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## Summary

Faba bean (*Vicia faba*) is the most important legume crop grown in Egypt. Green broad beans, freshly shelled, rank the highest in protein contents among the fresh vegetables.

Garden peas (*Pisum sativum* L.) is among the most popular vegetable crops in Egypt. It has a great nutritional value because of its higher components of protein (7.0g), calcium (25mg), phosphorous (124mg), thiamin, riboflavin, niacin and ascorbic acid (0.38, 0.14, 2.3 and 26 mg/100g seed, respectively).

Faba bean and garden peas crops are liable to attack by several insect-pests, throughout the elapsing period from the early stage up to the late development and the post-harvest stage. Many insects belonging to the orders of Lepidoptera, Diptera, Hemiptera and Homoptera are well known injurious insects of faba bean and garden peas plants.

Cost of insecticide applications, development of resistance in pest population exposed to repeated insecticide treatments and adverse environmental effects of insecticides demand the minimization of chemical controls whenever possible. Therefore, the present study was conducted to:

- 1- Survey, identify and discriminate the insect-pests and natural enemies species found on faba bean and garden pea plants.
- 2- Study the seasonal dynamical fluctuations of these insects during the growing seasons of 2014-2015 and 2015-2016.
- 3- Determine the relationship between the inspected insect-pests and prevailing hygro-thermic conditions (temperature and relative humidity) in the field.
- 4- Determine the susceptibility of tested faba bean varieties to infestation by their commonly economic injurious pests.
- 5- Evaluate the effect of three foliar nutrients on the tolerancy of faba bean and garden pea plants to infestation by their common insect-pests.
- 6- Evaluate the efficiency of certain safe chemical compounds against the insect-pests of faba bean and garden peas and determine the side-effect of these tested chemical insecticides on the (water content and crude protein) of treated faba bean and garden peas.
- 7- Determining economics and profits of the studied compounds as compared with the untreated checks (controls).

The obtained results could be summarized as follows:

### **5.1. Survey of the prevailing insect- pests and their natural enemies on faba bean and garden pea plants:**

A survey of insect- pests and beneficial –insects of faba bean and garden pea plants was conducted during the consequent growing seasons of 2014-2015 and 2015-2016 at Abis, Alex. Egypt.

The identified insect- pests of faba beans foliage implied 4 species : *Liriomyza trifolii* (Burgess), *Aphis craccivora* (Koch.), *Bemisia tabaci* (Gennadius) and *Empoasca lybica* (De Berg.). The highest recorded occurrence of inspected insects was determined for aphids, versus the lowest recorded one of *E. lybica*, throughout both the consequent seasons of ( 2014-2015) and ( 2015-2016).

Both the inspected and identified insect species on garden peas foliage were *Liriomyza trifolii* and *Bemisia tabaci* . Leafminer was recorded in higher numbers throughout both the growing seasons .

Additionally both the detected lepidopteran insects; the blue butterfly, *Cosmolyce baeticus* Polyommatus and the bean pod borer, *Etiella zinckenella* Treitschke injuriously infested faba beans and garden peas pods. Where as, *C.baeticus* has been registered at high numbers on faba bean pods during both the growing seasons , versus *E.zinckenella* , which was relatively high on garden peas pods.

The three inspected and identified beneficial insect species on faba beans plants were *Diglyphus isaea* (Walker) (Or.Hymenoptera), *Chrysoperla carne* ( Stephens ) (Or. Neuroptera ) & *Coccinella undecimpunctate* (Linnaeus) (Or.Coleoptera). The calculated numbers of parasitoids and predators on faba bean plants increased as the number of their hosts increased. The calculated number of ( *Diglyphus isaea*) was relatively the higher followed by *Chrysoperla carnea* and *Coccinella undecimpunctate* throughout both the growing seasons .

Also, two species of natural enemies were inspected and identified on garden peas plants, ie. *D. isaea* and *C. undecimpunctate*. In this concern, *D. isaea* was recorded in higher number , versus the inspected predators *C. undecimpunctata* as the lowest one.

