SUGAR BEET: INTEGRATED CROP PRODUCTION AND INTEGRATED PEST MANAGEMENT IN RELATION TO YIELD AND PROFITABILITY

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Abstract

During 2004-2005 season, three trials were carried out at three locations of Kafr El-Sheikh region to integrate several control techniques and apply suitable cultural practices in an integrated control program for suppressing insect pests attacking sugar beet plants. Producing healthy, strong and insect tolerant plants is of extreme importance in working out a satisfactory pest management program which takes into account all suitable practices: crop rotation, good preparation of land, planting in suitable time, accurate plating spaces, compensation plant losses by transplanting paper-pots and adequate doses of NPK fertilizers. Blending these practices gave a complete stand (36666.6 plants/fed.) and resulted in optimum yield (35.156 tons/feddan) compared with 26033.3 plants that resulted an average of 28.63 tons/feddan in the farmers, fields.

On the other hand, for controlling sugar beet insects, several tactics were applied throughout the growing season: using insect-tolerant sugar beet variety, treating seeds with systemic insecticide (Gaucho), removing weeds, planting insect repellent plants (onion and garlic) on the field borders and dikes, releasing the egg-parasitoid, *Trichogramma evansences* to control the two rib miners, *Ostrinia nubilalis* Hub. and *Scrobipalpa ocellatella* Boyd., spraying the biocide, Dipel 2x two months before harvest and the aqueous extract of coriander pre one month before harvest to control high populations of insects without adverse effects on natural enemies, residues in roots and tops and toxicity upon man and animals.

Application of the previous control methods greatly reduced the average number of insects which attack sugar beet plants since the insect reduction rates averaged 56.8-72.7% of the control insect populations average throughout investigation months. Throughout the growing season examinatios, the general rate of insect reductions ranged between 60.2-70.0% than that of each insect populations in the control areas.

Blending agro practices and control measures reduced insect populations, below the the economic injury levels and increased yield potentials. The area (one feddan) received integrated pest management (IPM) gained pure profit of 1604.93 L.E. over the farmers, fields.

INTRODUCTION

The list of pests attacking sugar beet plants is long and includes numerous insect pests which cause serious problems for sugar beet growers and cause yield reductions (Bassyouni and Khalafalla, 1996). The crop is annually planted in an area of 175.000 feddans in Egypt, more than 50% of this area is located at Kafr El-Sheikh Governorate (Sugar Crops Council Report, 2005).

Research and development programmes have provided beet growers with several ways for minimizing yield loss resulting from pest attack. Sugar-beet research workers have advocated to use integrated systems of pest management, recommending optimum cultural techniques, pest-resistant sugar beet varieties, mechanical, biological and chemical control measures.

To control these insect pests, it is essential to understand the nature of the crop, since the application of an incorrect control measures or incorrect agricultural practices may cause resurgences in the population of certain insects and may influence the buildup of these insects (Lange, 1972). Thus, the goal for the future in the control of sugar-beet insects is to prepare systems involving perfect integrated control program which takes into account all methods that utilize all suitable techniques in a completable manner to reduce and maintain insect populations below the injury level. In the current investigation, two complementary techniques were adopted:

1. Integrated Crop Production Management (ICM):

Applying all agricultural practices and treatments which produce healthily and strong plants tolerant to the insect infestations, consequently, reduce the insect damage and increase yield quantity and quality of yield.

2. Integrated pest Management (IPM.):

Applying a combination of control measures that induce cultural, mechanical, biological and chemical control methods without detrimental effects on natural enemies and residues in roots and tops.

MATERIALS AND METHODS

Three equal experimental areas were chosen at three locations of Kafr El-Sheikh region, Sidi-Salem, El-Reyad and Kafr El-Sheikh districts. Each area measured one feddan divided into two equal parts, the first part for applying IPM program and the second was left to the farmer to apply traditional and normal agricultural practices along the season.

IPM program parts were well prepared for planting sugar beet seeds, and agricultural procedures were conducted along the season as following:

1. Integrated Crop Management Programme:

The experimental fields were chosen from those cited in triseasonal rotation. The optimum sowing date favorable for the crop and unfavorable for the insect activities was limited at mid-October. Seed of sugar beet variety Raspoly tolerant to the insect infestation and gain high yields of roots and sugar were sown in IPM areas. Distances were adequated as 50 cm between rows and 20 cm between hills in IPM areas, while the corresponding values in farmers fields were 60-65 and 20cm. Transplanting paper-pots were planted with the same variety seeds at the same time of sowing permanent land on borders of IPM areas to be used for compensation of hill losses resulting from soil pests, birds, rats and other factors (disease, tillage....etc.). Seedlings were transplanted after thinning (30 days of planting) in missed hills to adequate stand and bridge gaps.

