ACARINES, 13:57-72, 2019

Diversity and Abundance of Spider and Other Soil Animals as Influenced by Fertilization and Their Effect on Yield of Onion at Fayoum Governorate, Egypt

Ayman Y. Zaki[*] and A. I. Aly[**]
[*]Vegetable and Aromatic Plant Mites Dept, Plant Protec, Res. Inst., Agric. Res, Centre, Dokii, Giza, Egypt. ayzaki1975@yahoo.com
[**]Vegetable Research Dept, Horticulture Res. Inst., Agric. Res, Centre, Dokii, Giza, Egypt.

ABSTRACT

A field experiment was conducted on onion plants, Giza 20 at Ibshway, Fayoum governorate, Egypt in winter season (2017-2018). Compost manure was applied in the main plots and nitrogen and Phosphors levels were applied in the sub plots to study the interaction effects on the biodiversity of spider, soil animals and the yield of onion. Spiders and soil animals were sampled using pitfall traps. Community composition of collected spiders was determined using the Shannon-Wiener and Simpson Indices of diversity. A total of 1080 spiders included 9 families, 22 genera, 22 species and 704 spiders included 8 families, 20 genera, and 20 species were collected in compost manure treatment and zero compost respectively. According to Simpson, Family Laycosidae recorded the highest number of spiders. Sorensen Quotient of Similarity between compost compared zero compost concluded that 80%, of similarity. A total of 8097 individuals in compost manure and 6506 individuals in Zero compost system were counted from 9 observations on onion plants from seedling to maturity by using pitfall trap. Statistical analysis for spider, soil fauna, yield and various parameters were discussed.

Key words: Fauna, Biodiversity, Spider, compost, Nitrogen, phosphor, fertilizer, yield.

INTRODUCTION

In Egypt onion is the second major export crop after cotton. This is mainly due to the in demand increase of the crop in local markets and for export. (Sabbour and Abbass 2006). Onion, *Allium cepa* L. Amaryllidaceae (Alliaceae) and the widely grown herbaceous biennial vegetable crop with cross-pollinated and monocotyledonous behavior having diploid chromosomes number 2n. Consumption of onions has been increasing significantly in the world partly because of the health benefits they possess (Straub and Emmett, 1992). Organic manures not only provide plant nutrient but also improve the soil structure by effect on soil aggregates. They also decrease Electrical conductivity (EC) and increase water holding capacity. Also, its phosphate availability of soils, besides improving the fertilizer use efficiency and microbial activity. Bio fertilizers play a key role in increasing the availability of nutrient (Bhavana *et al.,* 2017). Organic manure is an eco-friendly, economically viable and ecologically sound that also played a significant role in improving physical, chemical and biological properties of soil. Organic manure improves soil structure and water holding capacity, resulting in more extensive root development and enhanced soil micro flora and fauna activity, which results in availability of plants available micronutrients (Zeidan, 2007). Organic farming makes positive contribution not only to the soil and environment but also to the human health as well (Singh and Attrey 2002). Many of the functions associated with soil organic matter are related to the activities of soil flora and fauna (Stevenson, 1994). Compost supports a diversity of microbes (e.g., fungi, bacteria, actinomycetes, and algae), micro-fauna (protozoa), and mesofauna (mainly annelids, arthropods, nematodes) (Cooperband, 2000 and Young *et al.,* 2005). The N or P addition strengthened top-down control relationships aggravated reducing microbial biomass. The NP-addition significantly increases microbial biomass, the abundance of nematodes and micro-arthropods, strengthened bottom-up control. Also, the unbalanced fertilization could increase the degree of top-down control relationship and greatly shifted toward adverse situation in soil (Sun *et al.,* 2016). The diversity of many predatory insects and spiders is under pressure in agricultural landscapes (Kalas *et al.,* 2010). Spiders also have a role in ecosystem services, and are one of the main arthropod predators in many habitats (Cardosa *et al.,* 2011). High abundance and diversity of spiders is considered to be important in both conventional and organic cropping systems because of the predatory function of spiders (Kuusk *et al.* 2008). Organic fields support a higher abundance of spiders than conventionally farmed fields (Schmidt *et al.,* 2005).

The objective of the present work is to study diversity and abundance of spider and other soil animals as influence by compost manure and inorganic fertilizers in onion plant and relation to yield.

MATERIALS AND METHODS

a. Experimental design:

The present investigation was conducted at Ibshway, Fayoum governorate during the winter season, 2017-2018. Onion seedlings *Allium cepa* (Amaryllidaceae:

Alliaceae) (Giza 20) produced by Ega-seed company were transplanted in the experimental field at the end week of November 2017. A spilt split plots design with three replicates was used. Compost manure was applied in the main plots and nitrogen and Phosphors levels were applied in the sub plots. During soil preparation, calcium supper phosphate (15.5% P_2O_5) at the rate of 30, 45 and 60 unit/fed was broadcasted before transplanting. Potassium sulphate (48% K_2O) at rate of 48 unit/fed was added before transplanting. Compost added before transplanting at the rate of 3.5 ton/fed. Nitrogen fertilizer were broadcasted at the rate of 50, 70 and 90 unit/fed were divided into two equal parts. Soil fauna was sampled by using pitfall traps method as described by Southwood (1978) and Slingsby and Cook (1986). Three pitfall traps were placed in each fertilizer treatment every ten days. Samples were sorted in the laboratory; collected spiders and others soil fauna were kept in glass vials containing 70% ethyl alcohol and some droplets of glycerin, counted and identified to species as much as possible.

b. Frequency and abundance values

The frequency values of the most abundant species were classified into three classes according to the system adopted by Weis Fogh (1948); "Constant species" more than 50% of the samples, "accessory species" 25-50 % of the samples and "accidental species" less than 25%. On the other hand, the classification of dominance values were done according to Weigmann (1973) system in which the species were divided into five groups based on the values of dominance in the sample; Eudominant species (>30% individuals), dominant species (>10-30% individuals), subdominant (5-10% individuals), recedent species (1-5% individuals) and sub-recedent species (<1% individuals).

c. Species diversity

The biodiversity of collected spider were measured by diversity index that reflected the number of spider species (richness) in the samples. Two common indices were computed, Shannon-Wiener index "H" and Simpson index "S". They were calculated as described by Ludwig and Reynolds (1988) as follow:

$$H' = -\Sigma (ni/n) \ln (ni/n) \qquad S = \Sigma (ni/n)^2$$

Where: ni is the number of individuals belonging to the i^{th} of "S" taxa in the sample and "n" is the total number of individuals in the sample. "H" is more sensitive to changes in a number of species and diversity, while "S" is a dominance index gives more weight to common or dominant species (Ludwig and Reynolds, 1988); it highly suggests that the two individuals drawn at random from the population belong to the same species. If the result is high then the probability of both individuals belonging to the same species is high, and as a result, the diversity of the community samples might be low.

d. Sørensen quotient of similarity

To allow a comparison of the two samplings between microhabitats of the two cultivation systems, Sørensen's quotient of similarity (Sørensen, 1948) was used to determine the similarities of spider species composition among the communities, it is: QS = 2 C/A + B. Where A and B are the number of species in samples A and B, respectively, and C is the number of species shared by the two samples; QS is the quotient of similarity and ranges from 0-1. [A = Organic management, B = conventional management].

e. Dominance and abundance Percentages of the recovered species using pitfall traps:

By using the same above mentioned samples, dominance and abundance percentages of arthropod pests and predators inhabiting cowpea plantations were determined by the formula (s) of Facylate (1971) as follows:

$$1\text{- } D = (t/T) \times 100$$

Where: D= Dominance percentage. t= Total number of each species during collecting period. T=Total number of all species collected during the collecting period.

$$2\text{- } A = (n/N) \times 100$$

Where: A= Abundance percentage, n= Total number of samples in which each species appeared. N= Total number of samples taken all over the season.

e- Data recorded

1- Vegetative growth characteristics :-

Six random plants from each sub-sub-plot after 45 days from transplanting were chosen cut off at ground level. Plant length/cm, Plant diameter/cm, Number of leaves/plant and fresh and dry weight (gm/plant) were recorded.

2- Total yield and quality

Total yield (ton/fed.): Total weight of onion plants including the damaged and disorder fruits

3. Regarding total soluble solids (TSS %):-

A total soluble solid (%) was determined using a hand refract-meter.

Soil sample from experimental site was taken before transplanting and subjected to analysis, soil physical properties were determined according to klute (1986) Chemicals properties determined according to Page *et al.*, (1982) P was determined according to Chapman and Pratt (1961).

