

## Organic Farming of Snap Bean and its Impact on Pests Population in Comparison with Certain Traditional Treatments

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**Abstract:** A field experiment was carried out during the two successive growing seasons of 2004 and 2005 at the experimental Station of National Research Centre to investigate the impact of organic fertilization with composted egg-plant, green pepper, maize and okra plant residues on bean infestation with white fly, leaf miners, aphids and red spiders as well as certain growth parameters and snap bean yield in comparison with the traditional recommended treatments. The obtained results show that the composted green pepper residue positively affects the reduction percent of infestation with the various tested blights. The reduction percent ranged from 15.8 for white fly to 76.1 for red spiders; meanwhile the reduction percent reached 22.9 and 53.2 for leaf miners and aphids consecutively. Organic fertilization with the composted residue of okra or farmyard manure reduced infestation numbers with three out of the four tested blights viz. white fly, leaf miners and red spiders for composted okra residue and leaf miners, aphids and red spiders for farmyard manure. The reduction percent reached 29.6, 65.7 and 21.9 by turns for the composted okra residue and 55.0, 27.3 and 61.9 respectively for farmyard manure treatment. Leaf miners were the only blight that affected by organic manuring with the composted egg-plant residue where the reduction percent amounted 33.6, while chicken manure application positively affect reduction percent of infestation with each of white fly and leaf miners as the reduction percent reached 57.8 and 74.0 respectively. The positive control affect the infestation numbers of leaf miners, aphids and red spiders with reduction percent reached 60.0, 36.7 and 67.7 by turns. Comparable results to the positive control were obtained for the tested bean growth parameters owing to the organic manuring of bean plants with the diverse composted agricultural residues without significant variations. Organic manuring of bean plants with different types of composted agricultural residues induced yield of snap bean significantly overcame the positive control either alone or when accompanied with microelements.

**Key words:** Organic farming, snap bean, insects, white fly, leaf miners, aphids, red spiders, composted agricultural residues.

### INTRODUCTION

Recently, man became in bad need to come back to the natural resources of various fields of his life especially for food to eschew the serious diseases caused due to the application of huge amounts of agro-chemicals in agriculture. Application of biofertilizers together with organic manures is an alternative safe way to get organic products safe to human consumption<sup>[4]</sup>. Further, both biofertilizers and organic manures improve biological, physical and chemical properties of soil<sup>[8]</sup>.

The current investigation is mainly focusing on studying the influence of organic fertilization with certain composted agricultural residues i.e., eggplant, green pepper, maize and okra on bean infestation with the most predominant blights (white fly, leaf miners, aphids and red spiders) under field conditions. Also, the

effect of composted agricultural residues on certain growth parameters and snap bean yield was considered. The traditional fertilization treatments (the recommended doses of NPK either alone or supplied by microelements, farmyard manure and chicken manure) were used as controls for comparing results of the suggested organic treatments.

### MATERIALS AND METHODS

A field experiment was conducted during the successive growing season of 2004/2005 at the experimental station of National Research Centre, Qalubeya governorate at Shalakan to study the influence of certain types of composted agricultural residues i.e., eggplant, maize, okra and pepper plants on infestation of snap bean (*Phaseolus vulgaris* L. Variety Nepraska)

plants with each of the white fly, (*Bemisia tabaci* L.), leaf miners (*Melanoagromyza phaseoli*), aphids (*Aphis craccivara* L.) and red spider (*Tetranychus* sp.) insects. The obtained results were compared with those obtained due to the application of either the traditional organic manures (chicken and farmyard manures) or the conventional chemical fertilizers treatment (NPK). infestation of snap bean leaves with white fly. In general, infestation of snap bean leaves with white fly. In general, infestation of snap bean leaves with white fly. In general,

The different agricultural residues were collected separately, chopped then subjected to composting process. A cellulose-decomposing yeast (*Candidia humicola*) was used at the rate of 10 L ( $5.3 \times 10^5$  cell/ml) per ton for accelerating degradation of residues<sup>[6]</sup>. The diverse composted residues and organic manures were applied on the base of their nitrogen content that equivalent to the recommended dose of urea applied to snap bean. Seeds of bean were coated with a thin film of *Rhizobium leguminosarum* bv. *phaseoli* using gum Arabic (40%) as adhesive material then seeds were sown in hills of 20 cm apart on rows of 60 cm width and the plot area reached 30 m<sup>2</sup>. Three to five seeds were sown per each hill at the first half of November of both 2004 and 2005. Ten days later the plantlets were thinned to two plantlets per hill. The whole scheme of work is as follows:

- Control.
- Positive control (100% NPK).
- Positive control + micronutrients.
- Chicken manure.
- Farmyard manure.
- Eggplant compost.
- Green pepper plants compost.
- Maize stalks compost.
- Okra plants compost.