Recommended fertilizers, urea (46% N), potassium sulphate (48%) and calcium superphosphate (15.5%) were added as 92, 48 and 45.5 units/feddan, respectively.

2. Integrated Pest Management Programme (IPM):

Weeds were manually removed from inside and outside IPM areas. Seeds were treated with systemic insecticide imidacloprid (Gaucho) WS 70 at 7 g/ 1 kg seeds.

Onion and garlic were planted 15days after thinning sugar beet plants on the rill (channel edges), field borders and dikes, in rows with 25cm between plants.

Egg masses of the cotton leafworm and beetfly were handly collected weekly and burnt out the field.

When the European corn, *Ostrinia nubilalis* (Hub.) and the beet moth, *Scrobipalpa ocellatella* Boyd. egg-masses appeared on the sugar beet leaves in mid February, the egg parasitoid, *Trichogramma evanescence* West was used as 30,000 parasitoids/feddan, twice, at 15- day intervals for control of both pests.

In mid-March, the bioinsecticide Dipel 2x (*Bacillus thuringiensis*) was used as 400 g/feddan against severe attack of beetfly, beet beetle, beet moth and other insects.

In mid-April, when majority of sugar beet insects peaked, aqueous extracts of Coriander (*Coriandrum sativum*) seeds were used for spraying sugar beet plants one month pre-harvesting. Thirty kg of seeds were crushed, soaked in water for 72 hr, squeezed, screened through muslin cloth and kept in refrigerator until application.

To count seed hills, seedlings, and plant losses, the first investigation started directly after germination and then every month until harvesting. Three replicates each measured $42m^2$ were used for counting seedling losses in IPM areas. Sampling

for counting insects and their stages in IPM and traditional areas started after thinning from mid-Nov. until mid-May. Seven examinations were practiced as forty -five sugar beet plants were randomly selected from each area and carefully examined for counting insects. The evidence of present injury of pest-induced plant loss was distinguished according to the damage identification key (Lejealle and d'Aglar, 1982 and Whiteney and Duffus, 1991).

The harvest was achieved at the end of May as the sugar beet roots were pulled, cleaned, counted and weighted and the sugar percentage were estimated by sucrometer apparatus. The return of each area was calculated according to the price-list of Delta Sugar Company in 2004-2005 season.

The quantities of garlic and onion as additional products were estimated, priced and added to profitability of IPM area/feddan.

Over-costs of all materials and fertilizers or treatments which were in IPM part, alone, were discounted from income to estimate the pure profitability.

RESULTS AND DISCUSSION

1. Integrated Crop Management (ICM):

Data in Table (1) revealed that adopting correct agrotechnical measures resulted in healthy and insect tolerant sugar beet plants, consequently, the yield potential was improved due to crop management strategy.

Estimates of sugar beet stands in both farmer and IPM areas (Table 1) obviously showed that the plant stand of the unit area increased by 6000 hills in IPM area than in the farmer one as a result of applying recommended distance between rows (50 cm) in the first area compared to 60-65 cm in the second one, which represents a reduction of 17.91% of the plant stand in the farmer part. Both areas suffered from missed plants, but in the farmers area it reached 39.92% (13372.99 plants/fedd.) from the initial number of hills while this rate was 11.36% (4826.67 plants/fed.) in integrated pest management area. This procedure increased plant density in IPM area giving an increase in yield benefits.

On the other hand, 3500 plants of the missed plants (4826.67 plants) were compensated by transplanting seedlings from paper-pots to IPM area while the farmers handly transplanted about 1500 seedlings only during thinning process. Final stand of plants in IPM area was almost complete, (36673.33 plant/fed) while it is 20127.01 plant /fed in farmer areas (Control) and the reduction % of control compared to IPM was 45.12.