Table (1) Initial physical and chemical soil properties of the studied soil (0-30)

Physical properties	
$CaCo_3$ %	2
Clay %	14.40
Salt %	6.60
Sand%	79.00
Textural class	Sandy loam
Chemical properties	
PH (1:2.5 soil: water susp)	7.9
Ec., mmhos/cm	0.9
Soluble cations (meq./L)	
Ca^{++}	2.6
Mg^{++}	3.2
Na^{+}	16.8
Soluble anions meq/L	
Hco_3	1
Cl	2.5
So_3	20.6
Available nutrients ppm	
N	50
P	4.6
K	420

f. Statistical analysis:

All collected data for various parameters were statistically analyzed according to the technique of analysis of variance for split-plot arranged in randomized complete block design using the InfoStat computer software package (version, 2012). The differences among treatment means were compared by LSD as a post hoc test at ≤ 5% level of significance (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

I- Spider collecting

Tables (2 and 3) showed that the collected spiders recorded were 1784 individuals, represented by 9 families of 22 identified genera. The 9 families found in the present study represent 40.91% of the 40 families recorded in Egypt (El-Hennawy, 2006).

Spiders inhabiting land of management Compost manure

A total of 1080 spiders were collected in compost manure treatment. They were identified to 9 families, 22 genera, and 24 species. Juvenile comprised 51.76% while adults averaged 48.24%. The sex ratio was 2.8 male: 1 female. The highest abundant species numbers were *Linyphid sp* (181 individuals), *Pardosa sp*. (161 indv.) Lycosidae, and *Hogns ferox*, Lycosidae (71 indv.). Table (2)

Zero Compost (Standard Fertilization)

From table (3) a total of 704 spiders were cached in treatment of Zero compost. They were identified in 8 families, 17 genera, and 20 species. Juvenile comprised 27.69% while adults averaged 72.30%. The sex ratio was 3.5 male: 1female. Of the most abundant species, 2 genera were recorded highest numbers, *Pardosa sp*, Laycosidae (213 individuals), and *Linyphid sp* (161 individuals).

Hafiz and Abida (2009) recorded highest number of spiders, 4645 spiders belonging to 7 families, 16 genera and 21 species in organic manure. Also, Cunha *et al.*, (2015) collected 506 spiders (21 families and 32 species) and found that the organic system of watermelon presented the highest number of spiders.

Species richness

Among the 22 species of the collected spiders (Table 2, 3), 24 species of 9 families were recorded in compost manure system and 17 species of 8 families in Zero compost. A total of 17 species had common occurrence in all treatment. Family Oonopidae and Thomosidae were absent in soil treated with Zero compost. Family Titanoesidae disappear in soil treated with compost as organic system.

Family Laycosidae recorded the highest number of spiders of 1108 individuals. In compost manure the highest number of spider belonging to family Lycosidae (756 individuals + one egg sac) comprised 70%. The numbers of Lycosidae decrease to 352 individuals in zero compost comprised 50%.

These results corroborate with the study of Cunha *et al.*, (2015) who found that the organic system of watermelon presented the highest number of spiders (n = 253), and conventional system (n =119). Also, family Lycosidae the most abundant in organic system. Also, Almada *et al.*, (2012), indicated this result that only four spider families constitute 95% of the spider community in cotton crops in Argentina.

Frequency and abundance values:

Table (4) showed exhibits of spiders associated with onion plants as affected by organic manure. Family Lycosidae was considered “Constant” in compost manure according to Weis Fog system which occupied 70% of the collected spiders. While considered “accessory” with family Linyphidae in standard fertilization (Zero compost).

Members of all species were considered sub resident species (<1% individuals) according to Weigmann classification of dominance. Rizk *et al.*, (2015) consent this result, that family Lycosidae was considered "Constant" according to Weis fog system, in the two type of cultivation organic. The presence of Lycosidae and Theridiidae families coincides with study of Young and Edwards (1990) for North American crops. Also, these results corroborate with the study of Eyre *et al.*, (2008) they stated that family Lycosidae species prefer the organic cultivation.

Table (2): Species richness of spiders inhabiting soil of compost manure associated onion plants

	N_{50}									N_{70}									N_{90}									Σ			Σ	Total	%
	P_{30}			P_{45}			P_{60}			P_{30}			P_{45}			P_{60}			P_{30}			P_{45}			P_{60}								
	♂	♀	j	♂	♀	j	♂	♀	j	♂	♀	j	♂	♀	j	♂	♀	j	♂	♀	j	♂	♀	j	♂	♀	j	♂	♀	j			
Lycosidae									397			23												3				0	0	423	423	756+▲	70.0
Wadicosa fidelis	3	3		5	7		3	6	40	1	3		2	2		1	4	1	3	1	2	1	5		6		2	25	31	45	101		
Pardosa sp.	6		4	17	4	3	15	1	3	14	1	2	21	2	6	14	1	6	12	5		19		2	2		1	120	14	27	161		
Hogna ferox	1	1		1	1	1		1		2	2	14		2		2		2	2		2	2		3	21	1	10	31	8	32	71		
Linyphiidae	11	6		17	5	1	1	5	14	7	1	2	11	5		16	7	1	15	5	2	17	8	1	12	9	2	107	51	23	181	237	21.9
prinerigone sp.		4		5		1	1			3	1		1			1	1		1			2				1		14	7	1	22		
Mermessus denticulatus	2	2		2	2			1		1			6	2		3	2		4			1	1			2		19	12	0	31		
Sengletus sp.										2												1						3	0	0	3		
Gnaphosidae																												0	0	0	0	13	1.2
Trachyzelotes sp.								1																	1			1	1	0	2		
Micaria dives	1											1									1							1	0	2	3		
Zelotes laetus	1						1						1															3	0	0	3		
Zelotes callidus	1			1									1						1									4	0	0	4		
Zelotes evagans						1																						0	0	1	1		
Salticidae													3		2				1									4	0	2	6	14	1.3
Hasarius sp.		1																	1							1		1	2	0	3		
Phlegra flavipes	2				1																	1						3	1	0	4		
pellenes arciger																1												1	0	0	1		
Thridiidae							1		1							1												2	0	1	3	46	4.3
Kochiura aulica																									1			1	0	0	1		
Steatoda erigoniformis	5			3	2		6	1		2	1		5			1	1		4			2			6	1	1	34	6	1	41		
Enoplognatha gemina				1																								1	0	0	1		
Philodromidae																												0	0	0	0	7	0.6
Thanatus albini		2																	2						2		1	4	2	1	7		
Oonopidae																												0	0	0	0	1	0.1
Opopaea sp.								1																				0	1	0	1		
Thomisidae																												0	0	0	0	3	0.3
Xysticaus promscus							1																					1	0	0	1		
Xysticaus acerbus										1			1															2	0	0	2		
Dictynidae										1						1						1						3	0	0	3	3	0.3
	33	19	4	52	22	7	29	17	455	34	9	42	52	13	8	41	16	10	46	11	7	47	14	9	51	15	17	385	136	559		1080	
	56			81+▲▲▲			501+▲▲			85			73+▲▲			67+▲▲			64+▲▲▲			70+▲			83+▲▲			1080					

▲: Egg sac **N_{50}, N_{70} and N_{90}**= Nitrogen fertilizer with the rate of 50, 70 and 90 unit/fed **P_{30}, P_{45} and P_{60}** = calcium supper phosphate (15.5% P2O5) at the rate of 30, 45 and 60 unit/fed

Table (3): Species richness of spiders inhabiting soil of Standard fertilization (Zero compost) associated onion plants

Families &taxa names	N_{50}									N_{70}									N_{90}									Σ			Σ	Total	%
	P_{30}			P_{45}			P_{60}			P_{30}			P_{45}			P_{60}			P_{30}			P_{45}			P_{60}								
	♂	♀	j	♂	♀	j	♂	♀	j	♂	♀	j	♂	♀	j	♂	♀	j	♂	♀	j	♂	♀	j	♂	♀	j	♂	♀	j			
Lycosidae			27			39																						0	0	66	66	352	50.00
Wadicosa fidelis	2	2	2	4	2	2	3	4		3	2		1	1		2			4	2		2	5			1		21	19	4	44		
Pardosa sp.	17	5	3	32	7	10	7	5	9	10	5	26	7	2	5	13		6	20	1	3	10		3	5		2	121	25	67	213		
Hogna ferox	2	2					2	2	3	3	1	1	1			2		3	3		2					2		13	7	9	29		
Linyphidae	11	2	2	13	7	2	14	4	3	16	8	6	15	3	4	11	2	1	9	3	1	4	3	6	8	2	1	101	34	26	161	247	35.09
prinerigone sp.	4		1	3		1				2			2			4			3		1	1		1	1			20	0	4	24		
Erigone sp.				3	2		2			1			1															7	2	0	9		
Mermessus denticulatus	4							2	1	2		1	10	6		8		2	5		2	4			1	1	1	34	9	7	50		
Sengletus sp.																			1			2						3	0	0	3		
Gnaphosidae						1																						0	0	1	1	24	3.41
Zelotes sp.	2	1	1				2			1	1									1	1				1			6	3	2	11		
Micaria dives														1														0	1	0	1		
Zelotes laetus	4							1						1											3			7	2	0	9		
Zelotes callidus																1												1	0	0	1		
Zelotes evagans																									1			1	0	0	1		
Salticidae		2								1		2				1		2										2	2	4	8	23	3.27
Phlegra flavipes	1						1						1	2		1						2	1		4			10	3	0	13		
pellenes arciger																			1			1						2	0	0	2		
Thridiidae	1						1						1									1			1	1		5	1	0	6	27	3.84
Kochiura aulica																									1			1	0	0	1		
Steatoda erigoniformis	3						3			2			3			4	1		4									19	1	0	20		
Philodromidae																												0	0	0	0	9	1.28
Thanatus albini	1			1		1							1							1		1			3			7	1	1	9		
Titanoesidae																												0	0	0	0	4	0.57
Nurscia albomaculata	1						1															1			1			4	0	0	4		
Xysticus acerbus																												0	0	0	0		
Dictynidae				2			2			1		2	3	1	1			1	1			2			1	1		12	2	4	18	18	2.56
	53	14	36	58	18	56	38	18	16	42	17	38	46	17	10	47	3	15	51	8	10	31	9	10	31	8	4	397	112	195	704		
	103+▲▲			132+▲▲			72+▲			97+▲			73+▲			65			69			50+▲			43			704					