The normal agricultural practices were carried out according to the recommendations of Ministry of Agriculture. Infestation of snap bean leaves with each of white fly, leaf miners, aphids and red spiders was recorded one week intervals starting from December 22 to march 8. Thirty leaves from each treatment were randomly collected then the mean numbers of infestation was calculated.

The obtained data were subjected to combined statistical analysis using the analysis of variance according to Snedcor and Cochran<sup>[11]</sup>.

## RESULTS AND DISCUSSIONS

Regardless of plant residues type, the composted

materials had reached their maturity stage after 65 day. The nitrogen content of the resultant composts reached 0.51%, 55%, 56% and 56% for egg plant, maize, okra and green pepper respectively. Table (1) demonstrates the impact of diverse types of composted residues on infestation of snap bean leaves with white fly. In general, the high numbers of bean leaves infestation with immature white fly were observed during January then gradually decreased till March. The treatment of positive control supplemented with micronutrients recorded the highest total infestation numbers (16888/30 leaves) in comparison with the rest treatments followed by the positive control (13954/30 leaves) and control (11466/30 leaves) treatments. For the organic treatments, the total mean infestation numbers ranged from 403 to 1003/30 leaves being lowest with chicken manure and the highest due to the application of composted maize residues. In comparison with the positive control (1162/30 leaves), it was found that the treatments which organically fertilized with chicken manure, farmyard manure, composted egg plant residue, composted green pepper residue and composted okra residue significantly lowered the infestation with immature white fly. Yepsen<sup>[12]</sup> and Oelhaf<sup>[9]</sup> stated that fertilization of plants with biological sources of soil nutrients such as manures and composted organic wastes are less susceptible to insects infestation than the conventionally grown plants. Furthermore, the obtained results are on the same line with those obtained by Gomaa *et al*<sup>[6]</sup> who stated that application of bio-organic farming reduced the infestation of potato leaves with immature white fly.

With regard to the influence of various tested organic treatments, in comparison with the traditional ones, on infestation of bean leaves with the leaf miners, Table (2) demonstrates that no infestation was recorded during the forth week of December then started to appear by the end of December and beginning of January. The total infestation numbers during the growth season ranged from 36 to 147/30 leaves irrespective of the treatments. A significant reduction in leaf miners infestation was observed owing to the application of each of chicken manure, farmyard manure and composted okra residue in comparison with the control treatment. Also, the positive control induced a significant reduction in leaf miners infestation in comparison with the control treatments, while the differences among the other treatments and the control were not significant. It is worthy to mention that the composted okra residue and farmyard manure treatments induced the lowest

**Table 1:** Effect of various types of composted agricultural residues on bean leaves infestation with white fly.

Treatments	Composted agricultural residues								
Control	Positive control (NPK)	Positive control+ Microelements	Ch.M	FYM	Eggplant	Green pepper	Maize	Okra	
The mean numbers of infestation with immature white fly/ 30 leaves									
December 22	274	327	412	135	144	225	107	141	245
29	671	417	1183	257	625	235	145	289	467
January 4	1716	1051	1881	204	1168	468	734	1239	1119
11	1216	2192	3516	289	1725	1585	1042	1119	1122
18	1824	2791	2558	358	1093	1298	1634	1949	1663
25	1197	1535	1243	419	935	2029	1172	1171	985
February 1	983	1148	1460	356	618	1961	1771	1583	925
8	963	1894	2116	364	645	1139	838	1442	644
15	886	539	609	328	773	985	708	1117	258
22	668	1034	537	819	355	806	444	734	289
March 1	632	445	622	823	252	645	523	664	231
8	436	572	751	488	475	591	483	587	128
Total	11466	13945	16888	4840	8808	11967	9651	12035	8076
Mean ±S.E (min. - max.)	955.5±179.1 (276-1824)	1162.1±228.9 (327-2791)	1407.3±275.4 (412-3516)	403.3±62.4 (135-419)	734±128.1 (144-1725)	997.3±179.1 (225-1961)	800.1±152.3 (107-1771)	1002.9±154.4 (141-1949)	673±139.8 (128-1663)
Statistical analysis	L.S.D <sub>0.05</sub> = 408.84 L.S.D <sub>0.01</sub> = 540.44								

FYM: farmyard manure; Ch.M: chicken manure; Means with same letters have no significant difference

**Table 2:** Fluctuation of leaf miners counts in bean leaves as affected by the different types of composted agricultural residues.

