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EFFECTS OF ORGANIC, SYNTHETIC AND BIOFERTILIZER SOURCES ON WHITEFLY *Bemisia tabaci* (Genn.) INFESTATION ON POTATO PLANTS

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ABSTRACT

The effects of organic, synthetic and biofertilizers on abundance of *B. tabaci* and predatory insects on potato plants were evaluated during 2003 and 2004. The application of either organic or synthetic fertilizers were found to increase pest populations on potato. However, there were lower populations of whitefly with the biofertilizer treatment. While, predator populations were larger on potato plants with high whitefly populations in the synthetic fertilizer than in the organic fertilizers treated plots. On the other hand, biofertilizer application reduced whitefly population and in the same time gave the highest tuber yield. Obtained data suggested that the use of biofertilizer may be recommended as a substitute for chemical fertilization to reduce whitefly infestation and increase potato yield and quality.

INTRODUCTION

The cotton whitefly *Bemisia tabaci* (Gennadius) has an extremely wide host range. It attacks more than 500 species of plants (Perring, 1995). Large populations of this insect can ingest sufficient quantities of plant phloem sap to cause yield reductions (Gerling *et al.*, 1980; Bellows & Arakawa, 1988 and Henneberry *et al.*, 1995). In addition, whitefly has an indirect damage by the vectoring of plant viruses (Cohen *et al.*, 1988).

Fertilizers are a major input for increased agricultural productivity. The form of these inputs can influence pest populations in various ways in agroecosystems, depending on the kind of fertilizer used, the crop grown and the insect species present. For instance, alfalfa grown under high soil fertility (phosphorus and potassium) regimes was more favorable to the alfalfa weevil *Hypera postica* (Gyllenhal) and weevil populations increased up to 34%, whereas potato leafhopper *Empoasca fabae* (Harris) populations became 43% greater on alfalfa stands under low soil fertilizer regimes (Shaw *et al* .,1986). Fertilizers affected aphids only minimally on cabbages (Kalule and Wright, 2002); they did not affect densities of Russian wheat aphid *Diuraphis noxia* (Mordvilko) on wheat (Archer *et al.*, 1995), nor did they affect fecundity, longevity and survivorship of melon aphid *Aphis gossypii* Glover on chrysanthemum (Bethke *et al.*, 1998). Damage levels caused by thrips, leafminers, flea beetles, and other insects on tomato plants did not change (Letourneau *et al.*, 1996); fruit infestation by *Heliothis armigera* (Hubner) decreased with fertilizer application to tomatoes (Kasyap and Batra, 1987).

Blua and Toscano (1994) indicated that on higher nitrogen-treated plants, early-instar nymphs of whiteflies initiated production of honeydew earlier than those on plants treated with medium or low nitrogen. There is some evidence that synthetic fertilizers reduce plant resistance to insect pests (Herms., 2002), tend to enhance insect pest populations and can increase the need for insecticide applications (Edwards and Stinner, 1990). For instance, synthetic nitrogen fertilization increased aphid infestations on winter wheat (Hasken and Poehling, 1995). Similarly, numbers of *Aphis fabae* (Scopoli) increased in faba beans when urea was employed (Patriquin *et al.*, 1988 and Patriquin *et al.*, 1995). It has been reported that the survival of the Colorado potato beetle *Leptinotarsa decemlineata* (Say) up to adult emergence was enhanced with increasing amounts of NPK (Barbour *et al.*, 1991). Conversely, there are reports in the literature demonstrating that field applications of a range of types of organic matter and traditional thermophilic composts suppress attacks by insect pests (Culliney and Pimentel, 1986; Eigenbrode and Pimentel, 1988 and Rao., 2002), organic fertilizers suppressed corn insect pests such as aphids (Morales *et al.*, 2001) and the European corn borer (Phelan *et al.*, 1995), and shoot and fruit borer infesting brinjal (Sudhakar *et al.*, 1998).

The present study aimed to assess the effects of organic, synthetic and biofertilizers on *B. tabaci* populations on potato plants. The influence of kind of fertilization on potatoes yield was also investigated.

