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EFFECT OF BIO AND MINERAL FERTILIZATION ON THE MAIN INSECT PESTS AND SOME CHARACTERS OF SUGAR BEET PLANTS

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ABSTRACT

Field studies were carried out at the experimental farm, Faculty of Agriculture, Kafr El-Sheikh University during two successive seasons; 2003/2004 and 2004/2005 to study the effect of mineral fertilizer and bio-fertilizers (Cerealine, Microbien and Phosphorine or mixture of three bio-fertilizers combined with mineral fertilizer) on major insect infestation for sugar beet and growth, yield and quality of roots.

Results showed that mineral fertilizer alone or combined with bio fertilizer highly significant increased the infestation with *Pegomyia mixta* Vill. compared with control. The highest population densities (1624 indiv. and 135 blotches/48 plants) were in treatment of 90 kg N/fed. followed by Cerealine + 46 kg N/fed. (666 indiv. and 99 blotches/48 plants). Population density of *Cassida vittata* Vill. highly significant increased on plants treated with biofertilizer plus 23 or 46 kg N/fed. compared with mineral fertilizer alone or control. Mixture of biofertilizers plus 46 kg N/fed. harboured the highest numbers (468 indiv./48 plants) of *Cassida vittata* Vill. The maximum population density of *Scrobipalpa ocellatella* Boyd. (73 larvae/48 plants) was recorded in control treatment, followed by biofertilizers plus 23 kg N/fed. While the lowest number of that insect was in treatment of 90 kg N/fed. Population density of jassids, *Empoasca* spp. highly significant increased on plants treated with mineral fertilizer followed by biofertilizer compared with control. In contrast, population density of *Nezara viridula* L. highly significant increased in treatments of bio and mineral fertilizer while insignificant at 90 kg N/fed. compared with control.

Results showed that biofertilization combined with mineral fertilization highly significant increased root length, root diameter and root & foliage weight of sugar beet plants compared with control treatment.

The highest root and foliage weight/plant (938.2 and 198.4g, respectively) were recorded in Cerealine combined with 70 kg N/fed. Phosphorine and Cerealine plus 70 kg N/fed highly significant and significant increased sucrose percentage (20.05 and 18.95%, respectively). Highly significant differences among treatments of mineral and biofertilizer were found for total soluble solids percent (T.S.S.%). Some treatments of bio and mineral fertilizer affected the quality of sugar beet juice such as potassium ions, sodium ions and α amino nitrogen and quality degree percentage.

Generally, it is concluded that Phosphorine or Cerealine or mixture plus 70 kg N/fed. are recommended for reducing major insect infestation for sugar beet and increasing root weight and sucrose percentages.

INTRODUCTION

Sugar beet (*Beta vulgaris* L.) provides about 40% of the world sugar production and represents the second source, after sugar-cane, for sugar production in Egypt. Improvement of sugar beet production can be achieved through optimizing the cultural practices such as fertilization. Nitrogen fertilizer is an essential element for sugar beet yield and quality. Biofertilization is a new approach of nitrogen fertilizer which may reduce the environmental pollution. In addition, biofertilizers play an important role in nitrogen fixation and plant nutrition as well as release of potassium and phosphorus in soil by introduced organisms (Brown, 1982 and Kennedy and Tchan, 1992).

The sugar beet plants attract numerous insect pests, that attraction rate could be affected by different doses of nitrogenous fertilization. Bassyouny (1987) and Bassyouny and Abou-Attia (1998) indicated that the infestations of most sugar beet insects were obviously related to the amount and source of applied fertilizer. Afify, *et al.* (1994) showed that inoculation of sugar beet seeds with nitrogen fixation bacteria alone or combined with mineral NPK fertilizer resulted in significant higher insect infestation than control treatment. Mesbah *et al*. (2002) indicated that the dressing of corn grains with the biofertilizers phosphorine & Rhizobacterine before sowing, lowered to some extent the levels of infestation by *Chilo Agamemnon* (Bles.) and *Ostrinia nubilalis* (Hb.), in comparison to the minerally fertilized corn plants. Relatively few studies evaluated the response of sugar beet to these bacteria and NPK fertilizers or major associated insect infestations under field conditions.