Treatments	Composted agricultural residues								
Control	Positive control (NPK)	Positive control+ Microelements	Ch.M	FYM	Eggplant pepper	Green	Maize	Okra	
The mean numbers of infestation with leaf miner/ 30 leaves									
December 22	0	0	0	0	0	0	0	0	0
29	4	0	0	1	0	0	5	8	0
January 4	14	8	15	5	0	5	13	17	9
11	16	6	13	5	5	18	18	28	7
18	23	7	2	6	11	22	20	33	3
25	20	9	8	4	8	12	15	30	6
February 1	18	10	6	1	11	9	9	13	8
8	13	7	9	3	9	9	8	10	5
15	6	4	15	2	2	8	4	5	0

**Table 2:** continued.

22	11	0	19	4	6	7	7	3	1
March 1	8	2	12	2	5	3	5	0	4
8	5	3	4	3	6	0	4	0	5
Total	140	56	103	36	63	93	108	147	48
Mean ±S.E (min.- max.)	11.7±2.04 (0-23)	4.7±1.1 (0-10)	8.6±1.8 (0-19)	3.0±0.5 (0-6)	5.3±1.2 (0-11)	7.8±2.02 (0-22)	9.0±1.8 (0-20)	12.3±3.5 (0-33)	4.0±0.9 (0-8)
Statistical analysis	L.S.D <sub>0.05</sub> = 4.787 L.S.D <sub>0.01</sub> = 6.328								

FYM: farmyard manure; Ch.M: chicken manure

infestation numbers of leaf miners in comparison with either the positive control or the other organic treatments. The obtained results are in harmony with those recorded by Rodale<sup>[10]</sup> and Balfour<sup>[3]</sup> who mentioned that the organically manured plants are less susceptible to insects than the traditionally fertilized plants. Table (3) reveals the impact of diverse tested organic treatments on bean leaves infestation withaphidsin comparison with the traditional mineral

treatments. No records were found during the forthweek of December but the aphids numbers were very low at the end of December and the first two weeks of January. The recorded total numbers of aphids per 30 leaves during the test period ranged from 37 to 157 being the highest with chicken manure treatment and the lowest due to fertilization with the composted green pepper residue. Both organic treatments of composted green pepper residue and farmyard manure

**Table 3:** Influence of diverse types of composted agricultural residues of infestation of bean leaves with aphids.

Treatments ----- Dates	Control	Positive control (NPK)	Positive control+ Microelements	Ch.M	FYM	Composted agricultural residues			
						Egg-plant pepper	Green	Maize	Okra
The mean number of aphids /30 leaves									
December 22	0	0	0	0	0	0	0	0	0
29	0	3	3	4	2	2	0	7	5
January 4	1	1	6	2	4	5	0	4	1
11	4	3	9	3	3	10	2	18	3
18	10	5	8	12	10	7	8	25	8
25	13	10	10	11	11	10	7	18	16
February 1	18	8	15	14	9	13	6	20	10
8	14	9	12	18	10	22	8	12	11
15	10	8	10	22	5	8	4	16	27
22	8	2	3	31	2	17	2	10	12
March 1	1	1	0	22	2	21	0	3	18
8	0	0	0	18	1	19	0	0	14
Total	79	50	76	157	59	134	37	125	127
Mean ±S.E (min.- max.)	6.6±1.8 (0-18)	4.2±1.1 (0-10)	6.3±1.5 (0-15)	13.1±2.8 (0-31)	4.9±1.2 (0-11)	11.2±2.1 (0-22)	3.1±0.96 (0-8)	10.4±2.2 (0-25)	10.6±2.2 (0-27)
Statistical analysis	L.S.D <sub>0.05</sub> = 5.1454 L.S.D <sub>0.01</sub> = 6.8017								