▲: Egg sac N_{50}, N_{70} **and** N_{90}= Nitrogen fertilizer with the rate of 50, 70 and 90 unit/fed P_{30}, P_{45} **and** P_{60} = calcium supper phosphate (15.5% P2O5) at the rate of 30, 45 and 60 unit/fed

Table (4): The dominance-frequency relationship of spider communities associated with onion plants affected by compost manure and Zero compost (standard fertilization)

Families &taxa names	Compost manure					Zero compost				
	Total	**Sp%**	**Dom.**	**F.%**	**Frq.**	**Total**	**Sp%**	**Dom.**	**F.%**	**Frq.**
Lycosidae	423	0.39	Sr			66	0.09	Sr		
Wadicosa fidelis	101	0.09	Sr	70.00	C	44	0.06	Sr	50.00	ac
Pardosa sp.	161	0.15	Sr			213	0.30	Sr		
Hogna ferox	71	0.07	Sr			29	0.04	Sr		
Linyphidae	181	0.17	Sr			161	0.23	Sr		
prinerigone sp.	22	0.02	Sr			24	0.03	Sr		
Erigone sp.				21.94	A	9	0.01	Sr	35.09	ac
Mermessus denticulatus	31	0.03	Sr			50	0.07	Sr		
Sengletus sp.	3	0.00	Sr			3	0.00	Sr		
Gnaphosidae	0	0.00	Sr			1	0.00	Sr		
Zelotes sp.						11	0.02	Sr		
Trachyzelotes sp.	2	0.00	Sr							
Micaria dives	3	0.00	Sr	1.20	A	1	0.00	Sr	3.27	A
Zelotes laetus	3	0.00	Sr			9	0.01	Sr		
Zelotes callidus	4	0.00	Sr			1	0.00	Sr		
Zelotes evagans	1	0.00	Sr			1	0.00	Sr		
Salticidae	6	0.01	Sr			8	0.01	Sr		
Hasarius sp.	3	0.00	Sr	1.30	A				2.98	A
Phlegra flavipes	4	0.00	Sr			13	0.02	Sr		
pellenes arciger	1	0.00	Sr			2	0.00	Sr		
Thridiidae	3	0.00	Sr			6	0.01	Sr		
Kochiura aulica	1	0.00	Sr	4.26	A	1	0.00	Sr	3.84	A
Steatoda erigoniformis	41	0.04	Sr			20	0.03	Sr		
Enoplognatha gemina	1	0.00	Sr							
Philodromidae	0	0.00	Sr	0.65	A	0	Sr		1.28	A
Thanatus albini	7	0.01	Sr			9	Sr			
Oonopidae	0	0.00	Sr	0.09	A					
Opopaea sp.	1	0.00	Sr							
Thomisidae	0	0.00	Sr							
Xysticaus promscus	1	0.00	Sr	0.28	A					
Xysticaus acerbus	2	0.00	Sr							
Dictynidae	3	0.00	Sr	0.28	A	18	0.03	Sr	2.56	A
Titanoesidae						0	0.00	Sr		
Nurscia albomaculata						4	0.01	Sr	0.57	A
Xysticaus acerbus						0	0.00	Sr		
Total	**1080**					704				

Frequency (abundance), by Weis Fog
> 50 % = Constant (C)
25 - 50 % = Accessory (ac)
> 25 % = Accidental (A)

Dominance, by Weigmann
> 30 % = Eudominant (E) 1 - 5 % Recedent (R)
10 - 30 % = Dominant (D) > 1 % = Subrecedent (Sr)
5 - 10 % = Subdominant (sd)

Species diversity

Table (5) compares the biodiversity of spiders collected from onion plants of the different treatments, i.e. compost manure and Zero compost, using Shannon-Wiener "H" and Simpson "S" Indices of diversity. The vegetations of different treatment varied in their spider richness. The spiders collected from onion plants treated with compost manure recorded the highest population (1080 individuals), while Zero compost recorded the least species richness (704 individuals).

Table (5) Estimation of Shannon-Wiener and Simpson Indices of spider diversity in compo manures and Zero compost (standard fertilization).

	Compost manure	Zero compost
Shannon-Wiener Index	1.92	2.24
Simpson Index	0.22	0.17

According to Shannon-Wiener "H" Index, the compost manure recorded 1.92 of 24 species and 9 families, while Zero compost recorded 2.24 of 20 species and 8 families, therefore, it could be concluded that enhanced that compost manure had a higher diversity index and Zero compost had a lower diversity index.

According to Simpson Index, which reflected the measure of dominance, it was found that compost manure included the highest number of dominant species of values 0.22, Lycosidae members recorded 756 individuals.

Similarity of species

Community of spiders collected from compost manure system (1080 indv.) was highest than those collected from Zero compost (704 indv.), while the number of spider species was greater in compost manure (24 sp.) than that of Zero compost which recorded 20 species. To estimate spider composition of that different microhabitat, Sørensen's quotient of similarity was applied by comparing the number of species and individuals of control apparently with catch one of those treatments.

It is concluded that the similarity to Zero compost compared by compost manure system recorded 0.8 that is to say that community of compost manure system nearly resembled a community of without compost system by 80%. Zaki *et al.*, (2015) concluded that the community of organic farming nearly resembled a community of standard by 89%. Also, Rizk *et al.*, (2015) found that Sørensen Quotient of Similarity concluded that the two communities (organic and conventional) are nearly approximate, as they recorded 67 % of similarity.

Total numbers of arthropods collected by pitfall trap:

a. Compost manure

Table (6) show that Arthropod pests and predators were represented by 26 species belonging to 19 identified families, 7 unidentified families, and 12 orders. Families Pyrrhocoridae and Chrysopidae not distinguished in all of those plots treated with compost manure.

b. Zero compost

Table (6) show that Arthropod pests and predators were represented by 26 species belonging to 20 identified families, 6 unidentified families, and 12 orders. Family Pyrrhocoridae and sub phylum Myriapoda not distinguished in all of those plots Zero compost manure.

In a similar study, Amro (2004) recorded that fifteen phytophagous species and five arthropod predators in addition unidentified true spiders to determined during 2000 and 2001 growing seasons in Assiut Governorate.

Dominance and abundance degrees of arthropod pests and their natural enemies:

Table (6) indicated a total of 8097 individuals in compost manure and 6506 individuals in Zero compost system were counted from 9 samples on onion plants from seedling to maturity by using pitfall trap.

In compost manure, the highest number of individuals was 1320, 947 and 870 in N_1P_3, N_2P_3 and N_3P_3 respectively. But in Zero compost system, the highest number of individuals was 890, 703 and 721 in N_1P_1, N_2P_2 and N_3P_1 respectively. From table (7, 8) the dominance and abundance degrees indicated that Collembola, Formicidae, and Spiders recorded the highest dominant and abundant in both compost and Zero compost system.

Liu *et al.*, 2013 found that total of 3870 individuals belonging to 32 taxonomic groups (10 orders and 30 families plus a larval Lepidoptera) were collected. Also, The overall ground arthropod assemblage was dominated by Coleoptera (i.e. Carabidae, Melolonthidae, Tenebrionidae, and subdominant Curculionidae) and Hymenoptera (i.e. Formicidae), which together comprised 86.12% of the total number of individuals. Also, the total abundance of ground arthropods showed significant differences between the microhabitats under two differences cultivation.

Kautz, *et al.* 2006 reported that organic manure in a field experiment led to increased abundance of soil micro-arthropods. Also, (Okada & Harada, 2007 and Birkhofer *et al.*, 2008) indicated that the application of both organic and inorganic fertilizers to ecosystems has been shown to increase the populations and diversity of soil fauna.