### **5.2. Susceptibility of tested faba bean varieties to the infestation of three common insect-pests during the growing seasons of 2014-2015 and 2015-2016**

The susceptibility of four tested of faba bean varieties ( Reina mora, Luz de otono, Giza plank and Equarto) to infestation of three insect-pests, leafminer ( *Liriomyza trifolii* ) , aphids ( *Aphis craccivora*) and the blue butterfly ( *Cosmolyce baeticus*) was investigated and determined.

### 5.2.1. Season (2014-2015)

The Egyptian variety Giza planka was the highest susceptible to infestation with the inspected leafminers and aphids-13.5 and 29.8, individuals /45 leaves with ranges of (10-17) and (4-82) insects/45 leaves in respect followed by the other tested Egyptian variety Equarto (12.6 & 24.9, respectively).

Vice versa, the Spanish variety Luz de otoño indicated a category of less comparative susceptibility to infestation with leafminers and aphids ( 10.1 and 16.4) insects/45 leaves, respectively .

Moreover, the examined green pods of inspected varieties, elucidated that the Spanish variety Renia mora the high susceptible one to infestation with the larvae of the blue butterfly (5.5 larvae/45 pods), followed by the Spanish one Luz de otoño (4.7 larvae / 45 pods). It could be said that the Egyptian varieties Equarto and Giza planka were significantly less susceptible ( 2.7 and 3.1 insects/45 pods, respectively).

### 5.2.2. season (2015-2016)

Similarly, the same trend of determined levels of revealed varietal susceptibility, was detected . Each of the Egyptian varieties Giza planka and Equarto were the highly susceptible to infestation with the leafminers and aphids, ( 13 & 50.6) and (12.9 & 47.7 insects/ 45 leaves, in respect).

But, in case of examined green pods infestation by the larvae of blue butterfly, the Spanish variety -Renia mora showed a remarkably high susceptibility to the infestation of these lepidopteran larvae .

The results showed also that the Egyptian faba bean varieties were very highly susceptible to infestation with aphids and/or leafminers than the Spanish varieties.

On the contrary, it was found that the green pods of Spanish varieties were more susceptible to lepidopteran insects infestation compared to the green pods of Egyptian varieties.

## **5.3. Effect of evaluated foliar nutrients on the infestation of commonly abundant insect-pests of faba bean and garden peas during the subsequent seasons of 2015 and 2016**

The purpose of this work was to investigate the effect of three foliar nutrients on the infestation of faba bean and garden pea by their common insects and yield. The obtained results of applied treatments could be summarized as follow :

### 5.3.1. Effect of the performed three foliar treatments on the infestation incidence of common faba bean insects during the growing winter seasons of 2015 and 2016

The fluctuating means numbers of both the abundant insect-pests: leafminer and aphid, during the growing winter season of 2015.

Each of Calsin®, Potasin® and Novatrin® was highly effective particularly, in reducing the mean number of inspected aphid throughout the elapsed period from the 4<sup>th</sup> till the 7<sup>th</sup> week post-treatment.

Regarding the calculated means numbers of inspected leaf miner, Calsin® came in the first rank (4 insects / 45 leaves) at the 2<sup>nd</sup> week post-spraying. Potasin® and Novatrin® gave the same low mean number of leafminer ( 8 insects / 45 leaves) compared to the untreated check.

The same trend of results was also revealed in season 2016.

### 5.3.2. Effect of foliar treatments on the infestation of garden pea plants during the growing seasons of 2015 and 2016

In general the estimated fluctuating means numbers of both the abundant insect-pests: leafminer and whitefly, during the growing winter season of 2015, showed that each of Calsin®, Potasin® and Novatrin® was highly effective particularly in reducing the mean number of inspected whitefly throughout the elapsed period from the 4<sup>th</sup> till the 6<sup>th</sup> week post-treatment.

Also, a same trend of results was revealed during season 2016. It was noticed that all the tested foliar treatments were insignificantly effective against the insects throughout all the adopted inspection periods.