MATERIALS AND METHODS

Experimental plots

The field experiments were carried out during 2003 and 2004 potato seasons at the Agricultural Research and Experimentation Center (vegetables farm) of Fac. Agric; Moshtohor, Benha Univ. The experiment was a randomized block design with 12 plots involving three fertilizer treatments and an untreated control, each replicated three times. Certified potato tubers *Solanum tuberosum* L. (cv. Diamant) were obtained from the general authority for producers and Exporters of Horticultural Crops, Cario, Egypt. Cultivation process was performed on February 20th by sowing tuber pieces in ridges 5m long and 70 cm apart. Other field practices for potato growing were followed according to the recommendations of the Ministry of Agriculture.

Fertilizer inputs

There were three different fertilizer treatments plus an untreated control as following:

(i)Biofertilizer: *Azotobacter chroococcum* UF5 and *Azospirillum lipoferum* Mn3 strains were provided by the unit of Biofertilization, Fac. of Agric., Ain Shams Univ., Cairo, Egypt. Pieces of potato tubers were washed with water and air dried, thereafter they were soaked in cell suspension of a mixture (1:1) from *A. chroococcum* and *A. lipoferum* (1ml contains about 8×10^7 viable cells) for 30 minutes.

(ii)Organic fertilizer: biogas manure was added to the soil before sowing at a rate of 6 ton (90kg N) / fed.

(iii)Synthetic (chemical) fertilizer: chemical phosphorus fertilizer at a rate of 31kg P2O5 in form of calcium superphosphate (15.5% P2O5) was applied during preparation of the soil for all treatments. Nitrogen and potassium fertilizers were added at rates of 90 kg N/fed. and 96 kg K2O /fed. in forms of ammonium sulphate (20.5% N) and potassium sulphate (48% K2O) in three equal doses at 15, 30 and 60 days after emergence.

(iv) An untreated control which received no fertilizer input.

No insecticide or fungicide treatments were applied.

Whitefly numbers

Monitoring of whitefly population started three weeks after planting. Weekly samples of 30 leaves each were chosen, at random, of each replicate. Whitefly adults were counted carefully, early in the morning. The collected samples were transported to the laboratory in paper bags. Whitefly immature stages were counted under a binocular stereomicroscope. Sampling was continued for 12 successive weeks. At the same time, the common predatory species found associated with whitefly were also determined.

At the end of the season, the yield was weighed and the average weight of tubers from every treatment was recorded, the obtained weight was recalculated to represent that / feddan.

RESULTS

The averages of *B. tabaci* counts under the different fertilizer treatments in potato plants in the two successive seasons of 2003 and 2004 were as follows:

2003 season,

As shown in table 1, the highest increase in population of *B. tabaci* adults was found on leaves of plants treated with synthetic fertilizer (157.3 adults/30 leaves), followed by organic fertilizer (129.3). While the lowest adults' population was found in control (79.9), followed by biofertilizer (94.5). Largest nymphal counts in synthetic fertilizer treatment (58.3), followed by organic fertilizer (53.7 adults), while the lowest nymphal population was found in control (28.4 nymphs /30 leaves), followed by biofertilizer (44.3). Concerning *B. tabaci* pupae, the highest population was detected in synthetic fertilizer (41.1), followed by organic fertilizer (33.1 nymphs). The lowest population of pupae was associated with control (19.8), followed by biofertilizer (26.8). The highest population of *B. tabaci* eggs was recorded in synthetic fertilizer treatment (261.7 eggs), followed by organic fertilizer (219.4). While the lowest eggs' population was found in control (146.7), followed by biofertilizer (154.5 eggs/30 leaves).

Table (1): Mean numbers of *Bemisia tabaci* adults and immatures (eggs, nymph and pupae) /30 potato leaves of plants received different fertilizer treatments in 2003.

