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EFFECT OF MINERAL NITROGENOUS FERTILIZATION AND COMPOST TEA ON INSECT INFESTATION OF SUGAR BEET AND YIELD CHARACTERISTICS

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ABSTRACT

Field experiments were carried out at the experimental farm of Sakha Agricultural Research Station during 2009/10 and 2010/11 seasons. Three levels of mineral nitrogenous fertilizers and/or different treatments of compost tea were evaluated as affecting on insect infestation in sugar beet, as well as fertilizer effect on yield and yield characteristics. Infestation by *Pegomia mixta* Vill, *Scrobipalpa ocellatella* Boyd and *Cassida vittata* Vill were significantly highest at 90 kg N/fed as compared with lower doses (60 or 75 kg N/fed). Compost tea treatments induced lower infestation by the aforementioned insects as compared with the check (control). Compost tea used as soil drench (30 L/fed.), applied 40 days after sowing, followed by foliar application of compost tea at 60, 90 and 120 DAS (20 L/fed) proved to be the best treatment against insect infestations. The combination of the latter treatment with the application of 60 kg N/fed resulted in the lowest infestation of sugar beet insects. In contrast, the highest infestation with pest complex (*P. mixta, S. ocellatella* and *C. vittata*) resulted from the application of 90 kg N/fed in plots free from compost tea. Compost tea treatment induced significantly high percentages of sugar, purity, and sugar beet extractability, root yield and sugar yield but produced the lowest levels of sodium, potassium and α-amino nitrogen as compared with plots free from the compost tea. From the current results, it could be recommended to use compost tea, particularly as soil drench (30 L/fed) at 40 days after sowing, followed by foliar spray of compost tea (20 L/fed) at 60, 90 and 120 days after sowing. This application was superior in enhancing sugar beet yield and yield components, as well as in reducing insect infestation. It also confirmed that compost tea can be used as organic substrate additives in plant cultivation and substitute for chemical nitrogen fertilizers.

Keywords: Compost tea; Sugar beet; insect infestation; foliar application; Nitrogenous fertilizer; Juice quality.

INTRODUCTION

There is a shortage in sugar production in Egypt, as about 33% of population requirements are imported (CCSC, 2011). The sugar production, in Egypt, has depended for a long time on sugar cane, but in the last decades, sugar beet was introduced as the second source of sugar production. Thus, all cultural practices, including plant protection measures, are of great importance to enhance sugar beet productivity.

Nitrogenous fertilization, from mineral and organic sources, is the most important element for most of crop production, as the nitrogen deficiency causes reduction in crop productivity, and delays the initiation of sugar storage process (Marschner, 1995). Different levels of applied nitrogen induce variable effects on sugar beet infestation by many insects. *Pegomia* *mixta* infestation was reported to increase when 120 kg N/fed was applied (Aly, 1988 and Talha 2001). *Cassida vittata* damage was also enhanced by excess of mineral nitrogenous fertilization (Talha, 2001). The application of organic manures, alone, produces dense foliage, and attracts greater number of *P. mixta* and *C. vittata*, but it greatly reduces the infestation by *S. ocellatella*. (Bassyouny and Abou-Attia 1998). Higher sugar beet root production obtained by higher levels of applied nitrogen. (Holmes 1982). Higher levels of sugar beet root length, root diameter, leaf area index and sugar yield obtained by increasing levels of applied nitrogen up to 150 kg N/fed (Sharif and Eghbal 1994). The filling process also depends on photosynthetic efficacy of leaves, which is not only controlled by light intensity and temperature, but also by mineral nutrition. Increasing nitrogen fertilizer significantly enhances length and diameter of roots, as well as sugar yield productivity (Nemeat-Alla, 2005, Ramadan, 2005).

The current study was carried out to evaluate the effect of mineral nitrogenous fertilizer levels on sugar beet infestation by the major insects. Also, the effect of compost tea applications as organic fertilizer, on the insect infestation was assessed.

