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EFFECT OF SELECTED BIO-INSECTICIDES AND INTERCROPPING SYSTEMS OF FABA BEEN AND ONION WITH SUGARBEET MAJOR INSECTS, QUALITY AND YIELD OF SUGARBEET

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ABSETRACT: *The present study was carried out at Farm of Nobaryia Research Station, Agricultural Research Center at El Beheira, Governorate, Egypt in two successive seasons of 2011/12and 2012/13 to study the effect of intercropping sugarbeet (Beta vulgaris) cv. Gloria which intercropped with Faba been (Vicia Faba,L) cv. Giza 3 and Onion (Allium cepa L) cv. Giza 20 and selected bio-insecticides comparing with chemical insecticide Selecron® on population density of tortoise beetle and beet fly (Cassida vittata and Pegomyia mixta) on sugarbeet plants. The population density of two major insect significantly decreased by different intercropping system in comparison with pure stand sugarbeet system. The intercropping system of (onion in 2 rows with sugarbeet) was less attractive to tortoise beetle, C. vittata (260.73 and 240.93 Larvae& adults 10/plants) through the first and second season under study, respectively. The pure stand of sugarbeet system was more sensitive to infested by C. vittata (350.33& 480.07 Larvae and adults 10/plnts) during 1st and 2nd seasons, there different significant between intercropping systems except between intercropping (onion in 2 rows with sugarbeet) and (onion in 3 rows with sugarbeet) in the first seasons. Population density of beet fly, P. mixta was significantly affected by intercropping systems where, pure stand of sugarbeet system was recorded the highest numbers of larvae of beet fly (510.7 and 600.27 larvae /10 plants) during 1st and 2nd seasons, respectively. In the opposition direction, the lowest values of rate infection by P. mixta was recorded (360.40 and 350.42 larvae /10 plants) with intercropping system (Faba been in three rows with sugarbeet). The roots and sugar yields were significantly affected by different intercropping system in both seasons and combined analysis. Yields were significantly decreased by all tested intercropping system in 1st and 2nd seasons and combined analysis as compared with pure stand system of sugarbeet. The highest values of this parameter with an average of 24.21, 25.29and 24.75 tons fed^{-1} for root yields and 3.81, 3.97 and 3.89 tons fed $^{-1}$ for sugar yield in 1st and 2nd seasons and combined analysis, respectively. Among the different intercropping systems under study , intercropping faba been in two rows with sugarbeet achieved the highest roots yield (23.19, 2.75and 23.47 tons fed^{-1}) and sugar yield 3.81 tons fed^{-1}) in 1st and 2nd seasons and combined analysis. The quality characters of sugarbeet, T.S.S. % and purity % were significantly affected by intercropping systems in both seasons and combined analysis but there were non significant effect in the second season for sucrose% characters. Percentage mortality of Cassida vittata and Pegomyia mixta affected by pesticides type and post treatment period. chemical insecticides, Selecron® 72% EC and bio-insecticides Protecto ®, Dipel 2X® Bioranza® and Biofly® at recommended rates®. The results indicated that chemical insecticides, Selecron® 72% w as most potent against two major sugarbeet insects at all treatment period followed by Biofly® , Bioranza®, Dipel 2X® and Protecto. The fungal insecticides were most effective against the C. vittata and P. mixta than bacterial insecticides in sugarbeet production. The infestation rats by tortoise beetle C. vittata and beet fly P. mixta were significantly affected by the interaction between intercropping system and tested insecticides in the first and second seasons. The lowest infestation rate by tortoise beetle (220 larvae and adults /10plants) and beet fly (277 larvae 10/ plants) on* *sugarbeet system and bio-insecticides recorded with Selecron 72% x intercropping onion in two rows with sugarbeet system and Bioranza x intercropping faba been in two rows with sugarbeet system in the 2nd season. The roots yield, leaves yield and sugar yield of sugarbeet were significantly affected by the interaction between intercropping system and tested insecticides in both seasons. The highest roots yield (25.6 tons fed^{-1}) was obtained by Selecron x intercropping faba been in two rows or onion in three rows with sugarbeet system in the first and second season. The highest values of T.S.S. % (22.33 %) was obtained with Selecron x intercropping faba been in two rows with sugarbeet in the second season and the lowest value (16.60%) with Protecto ®x intercropping faba been in two rows with sugarbeet in the first season. The purity % significantly affected by interaction between tested insecticides and intercropping system. Finally, from results of this study , it can be conducted that fungal insecticides are the most effective than bacterial insecticides and intercropping sugarbeet with faba been in two and/or three rows decreased the rat infestation by Tortoise beetle, Cassida vittata and Beet fly, Pegomyia. Mixta as major insect pest and produced the highest values of total income return compared to a sugarbeet monoculture.*

Key words: *bio-insecticides- intercropping systems - Faba been - Onion –Sugarbeet- tortoise beetle- Cassida vittata - and beet fly –Pegomyia mixta .*