From the previous data, it was attempted to integrate several available control techniques for the suppression of the crop pests by producing strong and healthy

plants. The attempt involved several points: following triseasonal crop rotation, using of insect tolerant variety (Raspoly), planting on optimum date [mid October] (which was favorable for the crop and unfavorable for the insect activities), removing weeds from inside and outside IPM areas because it is considered asource of many insect stages and to avoid build up of insect population. Blending these factors gave a complete and strong stand of the crop plants as reported previously by Lange (1972) who mentioned that continuos growing in one field and spacing of sugar beet may influence the build up of certain insects. Bassyouni and Khalafalla (1996) found that Raspoly variety was the most tolerant for the insect infestations. Gadzhieva (2002) reported that increasing rates of nitrogen, phosphorous and potassium fertilizers facilitated development of some insect species specially the beet leaf mines. On the other hand, the yields of roots and sugar increased as two-fold with the highest rate of K (Jhonston and Kamh, 2003). However, excess of nitrogen increases leaf area and decreases sugar content of sugar beet plants (Lang,1972).

2. Integrated Pest Management Programme (IPM):

The integrated insect management measures were started using seed treated with imidacloprid (Guacho) as a systemic insecticide to protect seeds and plants from soil and foliar insect pests. The data in Table (2) indicated to the effective role of the seed treatment in crop protection against soil insects, cut-worms, mole crickets and foliar insects, the cotton leaf-worm and the beet-fly for more than 3 months.

In Table (1) the average number of plant losses in IPM area (4826.67) was about three- folds of the same number in the farmers area (13372.99), (Table 1).

The reduction rates of insect populations in IPM area through the first three months were 65.2, 59.3 and 72.7%, respectively than those in farmers areas (Table 2). So, pre-emergence insecticide (imidacloprid) improved seedling emergence and provided a good control of soil and foliar insects for a long period. Resemble results were recorded by Mains *et al.* (1994) and Weismann (1996) who emphasized that the critical age of sugar beet plants and the best time for insecticide application placed on the period from germination and emergence of plants up to development of the 6^{th} true leaf.

Onion and garlic which has insect repellent odour (Awadallah *et al.* 1993). Thus, planting onion and garlic on the field borders (as where the border rows are always severely attacked by many insects), dikes and furrow channel edges greatly reduced the attack of the tortoise beetle, the beet moth but slightly affected on the beet fly infestation(Table 2) Awadallah *et al.* (1993) emphasized that the onion bulb planted with maize had a repellent effect to females of *Sesamia cretica*. Also, Bassyuouni and Abo Attia (1997) got the same result by planting onion and garlic in sugar beet fields as repellents to several lepidopterous insects.

Table 1. Reduction percentages in sugar-beet hills in IPM and Control plots, 2004 / 2005.

Parameter	Sidi-Salem		El-Reyad		Kafr El-Sheikh		Average		Stand Reduction %	
	IPM	Control	IPM	Control	IPM	Control	IPM	Control	IPM.	Control
Initial No. of hills/feddan	38000	35000	38000	32000	38000	32000	38000	32000		
Compensation	4000	1500	4300	1500	2200	1500	3500	1500		
Total stand	42000	33500	42300	33500	40000	33500	41500	33500		
Missed hills due to:										
Wider rows than recommended	0000	6000	0000	6000	0000	6000	0.000	6000	0.00	17.91
Birds	910	779	1200	980	470	350	860.00	713.00	2.07	2.10
Rats	430	780	710	310	140	120	426.67	403.33	1.03	1.20
Cut-Worm	790	670	880	1300	350	520	673.33	830.00	1.62	2.48
Mole-cricket	520	1010	740	1510	460	790	573.33	1103.33	1.38	3.29
The cotton leafworm	490	1830	640	1960	720	1680	616.67	1823.33	1.49	5.44
Others (unknown)	2190	2070	1410	2640	1430	2820	1676.67	2510.00	4.04	7.49
Total missed hills	5330	13139	5580	14700	3570	12280	4826.67	13372.99		
Final stand	36670	20361	36720	18800	36430	21220	36673.33	20127.01		
Reduction % of control compared to IPM							45.12			

Table 2. Average number of insect pests/10 sugar beet plants during the growing season (2004/2005) in IPM unit area compared with the farmers areas in three locations at Kafr El-Sheikh region.