Compost tea contains a set of aerobic organisms that perform a variety of beneficial functions, consume disease-causing organisms and produce compounds that inhibit the growth of disease-causing organisms and insects (Ingham, 2005 and El-Gizawy 2005)

MATERIALS AND METHODS

Field experiments were conducted at the experimental farm of Sakha Agricultural Research Station during 2009/10 and 2010/11 seasons. The study aimed to find out the effect of applying different rates of mineral nitrogenous fertilizer, compost tea (as organic fertilizer) and their combinations on the insect infestation in sugar beet, as well as sugar beet yield and some juicy characteristics. The target insects are beet fly, *Pegomia mixta* larvae, beet moth, *Scrobipalpa ocellatella* larvae and tortoise beetle, *Cassida vittata* larvae and adults. The experimental field was prepared, as normal and both phosphorus and potassium fertilizers (100 kg/fed each) were soil incorporated during land preparation as 15.5% P_2O_5 and 48% K_2O, respectively. Sugar beet seeds (Loula cultivar) were sown by the first week of October in both seasons. The treatments were laid out in a split-plot design, where the mineral nitrogen treatments were allocated in the main plots and compost tea treatments were allocated in the sub-plots. Compost tea was obtained from bacterial lab at Sakha Agriculture research station according to the method described by El-Gizawy 2005. The treatments and their rates were as follows:

1. Mineral nitrogenous fertilizers:
   a) 60 kg N/fed.
   b) 75 kg N/fed.
   c) 90 kg N/fed.
2. Compost tea treatments:
   B_1: Soil drench, 40 days after sowing (DAS), at a rate of 30 L/fed.

B_2: Foliar, 60 DAS, at rate of 20 L/fed.
B_3: Foliar, 60 and 90 DAS, at rate of 20 L/fed.
B_4: Foliar, 60, 90 and 120 DAS, at rate of 20 L/fed.
B_5: $B_1 + B_2$
B_6: $B_1 + B_3$
B_7: $B_1 + B_4$
B_8: Control (without compost treatments)

The other agricultural practices were carried out in the same manner prevailing in the region, but without any pesticidal treatments.

When the sugar beet plants aged 120 days, 30 plants were taken from each treatment (as 10 plants x 3 replicates). Each sampled plant was completely introduced into a plastic bag, and cut at the soil surface. The confined plants were transferred to the laboratory. To avoid the escape of insects during inspection, a piece of cotton saturated with chloroform was introduced into the bag for 15 minutes to anaesthetize the mobile insect stages. Sampling was carried out at 15 day intervals, and continued up to harvest.

At harvest, ten sugar beet roots, from two guarded rows, were taken to determine sugar beet yield and juice quality characteristics. These parameters were recorded according to the standard evaluation of Delta Sugar Company Limited Laboratories, El-Hamoul, Kafr El-Sheikh Governorate, and according to the method of McGinnus (1971) juice quality characteristics were determined in the fresh roots using an Automatic French System (HYCEL) as follows:-

1. Sucrose percentage (Pol%) was determined using polarimeter on lead acetate extract of fresh macerate root according to the method of Carruthers and Oldfield (1960).
2. Potassium and sodium percentages were determined using flame photometer, and α-amino-N was determined using ninhydrin and hydrindantin method according to Carruthers *et al*. (1962).
3. Purity % was calculated according to the following formula:
   Purity % = $99.36 – [1427 (V_1 + V_2 + V_3)/V_4]$ (Devillers, 1988).
   Where: V_1 = Sodium, V_2 = Potassium, V_3 = α-amino -N these in mill equivalents /100 g beet, V_4 = Sucrose % (Pol %).
4. Sugar beet extractability % was calculated according to Abou-Salama and EL-Syiad (2000) using the following formula:
   Sugar extractability = Sugar yield x 100 / V_4

The analysis of variance was carried out according to Gomez and Gomez (1984). Treatment means were compared using Duncan's Multiple Range Test (Duncan, 1955). All statistical analyses were performed using MSTAT computer software package.

RESULTS AND DISCUSSION

Data presented in Table (1) show the effect of mineral and organic fertilization on insect infestations in sugar beet plants. *Pegomia mixta* larval population varied with highly significant differences in 2009/10 season and with significant differences in 2010/11 season due to 60, 75 and 90 kg N/fed.

