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Effect of Peas and Garlic Intercropping on Population Density of Some Pests in Sohag Governorate

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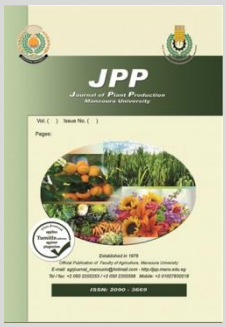

ABSTRACT

Two field trials were carried out in Shandweel Agriculture Research Station, Sohag, Governorate during 2015/2016 and 2016/2017 seasons. This study aimed to investigate the effect of intercropping some garlic varieties in pea varieties field under different garlic planting densities in relation to yield and yield components of both crops. The treatments in which the two varieties of peas and garlic were grown alone individually gave the highest values obtained for most of the vegetative characters, yield and its components. during the two seasons. Intercropping with density of two rows of garlic significantly exceeded the treatments in which garlic was intercropping with a density of one row. Land equivalent ratio (LER) values were greater than one by all intercropping treatments of pea with garlic, in both seasons. Pea_2+two rows $garlic_2$ gave the highest values of relative crowding coefficient, while pea_1+one row $garlic_1$ gave the lowest values. The intercropping of garlic on the peas led to a decrease in the number of pods infected with *E. zinckenella* compared to the solo peas plantation for both seasons of agriculture for all varieties. While, the intercropping led to increase the count of thrips on garlic during the intercropping period, the numbers decreased after the peas were removed. Through this study it can be recommended to intercropping garlic, variety Sids-40, at a density of two rows cultivation on the pea of cultivar Intsar 2, to obtain the highest yield compared to other treatments of intercropping.

Keywords: garlic, peas, intercropping and thrips, Shandweel Agriculture Research Station.

INTRODUCTION

Garlic (*Allium sativum* L.) and Pea (*Pisum sativum* L.) are two of the most important vegetable crops in Egypt. They are grown for local and export markets, garlic blubs and pea green pods or/and dry seeds. Since the cultivated land in Egypt is limited, the agriculture intensification had become urgent necessity to optimize the beneficial of unit area. Intercropping systems are the most utilizing to small farmers as they maximize the production of the unit, and these systems are spread in third world countries as well as intercropping with legumes crops is an excellent practice for controlling soil erosion and sustaining crop productivity (kanwar, 1980, El-Swaify *et al*., 1988, Agegnehu *et al.*, 2008, Launay *et al.*, 2009, Fustec *et al.*, 2010, Lithourgidis *et al.*, 2011, and Mao *et al.*, 2012). Shahien (1987) found that, intercropping the peas and garlic did not affect the productivity and growth of either of them. Toaima (2001) showed that the intercropping pattern of 120 cm width gave the pest results for land equivalent ration, relative crowding coefficient and aggressivity. El-Shaikh and Bekheet (2006), found that, the sole of sugar bean significantly surpassed in vegetative growth, sugar yield and quality at all intercropping systems with faba bean or garlic. Xingang Zhoua *et al.*, (2011) noted that increasing in productivity of cucumber when intercropped with onion or garlic, moreover improved soil environment at different levels and these impacts still existed in the second and third growing seasons. On the other hand, growing snap been plants on ridges of garlic decrease plant height and dry matter of garlic plants, while bulb diameter of garlic was not affected. Abou-Keriasha *et al.*, (1991) mentioned that the yield and yield components of fodder beat grown on the same ridge with faba been ware comparatively less than those grown on sole ridges. Ghobashi and El-Aweal (1999) found that faba been seed yield was significantly reduced, when intercropped decreased significantly by intercropping with garlic. El-Moursi (1999) studied that, intercropping garlic with snap bean reduced plant height, bulb weight, total yield and cloves/bulb did not affect. Many Researchers were interested with garlic intercropping on some vegetables crops i.e., Zhou, *et al.*,(2011) on cucumber, Amoli,(2012) on lettuce, Syed *et al*., (2012) on pea, turnip and cauliflower, Xiao *et al.*,(2013) on cucumber, Wang *et al.*, (2015) on eggplant. Onion thrips is a key insect pest in most onion and garlic production regions of the world. They are cosmopolitan in nature and can feed on broad host range. Both Immature and adult thrips feed by piercing surface tissues and suck the exuded plant juices. They cause direct damage to leave and bulbs and also act as vector for viral diseases. A better use of resources may be achieved by intercropping garlic on pea in suitable intercropping system In many cases, the use of intercropping has resulted in less severe pest outbreaks and increased diversity of natural enemies compared to monoculture systems (Mcsorley, 2008). Garlic is one of the potential plant that could be inserted in crops to decrease the pests in neighboring crop plots, these results founded by Hai-bo *et al.*, (2013), they found that, both intercropping and application of volatile chemicals emitted by garlic could

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improve the population densities of natural enemies of cereal aphid, including ladybeetles and mummified aphids. Intercropping of pea with tansy phacelia and white mustard had significant effect of decreasing the pea thrips population (Wnuk, 1998). Intercropped of mustard (*Brassica napus*) with onion (*Allium cepa* L.) and garlic (*Allium sativum* L.) as well as spice crops reduced the aphid population significantly (Sarker *et al.*, 2007). Garlic, and pea are main winter vegetables of Egypt.