Site	Exam. month	Sidi-Salem						El-Reyad						Kafr El-Sheikh						Average						Red. %
		S. littoralis(L)	*P. mixta*(L)	*S. ocellatella*(L)	*C. vittata*(L+A)	*O. nubilalis*	Total	*S. littoralis*	*P. mixta*	*S. ocellatella*	*C. vittata*	*O. nubilalis*	Total	*S. littoralis*	*P. mixta*	*S. ocellatella*	*C. vittata*	*O. nubilalis*	Total	*S. littoralis*	*P. mixta*	*S. ocellatella*	*C. vittata*	*O. nubilalis*	Total	
Farmer area	Nov.	2.0	2.5	4.0	0.0	0.0	8.5	2.3	2.3	2.6	0.0	0.00	7.2	4.5	3.8	6.0	0.0	0.0	14.3	2.9	2.9	4.2	0.0	0.0	10.0	65.2
	Dec.	2.8	2.3	3.3	0.0	0.0	8.4	2.6	4.2	2.6	0.2	0.0	9.4	4.8	5.0	5.2	4.0	0.0	19.0	3.4	3.8	3.7	1.4	0.0	12.3	59.3
	Jan.	2.7	1.8	2.74	4.2	0.8	12.2	3.0	3.5	3.1	5.4	0.0	15.0	..6	3.4	5.4	4.6	0.4	17.4	3.1	2.9	3.7	4.7	0.4	14.8	72.7
	Feb.	2.1	2.6	2.9	10.4	1.4	19.4	3.6	5.1	3.3	12.0	0.4	24.4	4.5	5.1	3.6	6.0	1.6	20.8	3.4	3.7	3.3	9.5	1.1	21.0	64.6
	Mar.	2.4	3.4	4.2	11.5	11.8	33.3	3.2	4.2	5.2	16.0	5.2	33.8	5.1	6.6	5.1	4.5	14.2	35.5	3.6	4.7	4.8	10.7	10.4	34.2	56.8
	Apr.	2.0	5.0	2.2	15.0	12.3	36.5	2.6	6.6	3.8	12.4	8.4	33.8	3.2	4.8	4.1	17.8	10.5	40.4	2.6	5.5	3.4	15.1	10.4	37.0	64.4
	May	1.8	2.1	1.4	12.8	8.0	26.1	1.9	3.2	1.2	16.3	10.0	32.6	0.9	2.6	3.4	21.3	12.4	40.6	2.4	2.6	2.0	16.8	10.1	33.9	67.2
Total		15.8	19.7	20.7	53.9	34.3	144.4	19.2	29.1	21.8	62.3	24.0	1565.2	26.6	91.3	32.8	58.2	33.1	188.0	21.4	26.1	25.1	58.2	32.4	163.2	64.4
Reduction %		79.5	73.8	68.7	62.9	58.2	70.1	71.9	63.2	65.8	56.8	59.3	62.0	64.9	65.5	60.3	63.5	54.9	59.6	71.0	68.1	64.5	60.2	62.3	64.4	
IPM area	Nov.	10.2	8.8	8.0	0.0	0.0	27.0	11.1	9.0	7.5	0.0	0.0	27.6	8.8	12.5	16.4	0.0	0.0	31.7	10.0	10.1	8.6	0.0	0.0	28.7	0.0
	Dec.	11.0	10.3	7.5	0.0	0.0	28.8	9.4	11.1	7.0	0.4	0.0	27.9	9.6	10.6	13.1	10.6	0.0	43.9	10.0	10.7	9.2	0.3	0.0	30.2	0.0
	Jan.	11.4	9.4	9.0	0.0	4.1	33.9	10.6	11.4	9.4	16.6	0.0	48.0	11.8	12.4	14.3	15.2	0.0	53.7	11.3	11.1	10.9	10.0	10.4	54.3	0.0
	Feb.	14.0	11.0	11.3	18.5	3.0	57.8	10.0	12.0	11.8	20.2	0.0	54.0	13.2	13.8	10.2	15.4	5.3	62.9	12.4	12.3	11.1	19.7	3.8	59.3	0.0
	Mar.	12.3	11.8	10.2	33.0	17.6	84.9	11.2	11.8	10.4	80.0	7.6	68.6	11.3	15.2	96.7	25.3	19.4	80.9	11.8	129	10.1	29.4	14.9	79.1	0.0
	Apr.	8.6	14.2	11.5	47.6	25.4	107.3	8.2	13.4	9.2	38.6	23.6	93.0	11.6	15.0	11.8	41.4	30.5	110.3	9.5	14.2	10.8	42.5	26.8	103.8	0.0
	May	9.8	9.8	8.8	46.4	31.0	105.8	7.2	11.3	8.4	38.4	27.8	92.1	9.4	11.3	13.1	46.8	31.6	112.2	8.8	10.5	10.1	43.9	80.1	103.4	0.0
Total		77.3	75.3	66.3	145.5	82.0	482.5	68.3	79.0	63.7	144.2	59.0	411.2	75.7	90.8	82.6	159.7	86.8	465.6	73.8	81.8	70.8	146.4	86.0	458.8	

Reduction % in insects due to IPM L: Larvae A: Adult

Table 3. Comparison between sugar beet yield, sugar percent and profitability per unit area (feddan) of IPM and farmer areas at three locations at Kafr El-Sheikh region during 2003/2004 season.