Average of both seasons shows that the highest infestation (30.33 larvae/10 plants) was recorded in case of 90 kg N/fed, and the lowest (22.38 larvae) was in case of using 60 kg N/fed.

Table (1):Effect of mineral and bio fertilizer application on sugar beet insect infestation at the experimental farm of Sakha Agricultural Research Station.

Fertilizer treatment	*P. mixta*			*S. ocellatella*			*C. vittata*		
Mineral nitrogen (kg/fed)	**2009/10**	**2010/11**	**Mean**	**2009/10**	**2010/11**	**Mean**	**2009/10**	**2010/11**	**Mean**
60	23.17 b	21.58 b	22.38	4.17 c	5.92 c	5.05	37.58	46.79 b	42.19
75	24.27 b	23.63 b	23.92	7.29 b	8.33 b	7.81	41.33 b	35.04 c	38.19
90	30.33 a	30.33 a	30.33	11.75 a	12.38 a	12.07	61.92 a	61.13 a	61.53
Bio fertilizer/.fed									
B_1	30.44 b	29.78 ab	30.11	9.89 ab	12.22 ab	11.06	56.44 bc	52.44 b	54.28
B_2	29.67 bc	29.11 b	29.39	9.11 ab	11.44 b	10.28	53.33 bc	52.00 b	52.67
B_3	26.67 cd	26.44 bc	26.56	8.56 ac	9.44 c	9.00	58.11 b	52.89 b	55.50
B_4	24.44 d	24.11 cd	24.28	7.56 bd	8.44 c	8.00	50.33 c	48.89 b	49.61
B_5	23.33 de	22.56 de	22.95	6.22 cde	7.00 d	6.61	38.11 d	43.33 c	40.72
B_6	20.67 ef	20.22 e	20.45	5.22 de	5.22 e	5.22	31.78 d	38.33 d	35.06
B_7	17.89 f	16.44 f	17.17	4.56 e	3.78 f	4.17	22.22 e	23.00 e	22.61
B_8	34.11 a	32.78 a	33.45	10.78 a	13.44 a	12.11	45.56 a	70.33 a	67.95
F	**	**		**	**		**	**	
Mineral x Biofertilizer interaction	NS	NS		NS	**		**	**	

B_1: Soil drench, 40 days after sowing (DAS), at a rate of 30 L/fed. **B_5:B_1 + B_2**
B_2: Foliar, 60 DAS, at rate of 20 L/fed. **B_6: B_1 + B_3**
B_3: Foliar, 60 and 90 DAS, at rate of 20 L/fed. **B_7:B1 + B_4**
B_4: Foliar, 60, 90 and 120 DAS, at rate of 20 L/fed.
B_8: Control (without compost treatments)

The same trend was found with *S. ocellatella*, as the highest average infestation (12.07 larvae/10 plants) was detected with the highest level of nitrogenous fertilization (90 kg N/fed) while the lowest (5.05 larvae) was found with the lowest level of nitrogen. In case of *C. vittata*, the highest level of infestation (61.53 larvae and adult /10 plants) was obtained with the maximum nitrogen, but the lowest infestation (38.19 larvae and adult) resulted from the medium level of nitrogen.

These results agree with those of Talha (2001) who reported that sugar beet infestations with *P. mixta* and *C. vittata* increase at the high levels of nitrogen fertilizer. However, Mesbah *et al*. (1985) and Abd El-Ghany (1995) concluded that the mineral nitrogenous fertilization had no effect on sugar beet infestation with *S. ocellatella.*

Compost tea treatments high significantly reduced the infestation of sugar beet by the three considered insects. However, the untreated plots were always the highest infested (Table 1). In case of *P. mixta*, the lowest level of infestation (17.17 larvae/10 plants) was detected in B_7 [B_1 (plots treated with compost soil drench, 40 DAS at a rate of 30 L/fed) followed by B_4 (compost tea foliar 60, 90 and 120 DAS at a rate of 20 L/fed)]. The B_7

treatment resulted also, in the least infestations of *S. ocellatella* (4.17 larvae/10 plants) and *C. vittata* (22.61 larvae and adults/10 plants). In general, it was found that all compost tea treatments induced significantly less insect infestation than the untreated plots. In such concern, Bassyouny and Abou-Attia (1998) concluded that the application of organic manure attract greater numbers of *P. mixta* and *C. vittata.*