INTRODUCTION

Under Egyptian conditions, sugarbeet plants are considered as very desirable host plant for many insect pests. The tortoise beetle, *Cassida vittata* Vill and beet fly, *(Pegomyia mixta* Vill) insects were reported as most serious insect pests of sugarbeet (Bassyouny, 1987; Abo El -Ftooh 1995; Ebieda and Bader, 1997 and El-Khouly 1998). Efforts protect the crops from the most destructive pests are crucial .Scientists developed synthetic pesticides to control insect pests and these have been more successful than biological and agriculture method albeit with detrimental consequences to the environment popular pesticides are hazardous to t he environment because they have reduces , destroyed the ecological balance ,are toxic to man and are volatile . Environmentalists and consumers are against use of agrochemical like pesticides in crop production. Researchers are developing alternative management techniques such as use of cropping systems biological control ageists and judicious use of pesticides. The biological control is an important component that should be utilized in integrated pest management programmers. In such concern, Whiteley and Schneph (1986) have shown that biological control of lepidopteron insect pests, affecting crop plants, is p0ossible using *Bacillus thuringeinsis (*BT). Bio-pesticides products containing *(*BT) account for more than 20% of the bio-pesticides used (Sanchis *et al*., 1996). In Egypt, Salama and foda (1982) and Salama *et .al* (1990) identified (BT) var *entomocidus* as a highly effective strain against larvae of *Spodoptera littoralis* (Boisd). Mosbah *et.al* (2004) indicated that application of Dipel 2x eliminated 19.28, 27.29 and 16.38 of the insect population of *Cassida vittata, Scrobiplpa ocellatela* and *Pegomyia mixta respectively*. Abo El-Ftooh. (2004) they reported that *Bacillus thuringeinsis entomocidus* application reduced cotton leafworm *S. littoralis* on sugarbeet. The entomopathogenic fungi have long been known to cause epizootics among certain insects both laboratory and filed conditions (Watson *et al*., 1996 and Reithinger, 1997).El-Husseini *et.al*.(2008) produced the conidiospores of *Beauveria bassiana* in two formulations for spraying and dusting applications in sugarbeet fields .They found the population of insect pest feeding by chewing all leaf tissue were considerably reduced by either technique .Also, Shalaby *et al* (2011) revealed that the biocides, Agrren ,Brotects and Bactospeine(bacteria –derived) caused average mortality of 50.06-57.19?% in leafworm population attacking sugarbeet fields .

Intercropping is a potential beneficial of crop production in the developing production, in the developing countries and especially Egypt where the population is rapidly increasing and cultivation land and irrigation water are limiting .In I addition high yield of intercrop compared to the monocrop and more income for growers .Also, intercropping system as agronomic practice reduced the losses in yield cussed by pest s, diseases and weeds (Andrews, 1974).

Omar *et al.* (1994) reported that intercropping of cowpea with cotton as a cultural method to decrease target pests of cotton. Banaszak *et al* (1998)found that oil radish and white mustard as intercrops has reduced the *H. schachtii* infestation by about 20-40% in sugarbeet crop .Also, Maarg *et .al* (2007) reported that the garlic and or onion intercropping with sugarbeet significantly lowered *M. javanica* root –knot nematode on sugarbeet .The highest reduction (65%) when garlic intercropping at density 66% with sugarbeet in ridges 120cm width .Hassan (2009) found that cowpea+ sorghum intercrop reduced aphid (*Aphis craccivora*) population significantly compared to sole cowpea crop . Some investigators concluded that the maximum yield and quality could be obtained from the unit area of sugarbeet due to intercropping pattern. Amer *et .al* (1997) found that planting faba been at 70%of its soled population intercropped with sugarbeet gave the highest income return while, 50% faba been population with sugarbeet gave the lowest value. Sugarbeet quality (sucrose, T.S.S. and purity %) were not affected due to intercropping with faba been .However, Toaima *et. al* (2001) reported that yield and yield components of sugarbeet as sold crop or when it was intercropped with onion in 60 cm ridges wide. while, Saleh (2003)found that intercropping onion with sugarbeet at 60 cm ridges width gave a higher yield ,yield components and quality parameters of sugarbeet than those of sole cropping as intercropping with onion in ridges 120 cm wide .On other hand , Toaima *et. al* (2001) reported that, growing garlic plants on the ridges 120cm width of sugarbeet gave higher yield than growing on ridges 60cm wide .Maarge *et. al* (2007) stated that the intercropping garlic or onion with sugarbeet in the 120cm ridges width gave the highest root yield , sugar yield , yield components' and quality characters of sugarbeet than those of sole cropping and intercropping with onion or garlic in ridges 60cm width.

The present study was conducted to study the effects of some bio-insecticides , intercropping faba been and or onion with sugarbeet and their interaction on sugarbeet yield and quality as well as infestation rate by the tortoise beetle (*Cassida vittata* Vill) and beet fly *(Pegomyia mixta* Vill) insects.

MAT ERIALS METHODES

The present investigation was carried out at Farm of Nobaryia Research Station, Agricultural Research Center at El Beheira, Governorate, Egypt during successive seasons of 2011/12and 2012/13 to study the effect of different intercropping systems Faba been (*Vicia Faba*,L cv. Giza 3) and Onion (*Allium cepa* L , cv. Giza 20) with sugarbeet (*Beta vulgaris*, cv. Gloria) and selected bio-insecticides comparing with chemical insecticide Selecron®72% EC on sugarbeet productively and infestation rate tortoise beetle (*Cassida vittata*) and beet fly and *(Pegomyia mixta*) under field condition.

The selected bio- insecticide used.

Protecto®: (*Bacillus thuringeinsis kurstaki*) It was applied at a rate of 300g/ Feddan (Feddan=4200m^2).

Dipel 2X®: (Selective bacterial insecticide) *B. thuringeinsis* sub sp. *kurstaki* 32000 International Units/mg. It was applied at a rate of 200g/ fddan.

Bioranza®: (*Metarhzium anisopliae*) as wettable powders, 200g/feddan.

Biofly®: *Beauveria bassiana* fungus suspension applied at a rate of 300 cm^3/100 liter water.

The chemical insecticide used.