Table (6): Number of arthropods collected by pitfall traps

Order	Family	Compost manure									Total	Zero Compost									Total
		N_{50}			N_{70}			N_{90}				N_{70}			N_{90}			N_{50}			
		P_{30}	P_{45}	P_{60}	P_{30}	P_{45}	P_{60}	P_{30}	P_{45}	P_{60}		P_{30}	P_{45}	P_{60}	P_{30}	P_{45}	P_{60}	P_{30}	P_{45}	P_{60}	
Coleoptera	Carabidae	32	24	24	24	15	21	18	28	17	203	16	18	19	25	15	16	22	20	13	164
	Coccinellidae	4	4	2		1		2	2	2	17	3		3		3	1	2	1		13
	Staphylinidae	5	8	6	6	6	9	9	10	8	67	2	5	9	2	2	1	4		2	27
Collembola	Collembola	490	586	542	450	474	537	562	507	478	4626	440	469	448	402	370	424	413	393	265	3624
Diptera	Muscidae	43	46	58	51	37	63	41	51	58	448	11	27	39	29	34	37	20	19	19	235
	Syrphidae	7	5	3	3	1	7	7	9	6	48		2	2	2	2	4	2		2	16
	Culicidae		1	1					1	1	4					1					1
Heteroptera	Anthocoridae									1	1							1			1
	Miridae	8	4	4	5	7	4	4	3	2	41	5	2	14	1		5	3	2	5	37
	Pyrrhocoridae										0									1	1
Homoptera	Aleyrodidae	1		2		2		2	2	2	11	1	4		1	1	2	1	5	2	17
	Aphididae	17	19	12	5	10	11	8	24	7	113	11	2	7	10	7	7	6	9	11	70
	Cicadellidae	5	3	1	11	9	6	3	2	4	44	3	3	3	3	3	2	3	3	1	24
Hymenoptera	Apidae							1			1										0
	Formicidae	125	55	97	48	116	86	67	84	145	823	196	78	107	76	99	111	119	139	140	1065
	Insect parasitoids	12	8	14	10	9	19	20	20	13	125	5	14	13	7	12	4	15	9	16	95
	Parasitoid wasps	5	3		1	2	3	2	2	4	22		2	3	1		5		2		13
	Vespidae		1								1		1	1			2	1			5
Orthoptera	Acrididae	5	7	4				1			17	5	1	3	3	1	3	1	1	2	20
	Gryllidae			1		2	1			1	5	4	2	2		1		1	1	4	15
Thysanoptera	Thripidae	41	35	22	2	23	25	8	47	90	293	60	17	5	1	60	3	13	21	11	191
Neuroptera	Chrysopidae										0			1							1
Dermapter	Labiduridae							1		1	2					1		1	2		4
Lepidoptera				6	1	1	2	2	1	2	15	1	3	2	2	2	2	1	1		14
Myriapoda									1		1										0
Isopoda		9	10	9	4	1	5	3	10	10	61	14	10	6	12	9	1	5	11	5	73
Mites		15	4	6	2	6	2	6	3	5	49	6	4	3	6	3	3	6	6	3	40
Spiders		61	81	506	67	69	69	58	58	90	1059	107	141	80	95	77	56	81	50	53	740
Total		**885**	**904**	**1320**	**690**	**791**	**870**	**825**	**865**	**947**	**8097**	**890**	**805**	**770**	**678**	**703**	**689**	**721**	**695**	**555**	**6506**

N_{50}, N_{70} and N_{90}= Nitrogen fertilizer with the rate of 50, 70 and 90 unit/fed **P_{30}, P_{45} and P_{60}** = calcium supper phosphate (15.5% P2O5) at the rate of 30, 45 and 60 unit/fed

Table (7): Dominance and abundance (D & A) of arthropod pests and their natural enemies collected from Onion plantation in with compost manure during 2017 season, Fayoum Governorate

Order	Family	Compost manure																	
		N_{50}						N_{70}						N_{90}					
		P_{30}		P_{45}		P_{60}		P_{30}		P_{45}		P_{60}		P_{30}		P_{45}		P_{60}	
		D%	A%	D%	A%	D%	A%	D%	A%	D%	A%	D%	A%	D%	A%	D%	A%	D%	A%
Coleoptera	**Carabidae**	3.62	90	2.65	70	1.82	90	3.48	70	1.89	50	2.41	80	2.18	70	3.24	80	1.8	70
	Coccinellidae	0.45	20	0.44	20	0.15	10	0	0	0.13	10	0	0	0.24	10	0.23	20	0.21	20
	Staphylinidae	0.56	40	0.88	60	0.45	40	0.87	50	0.76	20	1.03	40	1.09	60	1.16	40	0.84	30
Collembola	**Collembola**	55.37	100	64.8	100	41.1	100	65.3	100	59.8	100	61.7	100	68.1	100	58.6	100	50.5	100
Diptera	**Muscidae**	4.86	90	5.09	100	4.39	90	7.4	100	4.67	80	7.24	90	4.97	100	5.9	80	6.12	80
	Syrphidae	0.79	40	0.55	20	0.23	20	0.44	20	0.13	10	0.8	30	0.85	40	1.04	40	0.63	30
	Culicidae	0.00	0	0.11	10	0.08	10	0	0	0	0	0	0	0	0	0.12	10	0.11	10
Heteroptera	**Anthocoridae**	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.11	10
	Miridae	0.90	40	0.44	10	0.3	30	0.73	30	0.88	30	0.46	20	0.48	20	0.35	20	0.21	20
	Pyrrhocoridae	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Homoptera	**Aleyrodidae**	0.11	10	0	0	0.15	20	0	0	0.25	20	0	0	0.24	20	0.23	20	0.21	20
	Aphididae	1.92	40	2.1	50	0.91	50	0.73	20	1.26	60	1.26	30	0.97	20	2.77	40	0.74	40
	Cicadellidae	0.56	30	0.33	30	0.08	10	1.6	50	1.14	50	0.69	50	0.36	30	0.23	20	0.42	20
Hymenoptera	**Apidae**	0.00	0	0	0	0	0	0	0	0	0	0	0	0.12	10	0	0	0	0
	Formicidae	14.12	100	6.08	90	7.35	100	6.97	90	14.6	100	9.89	100	8.12	100	9.71	100	15.3	90
	Insect parasitoids	1.36	50	0.88	50	1.06	50	1.45	40	1.14	40	2.18	50	2.42	50	2.31	60	1.37	50
	Parasitoid wasps	0.56	30	0.33	20	0	0	0.15	10	0.25	20	0.34	20	0.24	10	0.23	20	0.42	20
	Vespidae	0.00	0	0.11	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Orthoptera	**Acrididae**	0.56	50	0.77	40	0.3	40	0	0	0	0	0	0	0.12	10	0	0	0	0
	Gryllidae	0.00	0	0	0	0.08	10	0	0	0.25	20	0.11	10	0	0	0	0	0.11	10
Thysanoptera	**Thripidae**	4.63	30	3.87	30	1.67	10	0.29	10	2.9	30	2.87	20	0.97	30	5.43	50	9.5	40
Neuroptera	**Chrysopidae**	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dermapter	**Labiduridae**	0.00	0	0	0	0	0	0	0	0	0	0	0	0.12	10	0	0	0.11	10
Lepidoptera		0.00	0	0	0	0.45	30	0.15	10	0.13	10	0.23	10	0.24	20	0.12	10	0.21	20
Myriapoda		0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0.12	10	0	0
Isopoda		1.02	50	1.11	50	0.68	20	0.58	20	0.13	10	0.57	30	0.36	20	1.16	30	1.06	40
Mites		1.69	80	0.44	30	0.45	30	0.29	20	0.76	40	0.23	10	0.73	30	0.35	20	0.53	40
Spiders		6.89	100	8.96	90	38.3	90	9.72	100	8.71	90	7.93	100	7.03	90	6.71	100	9.5	90

N_{50}, N_{70} and N_{90}= Nitrogen fertilizer with the rate of 50, 70 and 90 unit/fed **P_{30}, P_{45} and P_{60}** = calcium supper phosphate (15.5% P2O5) at the rate of 30, 45 and 60 unit/fed

Table (8): Dominance and abundance (D & A) of arthropod pests and their natural enemies collected from Onion plantationin Zero compost (Standard fertilization) during 2017 season, Fayoum Governorate