### 5.3.3. Effect of tested foliar nutrients on the yield of harvested green pods of faba bean and garden peas during the growing seasons of 2015 and 2016

The evaluated foliar nutrient - Novatrin® gave the higher yield of faba bean and garden peas green pods ( 8.0 -8.5 ton / fed) and (3 ton/ fed) in respect during the growing seasons of 2015 and 2016; followed by Calsin® and Potasin®, which gave lower yield of 7-7.5 ton / fed. for faba bean pods , and ( 3- 2 ton/ fed), for garden pea pods .

## **5.4. Effectiveness of the evaluated chemical- insecticides on the calculated reduction percentages of inspected insect- pests of faba bean ( *Vicia faba*) and garden peas (*Pisum sativum*) plants.**

Five chemicals belonging to different chemical groups [emamectin(Emamectin)®, Acetamiprid(Twistrin)®, Indoxacarb (Indoprem)®, Dinotefuran (Oshin)® and Lufenuron( Regurone)®] were evaluated to be involved in IPM for controlling the main prevailing insect-pests of faba bean and garden peas plants :the leafminer (*Liriomyza trifolii*) and both of the lepidopteran

insect-pests: *Cosmolyce baeticus* and *Etiella zinckenella* in pods of faba bean and / or garden peas. Besides, their probable occurring side effects on the ectoparasitoid of the leafminer *D. isaea* .

The evaluation of insecticides was run through field application of two sprays on the growing plants during the growing seasons of 2015 and 2016 .

#### 5.4.1. Efficiency of tested chemical compounds against faba bean leafminer during the growing seasons of 2015 and 2016

##### 5.4.1.1. season 2015

The calculated general means of reduction percentages after the 1<sup>st</sup> application, indicated that Twistrid® was the highest effective one- 75.9%, followed by Oshin®- 66.6% . Both of the tested compounds of Emamictin® and Regurone® proved to be relatively, equally efficient and gave merely equal values of general mean of reduction comprised 62.5% and 61.7%, ,in respect while, the least efficient, Indoprem® gave the least general mean of reduction- 7.5%.

The consequent delayed-effect after the 2<sup>nd</sup> application of these tested insecticides on the infestation reduction percentages of the insect during the same season of 2015 showed that Regurone® proved to be the highly effective compound against the leafminer giving a high value of calculated general mean of reduction comprised 52.7%, followed by Twistrid®- 49.7%, Indoprem®- 46.1% Oshin ® -43.8% and the relatively least one Emamictin®- 39.7%.

##### 5.4.1.2. season 2016

According to the extracted general mean of residual reduction , the superior compound against the larval stage of leafminer of faba bean plants was Twistrid®, - 68.4%, followed by Reguron®- 48.7%.

After the 2<sup>nd</sup> application of tested insecticides; the extracted general means of the biological performance percentages for each compound comprised 72.6% for Twistrid® , 65.4% for Reguron®, 62.8% for Emamictin® and 59% for Oshin®. Indoprem® showed a relatively lower efficiency, as general mean of reduction reached 39.6%.

#### 5.4.2. Drastic side effect of the tested insecticides on the leafminers parasitoid *Diglyphus isaea* during the seasons of 2015 & 2016

To overcome the problem of the leafminer infestation, the chemical insecticides are usually used in routine spray programs for controlling the insect. Herein, such chemical insecticides affect the leafminer as a main target, and also have more or less drastic side effects on the existing biological agents in particular the ectoparasitoid *D. isaea* .

#### 5.4.2.1. Season 2015

The obtained results post 1<sup>st</sup> application of the tested insecticides on the ectoparasitoid *D. isaea*, expressed as calculated general means of the biological performance percentages after 1,3,5,7,9 and 14 days from application revealed a more or a less inspected variations of the drastic toxic effects of these tested compounds against the larvae of the ectoparasitoids *D. isaea*. In this concept, the extracted values indicated that Twistrid® was the highly drastically toxic one on the larvae of the ectoparasitoid (58%), followed by Oshin® (41.1%), versus the insignificantly detected lower harm side effects of the other tested Emamictin®, Indoprem® and Regurone®, (17.1%, 21.3% and 21.4%, respectively).