With respect to bio-mineral N-fertilizer effects, Favilli *et al*., (1993) noticed that inoculation of sugar beet seeds with *Azosprillum lipoperum* plus 60 kg N/ha improved the root weight compared with 100 kg N alone. Shabev *et al*. (1995) showed that inoculation of sugar beet seed with nitrogen fixation bacteria led to an increase in plant yield. Abu El-Fotoh *et al*. (2000) showed that the addition of biofertilizer with 50% of N mineral recommended dose produced significantly higher root yield and sugar beet quality affected sodium ions, potassium ions, α amino nitrogen and total sugar percentage. Nemeat-Alla (2004) concluded that inoculation of sugar beet seed with biofertilizers (Cerealine plus Phosphorine) or 90 kg N/fed. increase sugar beet yield.

The objectives of the present investigation are to study the effect of bio and mineral fertilizer combination compared to mineral fertilizer alone or control on : 1) population of some major sugar beet insect pests and 2) yield and quality parameters of sugar beet crop.

MATERIALS AND METHODS

Field studies were carried out at the experimental farm, Faculty of Agriculture, Kafr El-Sheikh University, during 2003/04 and 2004/05 growing season using Pleno variety of sugar beet to study the effect of biofertilizer, mineral fertilizer or their combination on major insect infestations, growth, yield and quality of sugar beet.

The experiments were laid out in a complete randomized block design with three replicates. Each plot (3×6 m^2) consisted of 6 rows; 6m long and 50 cm apart. During land preparation, superphosphate (15.5% P_2O_5) and potassium sulphate (48% K_2O) were incorporated into the soil at a rate of 100 and 50 kg/fed. respectively. Ammonium nitrate (33.5% N) at a rate of 90, 70, 46 or 23 kg/fed. was added in two equal splits, the first directly after thinning, and the second one month later. Sugar beet seeds were sown during the fourth week of November. At sowing, the seeds were inoculated with

Cerealine (*Azosprillum brasilens* Tarrand, Krieg and Döbereiner), Microbien (*Azotobacter chroococcum* Beijerinck) and Phosphorine (*Bacillus megatarium* de Bary) at rates of 600, 600 and 800 g per feddan, respectively. both Cerealine and Microbien contain nitrogen fixing bacteria, while phosphorine contains phosphate dissolving bacteria. Arabic gum was used as an adhesive agent of biofertilizers to sugar beet seeds. The mineral fertilizer alone or combined with biofertilizers were arranged in 16 treatments, in addition to control with three replicates (Table 1). The biofertilizers were supplied by Soil and Water Research Institute, Agricultural Research Center, Egypt.

Table (1): Applied bio and mineral fertilizers

Treatment No.	Kg/feddan				
1	Ammonium nitrate		90 kg		
2	Ammonium nitrate		70 kg		
3	Ammonium nitrate		46 kg		
4	Ammonium nitrate		23 kg		
5	Cerealine	600 g	+	Ammonium nitrate	70 kg
6	Cerealine	600 g	+	Ammonium nitrate	46 kg
7	Cerealine	600 g	+	Ammonium nitrate	23 kg
8	Microbien	600 g	+	Ammonium nitrate	70 kg
9	Microbien	600 g	+	Ammonium nitrate	46 kg
10	Microbien	600 g	+	Ammonium nitrate	23 kg
11	Phosphorine	800 g	+	Ammonium nitrate	70 kg
12	Phosphorine	800 g	+	Ammonium nitrate	46 kg
13	Phosphorine	800 g	+	Ammonium nitrate	23 kg
14	Cerealine	300 g	+	Microbien 300g +	Phosphorine 400g + Ammonium nitrate 70 kg
15	Cerealine	300 g	+	Microbien 300 g +	Phosphorine 400 g + Ammonium nitrate 46 kg.
16	Cerealine	300 g	+	Microbien 300 g +	Phosphorine 400 g + Ammonium nireate23 kg.
17	Control (without fertilizers)				

For insect investigation, eight samples of sugar beet plants were taken throughout the growing season. Two plants were taken from each plot, thus each treatment was represented by six plants in each sampling date and represented by 48 plants throughout the experimental period. each plant was examined for counting some major insects; *Pegomyia mixta* (eggs, maggots and blotches), *Cassida vittata* (larvae, pupae and adults), *Scrobipalpa ocellatella* (larvae), jassids *Empoasca* spp. (nymphs and adults) and *Nezara viridula* (nymphs and adults).

At harvesting, root length (cm.), root diameter (cm.), root weight (g.), foliage weight (g.) were estimated on nine plants (3 plants $\times$ 3 replicates) during both seasons, while sugar percentage, total soluble solids (T.S.S%), potassium ion (K %), Sodium ion (Na%), α-amino nitrogen % and quality degree percentage were determined at Sugar Delta Company during the second season. Data were statistically analyzed according to Duncan's Multiple Range Test (1955).