Therefore, the aim of this work was to study the effect of intercropping two cultivars of garlic in different planting densities on two pea cultivars to find out the best one which gives the highest production per unit area and lowest pest infestations.

MATERIALS AND METHODS

Two field experiments were carried out in Shandaweel Research Station, Sohag Governorate (Upper Egypt) during 2015/2016 and 2016/2017 seasons, to study the effect of intercropping some pea cultivars on garlic cultivars). Treatments were arranged in randomized complete block design with three replications design with three replicates were used. Each plot (10.5 m^2) consisted of five ridges, 3.5 m length and 60 cm apart. Garlic and pea were planted on 14 October in the two seasons. The soil of the experiment was clay loam, superphosphate (15.5% P_2O_5) at the rate of 150 Kg/fed and potassium sulphate (48% K_2O) at the rate of 48 kg /fed were applied during soil preparation. Nitrogen fertilizer was applied at the rate of 80 kg N/fed in the form of ammonium nitrate (33.5% N) in two equal doses at 30 and 60 days after planting date.

Intercropping system:

T1- Pure stand of pea Entsar 1 cv. (Pea_1) was grown in hills, 10 cm apart in the one side of ridge one plant/hill.
T2- Pure stand of pea Entsar 2 cv. (Pea_2) was grown in hills, 15 cm apart in the one side of ridge one plant/hill.
T3- Pure stand of garlic Balady cv. ($Garlic_1$) was grown in hills, 10 cm apart in the two sides of ridge one plant/hill.
T4- Pure stand of garlic Sids-40 cv. ($Garlic_2$) was grown in hills, 10 cm apart in the two sides of ridge one plant/hill.
T5- Pea_1+one row $garlic_1$.
T6- Pea_1+one row $garlic_2$.
T7- Pea_1+two rows $garlic_1$.
T8- Pea_1+two rows $garlic_2$.
T9- Pea_2+one row $garlic_1$.
T10- Pea_2+one row $garlic_2$.
T11- Pea_2+two rows $garlic_1$.
T12- Pea_2+two rows $garlic_2$.

All pea treatments were planted under 100% of pure stand. The other normal practices of both pea and garlic were maintained at the recommended level to assure optimum production garlic was harvested in the 8 April in both seasons. Pea was harvested when the marketable green pods reached maturity.

At harvest, a sample of ten plants was taken at random, from the pure stand and from intercropped plots of pea and garlic. The following data were recorded:

A- pea: growth and productivity characteristics**:**

1-Plant height (cm) average of measurements taken from cotyledonary node to the top of the main stem of the plant, 2- Number of branches/plant, 3- Number of pods/plant, 4- Pod length (cm), 5- Number of seeds/pods and 6-Green yield (ton/fed.).

B- Garlic: growth and productivity characteristics.

1- Plant height (cm), 2-Number of leaves/plant., 3- Dry matter of blub% , 4-Bulb diameter (cm), 4- Average weight of bulb (gm), 6-Number of cloves/bulb, 7- Average weight of clove (gm), and 8- Total fresh yield ton/fed. was determined on the basis of fresh yield for the experimental unit (kg) related to feddan (ton).

C- Competitive relationships and yield advantages:

C.[1] Land equivalent ratio (LER): was determined as the sum of the fractions of the yield of intercrops relative to their sole crop yield (Willey and Osiru 1972). Land equivalent ration LER was determined according to the following formula:

$$LER = \frac{Ypg}{Ypp} + \frac{Ygp}{Ygg}$$

Where: Ypp is pure stand yield of pea, Ygg is pure stand yield of garlic, Ypg is mixture yield of pea (when combined with garlic) and Ygp is mixture yield of garlic (when combined with pea).

C.[2].Relative crowding coefficient (K): was calculated as described by Hall (1974).

$$Kp = (Ypg\ x\ Zgp)/(Ypp - Ypg)Zpg$$

$$Kg = (Ygp\ x\ Zpg)/(Ygg - Ygp)Zgp$$

$$K = Kp\ x\ Kg$$

Where: Zpg and Zgp are sown proportion of pea and garlic, respectively.

C.[3]Aggressivity (A): was proposed by Mc-Gilichrist (1965) and was determined according to the following formula:

$$Apg = \frac{Ypg}{Ypp\ x\ Zpg} - \frac{Ygp}{Ygg\ x\ Zgp}$$

$$Agp = \frac{Ygp}{Ygg\ x\ Zgp} - \frac{Ypg}{Ypp\ x\ Zpg}$$

Where: Apg and Agp are aggressivity values for pea and garlic, respectively.

D- insect infestations:

The cultivation of both crops took place on October 14 for the two seasons, while the harvest of the peas ended for both vars by mid-February. On this basis the average incidence of *Thrips tabaci* was calculated during the period of the presence of both crops (from planting date to the end of the peas harvest) and the average incidence was calculated for the remainder until the garlic harvest on April 8th. Where the number of Thrips on 5 garlic plants of each replicate was estimated three times a month.