Data in Table (2) present the effect of interactions among mineral and organic fertilizers on the insect infestation in sugar beet plants. In 2010/11 season, *S. ocellatella* infestation was highest in plots that have not received any compost tea treatments; with values of 8.33, 14.00 and 18.00 larvae/10 plants at 60, 75 and 90 kg N/fed, respectively. In contrast, the lowest levels of beet moth infestation were detected in the plots treated with B_7 [B_1 (compost tea, soil drench, 40 DAS at a rate of 30 L/fed) followed by B_4 (compost tea, foliar, 60, 90 & 120 DAS at a rate of 20 L/fed)]. These values were 3.33, 3.00 and 5.00 larvae/10 sugar beet plants at 60, 75 and 90 kg N/fed, respectively. Usually, the plots treated with the highest dose of nitrogenous fertilizer had the highest *S. ocellatella* infestation whatever the compost tea treatment. This shows the dilutive effect of mineral nitrogenous fertilizer to the effect of compost tea treatments on *S. ocellatella* infestation. Data of the first season (2009/10) are not presented, because the statistical analysis revealed no significant effect to the interaction between mineral and organic fertilizer on the insect pest infestation. El-Wakeil and El-Sebai (2007) reported that the mixed inoculants strains of *Rhizobia, Mycorrhiza* and *Pseudomonas* improved the growth conditions of faba bean and caused 71.3% reduction in aphid population compared to the application of one isolate (64.0% aphid reduction). The authors recommended using the mixed inoculants as commercial inoculate for improving production of faba bean.

Table (2):Effect of mineral and bio fertilizer application on *S. ocellatella* infestation at the experimental farm of Sakha Agricultural Research Station.

	No. of insect/10 sugar beet plants		
	60 kg N/fed.	**75 kg N/fed.**	**90 kg N/fed.**
Bio fertilizer/fed			
B_1	7.33 fg	11.67 cd	17.67 a
B_2	7.00 fg	12.67 bc	14.67 b
B_3	7.67 f	6.67 fgh	14.00 bc
B_4	5.00 ghi	8.00 ef	12.33 bc
B_5	4.33 hi	6.67 fgh	10.00 de
B_6	4.33 hi	4.00 i	7.33 fg
B_7	3.33 i	3.00 i	5.00 ghi
B_8	8.33 ef	14.00 bc	18.00 a

B_1: Soil drench, 40 days after sowing (DAS), at a rate of 30 L/fed. **B_5:B_1 + B_2**
B_2: Foliar, 60 DAS, at rate of 20 L/fed. **B_6: B_1 + B_3**
B_3: Foliar, 60 and 90 DAS, at rate of 20 L/fed. **B_7:B1 + B_4**
B_4: Foliar, 60, 90 and 120 DAS, at rate of 20 L/fed.
B_8: Control (without compost treatments)

Data presented in Table (3) disclose the interaction effect of mineral and organic fertilizers on *C. vittata* infestation, during 2009/10 and 2010/11 seasons. Also, the plots free from compost tea treatments exhibited the highest levels of *C. vittata* infestations, with values of 51.00, 63.33 and 82.33 larvae/10 plants in 2009/10 season at 60, 75 and 90 kg N/fed, respectively. The corresponding values of the second season were 65.67, 58.00 and 87.33 larvae/10 plants, respectively.

Table (3):*C. vittata* infestation as affected by the interaction between bio fertilizer and mineral nitrogen levels.