Selecron®: Selecron 72% EC, (Organic phosphors insecticide), O-(4- bromo-2-chlorophenyl) O- ethyl S- propyl phosphoro-thioate. It was applied at rate of 750 cm^3 /feddan.

Experimental field

The plot area was 42 m^2 represent 6 ridges (100 cm in width × 7m in length) equal 0.01 feddan. Spacing between hills was 20 cm. The sugarbeet cultivar, Gloria was chosen as the major crop and sowing in 20^{th} October. Each treatment was represented by three replicates arranged in a arrangement in randomized complete blocks design. The mien plots were seven in intercropping systems and the sub plots were five insecticides. The seeds of faba bean and onion crop were planted in the back of terraces and sugarbeet were planted on the two sides of the terraces in the two growing seasons on 20^{th} and after 10 days on 30th October. Onion seedlings were transplanted into Nursery. Inspection started 30 days after sowing. Numbers of *C.vittata* and *P. mixta* were counted on 10 plants picked from each replicate in the field. Counts of *C. vittata* (larvae and adults) and *P. mixta* (Larvae) were recorded before and after spraying and after 1, 3, 5, 7, 10, 14 and 21 days after application for two major sugarbeet insects *(C. vittata and P. mixta)*.the application times were in Mid-November for *P. mixta* and Mid–March for *C. vittata* during 1^{st} and 2^{nd} season. Percentage of reduction was calculated according to Henderson and Telton (1955) equation.

The main plots were occupied at random with seven intercropping system as follow:

1- Pure stand of sugarbeet was planted in the terraces100 cm width. Spaced 20 cm between hills on both sides of terraces.

2-Intercropping faba been with sugarbeet by planting sugarbeet as a pure stand in two sides of terraces and planting faba been two rows in the top of terraces.

3- Intercropping faba been with sugarbeet by planting sugarbeet as a pure stand in two sides of terraces and planting faba been three rows in the top of terraces .

4- Intercropping onion with sugarbeet by planting sugarbeet as a pure stand in two sides of terraces and onion planting two rows in the top of terraces.

5- Intercropping onion with sugarbeet by planting sugarbeet as a pure stand in two sides of terraces and onion planting three rows in the top of terraces.

6- Pure stand of Faba been was planted in four rows on the back of terraces, 100 cm width. Spaced 20cm between rows and 10cm between hills (2 plant /hill).

7- Pure stand of onion was planted in four rows on the back of terraces. Spaced 20 cm between rows and 10 cm between hills (2 sapling /hill).

Characters studies

Sugarbeet:-

At harvest time (210 days from sowing) the two terraces from pure stand and of each intercropping system of sugarbeet harvested were collected and cleaned . Roots and top were separated and weighted to determine yield characters. Where, the root samples sent to a laboratory Nile Sugar Company to determine the quality characters for sugarbeet plants.

Faba been: -

At harvest the plants in two terraces of each intercropping system were harvested, collected together, labeled, thrashed and the grains were separated. The grain yields was recorded in kg/m2 and converted to grain yield ardab/fed.

Onion: - At harvest time (90-110 days) the plant in two terraces were harvest to determine the bulb of onion (ton/ fed). All data collected were subjected to statical analysis of variance as described by Steel and Torriie (1980). The treatment, main were compared using LSD test at 0.05 level of significant .The combined analysis was calculated across the two seasons and that was done when over the homogeneity of variance was detected.

RESULTS AND DISCUSSION

1-Effect of intercropping systems on population density of major sugarbeet insects.

1-1. Tortoise beetle *Cassida vittata* Vill

Data in Table (1) indicated that the population density of two major insect significantly decreased by different intercropping system in comparison with pure stand sugarbeet system. Also, data clarified that the intercropping system of (onion in 2 rows with sugarbeet) was less attractive to tortoise beetle, C. *vittata* (260.73 and 240.93 Larvae& adults 10/plants) through two growing seasons under study, respectively. On the other hand, the pure stand of sugarbeet was more sensitive to infested by *C. vittata* (350.33& 480.07 Larvae and adults 10/plnts) during 1st and 2nd seasons, respectively. As, data in Table (1) indicated that there different significant between intercropping systems except between intercropping (onion in 2 rows with sugarbeet) and (onion in 3 rows with sugarbeet) in the first seasons.

1-2- beet fly, *Pegomyia mixta*:

Data in Table (1) revealed that population density of beet fly, *P. mixta* was significantly affected by intercropping systems where, pure stand of sugarbeet system was recorded the highest numbers of larvae of beet fly (510.7 and 600.27 larvae /10 plants) during t1st and 2nd seasons, respectively. In the opposition direction, the lowest valus of rate infection by *P. mixta* was recorded (360.40 and 350.42 larvae /10 plants) with intercropping system (Faba been in three rows with sugarbeet) .Comparing with the pure stand of sugarbeet and other intercropping systems. There were no significant different between the faba been in 3 rows with sugarbeet and Intercropping onion in 2 rows with sugarbeet in the first season but there were significant different between other intercropping system. This results were agreement with El-Fakharany *et al* (2012) who found that the rate of infestation of both *C. vittata* and or *P. mixta* was higher in the sole sugarbeet plants than in those intercropped with faba bean, maize and cabbage plants which caused reduction of sucking pests and *P. mixta* eggs .Also, these results are harmony with Oso and Falade (2010) they reported that the intercropping systems may necessarily reduce pest load in any given situation.