FYM: farmyard manure; Ch.M: chicken manure

treatments greatly reduced the aphids number/30 leaves in comparison with the other treatments. The same finding was observed by Gomaa *et al*<sup>[6]</sup>. The influence of different tested treatments on infestation of bean leaves with the red spider was presented in Table (4). Once again, no records were found at the forth week of December, while the recorded numbers of red spiders during the first two weeks of January were very low irrespective of the treatments. The total numbers of red spiders ranged from 37 to 201/30 leaves being the highest with chickenmanure treatment and the lowest due to organic fertilization with the composted green pepper residue. Significant reductions in the numbers of red spiders were recorded due to the organic fertilization with composted green pepper residue and farmyard manure in comparison with the control treatment. Moreover, a significant decrease in red spiders was found with the positive control treatment in comparison also with the positive control. The same observation was found by Rodale<sup>[10]</sup>, Balfour<sup>[3]</sup> and Gomaa *et al*<sup>[6]</sup>.

Table (5) demonstrates the overall effect of various tested organic treatments on the most predominant harmful blights in Egyptian agriculture i.e., white fly, leaf miners, aphids and red spiders. It is obvious that organic fertilization of bean plants with the composted green pepper residue positively affect the reduction percent of infestation with various insects. The reduction percent ranged from 15.8 for white fly to 76.1 for red spiders; meanwhile the reduction percent reached 22.9 and 53.2 for leaf miners and aphids respectively. Furthermore, organic fertilization with composted residue of okra or farmyard manure reduce the infestation numbers with three out of the four tested insects viz. white fly, leaf miners and red spiders for the second. The reduction percent reached 29.6, 65.7 and 21.9 consecutively for the composted okra residue and 55.0, 27.3 and 61.9 by turns for farmyard manure treatment. Table (5) also reveals that leaf miners were the only blight that affected by organic manuring with the composted eggplant residue where the reduction percent reached 33.6, while chicken manure application

**Table 4:** Application efficiency of various composted agricultural residues on infestation of bean leaves by the red spiders.

Treatments ----- Dates	Control	Positive control (NPK)	Positive control+ Microelements	Ch.M.	FYM	Composted agricultural residues -----			
						Egg-plant	Green pepper	Maize	Okra
----- The mean numbers of red spider / 30 leaves -----									
December 22	0	0	0	0	0	0	0	0	0
29	0	3	3	4	2	2	0	0	5
January 4	0	1	6	2	4	5	0	3	1
11	0	3	9	3	3	10	2	7	3
18	8	5	8	12	10	7	8	4	8
25	13	10	10	11	11	10	7	12	16
February 1	15	8	15	14	9	13	6	15	10
8	12	9	12	18	10	22	8	33	10
15	10	8	10	22	5	8	4	21	11
22	19	2	3	31	2	17	2	44	27
March 1	38	1	0	22	2	21	0	55	12
8	40	0	0	18	1	19	0	10	18
Total	155	50	76	157	59	134	37	201	127
Mean ±S.E (min.- max.)	12.9±3.9 (0-40)	4.2±1.1 (0-10)	6.3±1.5 (0-15)	13.1±2.8 (0-31)	4.9±1.2 (0-11)	11.2±2.1 (0-22)	3.1±0.96 (0-8)	17±5.2 (0-55)	11.1±2.2 (0-27)
Statistical analysis	L.S.D. <sub>0.05</sub> =7.496 L.S.D. <sub>0.01</sub> = 9.88								

FYM: farmyard manure; Ch.M: chicken manure

**Table 5:** Reduction percent of bean leaves infestation with certain insects owing to the application of various composted agricultural residues.

Insects	Control	Positive control (NPK)	Positive control+ Microelements	Ch.M	FYM	Composted agricultural residues			
						Eggplant	Green pepper	Maize	Okra
Reduction percent of Infestation with the different tested insects									
White fly	0.0	-21.6*	-47.3*	57.8*	-667***	-4.37*	15.8	-4.9	29.6*
Leaf miners	0.0	60.0**	26.4*	74.0**	55.0**	33.6*	22.9*	-5.0	65.7**
Aphids	0.0	36.7*	3.8	-98.7***	27.3*	-69.6**	53.2*	-58.2**	-60.8**
Red spider	0.0	67.7**	50.9*	-1.3	61.9**	13.6	76.1**	-29.7*	90.9**

\*(-) values means there is no reduction in infestation.