Order	Family	Zero compost (Standard fertilization)																	
		N_{50}						N_{70}						N_{90}					
		P_{30}		P_{45}		P_{60}		P_{30}		P_{45}		P_{60}		P_{30}		P_{45}		P_{60}	
		D%	A%	D%	A%	D%	A%	D%	A%	D%	A%	D%	A%	D%	A%	D%	A%	D%	A%
Coleoptera	Carabidae	1.8	90	2.2	70	2.5	70	3.7	70	2.1	60	2.3	70	3.1	80	2.9	90	2.3	60
	Coccinellidae	0.3	20	0	0	0.4	20	0	0	0.4	20	0.1	10	0.3	20	0.1	10	0	0
	Staphylinidae	0.2	20	0.6	40	1.2	40	0.3	20	0.3	10	0.1	10	0.6	40	0	0	0.4	10
Collembola	Collembola	49	100	58	100	58	100	59	100	53	100	62	100	57	100	57	100	48	100
Diptera	Muscidae	1.2	70	3.4	90	5.1	100	4.3	80	4.8	100	5.4	90	2.8	80	2.7	100	3.4	60
	Syrphidae	0	0	0.2	20	0.3	10	0.3	20	0.3	20	0.6	10	0.3	20	0	0	0.4	20
	Culicidae	0	0	0	0	0	0	0	0	0.1	10	0	0	0	0	0	0	0	0
Heteroptera	Anthocoridae	0	0	0	0	0	0	0	0	0	0	0	0	0.1	10	0	0	0	0
	Miridae	0.6	10	0.2	20	1.8	30	0.1	10	0	0	0.7	20	0.4	10	0.3	20	0.9	30
	Pyrrhocoridae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2	10
Homoptera	Aleyrodidae	0.1	10	0.5	20	0	0	0.1	10	0.1	10	0.3	20	0.1	10	0.7	30	0.4	10
	Aphididae	1.2	40	0.2	20	0.9	30	1.5	30	1	30	1	40	0.8	40	1.3	40	2	50
	Cicadellidae	0.3	20	0.4	30	0.4	20	0.4	30	0.4	20	0.3	20	0.4	20	0.4	30	0.2	10
Hymenoptera	Apidae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Formicidae	22	100	9.7	90	14	100	11	90	14	100	16	100	17	100	20	100	25	100
	Insect parasitoids	0.6	40	1.7	70	1.7	60	1	80	1.7	50	0.6	40	2.1	60	1.3	40	2.9	80
	Parasitoid wasps	0	0	0.2	10	0.4	20	0.1	10	0	0	0.7	20	0	0	0.3	20	0	0
	Vespidae	0	0	0.1	10	0.1	10	0	0	0	0	0.3	10	0.1	10	0	0	0	0
Orthoptera	Acrididae	0.6	30	0.1	10	0.4	30	0.4	20	0.1	10	0.4	20	0.1	10	0.1	10	0.4	20
	Gryllidae	0.4	30	0.2	20	0.3	20	0	0	0.1	10	0	0	0.1	10	0.1	10	0.7	40
Thysanoptera	Thripidae	6.7	20	2.1	20	0.6	20	0.1	10	8.5	60	0.4	10	1.8	40	3	40	2	30
Neuroptera	Chrysopidae	0	0	0	0	0.1	10	0	0	0	0	0	0	0	0	0	0	0	0
Dermapter	Labiduridae	0	0	0	0	0	0	0	0	0.1	10	0	0	0.1	10	0.3	20	0	0
Lepidoptera		0.1	10	0.4	30	0.3	20	0.3	20	0.3	10	0.3	20	0.1	10	0.1	10	0	0
Myriapoda		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Isopoda		1.6	40	1.2	60	0.8	30	1.8	40	1.3	50	0.1	10	0.7	40	1.6	70	0.9	20
Mites		0.7	50	0.5	30	0.4	30	0.9	40	0.4	20	0.4	30	0.8	20	0.9	30	0.5	30
Spiders		12	100	18	90	10	100	14	90	11	90	8.1	80	11	90	7.2	100	9.5	90

N_{50}, N_{70} and N_{90}= Nitrogen fertilizer with the rate of 50, 70 and 90 unit/fed

P_{30}, P_{45} and P_{60} = calcium supper phosphate (15.5% P2O5) at the rate of 30, 45 and 60 unit/fed

Statistical analysis

A- Spider and soil fauna

Effect of manure:

Table (9) show that number of spider and soil fauna were no significant by manures but the highest number of spider and soil fauna were 12.00 and 89.27 individuals in compost manure (C_1).

Effect of nitrogen:

Data in table (9) indicated that was no significant by added levels nitrogen fertilizers (N1, N2 and N3) where the highest number of spiders and soil fauna were 15.75 and 88.20 individuals in N_1.

Effect of phosphor:

From Table (9), it is also clear that no significant by added levels phosphor fertilizers (P_1, P_2 and P_3) where the highest number of spider and soil fauns were 13.85 and 76.16 individuals in P_1.

Interaction effect between manure and nitrogen levels:

Data of Table (9) showed that the main effect of interaction between manure and nitrogen fertilization on number of spider and soil fauna were high significant, where the highest number was 21.27 and 98.57 indv. in interaction between compost manure (C_1) and nitrogen fertilizer (N_1).

Interaction effect between nitrogen and phosphor levels:

Table (9) show that number of spider significantly by effect of interaction effect between nitrogen and phosphor fertilization. The highest numbers of spider and soil fauna were 28.65 and 99.75 indiv. in interaction between nitrogen and phosphor level (N_1P_3).

Interaction effect between compost manure and phosphor levels:

Table (9) show that the main effect of interaction between compost manure and phosphor fertilization on number of spider and soil fauna were high significant. The highest number of spider was 21.70 and 103.10 indv. in interaction between compost manure and phosphor fertilization (C_1P_3).

Interaction effect between compost manure, Nitrogen and phosphor levels:

Table (9) show that significantly increased by added compost manure, nitrogen and phosphor fertilizers where the highest number of spider and soil fauna were 50.10 and 123.00 indv. in interaction between compost manure, nitrogen and phosphor fertilization ($C_1N_1P_3$).

B- Vegetative growth characteristics:

1-Effect of compost:

Data on vegetative growth parameters, i.e. Plant length, plant diameter, number of leaves, fresh and dry weight per plant- for the organic manure under different nitrogen levels and phosphorus levels were presented in Table (9). Such data revel that, there were significant differences in most studied plant growth characteristics among two different factors. In this respect 100% compost recorded the highest values in plant length 74.04cm. Compared with no compost 72.74 cm. Regarding to the vegetative growth parameters of onion plant, organic manure rate of 100% increase plant diameter was 1.66 cm, number of leaves was 12.52 leaves/plant, fresh weight was 69.13gm and dry weight was 5.40gm/per plant. These results that may be attributed to increasing the rate of organic compost which led to increase the roots and release the mineral with soil. These results are in agreement with those obtained by Muhammad *et al.* (2015); Al- Fraihat (2016); Adeyeye *et al.*, (2017) and Rukmowati and Dyah (2017). These results may be due to the fact that the decomposition of organic matter decreased the PH value and consequently nutrients in the soil became more available to plant hence enhancing plant growth. Organic manures activities many species of living organisms which release phytochromes and may stimulate the plant growth and absorption of nutrients (Arisha *et al.* 2003).

2- Effect of nitrogen levels:

Table (9) show the relationship between nitrogen levels and compost. As nitrogen levels increased vegetative growth plant length (76.06cm), plant diameter (1.8 cm), number of leaves (13.72), fresh and dry weight (85.42gm and 6.49gm) per plant increased up to the nitrogen levels. Some investigators showed the same trend (Ahmed, 2016) on onion and (Abou El Magd *et al.*, 2014, Diriba-shiferow 2014 and Patel *et al.*, 2012) on Garlic.

The increase of plant growth by increasing nitrogen levels might be due to its role in photosynthesis, protein synthesis, cell division and enlargement which are the basal steps of plant growth, in addition, nitrogen plays an important role in the enzyme activity which reflects more products needed in plant growth.

3- Effect of phosphorus levels:

Phosphorus increased the vegetative growth of onion plants expressed as plant length (74.22cm), plant diameter (1.57cm), number of leaves (12.44), fresh and dry weight (72.95gm and 5.84gm) per plant as showed in Table (9). These increases were statistically significant. Many investigators reported that, phosphorus increased growth of onion plants (Alt *et al.* 1999). The increase in the vegetative growth of onion plants by phosphorus might be due to the effect of P- application on plant growth could be explained through the role of phosphorus which is

Table (9): effect of compost manure system and Zero compost (standard fertilizer) on Spider, soil fauna and other characters of onion crop