2-Effect of intercropping systems on yield characters

Data in Table (2&3) show that the roots , leaves and sugar yields as well as , qualities characters of sugarbeet crops were significantly affected by different intercropping faba been and /or onion with sugarbeet system in both seasons and combined analysis. With respect to roots yield, leaves yield and sugar yield tons fed^{-1} of sugarbeet data in Table (2) indicated that these yields were significantly decreased by all tested intercropping system in 1st and 2nd seasons and combined analysis as compared with pure stand system of sugarbeet .The pure stand system of sugarbeet, the highest values of these parameter were 24.21, 25.29and 24.75 tons fed^{-1} , 11.21 , 14.90and 13.06 tons fed^{-1} for leaves yield and 3.50, 3.54 and 3.52 tons fed $^{-1}$ for sugar yield in 1st and 2nd seasons and combined analysis , respectively. Among the different intercropping systems under study, intercropping faba been in two rows with sugarbeet achieved the highest roots yield (23.11, 23.75and 23.47 tons fed^{-1}) &(3.74, 3.83 and 3.81 tons fed^{-1}) sugar yield in 1st and 2nd seasons and combined analysis , respectively. However, the intercropping systems of onion in two rows and in three rows with sugarbeet produced the highest leaves yield (10.76, 10.50 and 10.6 tons fed^{-1})and (10.14,10.18and 10.16 tons fed^{-1})in the two seasons and combined analysis , respectively as compared with other tested intercropping systems, as shown in Table (2) .

Concerning, quality characters of sugarbeet, T.S.S. % sucrose % and purity % were significantly affected by intercropping system in both seasons and combined analysis. The pure stand of sugarbeet system recorded higher values for T.S.S. % (20.68, 20.11 and 19.78 %). While, the intercropping of faba been in two rows with sugarbeet obtained the higher values for sucrose % (16.33, 16.13 and 16.23 %) and purity % (78.13, 78.26 and 78.00) in the two seasons and combined analysis, respectively. As shown in Table (3).

Table 1

Table 2

Table 3

Generally, the roots yield and sugar yield of sugarbeet as solo crop (pure stand) recorded the highest values with pure stand system compared to intercropping of faba been and /or onion in two or three rows with sugarbeet system in two seasons.. These results in contrary with these obtained by Amer (1997), Toaima (2001), Salah (2003) and Maarge *et. al* (2007) they found that intercropping onion with sugarbeet gave higher yield and yield components of sugarbeet than those of solo cropping . Also, Attia *et* al. (2007) they found that the intercropping faba been with sugarbeet increased roots, leaves and sugar yield (tons fed^{-1}) as compared with pure stand systems. Also, Toaima *et al* (2001) Maarge *et. al* (2007).

3- The effect of selected bio-insecticides on population of major insect pest on sugarbeet on comparison to chemical insecticide, Selecron®:

Data in Table (4) shown that percentage mortality of *Cassida vittata* and *Pegomyia mixta* affected by pesticides type and post treatment period. In general, the reduction percentage increased with the progressive increase in time in each treatment. After one days, the reduction % was 50.7, 9 , 22 and 20 for *C. vittata* larvae , 34,2,1,11 and 18 for *C. vittata* adults and 58, 10, 12, 36 and 31 for *P. mixta* larvae occurred by Selecron , Protocta, Diple 2x , Bioranza and Bio fly , respectively. The reduction% increased then sharply to be 88,37,40,55 and 59 %, 87, 35, 39, 41 and 46% and 77, 45, 48, and 58% for *C. vittata* larvae and adult and *P .mixta* larvae, respectively after 7 days from application. Reached 96, 60, 63, 70 and 73% for *C. vittata* larvae, 95, 41, 44, 52 and 66 for *C. vittata* adults and 99, 80, 85, 88, and 89% for *P .mixta* larvae.

Compared to untreated treatment (water treatment). Significance reduction % was obtained in all pesticides treatments after 1, 3, 5, 7, 14 and 21 days post treatment (Table, 4).

Comparison between chemical insecticides, Selecron® 72% EC and bio-insecticides Protecto ®, Dipel 2X® Bioranza® and at recommended rates, the results indicated that chemical insecticides Selecron® 72% w as most potent against two major sugarbeet insects at all treatment period followed by Biofly®, Bioranza®, Dipel 2X® and Protecto ®.Also, the results indicated that the fungal insecticide were most effective against the *C. vittata* and *P. mixta* than bacterial insecticide in sugarbeet field. These results are agreement with those obtained by El-Sebae *et al* (1987) they found that organophosphrous components, Selecron®, Reldan and Tamaron gave nearly complete reduction against *C. vittata*. Also, Abo El-Nagar (2004) reported that Selecron® was most effective insecticide on *C. vittata* in sugarbeet field .El –Agamy *et al* (2009) reported that Biofly was most toxicity than Diple 2x on beet fly *P. mixta* but Diple 2x was ineffective against *C. vittata*, and El-Khouly (1998), Abo El Ftooh (2004) and El –Fakharany *et al* (2012) found that the application of Bacillus thurrgensis reduction the infestation by *C. vittata* on sugarbeet field.

4-Effect of interaction between intercropping systems and selected insecticides on population density *C. vittata* and *P. mixta* on sugarbeet.

Results in Table, 5 revealed that the infestation rats by tortoise beetle *C. vittata* and beet fly *P. mixta* were significantly affected by the interaction between intercropping system and tested insecticides in the first and second seasons. It is clear that the lowest infestation rate by tortoise beetle (220 larvae and adults /10plants) and beet fly (277 larvae 10/ plants) on sugarbeet system and bio-insecticides recorded with Selecron 72% x intercropping onion in two rows with sugarbeet system and Bioranza x intercropping faba been in two rows with sugarbeet system in the 2nd season, respectively. However, the highest infestation rate by tortoise beetle (627 larvae and adult /10plants) and beet fly 693 larvae /10plants) occurred on sugarbeet by bio-insecticides Protecto x intercropping faba been in 3 rows with sugarbeet system in the first and second seasons, respectively.