Sampling date	Biofertilizer				Organic fertilizer				Synthetic fertilizer				Control			
	Ad.	Ny.	Pup.	Egg	Ad.	Ny.	Pup.	Egg	Ad.	Ny.	Pup.	Egg	Ad.	Ny.	Pup.	Egg
14/3/03	21.3	58.6	9.6	43.2	21.7	86.3	18.2	51.2	32.3	116.2	24.6	58.4	6.4	16	11.2	18.3
21/3	46.2	28	38.8	96.6	66.3	118.6	6.6	115.4	68.6	113.3	29.2	103.2	36.8	56	3.2	85.6
28/3	58.6	23.3	26.2	128.3	119.3	25.2	62.3	173.6	207.6	48.6	51.3	148.6	57.6	12.4	12.8	116.4
4/4	67.2	16.6	23.3	137.2	91.6	12.4	31	152.3	213.2	24.6	61.2	196.2	66	16.3	21.4	134.4
11/4	201.6	22.2	24.4	296.3	183.2	23.6	59.2	311.4	204.2	18.2	52.3	382.3	68.8	13.4	15.6	185.3
18/4	77.7	92.4	47.6	165.6	81.3	89.6	78.3	166.2	127.6	78.4	89.2	291.4	21.3	45.6	63.2	113.6
25/4	134.2	113.3	38.2	242.4	279.6	97.2	28.3	381.3	188.6	89.3	36.6	364.6	162.3	43.4	22.3	215.3
2/5	146.6	47.3	21.2	218.2	186.6	58.4	17.3	363.6	281.4	40.6	29.3	412.6	178.4	26.6	13.6	282.6
9/5	75.6	23.4	14.3	133.4	151.3	22.6	9.6	286.2	147.2	33.4	23.6	321.4	83.3	15.4	11.2	176.2
16/5	93.6	31.2	22.4	156.2	122.3	30.6	21.2	215.4	128.2	42.3	27.2	281.2	77.6	24.3	18.2	181.4
23/5	118.4	35.6	27.2	123.6	136.6	41.2	34.3	234.6	155.3	51.4	32.3	306.6	112.3	38.2	23.4	138.6
30/5	93.3	39.2	28.6	112.6	111.3	38.2	30.3	181.3	133.6	43.6	36.2	274.4	88.2	32.6	21.4	112.4
total	1134.3	531.1	321.8	1853.6	1551.1	643.9	396.6	2632.5	1887.8	699.9	493	3140.9	959	340.2	237.5	1760.1
mean	94.5	44.3	26.8	154.5	129.3	53.7	33.1	219.4	157.3	58.3	41.1	261.7	79.9	28.4	19.8	146.7

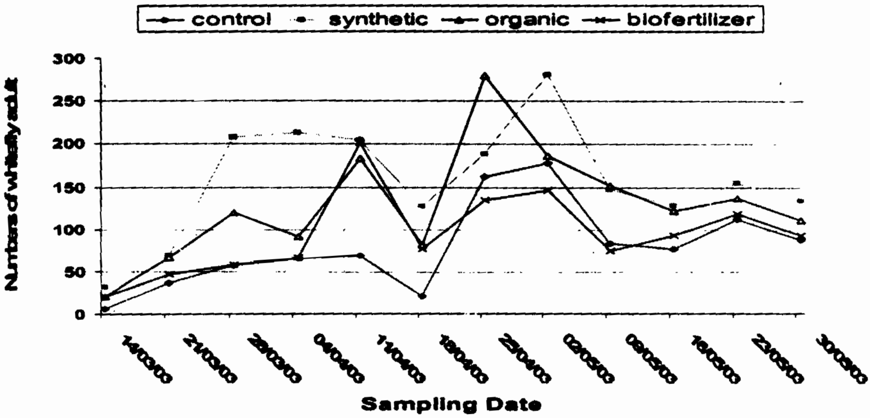

Fig. (1) Mean numbers of *B. tabaci* adults in different kind of fertilizers in experimental potato plots in 2003.

2004 season,

Estimations of adult counts in 2004 season (table, 2) indicated that the highest population was detected on potato plants that received synthetic fertilizer (180.1 adults/30 leaves), followed by organic fertilizer (158), while the lowest adults' population was found in control (106.6), followed by biofertilizer (138.1 adults). Higher population of *B. tabaci* nymphs was in organic fertilizer treatment (85), followed by synthetic fertilizer (84.9), meanwhile the lowest seasonal mean count of nymphs was recorded in control (60.2 nymphs /30 leaves), followed by biofertilizer (69.9). In case of pupae, the highest number occurred in organic fertilizer treatment (59.6), followed by synthetic fertilizer (56.6), while the lowest pupal population was found in control (39.2), followed by biofertilizer (49.9 pupae/30 leaves). Egg counts in 2004 season indicated largest counts in synthetic fertilizer (170.7 eggs), followed by organic fertilizer (157.1). While the lowest eggs population was found in control (111.8), followed by biofertilizer (142.9 eggs/30 leaves).