Bio fertilizer/fed	2009/2010			2010/2011		
	60 kg/fed	75 kg/fed	90 kg/fed.	60 kg/fed	75 kg/fed	90 kg/fed.
B_1	49.67 eh	45.67 f-h	73.00 ab	44.33 ghi	41.33 g-j	71.67 b
B_2	49.67 eh	41.67 g-i	68.67 bc	48.00 fgh	40.33 h-j	67.67 bc
B_3	61.33 be	46.33 f-h	66.67 bc	57.67 de	37.33 i-h	63.67 cd
B_4	48.67 eh	44.00 gh	58.33 c-f	54.00 ef	34.67 j-k	58.00 de
B_5	20.00 j	36.33 hi	58.00 c-f	42.67 g-j	31.67 kl	55.67 ef
B_6	17.00 j	29.67 ij	48.67 e-h	41.00 g-j	25.00 lm	49.00 fg
B_7	3.33 k	23.67 j	39.67 g-i	21.00 m	12.00 n	36.00 jk
B_8	51.00 d-g	63.33 bcd	82.33 a	65.67 bc	58.00 de	87.33 a

B_1: Soil drench, 40 days after sowing (DAS), at a rate of 30 L/fed. B_5:B_1 + B_2
B_2: Foliar, 60 DAS, at rate of 20 L/fed. B_6: B_1 + B_3
B_3: Foliar, 60 and 90 DAS, at rate of 20 L/fed. B_7:B1 + B_4
B_4: Foliar, 60, 90 and 120 DAS, at rate of 20 L/fed.
B_8: Control (without compost treatments)

The least levels of infestations were detected in plots treated with B_7, with values of 3.33, 23.67, 39.67 in the first season, and 21.00, 12.00, and 36.00 larvae/10 plants at 60, 75 and 90 kg N/fed., respectively.

Data in Tables (4 & 5) show the effect of mineral and organic fertilizer and their interactions on insect infestation on sugar beet yield and juice purity characteristics. In 2009/10 season (Table 4), the insect complex infestations increased as the mineral nitrogenous levels increased. As for compost tea, the highest infestation (113.51 larvae & adults/10 plants) was detected in compost-free plots, while the lowest one was detected with B_7 (43.95), followed by the infestation in B_6 plots.

In Table (4), significant differences were detected among sugar percent in sugar beet roots due to the mineral nitrogenous fertilizers, with 75 and 90 kg N/fed being of higher influence in increasing the sugar percent. However, the mineral nitrogen had no significant effects on purity and sugar extractability %. Both root yield and sugar yield were significantly higher in plots treated with 90 kg N/fed, followed by those treated with 75 kg N, and then those of 60 kg N/fed.

4-5

Compost tea treatments resulted in highly significant differences in sugar percentage, purity, extractability %, root yield and sugar yield (Table 4). The highest sugar percentages, purity and extractability % were obtained with B_7 followed by B_6. Sodium and potassium ions play an important role on physiological equilibrium condition in cellular solution for sugar contents of sugar beet yield. Also the cations, Na and K and α-amino nitrogen are quantitatively and qualitatively important because they are the major non-sugar components in sugar beet roots and expressed as juice impurities and they affect the sugar beet roots quality. Now it's known that nitrogenous compound in sugar beet roots especially those containing α-amino nitrogen have a highly deleterious effect on juice purification and sugar crystallization (Jensen *et al.,* 1983 and Marcussen, 1985). Also, data in table 4 indicate that the levels of Na, K and α-amino nitrogen were highest (2.86, 5.43 and 2.72), respectively in the untreated plots. But, the lowest levels (1.47, 4.29 and 1.47, respectively) resulted in treated plots (B_7 followed by B_6). On the other hand, the highest root and sugar yield were obtained with B_7 and B_6. These results agree with those of Ingham (2005) who reported the role of spraying compost tea for reduction of plant infestations with the major insects, El-Gizawy (2005) concluded that the compost tea has a significant effect on plant protection and growth. Hegazy *et al*. (2010) indicated that cyano-bacterial enhances the soil biological activity in soils cultivated with common bean. It increases CO_2 evolution, dehydrogenase enzyme and nitrogenase enzyme activities. Results suggest that ¼ or ½ of the recommended dose of N mineral fertilizer could be saved by using some species of nitrogen fixing cyano-bacteria. Ibiene *et al*. (2012) reported that the consortium of three isolates of *Rhizobacteria* have given the best performance of plant height, stem width, root length and inter-node length of *Lycoeprsicon esculentum*.

Data of the second season (2010/11) took almost the same trend (Table 5).