Table (4): Effect of bio-insecticides on population density of major insect pest in sugarbeet, *Cassida vittata* Larvae and adults and *Pegomyia mixta* larvae in comparison with chemical insecticide Selecron®.

Period after application of insecticides	Insects	Stages	Reduction percentage of sugarbeet insects				
			Selecron®	Protecto ®	Dipel 2X®	Bioranza®	Biofly®
First day	*C. vittata*	Larvae	50	7	9	22	20
		Adults	34	2	1	11	18
	P. mixta	Larvae	58	10	12	36	31
Third day	*C. vittata*	Larvae	71	7	13	29	35
		Adults	49	3	5	16	20
	P. mixta	Larvae	66	12	15	41	44
Fifth day	*C. vittata*	Larvae	81	38	43	49	45
		Adults	70	24	26	33	31
	P. mixta	Larvae	71	33	44	64	55
Seven day	*C. vittata*	Larvae	88	37	40	55	59
		Adults	87	35	39	41	46
	P. mixta	Larvae	77	45	48	56	58
Fourteenth day	*C. vittata*	Larvae	90	56	58	60	62
		Adults	85	41	42	56	51
	P. mixta	Larvae	91	66	67	72	75
Twenty one day	*C. vittata*	Larvae	96	60	63	70	73
		Adults	95	41	44	52	66
	P. mixta	Larvae	99	80	85	88	89
LSD $_{0.05}$ between insecticides			1.66	1.92	1.95	2.19	2.03
LSD $_{0.05}$ between days			0.89	1.02	1.04	1.71	1.88

Table 5

5- Effect of interaction between intercropping systems and selected insecticides on yield and quality parameters of sugarbeet.

When calculating the interaction between two factors of (intercropping systems and insecticides) found that there were significant differences between all the yield and qualities parameters tested except leaves yield. Also found that there was no significant difference between the sucrose percentage in the first season's On yield parameters.

Results in Table (6) indicated that roots yield and sugar yield of sugarbeet were significantly affected by the interaction between intercropping system and tested insecticides in both seasons. The highest roots yield (25.6 tons fed^{-1}) was obtained by Selecron x intercropping faba been in two rows or onion in three rows with sugarbeet system in the first and second season, respectively. However, the lowest roots yield (14.6 tons/ fed^{-1}) produced by protecto x intercropping onion in 3 rows with sugarbeet system in the first season Table (6).

Concerning, the highest sugar yield (3.93 tons /fed^{-1}) was recorded with Selecron® x pure stand sugarbeet in the first season; however, the lowest sugar yield (2.17 tons /fed^{-1}) was obtained by Protecto ® x intercropping faba been in 3 rows with sugarbeet system in 2nd season Table(6).

On quality parameters

Quality parameters, Total soluble solids (T.S.S %), sucrose % and purity % of sugarbeet root juice were significantly affected by interaction between tested insecticides and intercropping system except sucrose % in the second season Table (7). The highest values of T.S.S. % (22.33 %) was obtained with Selecron x intercropping faba been in two rows with sugarbeet in the second season and the lowest value (16.60%) with protecto x intercropping faba been in two rows with sugarbeet in the first season.

Concerning, however, the lowest value (13.80%) was produced from Selecron x intercropping faba been in three rows with sugarbeet system in the first. Also, purity % significantly affected by interaction between tested insecticides and intercropping system. The highest value of purity (80.73%) was recorded with interaction between Diple 2x and pure stand of sugarbeet system, however, the lowest value (75.33%) was obtained by Selecron x intercropping faba been in 3rows with sugarbeet system in the second season.

The economic evolution:

The results in Table (8) show that the advantage of intercropping faba been or onion with sugarbeet system as economic evaluation. The highest value of total income (11060 L.E) was achieved by the intercropping system of faba been in 3rows with sugarbeet and (10545 L.E) for intercropping faba been in 2 rows with sugarbeet system with increase of 27.42% and 21.49%, respectively tnan sugarbeet pur stand system. While, the lowest values recorded by pure stand of faba been (7200 L.E). The order of agriculture systems basis of the rate of income per feddan ascending output by Egyptian pounds as follow. pure stand of faba been (7200 L.E), pure stand of onion (8450 L.E), pure stand of sugarbeet 8661 L.E), sugarbeet with 2 rows of onion (8740 L.E), sugarbeet with 2 rows of onion (9923 L.E) sugarbeet with faba been 2 rows (10533 L.E) and sugarbeet with 3rows of faba been (11200 L.E). The income of intercropping systems more profitable than pure stand of sugarbeet, faba been and onion. The used of different intercropping systems increase in income ranged from 0.01% to 21.42%.

Conclusion.

Finally, from results of this study , it can be conducted that fungal insecticides are the most effective than bacterial insecticides and intercropping sugarbeet with faba been in two and/or three rows decreased the rat infestation by Tortoise beetle*, Cassida vittata* and Beet fly, *Pegomyia. Mixta* as major insect pest and produced the highest values of total income return compared to a sugarbeet monoculture.

Table (6): Effect of interaction between intercropping systems and selected bio-insecticides on sugarbeet yield characters during 2011/12 and 2012/13 seasons.