The average pods infected with *E. zinckenella* in peas crop were calculated at harvest. The sample was 100 green pods collected randomly from the diagonal of each plot, kept in a paper bag and directly transferred to the laboratory to count the larvae.

Statistical analysis:

Data were statistically analyzed according to the procedure outlined by Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

A-Pea characters:

Effect of intercropping systems of pea on its vegetative and productively characterizes are presented in Table (2).

Plant height: Intercropping systems significantly affected on these traits in two seasons. Plant height was at maximum with the solid planting of T1 (Pea_1) in both seasons. While the lowest of this character was when T7 (Pea_1+two rows $garlic_1$) in two seasons. This result could be attributed to the reduction in light intensity caused by high plant population, encourage IAA synthesis, which caused cell enlargement and hence plant. This result is in agreement with those found by Amer *et al.,* (1997), Abd EL-All (2002) and Abd El-Hady *et al*., (2009).

Number of branches/plant: Number of branches/plant significantly affected by intercropping system in two seasons. The pea $Entsar_2$ (T2) recorded the highest values of this characters (2.67and 3.17) in both seasons, respectively, concerning to the intercropping systems, the lowest values results from planting of T8 (Pea_1+two rows $garlic_2$) was (1.30 and1.50) in the first and second seasons, respectively These results are in agreements with those reported by Abd El-Hady *et al.,* (2009).

Number of pods/plant: Number of pea pods/plant significantly affected by intercropping system in both seasons. The pure stand of pea Entsar2 recorded the highest values of this characters (15.00 and 16.23) in both seasons, respectively, concerning to the intercropping systems, the lowest values results from planting of T7 (Pea_1+two rows $garlic_1$) was (6.30 and 6.60) in the first and second seasons, respectively These results are in agreements with those reported by Abd El-Hady *et al.,* (2009).

Pod length: Pod length of pea significantly affected by intercropping system in two seasons. The heights values of this character were recorded of pea Entsar1cv. when planting pure stand compared the other intercropping system. In same time the lowest values of this character were resulted from planting T11(Pea_2+two rows $garlic_1$) in both seasons.

Number of seeds/pod: The pure stand planting of pea Entsar 2 cv. produced the highest number of seed/pod (7.70 and 8.00) in the first and second seasons respectively. One the other hand T7 (Pea_1+two rows $garlic_1$) gave the lowest of this character (6.43 and 6.70) in both seasons, respectively. The effect of intercropping on number of seeds per pod approved by many investigators (EL-Shaikh and Bekheet, 2006, and Abd El-Hady *et al*., 2009)

Green yield (ton/fed.). Green yield (ton/fed) of pea was significantly affected by intercropping in both seasons. Planting pea in solid planting increased green yield as compared to other intercropping treatments. While, the highest values (6.551 and 6.791 ton/fed) were recorded by pea_2 in the first and second seasons, respectively as compared to T7 (Pea_1+two rows $garlic_1$) was (2.447 and 2.750 ton/fed) in both seasons, respectively. The superiority of pure stand of pea may be attributed to the better distribution of pea plants and less competition for light, nutrition and other environmental factors. Regarding to intercropping systems, total seed yield was significantly affected by intercropping systems These results are in line with those reported by EL-Hawary, *et al.* (1991); Amer et al. (1997), Abd EL-All (2002) and Abd El-Hady *et al*, (2009).

Table 1. Effect of intercropping systems on growth and productivity of pea during 2015/2016 and 2016/2017 seasons.

Traits	Plant height (cm)	No. of branches /plant	No. of pods /plant	pod length (cm)	Numbers of seeds/pod	Total seed yield ton/fed
Treatments			**Season 2015-2016**			
1-pea_1	41.20	1.58	7.13	10.60	7.00	4.157
2-pea_2	63.30	2.67	15.00	10.10	7.70	6.551
5- Pea_1+one row $garlic_1$	35.70	1.43	6.53	10.27	6.53	2.675
6- Pea_1+one row $garlic_2$	36.57	1.47	6.73	10.38	6.93	3.123
7- Pea_1+two rows $garlic_1$	32.77	1.37	6.30	10.10	6.43	2.447
8- Pea_1+two rows $garlic_2$	34.37	1.30	6.57	10.20	7.03	2.776
9- Pea_2+one row $garlic_1$	60.43	2.53	14.73	9.67	7.43	4.923
10- Pea_2+one row $garlic_2$	62.83	2.57	14.47	9.97	7.57	5.450
11-Pea_2+two rows $garlic_1$	55.53	2.50	13.50	9.23	7.20	4.633
12-Pea_2+two rows $garlic_2$	57.50	2.47	13.20	9.80	7.40	5.083
LSD $_{0.05}$	3.21	0.51	1.12	0.20	0.21	0.211
			Season 2016-2017			
1-pea_1	43.47	1.87	7.37	10.87	7.23	4.453
2-pea_2	65.53	3.17	16.23	10.30	8.00	6.971
5- Pea_1+one row $garlic_1$	35.90	1.57	6.90	10.44	6.77	2.960
6- Pea_1+one row $garlic_2$	37.87	1.63	7.00	10.61	7.23	3.387
7- Pea_1+two rows $garlic_1$	32.97	1.53	6.60	10.40	6.70	2.750
8- Pea_1+two rows $garlic_2$	35.83	1.50	6.87	10.10	6.90	3.080
9- Pea_2+one row $garlic_1$	60.77	3.03	16.00	9.93	7.73	5.137
10- Pea_2+one row $garlic_2$	63.07	2.93	15.73	10.00	7.90	5.783
11-Pea_2+two rows $garlic_1$	57.80	2.57	15.17	9.53	7.43	4.860
12-Pea_2+two rows $garlic_2$	60.83	2.63	15.43	9.97	7.57	5.337
LSD $_{0.05}$	2.01	0.40	1.34	0.19	0.35	0.219