From the previous results, it could be recommended to use compost tea, particularly as soil drench (30 L/fed.) at 40 days after sowing, followed by foliar spray of compost tea (20 L/fed.) at 60, 90 and 120 days after sowing. This application was superior in enhancing sugar beet yield and yield components, as well as in reducing insect infestation. It also confirmed that compost tea can be used as organic substrate additives in plant cultivation and substitute for chemical nitrogen fertilizers.

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تأثير استخدام الأسمدة الأزوتية المعدنية وشاى الكمبوست على الإصابات الحشرية فى بنجر السكر وخواص المحصول

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أجريت تجربة حقلية بالمزرعة البحثية بمحطة بحوث سخا خلال موسمى ٢٠١٠/٢٠٠٩ ، ٢٠١١/٢٠١٠ على محصول بنجر السكر لدراسة تأثير استخدام معدلات مختلفة من الأسمدة الأزوتية المعدنية وشاى الكومبوست على الإصابات الحشرية وبعض صفات الجودة لمحصول بنجر السكر

أدى استخدام السماد الأزوتى المعدنى بمعدل ٩٠ كجم للفدان إلى إحداث إصابة أعلى بحشرات ذبابة البنجر وفراشة البنجر و خنفساء البنجرالسلحفائية وذلك بالمقارنة بمعدلات ٦٠ و ٧٥ كجم أزوت للفدان. وعند اضافة شاى الكمبوست إلى التربة بمعدل ٣٠ لتر/فدان بعد ٤٠ يوماً من زراعة بنجرالسكر ، ثم استخدامه مرة أخرى رشاً على الأوراق عند ٦٠ و ٩٠ و ١٢٠ يوماً بعد الزراعة (بمعدل ٢٠ لتر/فدان فى كل مرة) ، حدث انخفاض للإصابات الحشرية ، وذلك بالمقارنة بعدم استخدام الكمبوست. كما أدى استخدام نفس معاملات الكمبوست السابقة مع ٦٠ كم أزوت معدنى إلى حدوث إصابات حشرية أقل وذلك بالمقارنة باستخدام ٩٠ كجم أزوت معدنى دون استخدام الكمبوست٠ ومن ناحية أخرى ، فإن استخدام شاى الكمبوست زاد من النسبة المئوية للسكر فى الجذور، وأدى أيضا إلى تحسين بعض صفات الجودة ، مثل زياة النقاوة ونسبة الاستخلاص وقلة معدل الشوائب المتمثلة في مركبات الألفا أمينو نيتروجين والصوديوم والبوتاسيوم علاوة على زيادة محصول كل من الجذور والسكر ومن هذه النتائج يمكن التوصية باستخدام شاى الكمبوست بمعدل ٣٠ لتر/فدان إضافة إلى التربة بعد ٤٠ يوما من زراعة بنجرالسكر ، ثم استخدامه بعد ذلك رشاً على النباتات بمعدل ٢٠ لتر/فدان بعد ٦٠ و ٩٠ و ١٢٠ يوماً من الزراعة ، للحصول على أقل إصابات حشرية وأعلى محصول لبنجر السكر كماً ونوعاً.

قام بتحكيم البحث

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Table (4):Relationship between average of insect infestation and yield characters of sugar beet plants under mineral and organic fertilization in 2009/10 season.