The main data of the yield	Sidi-Salem Dist.		El-Reyad Dist.		Kafr El-Sheikh Dist.		Average	
	IPM	Farmer	IPM	Farmer	IPM	Farmer	IPM	Farmer
Av. no. of roots in 42 m^2 (1/100 of fedd.)	387	281	362	249	351	251	366.66	260.33
Av. no. of roots in feddan	38700	28100	36200	24900	35100	25100	36666.66	26033.33
Av. weight of roots in 42 cm^2 (kg)	382.60	307.37	345.00	271.35	327.00	280.20	351.53	286.30
Av. weight of roots in feddan (ton).	38.260	30.737	34.500	27.135	32.700	28.02	35.156	28.63
Discount 5% of weight as impurities (ton).	1.91	1.54	1.73	1.36	1.64	1.40	1.76	1.43
Av. net weight of roots feddan (ton).	36.35	29.19	32.775	25.778	31.06	26.62	33.39	27.20
Av. of sugar percent (5)	21.10	18.30	20.40	19.30	20.00	17.90	20.50	18.50
Av. value of the ton of roots containing 16% sug.	140 L.E.	140 L.E.	140 L.E.	140 L.E.	140 L.E	140 L.E.	140 L.E.	140 L.E.
*Av. value of the ton of roots in each site.	191.00	163.00	184.00	173.00	180.00	159.00	185.00	165.00
Av. value of total yield/feddan (L.E)	6942.85	4757.97	6029.68	4458.21	5590.80	4232.58	6177.15	4488.00
Discount the additional cost in the IPM area	-250 L.E	-	-250 L>E	-	-250 L.E.	-	-250 L.E.	-
After adding price of 1/2 ton onion and garlic	+250 L.E	-	+250 L.E	-	+250 L.E	-	+250 LE	-
Net price after discount costs of IPM	6942.85	4757.97	6029.68	4458.21	5590.80	4232.58	6177.15	4488.00
Profitability resulted of theIPM application	2184.88	-	1271.71	-	1358.22	-	1604.93	L.E./fed.

*Each pont of sugar % over 16% (standred) equal 10 LE.

Biological control and natural pathogens may be used in the control of sugar beet insects. The egg-parasitoid, *Trichogramma evanescens* West. was released in the current investigation when the egg masses of both rib miners, the European corn borer, *Ostrinia nubilalis* (Hub.) and the beet moth, *Scrobipalpa ocellatella* Boyd. appeared mid-February at a rate of 30,000 parasitoids/feddan in IPM areas twice at 15-day intervals. This rate successfully suppressed both insect infestations by 62.3 and 64.5%, respectively as compared to the control area (Table 2). Bassyouni *et al.* (2000) recorded the European corn borer as a serious pest in sugar beet fields and Mesbah *et al.* (2004) used effectively the egg parasitoid, *T. evanescens* against the beet moth and the corn borer in sugar beet fields. Also, in (2004), Marie released the same parasitoid three times at 12,000 indiv./feddan and successfully reduced the beet moth infestation in sugar beet fields.

Two months, before harvest, nearly, there is a need to use safe and short term persistence materials, to replace chemicals to decrease the complex of insect pests which peaks by mid of March. Then, the application of biocide, Diple 2x was necessary and the compound preparation successfully suppressed the average rate of different insect infestations for ten days after application. The same procedure was followed by Marie (2004) as she used the biocides for controlling sugar beet insects. Opposite results were obtained by El-Husseini *et al.* (2004) as they reported that using entomopathogenic fungi was not effective against larvae of *S. ocellatella*, *O. nubilalis* and *P.hyoscyami* in sugar beet fields.

In mid April (a month before harvest), the rate of the insect infestations was in its peak (37 insects/10 plants) in IPM area while it greatly reached to 103.8 insects/10 plants in the farmer fields (Table 2). So, more selective compounds, were chosen to control these insects without disadvantages of determinal effects on natural enemies, residues in roots and tops, pollution of the environment, and adverse effects on wildlife or man and animals. All of the previous advantages were found in using an aqueous extract of coriander seeds at a rate of 30 kg/feddan prepared by a simple technique. Shalaby *et al.*(2005) successfully used plant extracts in reducing the sugar beet insect population.