Treatments	Characters								
	Spiders	**Soil fauna**	**Plant length cm**	**Plant diameter cm**	**Number of leaves per plant**	**Fresh weight/gm/ plant**	**Dry weight/ gm/ plant**	**Total yield/Ton /Fed**	**Total soluble solids %**
Manure									
Compost (C1)	12.00	89.27	74.04	1.66	12.52	69.13	5.40	4.84	4.75
Zero compost (C2)	7.82	72.67	72.74	1.43	11.33	67.95	5.29	4.81	4.32
LSD (5%)	**9.91**	**19.48**	**0.384**	**0.014**	**0.133**	**0.650**	**0.045**	**0.106**	**0.021**
Nitrogen (N)									
N_{50}	15.75	88.20	70.28	1.34	10.17	50.01	4.13	3.49	4.63
N_{70}	7.67	75.92	72.83	1.49	11.89	70.19	5.41	4.91	4.41
N_{90}	6.32	78.78	76.06	1.80	13.72	85.42	6.49	6.06	4.31
LSD (5%)	**9.84**	**16.58**	**0.249**	**0.042**	**0.149**	**0.401**	**0.007**	**0.315**	**0.041**
Phosphor (P)									
P_{30}	13.85a	76.16	72.50	1.52	11.50	64.41	4.94	4.52	4.40
P_{45}	7.98a	81.27	73.44	1.54	11.83	68.26	5.25	4.86	4.43
P_{60}	7.90a	85.48	74.22	1.57	12.44	72.95	5.84	5.12	4.51
LSD (5%)	**9.53**	**12.79**	**0.104**	**0.015**	**0.064**	**0.310**	**0.063**	**0.239**	**0.007**
Interaction: C*N									
$C_1 \times N_{50}$	21.27	98.57	70.78	1.40	10.56	49.64	3.95	3.87	4.73
$C_1 \times N_{70}$	7.50	77.77	74.67	1.60	12.33	96.72	5.67	4.88	4.64
$C_1 \times N_{90}$	7.23	91.47	76.67	1.90	14.67	88.03	6.59	6.16	4.54
$C_2 \times N_{50}$	10.23	77.83	69.78	1.20	9.78	50.37	3.31	3.23	4.32
$C_2 \times N_{70}$	7.38	74.07	73.00	1.30	11.44	70.67	5.15	3.95	4.27
$C_2 \times N_{90}$	5.40	66.10	75.44	1.40	12.78	82.80	6.39	5.06	4.17
LSD (5%)	**13.91**	**23.44**	0.628	0.084	0.299	0.802	0.149	0.632	0.082
Interaction: N*P									
$N_{50} \times P_{30}$	7.95	78.85	69.00	1.32	9.83	46.97	3.68	3.19	4.60
$N_{50} \times P_{45}$	10.65	86.00	70.33	1.34	10.17	49.29	3.97	3.53	4.60
$N_{50} \times P_{60}$	28.65	99.75	71.50	1.37	10.50	53.76	4.74	3.86	4.68
$N_{70} \times P_{30}$	9.10	71.10	73.17	1.47	11.40	65.28	3.93	4.57	4.37
$N_{70} \times P_{45}$	7.30	77.55	73.83	1.48	11.67	70.41	5.46	4.93	4.38
$N_{70} \times P_{60}$	6.60	79.10	74.50	1.51	12.50	74.89	5.85	5.30	4.47
$N_{90} \times P_{30}$	6.65	78.50	75.33	1.78	13.17	80.98	6.23	5.66	4.23
$N_{90} \times P_{45}$	6.00	80.25	76.17	1.80	13.67	85.08	6.53	6.21	4.30
$N_{90} \times P_{60}$	6.30	77.60	76.67	1.83	14.33	90.18	6.92	6.53	4.38
LSD (5%)	**16.51**	**22.16**	**0.314**	**0.049**	**0.192**	**0.931**	**0.189**	**0.312**	**0.021**
Interaction: C*P									
$C_1 \times P_{30}$	6.83	78.07	73.11	1.64	12.00	65.05	4.35	4.94	4.52
$C_1 \times P_{45}$	7.47	86.63	74.11	1.65	12.44	96.67	4.57	5.55	4.56
$C_1 \times P_{60}$	21.70	103.10	74.89	1.68	13.11	72.65	4.79	5.97	4.66
$C_2 \times P_{30}$	8.97	74.23	71.89	1.41	11.00	63.77	4.21	4.26	4.28
$C_2 \times P_{45}$	8.50	75.90	72.89	1.43	11.22	66.83	4.39	4.34	4.30
$C_2 \times P_{60}$	6.00	67.87	73.56	1.45	11.78	70.24	4.56	4.53	4.38
LSD (5%)	**13.48**	**18.10**	**0.209**	**0.032**	**0.128**	**0.625**	**0.126**	**0.479**	**0.014**
Interaction: C*N*P									
$C_1 \times N_{50} \times P_{30}$	5.60	81.20	69.33	1.40	10.33	48.45	3.60	3.39	4.70
$C_1 \times N_{50} \times P_{45}$	8.10	91.50	70.67	1.44	10.67	49.70	3.88	3.48	4.70
$C_1 \times N_{50} \times P_{60}$	50.10	123.00	72.33	1.46	10.67	50.76	4.36	3.55	4.80
$C_1 \times N_{70} \times P_{30}$	8.50	69.00	74.00	1.60	11.67	63.92	4.99	4.47	4.50
$C_1 \times N_{70} \times P_{45}$	7.30	77.60	75.00	1.61	12.00	71.05	5.82	4.97	4.53
$C_1 \times N_{70} \times P_{60}$	6.70	86.70	75.00	1.66	13.33	74.20	6.18	5.19	4.60
$C_1 \times N_{90} \times P_{30}$	6.40	84.00	76.00	1.89	14.00	82.79	6.46	5.78	4.37
$C_1 \times N_{90} \times P_{45}$	7.00	90.80	76.67	1.90	14.67	88.30	6.19	6.18	4.43
$C_1 \times N_{90} \times P_{60}$	8.30	99.60	77.33	1.93	15.33	92.99	7.13	6.58	4.53
$C_2 \times N_{50} \times P_{30}$	10.30	76.50	68.67	1.23	9.33	45.49	3.75	3.18	4.10
$C_2 \times N_{50} \times P_{45}$	13.20	80.50	70.00	1.24	9.67	48.87	4.05	3.42	4.10
$C_2 \times N_{50} \times P_{60}$	7.20	76.50	70.67	1.27	10.33	56.75	5.12	3.97	4.07
$C_2 \times N_{70} \times P_{30}$	9.70	73.20	72.33	1.34	11.33	66.65	4.52	4.66	4.03
$C_2 \times N_{70} \times P_{45}$	7.30	77.50	72.67	1.36	11.33	69.77	5.09	4.88	4.03
$C_2 \times N_{70} \times P_{60}$	6.50	71.50	74.00	1.35	11.67	75.59	5.52	5.29	4.01
$C_2 \times N_{90} \times P_{30}$	6.90	73.00	74..67	1.65	12.33	79.17	6.00	5.54	4.01
$C_2 \times N_{90} \times P_{45}$	5.00	69.70	75.67	1.70	12.67	81.86	6.47	6.23	4.01
$C_2 \times N_{90} \times P_{60}$	4.30	55.60	76.00	1.73	13.33	87.37	6.70	6.12	4.00
LSD (5%)	**23.35**	**31.35**	**0.628**	**0.134**	**0.385**	**1.862**	**0.379**	**0.438**	**0.435**

C1= Compost manure **C2**= Zero compost (standard fertilization)

N_{50}, N_{70} and N_{90}= Nitrogen fertilizer with the rate of 50, 70 and 90 unit/fed

P_{30}, P_{45} and P_{60} = calcium supper phosphate (15.5% P2O5) at the rate of 30, 45 and 60 unit/fed extremely important as a structural part of many components notably nucleic acid and phospholipids. In addition phosphorus on indispensable role in energy of hydrolysis of phosphate being used to induce chemical reaction.

4- Effect of interactions (C and N):

The combined effect of compost and nitrogen levels increased in the vegetative growth of onion plant Table (9). Plant length (76.67cm), plant diameter (1.90 cm), number of leaves (14.67), fresh and dry weight (88.03 gm and 6.59 gm) per plant obtained by 100% compost and nitrogen 90 k.gm.

5-The interaction between compost and phosphorus levels:

Table (9) showed that, higher levels of phosphorus and zero level of organic recorded significantly vegetative growth plant length (74.89cm), plant diameter (1.68cm), number of leaves (13.11), fresh and dry weight (72.65 g and 4.79 gm) per plant. This is due to the N and P that promotes the development of the vegetative parts. These results are in agreement with those obtained by Ali *et al.,* (2008).

In Table (9) the combined effect of nitrogen and phosphorus levels were found significant for vegetative growth parameters significantly higher.

Vegetative growth was recorded (plant length 76.67cm) (plant diameter 1.83 cm), (number of leaves 14.33), (fresh and dry weight per plant 90.18 and 6.92 gm). These results are in agreement with those obtained by (Aliyu *et al.* 2007).

6- Interaction effect of N, P and compost

The results in Table (9) revealed that, the interactions between high levels N, high level P and compost or zero compost gave the highest value and was more significantly than other treatments. These results are in agreement with those obtained by (Aisha *et al.*, 2007).

C-Total yield and quality

1-Effect of compost

Table (9) revealed an increment of total yield due to applying organic compost 100%**.**The increment of yield may be to the addition of organic fertilizers leaded to the increment of total yield, 4.84 ton/fed**.**

2- Effect of nitrogen

Table (9) show that N significantly improved total yield of onion. Application of N at rate of 90 kg/fed improved the total yield to 6.06 ton/fed. This positive response may be due to the role of N in promoting the growth of onion plant because nitrogen plays important role in leaf production via its role in vegetative growth and it reflected on the yield (Abdissa, *et al*., 2011 and Geries *et al*., 2012).

3-Effect of phosphorus

In Table (9) show the trend of levels phosphorus application had positive effect on yield onion plant. The highest yield was found P_{60} kg/fed phosphorus (5.12 ton/fed). Similar results were obtained by (Ali *et al*., 2008).

Interaction effect of compost and Nitrogen on yield

Table (9) show that significantly maximum yield were 6.16 ton/fed obtained with 100% compost + 90 kg/fed N. In might be due to the synergistic effect of nitrogen and compost. Similar results were reported by (Ahmed, 2016).

Interaction effect of compost and phosphorus on yield:

Table (9) revealed the superiority of applying the highest rates of organic and phosphorus in two seasons (5.97 ton/ fed).