RESULTS AND DISCUSSION

1. Effect of bio and mineral fertilization on sugar beet insect infestation:

Data in Tables (2 and 3) show that the response of insect infestation to mineral fertilization alone or bio-fertilization combined with mineral fertilization during 2003/2004 and 2004/2005 seasons. Data in Table (4) present average of two season.

1.1. Sugar beet fly, *Pegomyia mixta* Vill.

Results in Tables (2 and 3) showed that the highest population densities of *P. mixta* (1550 and 1698 individuals/48 plants) during the first and second season, respectively were got from treatment receiving 90 kg N/fed. as recommended level of mineral fertilization, followed by Cerealine combined with 46 kg N/fed. (676 and 655 indiv./48 plants) and Microbien combined with 46 and 23 kg N/fed. (536 and 549 indivi.). Then, mixture of Bio-combined with 46 kg N/fed. (520 and 510 indiv.) and Phosphorine combined with 23 kg N/fed. (459 and 450 indiv.). While control treatment harboured the lowest population density of *P. mixta* (275 and 315 indiv.) compared with biofertilization and mineral fertilization. Concerning blotches of *P. mixta*, results in Tables (2 and 3) showed that the highest numbers of blotches were recorded in plots of 90 kg N/fed. (140 and 129 blotches) in the first and second seasons, respectively, followed by moderate numbers of blotches in treatments of biofertilization. While the lowest numbers of blotches were found in control treatment (42 and 54 blotches) in the first and second seasons, respectively. Data in Tables (2 and 3) revealed that the sugar beet plants fertilized with high rate of nitrogen (90 kg N/fed.) produced a large amount of foliage but were severely attacked by *P. mixta*, about three times higher compared with treatments of biofertilizer.

Results in Table (4) revealed that the highest average two seasons 2003/04 and 2004/05 for population density of *P. mixta* (1624 indiv./48 plants) and their blotches (135 blotohes/48 plants) were recorded in treatment receiving 90 kg N/fed. as chemical fertilizer. While Cerealine + 46 kg N/fed. gave the next highest population density (666 indiv. and 99 blotches/48 plants) followed by mixture of biofertilizer, Microbien and Phosphorine compared with control treatment (295 indiv. and 48 blotches/48 plants) while other treatments harboured lower average for population density of that insect.

Statistical analysis showed that the application of mineral fertilizer alone or biofertilizer combined with mineral fertilizer highly significant increased the infestation with *P. mixta* (Eggs, larvae and blotches) compared with control treatment.

The present results are in agreement with those obtained by Aly (1988) who revealed that sugar beet infestation with *P. mixta* increased at rates of 80 and 100 kg N/fed. Talha (2001) showed that the number of insects per sugar beet leaf increased by the increase of nitrogenous fertilization mainly *Spodoptera littoralis, P. mixta, Jassids* and *N. viridula* during late planting date. Affify, *et al*. (1994) showed that high population density of *P. mixta* was recorded in the treatment receiving mineral NPK fertilizers or single bacterial inoculants over two or three inoculants combinations, while the lowest population density was recorded in the untreated control.

1.2. Tortoise beetle, *Cassida vittata* Vill.

Data in Tables (2 and 3) showed that the maximum population density of *C. vittata* (467 and 487 indiv./48 plant) was recorded in the treatment receiving mixture of three inoculants combined with mineral fertilization (23 or 46 kg N/fed.) in the first and second seasons, respectively followed by treatments receiving Phosphorine (400 indiv.) and Microbien (397 indiv.) combined with 23 kg N/fed. in the first and second season respectively. Also, the highest population density of *C. vittata* was recorded in treatment receiving 23 and 46 kg N/fed. (309 and 299 indiv./48 plants) in the first and second seasons, respectively. Population density of *C. vittata* highly significant increased on plants treated with biofertilization (Cerealine, Microbien, Phosphorine and their mixture). plus mineral fertilization at a rate of 23 kg N/fed. compared with plants treated with mineral fertilization alone or control treatment, in the first season. While in the second season, highly significant differences were recorded between population density of *C. vittata* in mixture of biofertilizer treatments combined with 70, 46 or 23 kg /fed. and Microbien combined with 46 or 23 kg N/fed. while other treatments highly negative significant compared with control treatment.

Data in Table (4) indicated that the maximum average population density of *C. vittata* (468 indiv./48 plants) was recorded in treatment receiving mixture of biofertilizer combined with 46 kg N/fed. followed by Microbien, Phosphorine or Cerealine combined with 23 kg N/fed. (390, 360 and 338 indiv./48 plants respectively) compared with control treatment (319 indiv./48 plants). While treatments of chemical fertilizer came in the end. The lowest average population density of *C. vittata* (128 indiv./48 plants) was found in treatment receiving 90 kg N/fed.