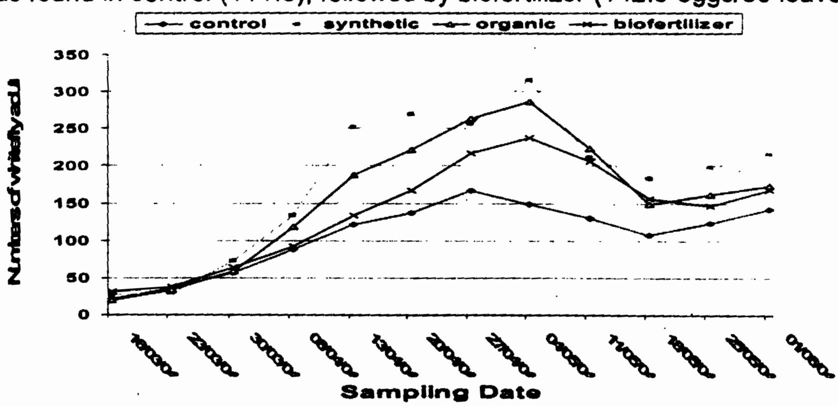

Fig. (2) Mean numbers of *B. tabaci* adults in different kinds of fertilizers in experimental potato plots in 2004.

Table (2): Mean numbers of *Bemisia tabaci* adults and the different stages (eggs, nymph and pupae) on potato leaves from different fertilizers treatments (2004 season).

Sampling date	Biofertilizer				Organic fertilizer				Synthetic fertilizer				Control			
	Ad.	Ny.	Pup	Egg	Ad.	Ny.	Pup.	Egg	Ad.	Ny.	Pup.	Egg	Ad.	Ny.	Pup.	Egg
16/3/04	31.3	16.2	28.3	22.4	19.4	18.3	31.2	14.3	27.6	23.2	28.4	33.2	21.9	10.6	16.4	18.6
23/3	38.2	25.8	31.2	41.3	33.2	29.6	27.3	47.6	29.3	38.6	30.2	69.6	36	12.8	18.8	29.4
30/3	63.8	32.4	25.4	83.6	58.4	46.8	32.6	71.3	72.4	52.3	41.3	114.4	56.2	23.8	20.3	64.2
6/4	92.3	54.2	39.3	118.9	118.6	55.6	48.3	133.2	133.2	55.3	53.2	128.4	87.8	36.4	23.4	79.3
13/4	133.4	61.3	41.2	142.6	187.8	62.3	53.2	164.6	251.8	65.2	62.4	136	121.3	51.6	28.6	117.4
20/4	167.3	79.8	53.6	169.4	221.2	81.2	72.8	188.6	268.4	83.4	61.6	203.6	136.2	62.3	41.3	138.6
27/4	216.8	102.4	69.2	191.3	263.2	116.6	83.6	211.3	255.2	104.3	67.3	262.2	167.4	72.3	48.4	144.6
4/5	237.4	115.8	63.4	184.3	286.4	178.8	61.3	171.2	315.2	145.6	72.6	211.3	148.2	96.9	57.3	131.4
11/5	206.2	113.4	73.8	172.2	223.6	150.6	118.6	209.8	211.3	153.2	82.2	182.5	130.3	111.2	65.2	153.4
18/5	155.8	72.4	59.3	163.3	148.2	107.3	71.8	177.4	183.4	96.4	64.6	203.2	107.4	88.3	58.9	151.6
25/5	146.3	100.4	61.4	211.6	161.6	93.6	66.2	233.6	198.3	106.6	62.3	278.3	123.9	93.2	48.4	167.4
1/6	168.4	64.2	52.3	213.4	173.8	78.8	47.8	261.8	215.6	94.3	53.4	225.6	142.3	63.4	43.6	163.8
total	1657.2	838.3	598.4	1714.3	1895.4	1019.5	714.7	1884.7	2161.7	1018.4	679.5	2048.3	1278.9	722.8	470.6	1341.1
mean	138.1	69.9	49.9	142.9	158	85	59.6	157.1	180.1	84.9	56.6	170.7	106.6	60.2	39.2	111.8