B- Garlic characters: Effect of intercropping systems of garlic on its vegetative and productively characterizes are presented in Table (2).

1. Plant height: Data indicated that intercropping patterns significantly affect this trait in both seasons. The tallest plants (88.23) and 90.57cm) were results from the solid plainly of garlic Balady cv. (T3) compared to the T12 (Pea_2+two rows $garlic_2$), achieved the lowest values of trait (43.90 and 47.43 cm) in first and second seasons, respectively. These results may be ascribed to the more competition between plant for light (El-Hawary 1991), Ghobashi and El-Aweel, 1999) and El-Shaikh and Bekheet, 2006).

2. Number of leaves /plant: The solid plant of garlic increased number of leaves per plant, an compared to intercropping system, but this increment failed to be

significant from the statistical point of view in the first season. However, T4 (Pure stand of garlic Sids-40 cv.) produced highest number of leaves per plant in two study seasons. The same general trend was reported by Toaima (2001) and El-Shaikh and Bakheet (2006).

3. **Dry matter of blubs%:** Data concerning to garlic dry matter % of blub parameter the pure stand of garlic sids40 cv gave the highest values for this parameter quality compared to all intercropping systems, in both seasons. Intercropping garlic cultivars on pea cultivars significant effect on dry matter% of blub parameter in both seasons. T6 (Pea_1+one row $garlic_2$) surpassed all studied intercropping treatments of dry matter % of blub of in both seasons.
4. **Bulb diameter:** Pure stand of garlic significantly increases of compared to different intercropping systems. Treatment 4 (Pure stand of garlic Sids-40 cv.) gave the highest of values of bulb diameter as compared to T11 (pea_2+two rows $garlic_1$) in both seasons. Similar results in this respect were reported by El Moursi (1999), Toaima (2001) El-Sheikh and Bekheet (2006) and Syed *et al*., (2012).
5. **Average weight of bulb**: The pure stand of garlic (T4) significantly increased the average weight of bulb as compared to the other treatments in both seasons. Garlic Sids40 recorded the heaviest values (71.37 and 73.57 gm) in the first and second seasons, respectively. Concerning to the to the all intercropping systems the data revealed that the Balady cv. recorded the decreasing of this character lowest of values when garlic Balady cv. planted at two rows and on pea (53.63 and 46.97 gm) in the first and the second seasons, respectively. These resulted are in line with those reported by EL-Moursi (1999), and Syed *et al*., (2012)
6. **Number of clovers/bub:** The pure stand of garlic Belady cv. (T3) significantly increased number of cloves/bulb as compared to intercropping system in two seasons. Treatment 3 achieved the highest number of cloves/bulb (43.47 and 45.00) in both seasons respectively. While, the lowest values of this trait were T12 (13.13 and14.17) as compared to other treatment in both seasons. These results are in harmony with those found by El-Moursi (1999) and El-Shiakh and Bekheet (2006).
7. **Average weight of cloves:** Solid plant of $garlic_2$ (T4) increased average weight of cloves a significant from the statistical point of view in both seasons. However, the pure stand planting of garlic Sids-40 cv. gave highest values of this character (4.30 and 4.50 gm) while the lowest values (1.17 and 1.19) compared to other intercropping systems in two seasons respectively. El-Moursi (1999) El-Shaikh and Bekheet (2006) came to the same general conclusion.
8. **Total yield (ton/fed):** Intercropping garlic on pea was significantly affected on this trait in two seasons. The solid planting of garlic (Sids-40 cv.) T4 yielded the highest values (13.432 and14.631ton/fed) in first and second seasons, respectively. On the other hand, T9 (Pea_2+one row $garlic_1$) gave the lowest values of total yield (4.743 and 4.803 ton/fed) in both seasons, respectively. A significant decrease occurred in bulb yield when garlic was intercropped in pea probably due to decrease in bulb size and weight in this intercropping treatment as there was an active competition between two crops for attaining essential nutrients for their growth. Similar results were concluded when chilies intercropped in garlic These results are in accordance with those found by Mallanagouda *et al.*, (1995) , El-Hawary *et al.,* (1991), EL-Moursi (1999), Toamia *et al.,* (2001), El-Shaikh and Bekheet (2006), and Syed *et al*., (2012).

Table 2. Effect of intercropping systems on growth and productivity of garlic during 2015/2016 and 2016/2017 seasons.