Interaction effect of Nitrogen and Phosphorus on yield:

Table (9) explains that, the highest level of Phosphorus (60) and Nitrogen (90) respectively increased onion yield. (6.53 ton/ fed). This agree with Aliyu *et al.*, 2007.

Interaction effect of compost, Nitrogen and Phosphorus:

Table (9) show that the significant increases in total yield was 6.58 ton/fed as result of combined application of compost × Nitrogen 90 ×Phosphorus 60 could be attributed to applying organic matter plus mineral, may be due to more availability of most of the essential plant nutrients. Similar result was attained by (Mouna, *et al.,* 2013 and Rizk, *et al.,* 2014) they recorded the highest yield of onion bulbs and were obtained by the combination of organic with inorganic fertilizers

D. Regarding total soluble solids (TSS %):

1-Effect of compost:

Tss was obtained 4.57% by application of compost Table (9). These results are in accordance with those obtained by **(Saad *et al.,* 2018)** by using 50% compost and 50% vermicompost.

2-Effect of nitrogen levels

Table (9) application of little level (50) of N significantly increased plant Tss (4.63 %) in onion when compared by the other N levels (60 and 90). These results are in agreement with (Abdelkader and Shimaa, 2016).

3- Effect of phosphorus levels

Application of P_{60} fertilizers increased Tss in onion plant (4.51%) Table (9), some investigators showed the same trend (Yogita and Ram, 2012)

4- Effect of the interaction: -

Table (9) indicated that the combined effect of compost and low nitrogen levels (N_{50}) increased in the Tss of onion plant (4.73%) compared with the control and the highest level of nitrogen (4.17%) which recorded the low levels.

The combined of compost and phosphorus in Table (9), compost with phosphor 60 levels significantly increased Tss in onion plant (4.66%).

The combined of nitrogen and phosphorus in Table (9) showed that, low level nitrogen (N_{50}) and high level of phosphorus (P_{60}) significantly increased Tss in onion plant, where the data recorded (4.68%).

The combined of compost, Nitrogen and phosphorus in Table (9) showed that, compost, low levels of nitrogen (N_{50}) and high levels of phosphorus (P_{60}) recorded the highest values of Tss in onion plant (4.80%) compared with the other treatments. These results agree with (Hole *et al.* 2005) that organic farming is associated with higher levels of biodiversity.

Organic farming can benefit a range of taxa. Organic farming appears to be associated with increased species richness and abundance for plants, predatory invertebrates (Bengtsson *et al.,* 2005 and Tuck *et al.,* 2014). (Krauss *et al.,* 2011) indicated that organic farming is one of the most successful agri-environmental schemes, as humans benefit from high quality food, farmers from higher prices for their products and it often successfully protects biodiversity. Also, organic fields had five times higher plant species richness and about twenty times higher pollinator species richness compared to conventional fields. Also, predator abundances were three times higher and predator-prey ratios twenty times higher in organic fields, indicating a significantly higher potential for biological pest control in organic fields (Reilly *et al.,* 2013) referred to that Organic management practices can have a beneficial effect on biotic aspects of soil health in a cultivated onion crop, including microbial activity and arthropods diversity.

ACKNOWLEDGMENTS

The authors gratefully acknowledge Mr. Hisham K. EL-Hennawy, Arachnology specialist (spiders and scorpions) for revising the identification of spiders. Also, sincere thanks to Dr Mona M.A.Ghallab, professor researcher in vegetable mite research department, P.P.R.I., A.R.C. for her help in classification specimens. Also, thanks to Dr Ahmed Shaban Mahmoud lecturer, Agron., Dept., Fac., of Agric., Fayoum University for helping in statistical analysis.

REFERENCES

Abd-Elkader, D. and Shimaa, M. Hassan 2016. Influence of different fertilization and harvest time on growth, head characters and nutrition quality of Endive under sandy soil. American Journal of plant physiology. 11(1-3): 23-32.

Abdissa, Y.; Tekalign, T. and Pant, L. M. 2011. Growth, bulb yield and quality of onion (*Allium cepa* L.) as influenced by nitrogen and phosphorus fertilization on vertisol I. growth attribute biomass production and bulb yield. African Journal of Agricultural Research, 6(14): 3252- 3258.

Abou-ElMagd, M. M.; Zaki, M. F.; AbouSedara, S.A. and El-Shorbagy, T.T. 2014. Evaluation of five Garlic (*Allium sativum* L.) Cultivars under Bio-chemical and mineral fertilization. Middle East Journal of Agriculture Research, 3 (4): 926-935.

Adeyeye, A. S.; Ishaku, M.A.; Gadu, H.O.; Olalekan, K. K. and Lamid, W. A. 2017. Comparative effect of organic and inorganic fertilizer treatments on the growth and yield onion (*Allium cepa*L.). Journal of Botanical Sciences, 6: 8-11.

Ahmad H. Al-Fraihat 2016. Impact of different fertilizer sources on vegetative growth, yield, quality and storability of onion. International Invention Journal of Agricultural and Soil Science. 4(1): 1-8.

Aisha, A.H.; fatma,A.; Rizk, A.; Shaheen, M. and Mona, M.A. Abdel-Mouty 2007. Onion plant Growth, bulbs yield and its physical and chemical properties as affected by organic and natural fertilization. Research Journal of Biological Sciences, 3(5):380-388.

Al-Fraihat, A. H. 2016. Impact of different fertilizer sources on vegetative growth yield quality and storability of onion. International Invention Journal of Agricultural and Soil Science, 4(1): 1-8.

Ali, U.K.; Alam, M. N.; Islam, M. S.; Islam, M. K. and Baree, N. A. 2008. Effect of cow-dung at different level of phosphorus on growth, yield and quality seed produ-ction of onion. Research Journal of Agriculture and Biological Sciences, 4(1):86-93.

Aliyu, U. M.; Magaji, D. M.; Singh, A. and Mohamed, S.G. 2007. Growth and yield of onion *(Allium cepa L.)* as Influenced by nitrogen and phosphorus levels. International Journal of Agricultural Research. 2: 937- 944.

Almada, M. S.; Sousa, M. A.; Gonzalez, A. 2012. Ara•neofauna (Arachnida: Araneae) en cultivos de algodon(Gossypium hirsutum) transgénicos y convencionales en el norte de Santa Fe, Argentina. Revista Biologia Tropical 60: 611•623.

Amro, M. A. M. 2004. The incidence of certain arthropod pests and predators inhabiting cowpea, with special reference to the variety resistance of selected cultivars to *Bemicia tabaci* (Gen) and *Tetranychus urticae* Koch. Ass. Univ. Bull. Environ. Res. Vol. 7(1): 31-39.

Alt, D.; Ladebusch, H. and Melzer, O. 1999. Long-term trial with increasing amounts of phosphorus, potassium and magnesium applied to vegetable crops. Acta Horticulturae, 506: 29–36.

Arish, H. M. E., Gad, A.A. and Younes, S. E. 2003. Response of some pepper cultivars to organic and mineral nitrogen fertilizer under sandy soil conditions. Zagazig Journal Agriculture Research, 30: 1875 – 1899.

Bengtsson, J.; Ahnstrom, J. and Weibull, A.C. 2005. The effects of organic agriculture on biodiversity and abundance: a meta-analysis. J. Appl. Ecol.; 42: 261–269.

Birkhofer, *et al.*, 2008. Long-term organic farming fosters below and aboveground biota: implications for soil quality, biological control, and productivity. Soil. Biol. Biochem. 40, 2297–2308.

Bhavana, D.; Sharma, R.K.; Chhipa, B.G. and Rathore, R.S. 2017. Effect of different organic manures on yield and quality of Onion (*Allium cepa* L.). Int. J. Curr. Microbiol. App. Sci. 6(11): 3412-3417.

Cardoso, P.; Pekar, S.; Jocque, R. and Coddington, J. A., 2011. Global patterns of guild composition and functional diversity of spiders. PLoS ONE, 6: (1-10). e21710

Chapman, H.D. and Pratt, P.F. 1961. Methods of analysis for soils, plants and waters. University of California, Los Angeles, 60-61, 150-179.

Cooperband, L.R. 2000. Composting: Art and science of organic waste conservation to a valuable soil resource. Laboratory medicine. 31, 283-290.

Cunha, J. A. S.; Andrade, E. B.; Silva, P. R. R.; Barros, R. F. M. 2015. Araneofauna (Arachnida, Araneae) in conventional and organic crops of watermelon (*Citrullus lanatus*) in northeas•tern Brazil. Revista Colombiana de Entomologia 41 (1): 68•75.

Diriba- Shiferaw, G.; Nigussie, R.I.; woldetsadik, K.; Tabor, G. and Sharma, J.J. 2014. Bulb quality of Garlic (*Allium sativum* L.) as influenced by the applicationof inorganic fertilizers. African Journal of Agriculture Research, 9 (8): 778-790.

El-Hennawy, H.K. 2006. A list of Egyptian spiders (revised in 2006). Serket, 10(2): 65-76.