Sugar beet yield and profitability of unit area of IPM programme compared to farmers fields:

An integrated control program achieves several available control methods in blended system might prove more advantageous, reducing pest populations and increasing yield potentials. As shown in Table (3), data revealed that following the correct agricultural practices resulted a complete stand of the crop plants. The average root yield, also, was estimated by 35.15 tons/fedd. in IPM area while it decreased to 28.63 tons/fed. in control one. After discount 5% impurities of both average yields, the net yield of one feddan was 33.39 tons in IPM part and

27.20 tons in the control one. Application of IPM program not only increased the yield production but also increased the yield quality as the average percentage of sugar was 20.5% by excess two points over that of the farmers sample (18.5%). According to the price-list of Delta Sugar Company during 2004-2005 season, the net value of IPM area yield = 6177.15 L.E after adding 250 L.E. as a value of onion and garlic and discount 250 L.E. that represents, the excess of costs in IPM area than farmers fields.

Finally, the profitability resulting form IPM program application = 6177.15-4488.00 = 1604.93 L.E. over the return of farmer field.

So, application of agrotechnical measures and other control methods in IPM program significantly increased the crop production. A large part of the production increase could be explained by improved plant stand and well-growing plants, until harvesting time resulting from reductions in damage caused by pests.

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بنجر السكر:الإنتاج المتكامل والمكافحة المتكاملة للآفات وعلاقتها بالمحصول و الأربحية

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خلال موسم ٢٠٠٤/٢٠٠٥ نفذت ثلاث تجارب فى ثلاث مناطق بمحافظة كفر الشيخ بغرض استخدام عدة أساليب متكاملة للمكافحة والاستفادة من تطبيق العمليات الزراعية المناسبة فى الخروج ببرنامج مكافحة متكاملة لخفض الآفات الحشرية بحقول بنجر السكر. استخدمت اساليب: الميعاد الناسب للزراعة، ضبط مسافات الزراعة لإعطاء كثافة نباتية عالية وتعويض المفقود من الجور عن طريق الشتل من الأصص الورقية ثم استعمال الجرعات المناسبة من الأسمدة الازوتية والفوسفاتية البوتاسية. وقد أعطى التطبيق الجيد لهذة العمليات كثافة نباتية عالية قدرت بحوالى ٦و٣٦٦٦٦نبات/فدان إنتاجية بلغت ١٥٦و٣٥ طن بنجر للفدان فى حين كانت الكثافة النباتية لدى المزارعين (مقارنة)٣و٢٦٠٣٣نبات للفدان بإنتاجية قدرها ٨٣و٢٨طن للفدان.

أما أساليب المكافحة التى طبقت لخفض تعداد الآفات الحشرية بحقل برنامج المكافحة المتكاملة فقد بدأت باستعمال بذور صنف يتحمل الإصابة الحشرية (راسبولى) ثم معاملة البذور بمبيد جهازى (جاوشو) لحماية البادرات من أفات التربة والحشرات الهوائية مع مدوامة التخلص من الحشائش داخل الحقل وخارجة ثم زراعة نباتات البصل والثوم على حواف الحقل والمشيات والقنى لاستغلال رائحتها فى طرد بعض انواع الحشرات الكاملة. ثم أطلق طفيل الترايكوجراما لخفض الإصابة بحشرتى دودة الذرة الأوربية وفراشة البنجر وقبل الحصاد بشهرين تم رش المبيد الحيوى Dipel-2x وقبل الحصاد بشهر واحد تم رش المستخلص المائى لنبات الكسبرة *Coriandrum sativum* لخفض تعداد الحشرات بالحقل والتى كانت فى أقصى تعداد لها دون التأثير السلبى على الأعداء الحيوية أو ترك اثر باق لاى مبيد بجذور البنجر واوراقة قبل التقليع. وأدى هذا التتابع فى تطبيق أساليب المكافحة المتكاملة السابق ذكرها إلى خفض تعداد الحشرات بمعدلات تتراوح بين ٨و٥٦-٧و٧٢%خلال اشهر الفحص فى حين تراوحت نسب خفض تعداد مجاميع كل حشرة بين ٦٠-٧٠% خلال الموسم بأكملة.

وأدى المزج بين تطبيق حزمة التوصيات الفنية وباقى طرق المكافحة المتكاملة للحشرات إلى خفض مجاميع الحشرات بالحقل بشكل ملحوظ وزيادة الإنتاج كماً ونوعاً بما يحقق ربحية بأرض برنامج المكافحة IPM بلغت٩٣و١٦٠٤ جنية زيادة عما حققة الفدان بأرض المزارع.