Intercropping System	Selected insecticides	Yield characters					
		Root yield		Leaves yield		Sugar yield	
		2011/12	2012/13	2011/12	2012/13	2011/12	2012/13
Pure stand of sugarbeet	Selecron®	25.12	25.80	12.30	11.87	3.93	3.73
	Protecto ®	18.33	16.83	10.33	10.07	2.90	2.60
	Dipel 2X®	15.83	18.47	10.50	9.77	2.67	2.47
	Bioranza®	22.30	22.83	11.43	10.57	3.40	3.03
	Biofly®	20.57	25.37	11.47	11.53	3.20	2.85
Intercropping faba been in two rows with sugarbeet	Selecron®	22.52	25.60	11.57	11.57	3.37	3.67
	Protecto ®	19.80	15.37	9.97	9.97	2.50	3.30
	Dipel 2X®	18.23	15.80	8.87	8.87	2.83	2.53
	Bioranza®	18.67	21.47	11.10	11.10	3.30	3.70
	Biofly®	22.03	22.83	8.87	8.87	3.20	3.50
Intercropping faba been three rows with sugarbeet	Selecron®	21.77	24.27	12.91	10.77	3.10	2.87
	Protecto ®	16.80	21.90	8.67	9.73	3.00	2.80
	Dipel 2X®	17.03	20.80	9.43	9.17	2.63	2.43
	Bioranza®	21.53	23.83	11.13	10.60	3.23	2.77
	Biofly®	17.80	22.27	10.37	10.43	3.09	3.00
Intercropping onion in two rows with sugarbeet	Selecron®	17.07	23.70	10.43	10.43	2.87	3.10
	Protecto ®	15.73	23.03	9.20	10.07	2.80	2.77
	Dipel 2X®	14.80	14.90	9.23	8.60	2.43	2.87
	Bioranza®	16.02	20.63	7.97	7.40	2.77	2.67
	Biofly®	16.30	20.47	9.10	9.00	3.00	3.03
Intercropping onion in three rows with sugarbeet	Selecron®	25.60	17.60	10.00	9.63	2.97	3.00
	Protecto ®	14.60	15.67	8.93	8.43	2.70	2.87
	Dipel 2X®	15.30	16.10	7.87	8.03	2.67	2.47
	Bioranza®	15.90	15.43	8.93	9.13	2.77	2.73
	Biofly®	15.77	17.53	8.83	8.70	3.13	3.03
LSD $_{0.05}$ between A xB		0.72		N.S		0.1	

Table (7): Effect of interaction between intercropping systems and four bio-insecticides on sugarbeet quality characters at 2011/12 and 2012/13 seasons.

Intercropping System	Selected insecticides	Quality characters					
		T.S.S. %		Sucrose%		Purity %	
		2011/12	2012/13	2011/12	2012/13	2011/12	2012/13
Pure stand of sugarbeet	Selecron®	21.33	22.00	16.33	16.77	79.40	80.67
	Protecto ®	18.73	18.83	16.17	16.08	79.83	76.17
	Dipel 2X®	19.00	19.17	15.10	15.63	80.73	78.77
	Bioranza®	20.50	20.73	15.60	15.17	79.33	77.67
	Biofly®	19.33	19.83	15.57	14.83	79.00	77.00
Intercropping faba been in two rows with sugarbeet	Selecron®	20.67	22.33	16.73	16.90	79.60	79.60
	Protecto ®	16.60	17.30	14.63	15.90	77.00	77.00
	Dipel 2X®	20.00	20.33	15.63	15.80	78.07	78.07
	Bioranza®	19.33	20.00	15.00	16.73	77.33	77.33
	Biofly®	19.00	19.40	14.65	15.30	78.67	78.67
Intercropping faba been three rows with sugarbeet	Selecron®	20.07	21.60	13.80	16.37	75.50	75.33
	Protecto ®	18.30	19.60	14.97	15.03	75.23	78.67
	Dipel 2X®	20.00	19.33	15.43	15.23	77.00	79.00
	Bioranza®	20.67	19.63	16.23	15.60	80.33	79.33
	Biofly®	19.67	19.17	15.83	15.83	77.83	77.67
Intercropping onion in two rows with sugarbeet	Selecron®	20.30	20.67	14.80	15.97	78.67	77.33
	Protecto ®	18.83	18.67	14.58	14.93	77.67	80.00
	Dipel 2X®	18.70	19.67	15.60	15.47	76.67	79.00
	Bioranza®	19.77	18.67	15.60	14.80	77.60	79.33
	Biofly®	18.23	18.33	15.87	14.49	79.67	78.67
Intercropping onion in three rows with sugarbeet	Selecron®	22.00	19.67	14.73	15.53	78.67	79.00
	Protecto ®	19.17	18.77	14.83	15.00	77.33	78.33
	Dipel 2X®	20.10	19.07	15.15	15.10	77.00	78.67
	Bioranza®	20.73	21.03	15.63	15.87	78.80	79.33
	Biofly®	19.20	18.67	16.03	14.13	77.33	76.00
LSD $_{0.05}$ between A.B		0.53		0.7	N.S	1.28	

A= Intercropping system B= selected insecticides

Table (8): The average income from agriculture sole and intercropping systems according to prices of the Egyptian market through the two seasons.