Traits	Plant height	No. of leaves/plants	Dry matter bulb%	Yield Ton/fed	Blub diameter (cm)	Bulb weight (gm)	No. Cloves /blub	Cloves weight (gm)
Treatments				**Season 2015-2016**				
3-$Garlic_1$	88.23	10.93	22.23	11.716	4.80	63.93	43.37	1.60
4-$Garlic_2$	63.73	13.27	24.50	13.432	5.63	71.30	15.40	4.30
5- Pea_1+one row $garlic_1$	70.30	10.27	18.60	5.183	3.93	57.93	39.23	1.40
6- Pea_1+one row $garlic_2$	57.83	12.90	24.70	6.113	5.30	64.63	14.97	3.53
7- Pea_1+two rows $garlic_1$	55.37	7.97	16.47	8.886	3.57	54.67	38.73	1.28
8- Pea_1+two rows $garlic_2$	46.73	12.30	22.57	9.543	4.60	60.57	13.57	3.40
9- Pea_2+one row $garlic_1$	58.47	8.07	16.77	4.743	3.60	56.87	38.73	1.30
10- Pea_2+one row $garlic_2$	51.20	12.50	23.20	5.553	4.93	62.00	14.50	3.73
11-Pea_2+two rows $garlic_1$	52.50	7.90	16.27	8.331	3.20	53.63	37.67	1.19
12-Pea_2+two rows $garlic_2$	43.90	11.63	22.23	8.932	4.43	57.40	13.13	2.93
$LSD_{0.05}$	3.17	NS	1.09	0.213	0.33	2.01	2.03	0.29
				Season 2016-2017				
3-$Garlic_1$	90.57	11.20	22.67	12.993	5.13	66.47	45.00	1.37
4-$Garlic_2$	66.73	14.67	25.47	14.631	5.97	73.57	15.63	4.50
5- Pea_1+one row $garlic_1$	63.73	13.27	24.50	5.731	5.63	58.30	42.40	1.30
6- Pea_1+one row $garlic_2$	61.17	13.87	24.90	6.636	5.60	61.93	15.20	3.80
7- Pea_1+two rows $garlic_1$	54.40	8.33	17.20	9.346	3.63	54.67	39.97	1.27
8- Pea_1+two rows $garlic_2$	55.90	13.17	22.70	9.935	4.93	60.83	14.20	3.60
9- Pea_2+one row $garlic_1$	60.70	8.33	17.97	4.803	3.77	51.53	39.07	1.17
10- Pea_2+one row $garlic_2$	59.27	13.40	23.87	5.936	5.40	54.23	14.73	3.50
11-Pea_2+two rows $garlic_1$	54.27	8.20	17.27	8.897	3.40	46.97	38.07	1.13
12-Pea_2+two rows $garlic_2$	47.43	13.13	22.47	9.423	4.60	50.20	14.17	3.27
$LSD_{0.05}$	3.07	2.11	1.13	0.323	0.30	2.33	1.97	0.32

C-Competitive relationships and yield advantages of intercropping:

1. Land Equivalent Ratio (LER):

Data in Table (3) cleared that Land equivalent ratio (LER) values were greater than one by all intercropping treatments of pea with garlic, this clear that the actual productivity was higher than the expected productivity when pea was intercropped with garlic. Intercropping of pea with garlic increased land usage by 9, 21, 35, 38, 16, 25, 42 and 44% in the first season; and by 11, 21, 34, 37, 14, 24, 38 and 41% in the second seasons; for T5 (pea_1+one row $garlic_1$), T6, (pea_1+one row $garlic_2$) T7 (pea_1+two rows $garlic_1$), T8(pea_1+two rows $garlic_2$), T9 (pea_2+one row $garlic_1$), T10 (pea_2+one row $garlic_2$), T11(pea_2+two rows $garlic_1$) and T12 (pea_2+two rows $garlic_2$), respectively. The highest LER values were observed under T12, while the lowest values were obtained under T5 in both seasons. These results were in accordance with that found by El-Kalla *et al* (1999) who reported that Land equivalent ratio was greater than 1 in all intercropping systems, and was highest (1.52) in the 2:4 faba bean : onion system, and by Banful and Mochiah (2012) who found that intercropped okra with onion at system of two rows of okra to one row of onion produced the highest agronomic productivity with a land equivalent ratio of 1.36.

2. Relative Crowding Coefficient (K):

If a species has a Relative Crowding Coefficient (K) less than, equal to or greater than one, this means that it produces less yield, the same yield or more yield than expected, respectively. If K>1 there ere is no difference and if K<1 there is a yield disadvantage. The results in Table (3) indicate that T12 (pea_2+two rows $garlic_2$) gave the highest values of relative crowding coefficient followed by T11 (pea_2+ two rows $garlic_1$) and T8 (pea_2+one row $garlic_2$), while T5 (pea_1+one row $garlic_1$) gave the lowest values. These results were true in both seasons.