Also, the performance of the 2<sup>nd</sup> applied spray treatments induced different initial reduction percentages against the parasitoid. The extracted general means of the biological performance percentages after 1,3,5,7,9 and 14 days also confirmed that Twistrid® was more drastically toxic to the larvae of *D. isaea*- 50.4%, followed by each of Regurone® and Oshin®- 46.1% and 43.1%, respectively. The least harm side effect (20.8%) was resulted post spray treatment of ectoparasitoid.

Therefore, it could be concluded that each of the tested Emamictin®, Indoprem® and Regurone® were comparatively more or less drastically toxic against the parasitoid than each of Twistrid® and Oshin® which indicated more increased toxic side effect and on the ectoparasite larvae *D. isaea*.

#### 5.4.2.2. season 2016

The detected side effects of five the tested insecticides upon *D. isaea* larvae during the season of 2016, and expressed as general mean of calculated reduction percentages all over the period of inspection (14 days), showed that these tested compounds can be arranged due to its drastic toxic side-effect on the parasitoid, as follow descendingly: Twistrid®, Oshin®, Regurone®, Indoprem® and the least Emamictin®, (-66.4, 59.4, 52.6, 22.3 and 20.8%, respectively).

After 14 days from 2<sup>nd</sup> application the observed variation of the drastic toxic effects of these tested compounds against the ectoparasitoid. Indicated the insignificant differences among their extracted lower general means of reduction; represented in Regurone®, Oshin®, Indoprem® and Emamictin® which gave the descending values of 33.4%, 30.2%, 22.2% and 11.2%, respectively. Noticeably, after the performance of 2<sup>nd</sup> application, a natural increase in the number of the parasitoid individuals was noticed in the untreated check.

That fact confirm the more or less determined harm side effect of each of these tested insecticides against the parasitoid.

#### 5.4.3. Efficiency of five tested chemical compounds against the lepidopteran insect-pest on faba bean plants *Cosmolyce baeticus*

In regard to the detected lepidopteran insect-pests of faba bean plants, *Cosmolyce baeticus* was lately inspected; identified and found infesting faba bean green pods throughout the elapsing period of fruting stage up to the end of the growing seasons;. This insect is considered to be one of the utmost abundant and severely injurious economic insect-pests in the performed survey the insect-pests of faba bean pods.

##### 5.4.3.1. season 2015

The obtained results post 2<sup>nd</sup> spray of insecticides application; coincided with the flowering -fruiting stage of the treated plants, which characterized by the existing green pods of different ripening stages;

The calculated general mean of reduction percentages throughout the whole performed inspections showed and confirmed the significant differences between the lowest and negligibly effective Emamictin® & Indoprem® (-15% & -15.1%) and other tested efficiently toxic compounds, i.e Twistrid®- 59.4%, Oshin – 55.6% & Regurone® -51.3% sequently, that elucidate the utmost efficient toxic effects of these three superior compounds according to their extracted higher general means of residual reductions.

##### 5.4.3.2. season 2016

Comparatively, the obtained results in season 2015 also showed the high toxic efficiency of each of the applied chemical- insecticides: Twistrid®, Oshin® and Regurone® in reducing the inspected larvae of *C. baeticus* infesting the green pods of the treated faba bean plants. The relative high efficiency of each was estimated as general means of reduction percentages of the insect during the extended period from the 1<sup>st</sup> day till the 14<sup>th</sup> day post-spraying . According to the extracted values of general means of residual reduction The superior compound was Twistrid®, which gave 71.4%, followed by Reguron®- 62.7% and Oshin®- 60.2% .

#### 5.4.4. Efficiency of the evaluated chemical compounds against the garden peas leafminer ( *Liriomyza trifolii*) during the consequent growing seasons of 2015 and 2016

##### 4.4.4.1. season 2015

Effect of each of the five tested insecticides on the estimated rate of garden pea plants infestation by leafminer, *L. trifolii* during the growing season of 2015, declared that the determined infestation rates of the leafminers on examined peas plants were to a more or a less extent, significantly, affected by the performed 1<sup>st</sup> application of tested insecticides. The calculated general means of reduction percentages along the whole inspection periods showed the significant differences



between the lowest effective Indoprem® (14.6%) and the other tested high effective compounds, which gave significantly different values ranged from 46.7% for Emamictin® to 78.8% for Twistrid®. Herein, according to the extracted general mean of residual reduction the superior toxic compound was Twistrid® secondly, followed by Oshin®- 66.5%.