Our results are in agreement with those found by Aly (1988) who reported that *C. vittata* was not affected with nitrogenous levels. Affify, *et al*. (1994) found that the plants inoculated with the three inoculants together hurboured the greatest mean numbers of *C. vittata* as compared to plants treated with two combined inoculant types. Also, it was noticed that the single inoculant of *Azotobacer chroococcum* gave the highest population density of *C. vittata* as compared with other inoculants, nitrogen fertilizer and control.

1.3. Sugar beet moth, *Scrobipalpa ocellutella* Boyd.

Data in Tables (2 and 3) showed that the highest population density of *S. ocellatella* (76 and 69 larvae/ 48 plants) was found in control in the first and second seasons, respectively, which might be due to the unhealthy plants, that contain small foliage and lead to increase number of *S. ocellatella*. The results cleared that the application of biofertilizers combine with low level of mineral fertilizer (23 kg N/fed.) increased population density of *S. ocellatella* compared with mineral fertilizer alone. The maximum population density of *S. ocellatella* (68 and 60 larvae/48 plants) was recorded in the treatment receiving Phosphorine combined with 23 kg N/fed., while mineral fertilizers (23 kg N/fed.) gave high population density of the insect (48 and 35 larvae/48 plants) compared with other mineral fertilization.

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The maximum average population density of *S. ocellatella* (73 larvae/48 plants) was recorded in control treatment Table (4), followed by Phosphorine (64 larvae), mixture of biofertilizer (57 larve), Microbien (55 larvae) and Cerealine (44 larvae) combined with 23 kg N/fed. Finally, mineral fertilizer at rate 23 kg N/fed. (42 larvae/48 plants) while, the lowest average population density was found in treatment 90 kg N/fed. (18 larvae/48 plants).

Statistical analysis showed highly negative significant differences between population density of *S. ocellatella* in treatments of mineral fertilizer alone and biofertilizer combined with different rates of mineral fertilizer (70, 46 and 23 kg N/fed.) compared with control treatment in both seasons.

The obtained results are in agreement with those obtained by Affify, *et al*. (1994) who indicated that the maximum population density of *S. ocellatella* was recorded from the untreated control treatment. Also, population density of the insect on plants receiving either mineral NPK fertilizer or single bacterial inoculant were higher over two or three inoculants combinations. Mesbah *et al*. (1985) indicated that nitrogen levels did not generally affect infestation levels significantly by *S. ocellatella*. Bassyouny and Abou-Attia (1998) found that application of organic manures alone produced dense foliage and greatly reduced number of the beet moth, *S. ocellatella*. Opposite results were obtained from application of organic manure with mineral fertilizer which produced small foliage and increased number of beet moth *S. ocellatella*.

1.4. Jassids, *Empoasca spp*.

Results in Tables (2 and 3) showed that the highest population density of jassids (nymphs and adults) (480 and 530 indiv./48 plants) were recorded in the treatment receiving 90 and 46 kg N/fed. in the first and second seasons, respectively, followed by Microbien + 46 or 23 kg N/fed. (352 and 372 indiv./48 plants). Then, treatment of Cerealine + 46 or 70 kg N/fed. (349 and 326 indiv./48 plants). Finally, treatments of Phosphorine and mixture of biofertilizer combined with 46 kg N/fed. hurboured lower population density of jassids 277 and 246 indiv. for Phosphorine and 269 and 233 indiv. for mixture of biofertilizer in both season respectively. While control treatment hurboured the lowest population density of Jassids (192 and 213 indiv./48 plants) in both season respectively. Generally, numbers of jassidas were lowers in treatments, of biofertilizers than in treatments of mineral fertilizers.

Results in Table (4) indicated that the maximum average population density of jassids (461 indiv./48 plants) were recorded in treatment of 46 kg N/fed., while treatments receiving biofertilizer combined with mineral fertilizer harboured low population density compared with mineral fertilizer alone. The lowest population density of jassids (175 indiv./48 plants) were found in treatment of Phosphorine combined with 70 kg N/fed.

Statistical analysis revealed highly significant differences among population density of jassids in treatments of mineral fertilizers alone or mixed with biofertilizers compared with control. Except, highly negative significant was recorded in treatments of Phosphorine and mixture of biofertilizer combined with 70 and 23 kg N/fed. then Serealine with 23 kg N/fed. in the second season.