Eyre, M.D.; Shotton, P.N. and Leifert, C. (2008) Spider (Araneae) Species activity, crop type and management factors in an extensive plot trial. Poster at: Cultivating the Future Based on Science: 2nd Conference of the International Society of Organic Agriculture Research ISOFAR, Modena, Italy, June 18-20, 2008.

Facylate, K.K. 1971. Field studies in soil invertebrate. 2nd ed. Vishia Shkoola Press, Moscow, USSR.

Geries, L.S.M.; Abo-Dahab, A.M.A. and Karam, S.S. 2012. Response of onion production and storability to some sources, rates and times of application of nitrogen fertilizers. Alex. J. Agric., 57(2):153-162.

Gomez, K.A. and Gomez, A.A., 1984. Statistical Procedures for Agricultural Research. 2nd ed. John Wiley and Sons, New York, USA, 680 pp.

Hafiz, M. T. and Abida, B. 2009. Effects of different management practices and field margins on the abundance of ground spiders in rice ecosystems. Pakistan J. Zool., vol. 41(2), pp. 85-93.

Hole, D. G.; Perkins, A. J.; Wilson, J. D.; Alexander, I. H.; Grice, P. V. and Evans, A. D. 2005. Does organic farming benefit biodiversity? Biol. Conserv. 122: 113–130.

Kalas, J.A.; Henriksen; S.; Skjelseth, S. and Viken, A.I. 2010. Environmental conditions and impacts for Red List species. Norwegian Biodiversity Information Centre, Trondheim, Norway.

Kautz, T.; Fando, C.L. and Ellmer, F. 2006. Abundance and biodiversity of soil microarthropods as influenced by different types of organic manure in a long-term field experiment in Central Spain. Appl. Soil Ecol. 33: 278–285.

Klute, A. 1986. Methods of Soil Analysis. No 9 Part I Physical and Mineralogical Properties. American Society of Agronomy Madison, Wisconsin.

Krauss, J.; Gallenberger, I. and Steffan-Dewenter, I. 2011. Decreased Functional Diversity and Biological Pest Control in Conventional Compared to Organic Crop Fields. PLoS ONE 6(5): e19502. doi:10.1371/journal.pone.0019502

Kuusk, A.K., Cassel-Lundhagen, A., Kvarnheden, A.and Ekbom, B. 2008. Tracking aphid predation by lycosid spiders in spring-sown cereals using PCR- based gut-content analysis. Basic and Applied Ecology 9:718–725.

Liu, R.; Zhu, F.; Song, N.; Yang, X. and Chai, Y. 2013. Seasonal Distribution and Diversity of Ground Arthropods in Microhabitats Following a Shrub Plantation Age Sequence in Desertified Steppe. PLoS ONE, 8(10): 1-12.

Ludwig, J.A. and Reynolds, J.F. 1988. Statistical Ecology: A primary methods and computing. New York. 337pp.

Mouna, M.; Wafa, S.; Khaled, I.; Azaeiz, G.; and Mohamed, B.K. 2013. Evaluating pre-crops and organic fertilizers for effects on soil properties and organic onion growth and yield in eastern Tunisia. Conférence Internationale des Energies Renouvelables (CIER), 2(13).

Muhammad, F.; Shah, A. H.; Malik, A.A.; Ali, N.; Khan, U.; Majid, A. and Ahmad. H. 2015. Nutrient management for improving onion productivity. *American*-Eurasian J. Agric and Environ. Sci., 15 (2): 220 – 225.

Okada, H. and Harada, H. 2007. Effects of tillage and fertilizer on nematode communities in a Japanese soybean field. Appl. Soil Ecol., 35: 528–598.

Page, A. L.; Millerand, R. H. and Keeney D. R. 1982. Methods of soil analysis. Part. 2, Amer. Soc. of agron.,madisan, Wisconsin, U.S.A.

Patel, P. B. and Patel, J. J. 2012. Impact of different nitrogen levels and irrigation intervals on incidence of thrips (*Thrips tabaci*) infesting garlic. Agyes An International e- Journal, 1 (3): 287 – 292.

Reilly, K.; Cullen, E.; Lola-Luz, T.; Stone, D.; Valverde, J.; Gaffney, M.; Brunton, N.; Grant, J. and Griffiths, B. S. 2013. Effect of organic, conventional and mixed cultivation practices on soil microbial community structure and nematode abundance in a cultivated onion crop, J. Sci. Food Agric. 93: 3700–3709.

Rizk, M. A.; Ghallab, M. M. and Zaki, A. Y. 2015. Effect of organic and conventional farming on the activity of spider assemblage (Araneae) in some medicinal plants in Fayoum, Egypt. Acarines 9: 69-75.

Rizk, Fatma A.; Shaheen, A.M.; Abd El-Samad, E.H. and El-Labban, T.T. 2014. Response of onion plants to organic fertilizer and foliar spraying of some micro-nutrients under sandy soil conditions. Journal of Applied Science Research, 10(5): 383-392

Rukmowati, R.R.B. and Dyah, A. 2017. Application of Granular Organic Fertilizer to Improve Yield of Red Onion. Int'l Journal of Advances in Agricultural & Environmental Engg. (IJAAEE). 4 (1): 89-92.

Saad, A.E.; El-mehrat, H. G.; Ragab, A.A. and Abou-Dahab, A.M.A. 2018. Growth, yield, bulb quality and storability of some onion cultivars response to compost, vermicompost and plant growth promoting Rizobacteria. Middle East Journal of Agriculture Research, 7(2): 292-306.

Sabbour, M.M. and Abbass , M.H. 2006. The Role of some bio-agent mixed with some fertilizers for the control onion pests. Journal of Applied Sciences Research, 2(9): 624-628.

Schmidt, M.H; Roschewitz, I.; Thies, C. and Tscharntke, T. 2005. Differential effect of landscape and management on diversity and density of ground dwelling farmland spiders. The role of perennial habitats for Central European farmland spiders, J. appl. Ecol., 42:281–287.

Slingsby, D. and Cook, C. 1986. Practical Ecology. Macmillan, London: 213pp.

Southwood, T.R.E. (1978). Ecological Methods with particular reference to the study ofinsect population, Chapman and Hall, London. 524 pp.

Straub, R.W. and Emmett B. 1992. Pests of Monocotyledon Crops. In: Mc Kinlay R.G. (Editor). Vegetable Crop Pests. Macmillan Press. U. K. Pp.213-26.

Singh, N. and Attrey, D.P. 2002. Studies on round the year organic production of beat leaf in trenches (underground green house) in cold desert high altitude condition of Ladakh. International Conference on Vegetable, Banglore, 11-14 Nov., 2002.

Stevenson, F.J. 1994. Humus chemistry. genesis, composition, reactions. 2nd Edition, John Wiley and Sons, Inc., New York.

Sørensen, T. 1948. A method of establishing groups of equal amplitude in plant sociology based on similarity of species and its application to analyses of the vegetation on Danish commons. Biologiske Skrifter / Kongelige Danske Videnskabernes Selskab, 5(4): 1-34.

Sun, F.; Tariq, A.; Chen, H.; He, Q.; Guan, Y.; Pan, K.; Chen, S.; Li, J.; Zhao, C.; Wang, H. and Gu, Y. 2016. Effect of nitrogen and phosphorus application on agricultural soil food webs. Archives of Agronomy and Soil Science. 63(8): 1176-1186.

Tuck, S. L., Winqvist, C.; Mota, F.; Ahnstrom, J.; Turnbull, L. and Bengtsson, J. 2014. Land-use intensity and the effects of organic farming on biodiversity: a hierarchical meta-analysis. J Appl Ecol.; 51: 746–755.

Weigmann, G. 1973. Zur Ökologie der Collembolen und Oribatiden im Grenzbereich Land – Meer (Collembola, Insecta- Oribatei, Acari). Zeitschrift für wissenschaftliche Zoologie 186: 295 – 391.

Weis-Fogh, T. 1948. Ecological Investigation on mites and collembolan in the soil. Nat. Jutlant, 1: 135- 270.

Young, O. P. and Edwards, G. B. 1990. Spiders in United States field crops and their potential effect on crop pests. Journal of Arachnology, 18: 1•27.

Yogita and Ram, R.B. 2012. Effect of chemical and bio fertilizers on quality of onion. Hortflora Research Spectrum, 1(4): 367- 370.

Young, C.C.; Rekha, P.D. and Arun, A.B. 2005. What happen during composting? In: Chen ZS (Ed) Compost Production: A Manual for Asian Farmers, Food and Fertilizer Technology Center. Taipei, Taiwan, pp 8-19

Zaki, A. Y.; Aly, A. I.; Eid, R. A. and Mergawy, M. M. (2015) Biodiversity of Ground spiders (Araneae) Occurred in Tomato and Tomato Yield Fertilized with Different Organic Manures in Fayoum Governorate. Egypt. Acad. J. Biolog. Sci. 8 (3): 87-96.

Zeidan, M.S. 2007. Effect of organic manure and phosphorus fertilizers on growth, yield and quality of lentil plants in sandy soil. Res. J. Agric. Biol. Sci. 3:748-52.