Another trend of results was revealed after the 2<sup>nd</sup> application of tested insecticides, where as, the extracted general means of the biological performance percentages for each compound, comprised 87.3% for the atmost effective Emamictin® , and (36.8%), for the less effective Regurone® then followed by Oshin® ( 36.5%) and Indoprem® (22.6%). Twistrid® showed a least lowered or neeligible toxicity giving a general mean of reduction reached – 2.4%.

#### 5.4.4.2. Season 2016

As to the previous growing season of 2015 the obtained results post 1<sup>st</sup> application, extracted as calculated general means of reduction percentages, Twistrid® was also the highest effective one- 70.5%, versus While, the least efficient, Indoprem® which gave the least general mean of 5.1%.

Thereafter, the consequent estimated delayed-effects of these tested insecticides post the 2<sup>nd</sup> application elucidated that Twistrid® gave somewhat increased effect (23.2%), Emamictin® (19.6%), while Indoprem® was the least toxic one.

#### 5.4.5. Side effect of the tested insecticides on the parasitoid *Diglyphu isaea*

The obtained results showed that after the performance of 2<sup>nd</sup> spray all treatments were nontoxic upon the ectoparasitoid giving – 3.1%, -19.1%, -12.5% , -27.8% and - 9.3% for Emamictin®, Indoprem®, Oshin® , Twistrid® and Regurone®, respectively.

The general mean of the biological performance percentages after 7, 9 and 14 days from application indicated that Oshin® to more was extent less harmful to the larvae of the ectoparasitoid *D. isaea* giving a general mean of 7.2%. Also, it was indicated that the larvae of *D. isaea* were not highly susceptible to Indoprem® and Twistrid® (- 23.2% & -31.5%, in respect).

#### 5.4.5.2. season 2016

From the extracted results post 1<sup>st</sup> spray, it could be concluded that Twistrid® was the most drastically effective and toxic compound against the ectoparasite *D. isaea* giving higher value of general mean reduction percentage comprised (54.1). This drastic side mainly effect could attributed toxic effect against the main host of this parasite. Hence, the reduction and vanishing of the main host led to reduction of the numbers of the parasitoid.

Moreover, the deduced general means of the biological performance percentages that proved the harmful side effect of Twistrid® upon the larvae of *D. isaea* ; was followed by the less effective Regurone® and Oshin® which gave 25.3% and 16.5% , respectively.

Contrarily, after the 2<sup>nd</sup> application of same tested chemicals, another trend of results was detected. Oshin® showed a lower reduction percentage of calculated - 29.2% after 5 days post-treatment .

Considering the general mean percentages of reduction all over the period of inspection ( 14 days) , the tested compounds can be arranged ascendingly due to their determined drastic side - effects on the parasitoid as follows: Oshin®, Regurone®, Indoprem®, Twistrid® and Emamictin® ( -19.7%, -15.3%, 11.8%, 20.9% & 27.4%).

#### 5.4.6. Efficiency of the tested compounds against the bean pod borer *Etiella zinckenella* infesting garden peas green pods

##### 5.4.6.1. season 2015

It was revealed from the extracted results that the applied insecticides gave more or less high reduction percentages of occurring *E. zinckenella* infestation on the garden peas pods.

The calculated reduction percentages for the relative high efficient Twistrid®; during the extended period from the 1<sup>st</sup> day post-spraying till the 14<sup>th</sup> day, which resembled the period of efficient reduction occurrence of inspected insect numbers on the pods treated of plants .

In this concern the calculated general mean of reduction percentage proved, the efficiency of Twistrid® which was merely equally efficient upon the insect and gave merely equal values of reduction percentages ranged from 32.2% at the 14<sup>th</sup> day to 99.9% at the 1<sup>st</sup> day post spraying with general mean of reduction comprised 62.6% compared of the other less efficient tested compounds (-4.7 -13.6%).