Fertilizer treatment Mineral nitrogen (kg/fed)	Av. No. of insect complex/ 10 plants	Sugar %	Purity %	extractability %	α-Amino N	Sodium	Potassium	Root yield (ton/fed)	Sugar yield (ton/fed)
60	69.62	18.91 b	92.84	86.41	1.93 b	1.69	5.31	23.02 c	4.05 c
75	69.92	20.53 a	93.49	83.81	1.52 c	1.89	5.02	29.37 b	5.64 b
90	103.93	20.02 a	93.56	83.65	2.24 a	2.14	4.31	32.24 a	6.04 a
F. test		*	**NS**	**NS**	**	**Ns**	**Ns**	**	**
Bio fertilizer/fed									
B_1	95.45	19.62 d	93.37 b	84.24e	1.91 bc	1.91 bc	4.73 g	26.10 c	4.79 d
B_2	92.34	19.61 d	93.41 ab	84.21f	1.99 b	1.64 cd	4.88 e	27.39 bc	5.05 cd
B_3	91.06	19.65 d	93.07 c	84.38d	1.84 cd	2.04 b	4.98 c	26.42 c	4.85 d
B_4	81.89	19.72cd	93.48 ab	84.38d	1.81cde	1.66 cd	4.90 d	29.52 ab	5.46 bc
B_5	70.72	19.93bc	93.33 bc	85.54 c	1.75 de	2.05 b	4.81 f	29.36 ab	5.48 bc
B_6	60.73	20.13 b	93.67 a	85.88b	1.70 e	1.65 cd	5.01 b	30.15 ab	5.71 ab
B_7	43.95	20.43 a	93.68 a	87.08a	1.47 f	1.47 d	4.29 h	31.66 a	6.08 a
B_8	113.51	19.73 d	92.37 d	81.28g	2.72 a	2.86 a	5.43 a	26.07 c	4.53 d
F	**	**	**	**	**	**	**	**	**

B_1: Soil drench, 40 days after sowing (DAS), at a rate of 30 L/fed. **B_5:B_1 + B_2**
B_2: Foliar, 60 DAS, at rate of 20 L/fed. **B_6: B_1 + B_3**
B_3: Foliar, 60 and 90 DAS, at rate of 20 L/fed. **B_7:B1 + B_4**
B_4: Foliar, 60, 90 and 120 DAS, at rate of 20 L/fed. **B_8: Control (without compost treatments)**

Table (5): Relationship between insect infestation and yield characters of sugar beet plants under mineral and organic fertilization in 2010/11 season.

Mineral nitrogen (kg/fed)	Av. No. of insect complex/10 sugar beet plants (L & A)	Sugar %	Purity %	extractability %	α-Amino N	Sodium	Potassium	Root weight (ton/fed)	Sugar yield (ton/fed)
60	69.62	19.53	93.22	83.06b	1.93 a	1.67 b	4.79 a	25.00 c	4.56 c
75	69.92	20.35	93.43	86.41a	1.91 a	1.89ab	5.02 a	28.88 b	5.50 b
90	103.93	20.01	93.16	83.81b	0.87 b	2.14 a	4.31 b	31.94 a	5.96 a
F. test		-	-	-	**	*	*	**	**
Bio fertilizer/ fed									
B_1	95.45	19.66d	93.21 bc	84.14 ef	2.94 a	0.93 bc	4.65 c	26.64 de	4.89 de
B_2	92.34	19.80cd	93.36 bc	84.08 f	1.62 c	1.70 c	4.63 c	28.19 cd	5.22 cd
B_3	91.06	19.87 d	93.13 c	84.29 df	0.89 d	2.03 b	4.79 bc	26.97 de	4.99 d
B_4	81.89	19.94 c	93.50 ab	84.39 d	2.30 b	1.74 bc	4.65 c	29.10 bc	5.43 c
B_5	70.72	20.22 b	93.47 ab	85.15 c	1.97 bc	1.91 bc	4.68 c	29.06 bc	5.49 bc
B_6	60.72	20.43 b	93.53 ab	85.59 b	01.62 d	1.65 cd	4.99 b	30.46 b	5.83 b
B_7	43.95	20.77 a	93.71 a	86.56 a	0.57 d	1.37 d	3.91 d	32.40 a	6.28 a
B_8	113.51	19.07 e	92.26 d	81.23 g	1.69 c	2.85 a	5.36 a	26.04 e	4.59 e
F		**	**	**	**	**	**	**	**

B_1: Soil drench, 40 days after sowing (DAS), at a rate of 30 L/fed. **B_5:B_1 + B_2**
B_2: Foliar, 60 DAS, at rate of 20 L/fed. **B_6: B_1 + B_3**
B_3: Foliar, 60 and 90 DAS, at rate of 20 L/fed. **B_7:B1 + B_4**
B_4: Foliar, 60, 90 and 120 DAS, at rate of 20 L/fed. **B_8: Control (without compost treatments)**