Effect of different fertilizer treatments on numbers of the common predatory insect species on potato plants:

Four predatory insect species were the most common on potato plants during both experimental seasons. Those included a neuropteran *Chrysoperla carnea* (eggs, larvae and adults); two coleopterous, *Coccinella undecimpunctata* (eggs, larvae and adults) and *Paederus alfierii* (adults) and a dipteran *Syrphus corollae* (adults and larvae). As shown in table (3), *C. carnea* recorded the highest total number with all treatments followed by *C. undecimpunctata*. In 2003 season, the highest total number of all predatory species was recorded in treatment by synthetic fertilizer followed by biofertilizer, control and organic fertilizer (112, 100, 98 and 77, respectively). 2004 season showed the same order of effect of different fertilizers on abundance of predaceous insect species (159, 140, 108 and 101 individuals, respectively).

Table (3) : Total counts of predatory species associated with *B. tabaci* infesting potato plants treated with different fertilizers during 2003 and 2004 seasons.

	total number of each predatory species				
Treatments	*C. carnea*	*C. undecimpunctata*	*Syrphus*	*P. alfierii*	total no.
		2003			
Biofertilizer	85	7	4	4	100
synthetic fertilizer	92	18	1	1	112
organic fertilizer	62	10	5	0	77
Control	81	12	4	1	98
		2004			
Biofertilizer	113	16	6	5	140
synthetic fertilizer	132	22	3	2	159
organic fertilizer	76	15	8	2	101
Control	88	13	6	1	108

Effect of different fertilizers on the potato yield

At the end of the two successive seasons 2003 and 2004, potato tuber yield was weighed/treatment. The weight of yield was recalculated to be represented as ton/fed. Also, the average number of tubers/kg. was recorded from different treatments. As shown in table 4, organic fertilizer treatment resulted the highest tuber yield/fed. in 2003 season, followed by biofertilizer, synthetic fertilizer and control (10.50, 10.0, 8.90 and 5.80 ton/fed., respectively). While in 2004 biofertilizer gave the highest tuber yield (12 ton/feddan), followed by synthetic fertilizer, organic fertilizer and control (11.20, 9.10 and 6.20 ton/fed., respectively). On the other hand, the highest tuber number/kg. in 2003 was in control treatment followed by synthetic fertilizer, organic fertilizer and biofertilizer (12.66, 10.60, 8.66 and 8.42 tubers/kg., respectively).2004 season showed the same order in numbers of tubers from different treatment/kg.(12.63, 10.33, 8.60 and 8.33 tuber/kg., respectively). The decrease of tubers' number/kg is a desirable character for consumers.

Table (4) Effect of different fertilizers on the potato yield and tubers number/kg.

Treatments/seasons	tubers yield ton/fed		tubers number/kg	
	2003	2004	2003	2004
biofertilizer	10.0c	12.0ab	8.42d	8.33d
synthetic fertilizer	8.90d	11.20b	10.60c	10.33c
organic fertilizer	10.50c	9.10c	8.66d	8.60d
control	5.80f	6.20e	12.66a	12.63a

Means followed by the same letter within each column are not significantly different at 5% level.