Intercropping systems	sugarbeet (tons/fed) Seed Yield (Ardab/fed), or Bulbs yield onion (Ton/fed)			Total Income Egyptian pounds	Increased or Decreased % than sugarbeet sole
	1st	2nd	Mean		
Pure stand of sugarbeet	24.2	25.3	24.8	8690	
Pure stand of faba been	8. 33	9.7	9.0	7200	-19.05
Pure stand of onion	8.33	8.6	8.45	8500	-2.65
Sugarbeet with Intercropping faba been in 2 rows	23.2	23.8	23.5	10515	+21.49
Sugarbeet with Intercropping faba been in 3 rows	20.4	23.6	22.0	11060	27.42
Sugarbeet with Intercropping onion in 2 rows	16.3	16.5	16.4	8740	+0.01
Sugarbeet with Intercropping onion in 3 rows	15.6	15.1	15.4	9920	+15.09
LSD $_{0.05}$ between intercropping system	0.84	0.89			

Total income was calculated as farm price tons or ardab
Sugarbeet =350 L.E tons^{-1} Faba been = 800 LE ardab-1 onion= 1000 LE ton^{-1}

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تاثير بعض المبيدات الحيوية والكميائية و انظمة التحميل المختلفة للفول البلدي و البصل مع بنجر السكر علي الحشرات الهامة و محصول وجودة بنجر السكر .

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الملخص العربي

تم اجراء هذا البحث في مزرعة محطة البحوث الزراعية بالنوبارية–محافظة البحيرة –مركز البحوث الزراعية خلال موسمي ٢٠١١/٢٠١٢ و ٢٠١٢/٢٠١٣ . وجد ان نظام التحميل (خطين بصل+بنجر السكر) اقل جاذبية لخنفساء البنجر السلحفائية *C. vittata* (٢٦٠.٧٣٣ و ٢٤٠.٩٣٣ يرقة و حشرة كاملة / ١٠نباتات) خلال موسمي الدراسة . الزراعة المنفردة لبنجر السكر كان اكثر حساسية للاصابة بخنفساء بنجر السلحفائية (٣٥٠.٣٣ و ٤٨٠.٠٦٧ يرقة وحشرة كاملة/١٠نباتات) خلال موسمي التجربة. كما سجلت الزراعة المنفردة اعلي ارقام الاصابة بذبابة البنجر *P. mixta* (٥١٠.٧ و ٦٠٠.٢٦٧ يرقة /١٠ نباتات) و بالعكس سجل نظام التحميل (خطين بصل مع بنجر السكر) اقل تعداد (٣٩٠.٣٣ ,410.87 يرقة لكل/١٠نباتات.كما سحل الزراعة المنفردة لبنجر السكر اعلي انتاج من محصول الجذور (24.21و 25.29 طن/فدان) سجلت نظام تحميل ٣ خطوط يصل مع بنجر السكر) اقل انتاجية (١٥.١٤٢ و ١٥.٥٧٣ طن /فدان). وجد انه لا يوجد تاثير معنوي بين انظمة التحميل و الزراعة المنفردة لبنجر السكر لانتاجية محصول الاوراق . سجلت الزراعة المنفردة لبنجر السكر اعلي انتاجية لمحصول السكر لكل انظمة الزراعة بالتحميل تحت التجربة كما سجلت الزراعة المنفردة اعلي نسبة مئوية للمواد الصلبة الذائبة الكلية (٢٠.٦٨ و ٢٠.١١ %) خلال موسمي الزراعة بينما سجل نظام الزراعة بالتحميل (٣ خطوط من البصل مع بنجر السكر) اقل نسبة للمواد الصلبة الذائبة بالكلية حيث سجلت ١٩.٤٨٥ و ١٩.٢٠٠ خلال الموسم الاول والثاني علي التوالي. كما كانت هناك فروق معنوية في الموسم الاول ولم تكن هناك فروق معنوية في الموسم الثاني للنسبة المئوية للسكروز . كما حقق مبيد السليكرون اعلي نسبة موت خلال ايام التجربة عند تطبيق المبيدات ضد حشرتي خنفساء بنجر السكر السلحفائية و ذبابة البنجر.كما حققت المبيدات الحيوية من اصل بكتيري(دابيل ٢x و بروتكتو) في اليوم الاول اقل نسبة موت هي (7 , 2 ,10 حشرة كاملة و يرقة) و (١و٩ و١٢ حشرة كاملة ويرقة) لحشرتي خنفساء بنجر السكر السلحفائية و ذبابة بنجرالسكر بنما كانت كفاءة من المبيدات من اصل فطري (بيوفلايو و بيورنز) متوسطة في نفس اليوم الاول بعد التطبيق (٢٢و١١و٣٦) للمبيد بيورنزو المبيد بيوفلاي (٢٠ و ١٨ و ٣١ %) علاوة علي ذلك كان المبيدان (دابيل ٢x و بروتكتو) عندما تتفاعل مع نظام التحميل (ثلاث خطوط من الفول البلدي مع بنجر السكر) اعلي تعداد من خنفساء البنجر السلحفائية

(٦٢٧ و ٦٢٣ يرقة و حشرة كاملة) و كذلك مع حشرة ذبابة بنجر السكر *P. mixta* (٦٤٣ و ٦٩٤) يرقة. واعطت كل نظم التحميل التي تفاعلت مع مبيد الحشرات سيلكرون اعي انتاجية من محصول الجذور مقارنة بتفاعل المبيدات الحيوية مع نظم التحميل المختلفة كما استمر تفوق مبيد السليكرون عندما تفاعل مع الزراعة المنفردة لانتاج محصول السكر حينما سجل المبيد بيورنيز اعلي محصول سكر عندما تفاعل مع نظام التحميل (خطين من الفول البلدي مع بنجر السكر) (٣.٣٠٠ و ٣.٧٠٠ طن/فدان) .

