakistan (19.0 Monds) is very low as compared to major cotton growing countries of the world i.e. China 30.7, Brazil 30.2, Turkey 29.8, Egypt 27.9, Mexico 27.8, Iran 23.7 and USA 19.5 Mds, is a great challenge for plant protectionists researchers extentionists and other allied scientists. Among the factors, which are contributing in low yield of cotton, inset pests have their own importance. In India, Bhat *et al.* (1986) has reported 25-45% reduction of cotton yield in non-hairy susceptible varieties due to jassid only. White fly is being ranked the most serious pest and has been proved a vector of CLCV. Due to irrational use of pesticides, the major insect pests of cotton have developed resistance to presently marked pesticides (Ahmad *et al.,* 1998) Moreover continuous and extensive use of fertilizers and pesticides has caused serious threats to agro-ecosystem. These threats include low soil organic matter, low soil biological activity, functional bio-diversity and nutrient deficiency. Different insect pests behave differently in soils having different levels of fertility and Hendrix *et al.* (1990) reported more activity of beneficial soil microorganisms and reduced insect pest damage in organically managed soils. Similarly high nitrogen fertilizes can stimulate out breaks of Homopteran insects such as leafhoppers and aphids (Campbell, 1989; Morales *et al.,* 1997; Leal *et al.,* 1997; Myers and Stolon, 1999). The objectives of the present studies are to compare the population levels and control of sucking and chewing insect pests on different 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 and control of insect pest on cotton varieties subjected to organic fertilizer and synthetic fertilizer was carried out at PARS, Jhang Road, Faisalabad, Pakistan during the year 2002.

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 Rarm Yard Manure was I tractor load per acre whereas that of synthetic fertilizer was as follows:

I: Nitrogen 69 kg acre^{-1} half at the time of sowing and 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 botton leaf of fifth plant and in this way counting was done until 15 plants were observed. The spotted and American bollworms were counted on percent infestation basis from randomly selected 15 plants.

RESULTS AND DISCUSSION

Keeping in view the questions in mind that was there any difference in population of insect pests complex in the two fertilizer regimes i.e. organic and Synthetic fertilizer and if it is so, whether this difference be helpful in pest management strategy and minimization the number of sprays of pesticides which is alarming threat to the environment and existing agro-ecosystem, the present studies were carried out. Through the pest scouting data collected on weekly basis it was revealed that there was no significant difference in the effect of organic and synthetic fertilizers on the seasonal per leaf population of sucking insect pests viz whitefly, jassid and thrips on the cotton varieties viz NIAB-98, FH-900, CIM-552, FH-901, NIAB-86 and NIAB-Krishma in unsprayed plots while number of Jassid nymphs on variety NIAB-86 and Jassid adults on the variety NIAB-98 between organic and synthetic fertilizer treatments showed significant difference (Table 1).

Table 1: Comparison of population (Seasonal mean population per leaf) of sucking insect pests viz Whitefly, Jassid (Adult and Nymph) and Thrips (Adult only) on Cotton varieties subjected to organic (FYM) and Synthetic fertilizer Treatments.)

		Fertilizer			
Insect	Variety	Organic	Synthetic	P–value	Response
White Fly	NIAB-98	4.32+1.0	4.02+1.3	0.60	N.S
(Adult)	CIM-552	3.93+0.3	4.12+0.4	0.91	N.S
Per leaf	FH-900	3.55+0.3	4.42+0.4	0.44	N.S
	NIAB-86	6.45+1.12	6.47+1.2	0.73	N.S
	FH-901	3.38+1.1	2.66+0.9	0.75	N.S
	NIAB-Krishma	6.55+1.2	6.62+1.2	0.70	N.S
White Fly	NIAB-98	12.9+1.8	13.5+1.8	0.99	N.S
(Nymph)	CIM-552	4.30+1.43	4.04+1.14	0.97	N.S
Per leaf	FH-900	11.1+1.7	12.0+1.9	0.40	N.S
	NIAB-86	6.15+0.90	6.29+0.89	0.60	N.S
	FH-901	3.28+1.15	2.79+1.10	0.06	N.S
	NIAB-Krishma	6.29+0.89	6.11+0.89	0.20	N.S
Jassid	NIAB-98	1.81+0.10	1.98+0.17	0.03	*
(Adult)	CIM-552	0.99+0.12	1.10+0.11	0.16	N.S
Per leaf	FH-900	1.98+1.0	1.86+1.86	0.21	N.S
	NIAB-86	2.85+0.18	2.90+0.19	0.70	N.S
	FH-901	1.92+1.1	1.84+1.82	0.87	N.S
	NAIB-Krishma	2.64+0.18	2.73+0.18	0.73	N.S
Jassid	NIAB-98	1.58+0.12	1.90+0.11	0.05	N.S
(Nymph)	CIM-552	1.32+0.13	2.17+0.52	0.10	N.S
Per leaf	FH-900	1.80+0.75	1.27+0.68	0.18	N.S
	NIAB-86	1.36+0.09	1.73+0.12	0.02	*
	FH-901	1.71+0.23	1.25+0.7	0.92	N.S
	NIAB-Krishma	1.57+0.69	1.59+0.69	0.45	N.S
Thrips	NIAB-98	1.48+0.32	2.0+0.22	0.38	N.S
(Adult)	CIM-552	1.84+0.65	1.79+0.65	0.99	N.S
Per leaf	FH-900	1.65+0.28	1.57+0.15	0.29	N.S
	NIAB-86	1.65+0.28	1.69+0.32	0.56	N.S
	FH-901	2.02+0.22	1.48+0.32	0.63	N.S
	NIAB-Krishma	0.50+0.07	0.59+0.89	0.84	N.S