DISCUSSION

Synthetic and organic nutrient inputs to the potato plants increased whitefly populations relatively consistently compared with biofertilizer which resulted also the highest tubers' yield. It is hypothesized that increases in nitrogen levels in plants can enhance populations of invertebrate herbivores living on them (White 1984; Patriquin *et al.*, 1995). Such increases in populations of insect pests on their host-plants in response to higher nitrogen levels can result from various mechanisms, depending on the insect species and host plant. For instance, some changes in nitrogen content in Poinsettias grown with ammonium nitrate stimulated the fecundity of the whitefly *Bemisia tabaci* and attracted more individuals to oviposit on them (Bentz *el al.*, 1995). Nitrogen fertilization may decrease plant resistance to insect pests by improving the nutritional quality of host plants and reducing the secondary metabolite concentrations (Herms 2002). It was reported that nitrogen applications increased the rate of population growth of green peach aphid on potatoes and that the growth was positively correlated with the concentrations of free amino acids in leaves (Jansson and Smilowitz, 1986). High levels of nitrogen reduced glycoalkaloid synthesis, which has an inhibitory effect on insect pests of potatoes (Fragoyiannis *et al.*, 2001). Some reports have indicated that smaller pest populations occur on plants that receive organic fertilizers, and that such plants can resist pest attacks better than those receive synthetic fertilizers (Culliney and Pimentel, 1986; Eigenbrode and Pimentel, 1988). It has been postulated that lower solubility and slower release of nutrients from organic fertilizers could be a reason for smaller pest populations on plants under organic management (Patriquin *et al.*, 1995). Edwards and Stinner (1990), in their review, indicated that organic fertilizers could contribute to decreased pest attacks by increasing pest and predator species diversity and enhancing the activity of pest microbial antagonists. Coccinellids have been reported to be more numerous on corn treated with organic than with synthetic fertilizer (Morales *et al.*, 2001). A comparison of pest incidence in organic and conventional chemical fertilizer-treated farms demonstrated that oviposition levels of *Ostrinia nubilalis* (H¨ubner) were significantly higher on corn (*Zea mays* L.) grown in conventional soil than in organic fertilizer-treated soils. This difference was attributed to biologically buffering characteristics of organically managed soil, because ovipositional preference of the European corn borer was not correlated with plant biomass (Phelan *et al.*, 1995). Similarly, densities of herbivorous insects were found to be lower on collards treated with sewage sludge and manure than with synthetic fertilizers or no fertilizers, although the growth of plants treated with manure and sludge was better than of those treated with synthetic fertilizers or none (Culliney and Pimentel, 1986). However, it seems that both synthetic and organic fertilizer inputs were able to increase whitefly populations, while the biofertilizer application reduced whitefly population and in the same time gave the highest tuber yield.

On the basis of the present results, the use of biofertilizer may be recommended as a substitute for chemical fertilization to reduce whitefly infestation and increase potato yield and quality.

REFERENCES

Archer, T.L., Bynum, E.D. Jr., Onken, A.B. andWendt, C.W. (1995). Influence of water and nitrogen fertilizer on biology of the Russian wheat aphid (Homoptera: Aphididae) on wheat. *Crop Prot.* 14:165-169.

Barbour, J.D., Farrar, R.R. and Kennedy, G.G. (1991). Interaction of fertilizer regime with host-plant resistance in tomato. *Entomol. Exp. Appl.* 60:289-300.

Bellows, T.S. and Arakawa, K. (1988) Dynamics of preimaginal populations of *Bemisia tabaci* (Homoptera: Aleyrodidae) and *Eretmocerus* sp. (Hymenoptera: Aphelinidae) in southern California cotton. *Environmental Entomlogy*, 17, 225J228.

Bentz, J.-A., Reeves, J. III, Barbosa, P. and Francis, B. (1995). Nitrogen fertilizer effect on selection, acceptance, and suitability of *Euphorbia pulcherrima* (Euphorbiaceae) as a host plant to *Bemisia tabaci* (Homoptera: Aleyrodidae). *Environ. Entomol.* 24:40-45.

Bethke, J.A., Redak, R.A. and Schuch, U.K. (1998). Melon aphid performance on chrysanthemum as mediated by cultivar, and differential levels of fertilization and irrigation. *Entomol. Exp. Appl.* 88:41-47.

Blua, M.J. and Toscano, N.C. (1994). *Bemisia argentifolii* (Homoptera: Aleyrodidae) development and honeydew production as a function of cotton nitrogen status. *Environmental Entomology*, 23, 316-321.

Cohen S, J. Kern, I. Harpaz and R. Ben-Joseph (1988). Epidemiological studies of the tomato yellow leaf curl virus (TYLCV) in the Jordan Valley, Israel. Phytoparasitica 16: 259-270.

Culliney, T.W. and Pimentel, D. (1986). Ecological effects of organic agricultural practices on insect populations. *Agric. Ecosyst. Environ.* 15: 253-256.