##### 5.4.6.2. season 2016

The estimated means percentages of infestation reduction all over the period of inspection ( 14 days), showed that the utmost efficient tested compound against the pod borer *E. zinckenella* Twistrid® followed by the less efficant Emamictin®( 51.6 and 29.7%, respectively).

Vice versa, another trend of results was revealed with decreasing rates of calculated percentages of general means reduction amounted percentages to -20.9, 2.3 and 4.9% for Indoprem® regurone® and Oshin®, inrespect.

## **5.5. Determination of certain chemical components of treated seed of faba bean and garden peas .**

In this study, five pesticides (Indoprem®, Emamictin®, Twistrid®, Regurone® and Oshin®). were selected for evaluating their side effects on certain chemical components i.e, moisture content and crude protein of developing faba bean and garden pea seeds, during two consequent ripening stages of growing seeds ( milky & dough stages).

### 5.5.1. The water content of milky and dough ripening stages of faba bean and garden peas seeds

All the tested compounds showed theirr insignificant effects on the water content of milky & dough ripening stages of faba bean and garden peas seeds compared with the untreated control plants. The of analysis of milky stage of faba bean seeds revealed that the treatment of Indoprem® and Regurone® gave comparative insignificant increase in the estimated water content, with values amounted to 8.1% and 7.9%,respectively. The analyzed seeds of ripening dough stage post treatments of all also showed the insignificant effect on the water content of seeds in this ripening stage indicating values comprised 5.5- 4.9%.

Similary, the water content of garden peas seeds in milky ripening stage was also insignificantly affected by the performed insecticides treatments, which gave asame trend of results compared to the untreated control ( 7.3%). In this concept, only Oshin® And Twistrid® somewhat decreased the measured values of water content than that attained for milky stage of control ( 6.7 & 6.9%), inrespect .

Also, the estimated insignificant values of water content in garden peas seeds in the dough repening stage of, Indoprem® showed a significant increase of water content equal to of 6.1% followed by Oshin® and Emamictin® ( 5.1 and 4.9%).

### 5.5.2. Determiation of total protein of milky and dough ripening stages of faba bean and garden peas seeds

The obtained results of total protein in both chemically analyzed ripening stages of faba bean and garden peas seeds after treatment with tested insecticides were insignificantly different and ducidated the following :

All of the performed chemical treatments gave similar insignificant values of estimated total protein in the seeds of milky ripening stage amounted to 2.1 - 2.3 % and/or 0.4 - 0.6% for faba bean and /or garden peas seeds, whilein the dough ripening stage these extracted protein values comprised 3.1 - 3.4% and 0.8 - 0.9% for faba bean & garden peas seeds, respectively.

Though, these above mentioned results the performed chemical analysis explain the negligible and insignificant effects of all experimented insecticides on the content of water and total protein in the seed.

#### **4.6. Determination of two insecticides residues in the green pods of faba bean and garden peas**

Data declared the absence or/ and the minimal detected residual value of both the tested insecticides ( Twistrid® and Oshin®) in the sampled faba bean and garden peas green pods post-harvest of the treated plants in the field. Whereas, both of Acetamprid and Dinotefuran didn't show any detected residues.

#### **5.7. Economic and profits of the tested insecticides in controlling the insect-pests of faba bean plants throughout the growing seasons of ( 2015& 2016).**

##### 5.7.1. Season 2015

The calculated values of profits for one Egyptian pounds ( L.E.) investment were 16.95, 2.03 , 36.14, 61.07, 26.27 and 0,00 for Emamictin®, Indoprem®, Oshin®, Twistrid®, Regurone® and control, respectively.

In the light of the calculated profits data, it could be concluded that the higher value is considered to be characteristic to the utmost profitable treatment. Therefore, depending upon the extracted investment profits, the used chemicals could be arranged in a descending order as follows: Twistrid®> Oshin®> Regurone®> Emamictin®> Indoprem®.