3. Aggressivity (A):

An aggressivity value of zero indicates that the components of species are equally competitive. For any other situation, both species will have the same numerical values, but the sign of the dominant crops will be positive and that of the dominated will be negative. The greater the numerical values the bigger the difference in competitive abilities and the bigger the difference between actual and expected yields. Data in Table (3) revealed that, the highest values of aggressivity were reported under T5 (pea_1+one row $garlic_1$), in both seasons. While, lowest values of aggressivity were reported under T11 (pea_2+ two rows $garlic_1$) in the first seasons, and under T11or T8 (pea_1+one row $garlic_2$) in the second seasons. In the first season pea crop under T10 (pea_2+one row $garlic_2$) and T12 (pea_2+two rows $garlic_2$) was the dominant crop (positive values), whereas garlic crop was the dominated crop (negative values), under T11the two crops are equally competitive and under the rest treatments garlic crop was the dominant crop, whereas pea crop was the dominated crop. In the second season, pea crop was the dominant crop under T8, T10, T11, T12, whereas garlic crop was the dominant crop in the rest of treatments. Table (3) Effect of intercropping systems on competitive relationship on 2015/2016 and 2016/2017 seasons.

Table 3. Effect of intercropping systems on competitive relationship on 2015/2016 and 2016/2017 seasons.

Traits	Relative Yield		LER	Relative Crowding Coefficient			Aggressivity	
Treatments	pea	garlic		K pea	K garlic	K	pea	garlic
Season 2015-2016								
5- Pea_1+one row $garlic_1$	0.64	0.44	1.08	0.90	1.59	1.43	-0.24	0.24
6- Pea_1+one row $garlic_2$	0.75	0.46	1.21	1.51	1.67	2.52	-0.16	0.16
7- Pea_1+two rows $garlic_1$	0.59	0.76	1.35	1.43	3.14	4.49	-0.17	0.17
8- Pea_1+two rows $garlic_2$	0.67	0.71	1.38	2.01	2.45	4.93	-0.04	0.04
9- Pea_2+one row $garlic_1$	0.75	0.40	1.15	1.51	1.36	2.06	-0.06	0.06
10- Pea_2+one row $garlic_2$	0.83	0.41	1.25	2.48	1.41	3.49	0.01	-0.01
11-Pea_2+two rows $garlic_1$	0.71	0.71	1.42	2.42	2.46	5.95	0.00	0.00
12-Pea_2+two rows $garlic_2$	0.78	0.66	1.44	3.46	1.98	6.87	0.11	-0.11
Season 2016-2017								
5- Pea_1+one row $garlic_1$	0.66	0.44	1.10	0.99	1.58	1.56	-0.22	0.22
6- Pea_1+one row $garlic_2$	0.76	0.45	1.21	1.59	1.66	2.64	-0.15	0.15
7- Pea_1+two rows $garlic_1$	0.62	0.72	1.34	1.61	2.56	4.14	-0.10	0.10
8- Pea_1+two rows $garlic_2$	0.69	0.68	1.37	2.24	2.12	4.75	0.01	-0.01
9- Pea_2+one row $garlic_1$	0.74	0.40	1.14	1.40	1.34	1.88	-0.07	0.07
10- Pea_2+one row $garlic_2$	0.83	0.41	1.24	2.43	1.37	3.32	0.02	-0.02
11-Pea_2+two rows $garlic_1$	0.70	0.68	1.38	2.30	2.17	5.00	0.01	-0.01
12-Pea_2+two rows $garlic_2$	0.77	0.64	1.41	3.27	1.81	5.91	0.12	-0.12

D- Insect infestations

1- Effect of intercropping pattern on *Thrips tabaci* infestation on garlic varieties.

The data presented in Fig. (1) showed that, the average number of thrips on garlic varieties before the pea varieties are harvested and after harvest for the first season. The data indicate that the number of thrips/plant of garlic increased in the second part of the examination (after February 15 and until harvest) where temperatures were suitable for the growth of the thrips population, where the average census was 112.23 and 98.34 thrips/plant at the end of the season compared to the average of 73.78 and 79.09 thrips/plant at early season (from planting to 15 Feb.) for Balady and Sids-40 vars. respectively. The Balady var. harbored more infestation at the beginning of the season than Sids40 var. and vice versa at the end of the season where the var. Sids-40 injuries higher than Balady var. at the end of the season. In the case of intercropping, the average number of thrips on garlic was higher before the removal of the peas plants where the numbers decreased significantly after harvest despite the favorable weather conditions for the spread of thrips as in the garlic planted

sole. It is noticeable that the decrease in the number of thrips was greater in the case of growing two rows of garlic with peas compared to the cultivation of one row of garlic with peas.