Edwards, C.A. and Stinner, B.R. (1990). The use of innovative agricultural practices in a farm systems context for pest control in the 1990s. *Brighton Crop Protection Conf. – Pests and Diseases* vol. 7C-3, pp. 679-684.

Eigenbrode, S.D. and Pimentel, D. (1988). Effects of manure and chemical fertilizers on insect pest populations on collards. *Agric. Ecosyst. Environ.* 20:109-125.

Fragoyiannis, D.A., McKinlay, R.G. and D'Mello, J.P.F. (2001). Interactions of aphid herbivory and nitrogen availability on the total foliar glycoalkaloid content of potato plants. *J. Chem. Ecol.* 27:1749-1762.

Gerling, D., Motro, U. and Horowitz, R. (1980). Dynamics of *Bemisia tabaci* (Gennadius) (Homoptera, Aleyrodidae) attacking cotton in the coastal plain of Israel. *Bulletin of Entomological Research*, 70, 213J219.

Hasken, K.-H. and Poehling, H.-M. (1995). Effects of different intensities of fertilizers and pesticides on aphids and aphid predators in winter wheat. *Agric. Ecosyst. Environ.* 52:45-50.

Henneberry, T.J., Hendrix, D.L., Perkins, H.H., Naranjo, S.E., Flint, H.M., Akay, D., Jech, L.F. and Burke, R.A. (1995). *Bemisia argentifolii* (Homoptera: Aleyrodidae) populations and relationships to sticky cotton and cotton yields. *Southwestern Entomolologist*, 20, 255J271.

Herms, D.A. (2002). Effects of fertilization on insect resistance of woody ornamental plants: Reassessing an entrenched paradigm. *Environ. Entomol.* 31:923-933.

Jansson, R.K. and Smilowitz, Z. (1986). Influence of nitrogen on population parameters of potato insects: Abundance, population growth and within-plant distribution of the green peach aphid, *Myzus persicae* (Homoptera: Aphididae). *Environ. Entomol.* 15:49-55.

Kalule, T. and Wright, D.J. (2002). Tritrophic interactions between cabbage cultivars with different resistance and fertilizer levels, cruciferous aphids and parasitoids under field conditions. *Bull. Entomol. Res.* 92:61-69.

Kasyap, R.K. and Batra, B.R. (1987). Influence of some crop management practices on the incidence of *Heliothis armigera* (Hübner) and yield of tomato (*Lycopersicon esculentum* Mill.) in India. *Trop. Pest Manage.* 33:166-169.

Letourneau, D.K., Drinkwater, L. and Shennan, C. (1996). Effects of soil management on crop nitrogen and insect damage in organic vs. conventional tomato fields. *Agric. Ecosyst. Environ.* 57:179-187.

Morales, H., Perfecto, I. and Ferguson, B. (2001). Traditional fertilization and its effect on corn insect populations in the Guatemalan highlands. *Agric. Ecosyst. Environ.* 84:145-155.

Patriquin, D.G., Baines, D. and Abboud, A. (1995). Diseases, pests and soil fertility. *in:* Cook, H.F. and Lee, H.C. [Eds.] Soil Management in Sustainable Agriculture. Wye College Press, Wye, UK. pp. 161-174.

Patriquin, D.G., Baines, D., Lewis, J. and MacDougall, A. (1988). Aphid infestations of faba beans on an organic farm in relation to weeds, intercrops and added nitrogen. *Agric. Ecosyst. Environ.* 20:279-288.

Perring, T. M. (1995). Biological differences of two species of *Bemisia* that contribute to adaptive advantage. *Bemisia* 1995: Taxonomy, Biology, Damage Control and Management (ed. by D. Gerling and K.F. Harris), pp. 3-16. Intercept, Andover.

Phelan, P.L., Mason, J.F. and Stinner, B.R. (1995). Soil-fertility management and host preference by European corn borer, *Ostrinia nubilalis* (H¨ubner), on *Zea mays* L.: A comparison of organic and conventional chemical farming. *Agric. Ecosyst. Environ.* 56:1-8.