##### 5.7.2. Season 2016

As to the calculated values of profits for one Egyptian pound ( L.E.) investment in season 2015; these obtained values in season 2016 were 25.19, 30.58, 54.69, 85.98, 20.62 and 0.00 for Emamictin®, Indoprem®, Oshin®, Twistrid®, Regurone® and control.

In the light of the obtained profits data, it could be mentioned that the higher value is considered to be the utmost profitable treatment. Though, depending upon the extracted investment profits; these used insecticides could be arranged descendingly as follows: Twistrid®> Oshin®> Indoprem® > Emamictin®> Regurone®.

#### **5.8. Economic and profits of the tested insecticides in controlling the insect- pests of garden peas plants during the following seasons of 2015 and 2016.**

##### 5.8.1. Season 2015

Identically, the calculated profits for one Egyptian pounds ( L.E.) investment amounted to 4.12, 11.12 , 15.17, 49, 31.9 and 0,00 for Emamictin®, Indoprem®, Oshin®, Twistrid®, Regurone® and control, respectively.

In the light of the calculated profits values, it could be revealed that the higher value is considered to be the utmost profitable treatment. Herein, depending upon these estimated values of investment profits, the used chemicals could be arranged in

a descending order as follows Twistrid®> Regurone®> Oshin®> Indoprem®> Emamictin®.

### 5.8.2. Season 2016

Similarly, as to the estimated profits for one Egyptian pound ( L.E.) investment were 12.09, 12.16, 20.52, 73.6, 42.24 and 0.00 for Emamictin®, Indoprem®, Oshin®, Twistrid®, Regurone® and control.

Also, in the light of these obtained profits data, it could be mentioned here that the higher value is considered to be the utmost profitable treatment. However, depending upon the investment profits; these used insecticides could be arranged descendingly as follows: Twistrid®> Regurone® > Oshin®> Indoprem® > Emamictin®.

Finally, from the above cited results of seasons 2015 & 2016 it could be seen and confirm that the highly profitably used insecticides for controlling the prevailing insect-pests of faba bean and garden peas plants are each of Twistrid®, Regurone® and Oshin®.

### **Final conclusion**

- It could be concluded that the possible use of following spraying applications by Calsin, Potasin and Novatrin, which sequentially reflected on the decreased level of infestation by both insect-pests and at the same time gave the plants a good status of tolerancy and enabled them to resist and compensate injury of occurring infestation of insects by the detected increase in the yield as a goal for reducing the rate and times of insecticidal sprays in controlling the occurring insect- pests of faba bean and garden pea plants.
- Consequently that will facilitate the prevention of the extensive and unwise use of conventional insecticides on faba bean and garden pea plants, as well as the other vegetable plants, since the extensive use of pesticides oftenly cause environmental pollution and hazardous problems related to agro-ecosystem; mainly to fish, domestic animals, welfare and human.

**Appendix 1: Physical and chemical properties soil of the experimental sites during 2014/2015 and 2015/2016 seasons**

Soil properties	First season (2014/2015)	Second season (2015/2016)
<b>Mechanical analysis</b>		
Sand %	13.70	13.90
Silt %	32.60	32.60
Clay %	42.50	42.30
pH (1:2)	7.80	8.1
E.C. (d <sub>s</sub> /m)	1.64	1.63
Total CO <sub>3</sub> <sup>-</sup> %	0.83	0.85
Organic C %	1.75	1.80
<b>Soluble cations (1:2) (mol/kg soil)</b>		
Ca <sup>++</sup>	0.80	3.00
Mg <sup>++</sup>	0.55	0.56
Na <sup>+</sup>	1.60	1.75
K <sup>+</sup>	0.07	0.98
<b>Soluble anions (1:2) (mol/kg soil)</b>		
CO <sub>3</sub> <sup>=</sup> + HCO <sub>3</sub> <sup>-</sup>	0.75	0.56
Cl <sup>-</sup>	3.00	2.10
SO <sub>4</sub> <sup>-</sup>	0.52	0.32
Available P (mg/kg soil)	3.20	3.30
Available K (mg/kg soil)	184	190