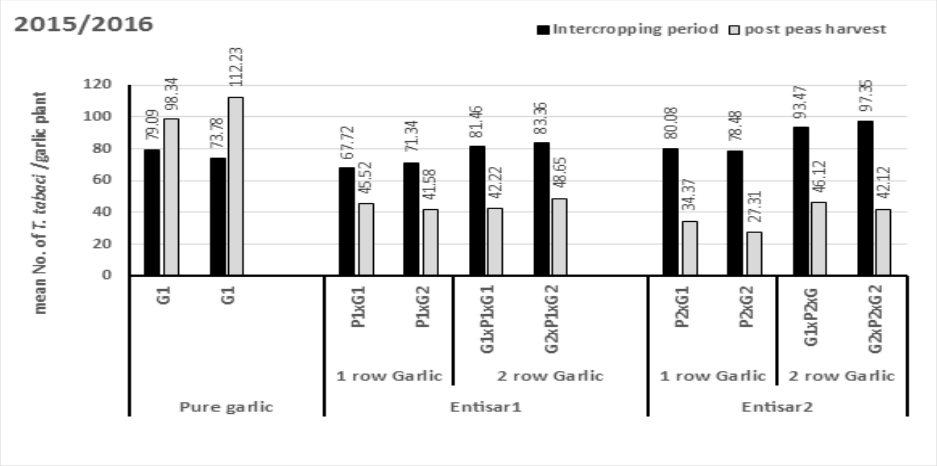

Fig. 1. Effect of intercropping systems on garlic infestation with *T. tabaci* on 2015/2016 season.

The results in Fig. (2), demonstrated the average count of thrips/garlic on all intercropping blends peas and garlic, moreover sole garlic vars. for the second season. The data indicate rise in the mean numbers of thrips on solo plantation of Balady variety in the first period (102.58 individual/plant) compared with the second period (97.34 individual/plant), while infestation of thrips in solo plantation of Sids-40 for second period (99.12 individual/plant) was higher than infestation during the first period (88.64 individual/plant). In the case of the intercropping of garlic on the peas at the rate of one row, the average number of thrips on Balady variety was higher than the Sids-40 variety in the intercropping period at the rate of 107.11 and 111.23 insects/plant for Entsar-1 and Entsar-2 peas varieties respectively. While the average population of thrips on Sids-40 variety was relatively higher than the Balady variety during the post-harvest period of the peas at a rate of 121.11 and 97.67 insects/plant for Entsar-1 and Entsar-2 peas varieties respectively. In the case of the cultivation of garlic at the rate of two rows with peas, the average population of thrips in the period of the presence of the two crops together was higher than the average population for the period after the harvest of the peas except in the case of the var. Entsar-2 with var. Seds-40, where the insect population was higher during the post-harvest period.

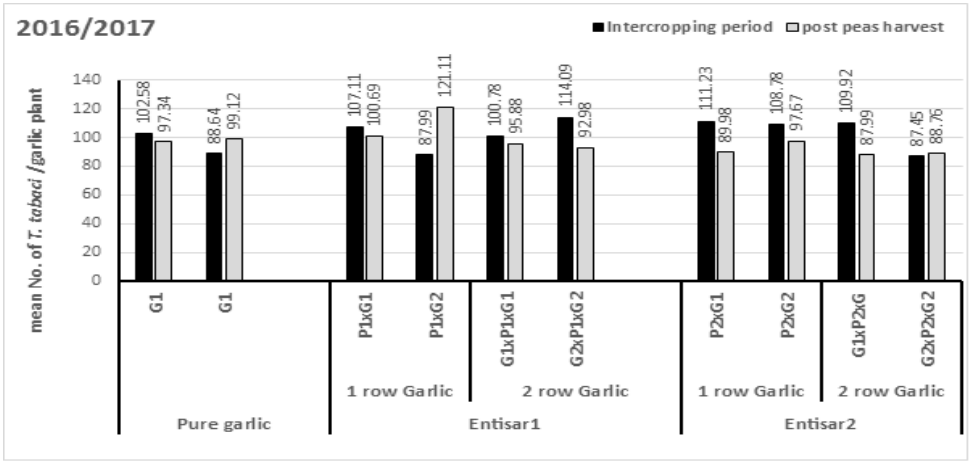

Fig. 2. Effect of intercropping systems on garlic infestation with *T. tabaci* on 2016/2017 season.

2- Effect of intercropping pattern on *E. zinckenella* infestation on peas varieties.

In general, the injuries of the *E. zinckenella* were higher in the second season of the first season of all treatments, as well as solo peas plantations suffered higher injuries of the intercropping systems. It seems through the average infestation of peas that the intercroped of garlic in all cases led to a decrease in injury, especially in the case of the cultivation of two lines of garlic of the variety of Balady with the peas variety Entsr-1 at the rate of 12.33 and 11.67% and with the peas variety Entsr-2 at the rate of 11.67 and 10.67% for the two planting seasons respectively (Fig. 3).

Garlic is one of the potential plant that could be inserted in crops to decrease the pests in neighboring crop plots, this results founded by Hai-bo *et al.*, (2013), they found that, both intercropping and application of volatile chemicals emitted by garlic could improve the population densities of natural enemies. Also, Suresh *et al*. (2010) and Vaiyapuri *et al*. (2010) indicated the role of intercropping in controlling pests and protecting beneficial insects relevant to enhancing biodiversity in an agroecosystem.