أخيرا، من نتائج هذه الدراسة، فإنه يمكن استخدام المبيدات الحيوية من اصل فطري حيث انها أكثر فعالية من المبيدات الحيوية من اصل بكتيري ونظام التحميل الفول البلدي في اثنين أو ثلاثة خطوط مع بتجر السكر انخفض معدل الإصابة بخنفساء البنجر السلحفائية *Cassida vittata* وذبابة بنحر السكر *Pegomyia mixta.* والحصول على أعلى القيم من إجمالي الدخل العائد مقارنة بالزراعة المنفردة بنجر السكر.

Table (1): Effect of intercropping on population density of two sugarbeet insects Tortoise beetle, *Cassida vittata* and Beet fly, *Pegomyia. mixta* during 2011/12 and 2012/13 seasons.

Intercropping system	Total numbers of Tortoise beetle *C. vittata* (adults and larvae /10 plants)			Total numbers of beet fly *P. mixta* (Larvae/ 10 plants)		
	1st season	2nd season	Combined analysis	1st season	2nd season	Combined analysis
Pure stand of sugarbeet	350.33	480.07	415.20	510.7	600.27	555.48
Intercropping faba been in two rows with sugarbeet	340.87	430.80	385.83	480.33	580.73	530.53
Intercropping faba been in three rows with sugarbeet	283.53	283.87	283.70	360.40	350.47	355.43
Intercropping onion two rows with sugarbeet	260.73	240.93	250.83	390.33	410.87	400.60
Intercropping onion in three rows with sugarbeet	280.27	280.33	280.30	430.33	470.73	450.53
LSD $_{0.05}$ between system	20.91	10.17	10.57	30.62	30.4	30.87
LSD $_{0.05}$ between year		8.86			20.70	

Table (2): Effect of intercropping systems on yield characters of sugarbeet crops on West Nubariyia region during 2011/12 and 2012/13 seasons.

Intercropping System	Root yield (tons/field)			Leaves yield (tons/field))			Sugar yield (tons/field)		
	1st season	2nd season	Combined analysis	1st season	2nd season	Combined analysis	1st season	2nd season	Combined analysis
Pure stand of sugarbeet	24.21	25.29	24.75	11.21	14.90	13.06	2.81	3.97	3.39
Intercropping faba been in two rows with sugarbeet	23.19	23.75	23.47	9.10	9.19	9.14	3.79	3.83	3.81
Intercropping faba been in three rows with sugarbeet	20.43	23.61	22.02	8.67	8.91	8.79	3.12	3.65	3.39
Intercropping onion two rows with sugarbeet	16.32	16.47	16.40	10.76	10.59	10.67	2.5	2.49	2.50
Intercropping onion in three rows with sugarbeet	15.57	15.14	15.36	10.14	10.18	10.69	2.38	2.29	2.34
LSD $_{0.05}$ between system	0.93	1.14	0.72	0. 8	0.82	0.56	0.16	0.12	0.1
LSD $_{0.05}$ between year		0.59			N.S			0.08	

Table 3: Effect of intercropping systems on quality characters of sugarbeet crops during 2010 /11 and 2011/2012 seasons.

Intercropping System	Total soluble solid (T.S.S.)			Sucrose %			Purity %		
	1st season	2nd season	Combined analysis	1st season	2nd season	Combined analysis	1st season	2nd season	Combined analysis
Pure stand of sugarbeet	20.68	20.11	19.78	15.74	15.713	15.725	79.66	78.05	78.86
Intercropping faba been (2) with sugarbeet	19.85	19.45	20.27	16.33	16.13	16.23	78.13	78.26	78.00
Intercropping faba been (3) with sugarbeet	19.74	19.87	19.80	15.25	15.47	15.36	77.18	77.87	77.59
Intercropping onion (2) with sugarbeet	19.54	19.23	19.37	15.29	15.13	15.21	78.05	78.87	78.46
Intercropping onion (3) with sugarbeet	19.49	19.20	19.36	15.28	15.13	15.20	78.25	78.00	78.26
LSD $_{0.05}$ between system	0.79	0.71	0.53	0.70	N.S	0.50	1.71	2.02	1.28
LSD $_{0.05}$ between year	0.43			0.41			1.05		

Table 5: Effect of interaction between intercropping systems and selected bio-insecticides on population density *Cassida vittata* and *Pegomyia mixta* in sugarbeet crops during 2011/12 and 2012/13 seasons.

Intercropping System	Pesticides	Selecron®		Protecto ®		Dipel 2X®		Bioranza®		Biofly®	
	Season	*C .v*	*P. m*	*C .v*	*P. m*	*C. v*	*P. m*	*C. v*	*P. m*	*C. v*	*P.m*
Pure stand of sugarbeet	1st	267	336	530	583	380	327	477	467	283	383
	2nd	260	340	550	580	507	500	350	327	290	417
Intercropping faba been in two rows with sugarbeet	1st	243	387	317	427	227	330	267	287	297	303
	2nd	247	367	407	370	363	370	243	277	270	297
Intercropping faba been in three rows with sugarbeet	1st	297	350	627	643	500	470	363	340	377	373
	2nd	257	343	623	693	537	453	430	467	343	420
Intercropping onion in two rows with sugarbeet	1st	223	317	313	410	417	513	470	513	323	340
	2nd	220	310	267	297	557	500	453	430	470	307
Intercropping onion in three rows with sugarbeet	1st	273	380	557	500	500	457	297	443	453	407
	2nd	297	390	543	520	553	407	267	443	420	423
LSD $_{0.05}$ between system	C. vittata	13.52									
	P. mixta	18.85									
LSD $_{0.05}$ between insecticides	C. vittata	8.23									
	P. mixta	10.88									
LSD $_{0.05}$ between year	C. vittata	8.23									
	P. mixta	10.88									