Rao, K.R. (2002). Induced host plant resistance in the management of sucking insect pests of groundnut. *Ann. Plant Prot. Sci.* 10:45-50.

Shaw, M.C., Wilson, M.C. and Rhykerd, C.L. (1986). Influence of phosphorus and potassium fertilization on damage to alfalfa, *Medicago sativa* L., by the alfalfa weevil, *Hypera postica* (Gyllenhal) and potato leafhopper, *Empoasca fabae* (Harris). *Crop Prot.* 5:245-249.

Sudhakar, K., Punnaiah, K.C. and Krishnayya, P.V. (1998). Influence of organic and inorganic fertilizers and certain insecticides on the incidence of shoot and fruit borer, *Leucinodes orbonalis* Guen. infesting brinjal. *J. Entomol. Res.* 22:283-286.

White, T.C.R. (1984). The abundance of invertebrate herbivores in relation to the availability of nitrogen in stressed food plants. *Oecologia* 63:90-105.

تأثير التسميد العضوي والكيماوي والحيوي علي إصابة نباتات البطاطس بحشرة الذبابة البيضاء

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أجريت هذه التجربة لدراسة تأثير التسميد العضوي والتسميد الكيماوي والتسميد الحيوي علي إصابة نباتات البطاطس بحشرة الذبابة البيضاء وعلاقة ذلك بالمحصول.

وقد تمت هذه الدراسة بمزرعة تجارب الخضر بكلية الزراعة بمشتهر خلال موسمي ٢٠٠٣ و ٢٠٠٤. تم استخدام سلالتين فعالتين من البكتريا المثبتة لأزوت الهواء الجوي هما *Azotobacter chroococcum Azospirillum lipoferum ,* كسماد حيوي كذلك تم استخدام سماد البيوجاز كسماد عضوي وسماد سلفات الأمونيوم كسماد كيماوي وقد أضيف سماد البيوجاز بمعدل ٦ طن/فدان (٩٠ كجم أزوت/فدان) كذلك تم استخدام نفس المعدل لوحدات الأزوت من سماد سلفات الأمونيوم.

وقد أظهرت النتائج أن أعلي تعداد للذبابة البيضاء كان علي النباتات التي عوملت بالسماد الكيماوي وكذلك التي عوملت بالسماد العضوي بينما كان أقل تعداد للذبابة البيضاء علي النباتات التي عوملت بالسماد الحيوي وذلك خلال موسمي الدراسة. ومن ناحية أخري كان أعلي تعداد للمفترسات المصاحبة للذبابة البيضاء علي النباتات التي عوملت بالسماد الكيماوي تلاها مباشرة تعداد المفترسات علي النباتات التي عوملت بالسماد الحيوي بينما كان أقل تعداد للمفترسات علي النباتات التي عوملت بالسماد العضوي.

كما أوضحت النتائج أن أعلي كمية محصول تم الحصول عليها من النباتات التي عوملت بالسماد العضوي ثم من النباتات التي عوملت بالسماد الحيوي ثم من النباتات التي عوملت بالسماد الكيماوي (١٠،٥٠ ; ١٠،٠٠ ; ٨،٩٠ طن/فدان علي التوالي مقابل ٥،٨ طن/فدان من المقارنة) خلال موسم ٢٠٠٣ . بينما كانت أعلي كمية محصول من النباتات التي عوملت بالسماد الحيوي ثم من النباتات التي عوملت بالسماد الكيماوي ثم من النباتات التي عوملت بالسماد العضوي (١٢،٠٠ ; ١١،٢٠ ; ٩،١٠ طن/فدان علي التوالي مقابل ٦،٢ طن/فدان من المقارنة) خلال موسم ٢٠٠٤. بالإضافة إلي ذلك فان أقل عدد للدرنات /كجم كان من النباتات التي عوملت بالسماد الحيوي خلال موسمي الدراسة (وهذه من الصفات المرغوبة سواء للمستهلك المحلي أو للتصدير).

في ضوء هذه النتائج يمكن أن التوصية باستخدام التسميد الحيوي في إنتاج محصول البطاطس كبديل للأسمدة الكيماوية والعضوية خاصة وانه يعطي أقل نسبة إصابة بالذبابة البيضاء وأعلي كمية محصول.