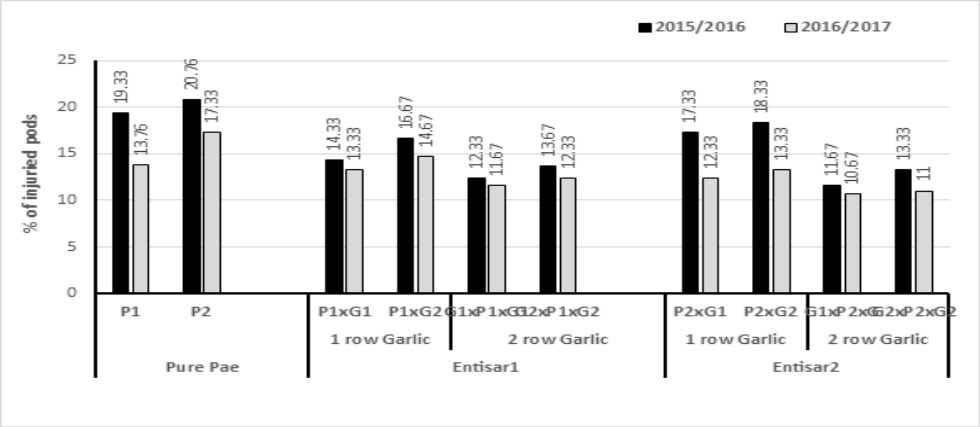

Fig. 3. Effect of intercropping systems on peas infestation with *E. zinckenella* on 2015/2016 and 2016/2017 seasons.

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دراسة تأثير تحميل بعض أصناف البسلة والثوم على الكثافة العدديه لبعض الافات فى محافظة سوهاج

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اجريت هذه الدراسة بغرض التعرف على انتاجية نباتات الثوم والبسلة و الكثافة العددية لبعض الآفات الحشرية المصاحبة من خلال عدة معاملات من أنظمة التحميل تحت ظروف محافظة سوهاج موسم شتاء ٢٠١٥/ ٢٠١٦ و٢٠١٦/ ٢٠١٧ بمزرعة البحوث الزراعية جزيرة شندويل سوهاج وقد اشتملت الدراسة ١٢ طريقة من طرق التحميل وهى زراعة صنفين من أصناف البسلة زراعة منفردة وايضا زراعة صنفين من اصناف الثوم زراعة منفردة بالكثافة الموصي بها وكذلك تحميل كل صنف من أصناف الثوم على البسلة بكثافة (زراعة خط أو خطين من الثوم على الريشة المقابلة البسلة).وقد كانت أهم النتائج المتحصل عليها من هذه الدراسة ما يلي :أعطت المعاملات التي تم فيها زراعة صنفي البسلة والثوم زراعة منفردة أعلى القيم المتحصل عليها لمعظم الصفات الخضرية وصفات المحصول ومكوناته حيث اظهر صنف البسلة انتصار١ تفوقا واضحا فى صفة طول القرن ووزن ١٠٠حبة في حين اعطى الصنف انتصار٢ أعلى القيم المتحصل عليها لصفات النمو الخضري خاصة طول النباتات وعدد البراعم وعدد الحبوب في القرن وكذلك المحصول الكلى للقرون الخضراء مقارنة مع المعاملات الأخرى للتحميل. وأوضحت النتائج المتحصل عليها أيضا أن زراعة الثوم زراعة منفردة تفوق الصنف سدس٤٠ في صفات عدد الأوراق لكل نبات ونسبة المادة الجافة للأبصال وقطر ووزن البصلة ومتوسط وزن الفص وكذلك المحصول الكلى للفدان في حين سجل الصنف البلدي الثوم أعلى القيم لطول النباتات وعدد الفصوص في الرأس وذلك خلال موسمي الدراسة.وقد اظهرت معاملات التحميل اختلافات فيما بينها في القيم المتحصل عليها لمعظم الصفات حيث أظهرت معاملات التحميل التي تم فيها تحميل الثوم على البسلة بزراعة خطين من الثوم ان كمية المحصول زادت معنويا مقارنة بزراعة خط واحد من الثوم.ادي تحميل الثوم على البسلة الي انخفاض في عدد القرون المصابة بدودة قرون اللوبيا مقارنة بزراعات البسلة المنفردة لكلا موسمي الزراعة لجميع الأصناف. في حين ادي التحميل لزيادة تعداد التربس علي الثوم في خلال فترة التحميل، ولكن الاعداد انخفضت بعد إزالة البسلة وحققت جميع معاملات الثوم على البسلة قيم اعلى من الواحد الصحيح من معدل كفاءة استغلال الارض، في كلا الموسمين. اظهرت المعاملة ١٢ اعلى قيمة من معامل الحشد النسبي، في حين اظهرت المعاملة ٥ اقل القيم، وذلك في كلا الموسمين. كان محصول البسلة هو السائد في المعاملات ١٠ و١٢ في الموسم الاول، وفى المعاملات ٨ و١٠ و١١ و١٢فى الموسم الثاني، في حين كان محصول الثوم هو المسود.من خلال الدراسة ومع الاصناف التي تم دراستها يمكن التوصية بتحميل الثوم الصنف سدس٤٠ بكثافة عددية ١٠٠% (زراعة خطين) على البسلة الصنف انتصار ٢ للحصول على اعلى محصول مقارنة بتحميل الثوم بكثافة عددية ٥٠% (زراعة خط واحد).