Value are mean + S.E and were compared by one way ANOVA (Minitab.II) –P- values <0.05 show significant difference between organic and synthetic fertilizer treatments, *= Significant, N.S= Non-Significant

Different varieties behaved differently against different insect pests for example range of number of whitefly adults was 3.55 to 6.55 per leaf on the varieties FH-900 and NIAB-Krishma respectively. Similarly range of number of whitefly nymphs was also amazing i.e. 3.28 to 12.9 per leaf on the varieties NIAB-98 and FH-901 respectively. None of the variety had consistent heavy infestation of one specific insect, which may suggest varietal potential to support lives of the insects. The seasonal percent damage by spotted bollworms and American bollworms data shows that there was non-significant difference in the effect of two treatments i.e. organic vs synthetic fertilizers related to percent damage by spotted bollworms (on bolls and on squares) on all cotton varieties. However significant difference between the treatments was observed in case of American bollworms on squares only on the varieties NIAB-98 and NIAB-Krishma (Table 2). All the varieties had more or less similar trend of spotted bollworm infestation and its range was 11.28 to 16.22% with a difference 2.94% in organic

Table 2: Comparison of seasonal percent damage of spotted bollworms and American bollworms on cotton varieties subjected to organic (FYM) and synthetic fertilizer treatments

		Fertilizer			
Insect	Variety	Organic	Synthetic	P-value	Response
Spotted	NIAB-98	16.22+2.32	15.33+0.98	0.40	N.S
Bollworms	CIM-552	15.79+1.25	14.98+0.91	0.15	N.S
(on bolls)	FH-900	13.62+0.88	13.42+0.92	0.44	N.S
(Percent	NIAB-86	14.56+0.58	18.05+2.49	0.11	N.S
damage)	FH-901	13.40+0.84	15.01+0.86	0.46	N.S
	NIAB-Krishma	13.28+0.51	14.36+1.24	0.36	N.S
Spotted	NIAB-98	3.58+0.61	4.04+0.52	0.31	N.S
Bollworms	CIM-552	2.84+0.51	3.02+0.41	0.45	N.S
(on squares)	FH-900	8.21+1.77	7.31+1.02	0.06	N.S
(Percent	NIAB-86	9.44+2.34	10.96+2.50	0.22	N.S
damage)	FH-901	4.05+1.6	9.82+1.13	0.45	N.S
	NIAB-Krishma	8.58+1.66	8.88+3.22	0.45	N.S
American	NIAB-98	14.22+2.13	14.11+2.11	0.34	N.S
Bollworms	CIM-552	13.92+1.90	13.01+1.84	0.42	N.S
(on bolls)	FH-900	13.21+1.84	12.84+1.20	0.15	N.S
(Percent	NIAB-86	14.61+1.20	14.11+1.72	0.11	N.S
damage)	FH-901	15.33+2.10	15.11+0.92	0.46	N.S
	NIAB-Krishma	17.22+1.50	16.94+1.74	0.22	N.S
American	NIAB-98	3.04+0.58	3.92+0.44	0.04	*
Bollworms	CIM-552	9.04+1.5	9.92+1.77	0.52	N.S
(on squares)	FH-900	8.52+1.16	7.94+1.02	0.71	N.S
(Percent	NIAB-86	9.56+3.5	8.94+2.92	0.04	N.S
Damage)	FH-901	2.62+0.61	3.22+0.82	0.74	N.S
	NIAB-Krishma	8.71+1.12	9.83+0.98	0.03	*

Values are mean+S.E. and were compared by one way ANOV-P-values <0.05 show significant different between organic and synthetic fertilizer treatments, *= Significant, N.S= Non-Significant

and 13.42 to 18.50% with difference of 4.63 in synthetic fertilizer treatment. Range of American bollworms was comparatively higher in case of squares infestation i.e. 2.62 to 9.84% with a difference of 7.22% in organic fertilizer treatment while it was 3.22 to 9.92% with a difference of 6.70% in synthetic fertilizer treatment (Table 2).

The results of these studies are 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), Morals *et al.* (1997), Leal *et al.* (1997) and Myers and Stolton (1999). These researchers have reported that population of sucking and Lepidopteron insect pests was significantly higher on crops grown with synthetic fertilizers. The contrast of the results can be envisaged due to difference in genetic make up of different varieties, insect pests and fluctuation in environmental conditions. Morales *et al.* (2001) have reported Maize in fields given organic fertilizer applied for two consecutive years hosted fewer aphids (*Rhopalosiphum maidis*) than maize grown with synthetic fertilizers. To reach the conclusion point, 2-3 years continuous use of organic fertilizers is necessary. The difference in results may be due to the difference in fertility levels of the field because gram was grown in the previous season on plots of cotton varieties. Else where reported findings (Altieri, 1994; Phelan *et al.,* 1996 and Morales *et al.,* 1997) of fewer insects on organically managed fields as compared to synthetically managed fields, which could forestall total reliance on it for pest management. The present studies has opened a new horizon for the researches to study on the same aspects and on the same lines on short duration crops especially vegetables which harbour the sucking insect pest of cotton before cotton crop and to make every efforts to minimize the number of sprays of pesticides to save the environment and for the restoration of disturbed agro-ecosystem.

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