^(+) values means there is increase in % of infestation reduction. \* FYM= farmyard manure \* Ch.M.= chicken manure

$$\text{Infestation Reduction (\%)} = \frac{\text{control} - \text{treated}}{\text{control}} \times 100$$

positively affect reduction percent of infestation with each of white fly and leaf miners where the reduction percent amounted 57.8 and 74.0 respectively. It is worthy to mention that the positive control affect the infestation numbers of each of leaf miners, aphids and red spiders with reduction percent reached 60.0, 36.7 and 67.7 by turns. On the other hand, the composted maize residue does not show positive influence on infestation numbers with any of the tested insects. The recorded data of Gomaa *et al*<sup>[6]</sup> confirm the current results where they stated that organic manuring of potato plants reduced the infestation percent with white fly and trips.

With respect to the influence of organic manuring with the varied composted agricultural residue on certain growth parameters and yield of snap bean, Table (6) shows that comparable results to the positive were obtained for tested bean growth parameters (plant eight, leaves number and shoots numbers per plant) owing to

organic manuring of bean plants with the various composted agricultural residues without significant variations. Moreover, organic manuring of bean plants with the various types of composted agricultural residues induced yield of snap bean significantly overcame that obtained due to the application of the recommended doses of NPK either alone or accompanied by the microelements. Further, the yield of snap bean due to organic manuring with diverse tested composted agricultural residues ranged from 110 to 137 g/plant being the highest with composted eggplant residue treatment. The current results are in harmony with those obtained by Amany and Gomaa<sup>[2]</sup>, Gomaa *et al*<sup>[4]</sup>, Abdel-Wahab and Said<sup>[1]</sup>, Gomaa and Khattab<sup>[5]</sup>, Gomaa *et al*<sup>[6]</sup> and Hoda and Gomaa<sup>[7]</sup> who mentioned that the application of either organic or bio-organic treatments improved the yield and its quality of various tested crops.

**Table 6:** Effect of different types of composted agricultural residues on certain growth parameters and yield of snap bean.

Parameters	Plant height (cm)	Leaves (no./plant)	Shoots (no./ plant)	Yield (g /plant)
Control	28.9 <sup>a</sup> ± 8.17	63.6 <sup>a</sup> ± 18.3	44.4 <sup>a</sup> ± 140.7	45.9 <sup>a</sup> ± 69.1
Positive control (NPK)	36.4 <sup>a</sup> ± 18.3	76.4 <sup>a</sup> ± 75.6	64.2 <sup>a</sup> ± 56.7	83.9 <sup>a</sup> ± 102
Positive control+Microelements	29.4 <sup>a</sup> ± 1.5	72.8 <sup>a</sup> ± 107	52.1 <sup>a</sup> ± 10.2	68.7 <sup>a</sup> ± 16.6
Ch.M.	38.3 <sup>a</sup> ± 5.6	76.7 <sup>a</sup> ± 243.3	79.3 <sup>a</sup> ± 3.01	117.9 <sup>c</sup> ± 8.4
FYM	40.0 <sup>a</sup> ± 81.8	79.6 <sup>a</sup> ± 119.4	78.6 <sup>a</sup> ± 123.2	112.5 <sup>c</sup> ± 56.6
Eggplant	31.6 <sup>a</sup> ± 9.2	77.9 <sup>a</sup> ± 1.4	85.6 <sup>a</sup> ± 138.7	137.2 <sup>c</sup> ± 71.1
Green pepper	33.1 <sup>a</sup> ± 6.7	66.9 <sup>a</sup> ± 60.01	75.5 <sup>a</sup> ± 24.5	110.2 <sup>c</sup> ± 71.1
Maize	36.6 <sup>a</sup> ± 15.02	71.9 <sup>a</sup> ± 10.36	84.3 <sup>a</sup> ± 56.7	136.8 <sup>c</sup> ± 152.1
Okra	30.7 <sup>a</sup> ± 8.6	74.8 <sup>a</sup> ± 5.8	86.4 <sup>a</sup> ± 28.7	132.8 <sup>c</sup> ± 6.8
LSD at 5%	17.42	37.52	33.74	54.91
LSD at 1%	3.29	50.29	45.24	73.62

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