1.5. The green stink bug, *Nezara viridula* L.

Data in Tables (2 and 3) showed that the highest population density of *N. viridula* (210 and 183 indiv./48 plants) was found in treatment receiving Microbien + 70 and 46 kg N/fed. in both season respectively, followed by mixture of biofertilizers combined with 46 kg N/fed. (164 and 84 indiv./48 plants) then, treatment of Phosphorine combined with 46 and 70 kg N/fed. (145 and 80 indiv./48 plants) in both seasons, respectively. Finally, treatment of Cerealine combined with 70 kg N/fed. harboured (102 and 73 indiv./48 plants). While control treatment harboured lower number of population density for *N. viridula* (48 and 33 indiv./48 plants). Results revealed that the sugar beet plants receiving 70 kg N/fed. as mineral fertilizer harboured the highest number of *N. viridula* (93 and 76 indiv./48 plants) in both seasons, respectively compared with other treatments.

Data in Table (4) revealed that the highest average population density of *N. viridula* (181 indiv./48 plants) were found in sugar beet plants treated with Microbien + 46 kg N/fed. followed by mixture of biofertilizer and Phosphorine combined with the same rate of mineral fertilizer (124 and 105 indiv./48 plants) respectively). On the other hand, mineral fertilizer showed low numbers of the insect compared with biofertilizer. The lowest average population density of *N. viridula* (41 indiv./48 plants) was recorded in control treatment.

Statistical analysis revealed highly significant differences among population density of *N. viridula* in all treatments of mineral fertilizer alone and biofertilizer combined with different rates of mineral fertilizer compared with treatment control in both season. Except insignificant difference was recorded in treatment 90 kg N/fed. as mineral fertilizer in both season.

The present results concerning the sucking insects are in line with those of Talha (2001) who indicated that the number of jassids and *N. viridula* increased by the increase of nitrogenous fertilization. Godfrey *et al*. (2000) showed that high levels of nitrogen can increase aphid populations. They indicated the possibility of using this as a cultural control measure. Gamieh and Saadoon (1998) indicated that the population density of the phytophagous mite, *Tetranychus cucurbitacearum* increased significantly with nodulation and N-fertilization recording the highest figure at 80 kg N/fed. Yanni *et al*. (1991) and Hegazy *et al*. (1997) indicated that increase of plant nitrogen content to a certain level was found to induce the severity of infestation with major soybean pests such as the red spider mite, *T. cucurbitacearum*.

2. Effect of Bio and mineral fertilization on sugar beet growth, yield and quality :

2.1. Root length and diameter :

Data in 152 (5) showed that the maximum root length/plant (27.5 cm.) was recorded in the treatment receiving Cerealine + 70 kg mineral N/fed. followed by Phosphorine + 46 kg N/ fed. (27 cm), The control treatment (without fertilizers) produced the shortest root (18.8 cm).

Results in Table (5) showed that maximum root diameter (11.4 cm) was recorded in the treatment receiving Phosphorine combined with 70 kg.

N/fed., while the minimum was recorded in the control (6.9 cm.). In general, sugar beet plants, which received 70 kg N/fed. alone as mineral fertilization or combined with bio-fertilization gave the biggest root diameter. The statistical analysis showed highly significant of differences among root length and root diameter values in all treatments of mineral fertilization alone and biofertilization combined with mineral fertilization.

These results are in agreement with those obtained by Afify *et al*. (1994) who indicated that bacterilization of sugar beet plants alone or in combination with mineral NPK fertilizer gave higher plant vegetative growth characters than untreated control. Bassal *et al*. (2001) and Badr (2004) indicated that root length and diameter at harvest were higher when sugar beet plants were treated by biofertilizer.

2.2. Root and foliage weight :

The maximum root weight/plant (938.2 g.) was recorded in the treatment receiving Cerealine + 70 kg N/fed., while the minimum (467.2 g.) was for control (Table 5). The bio-fertilization is responsible for increased nitrogen content by nitrogen fixing bacteria which lead to increase of root weight.

The maximum foliage weight per plant (198.4 g.) was recorded in the treatment receiving (Cerealine) combined with 70 kg N/fed., while the minimum (134.4 g.) was of control (Table 5). The application of three bio-fertilizers combined with 23 kg N/fed. gave the next high foliage weight (193 g.). Statistical analysis showed highly significant differences among treatments of mineral fertilization alone and biofertilization combined with mineral fertilization for root and foliage weight compared with control in the first season. While significant and insignificant differences were recorded between treatments compared with control treatment in the second season.

The current results are in agreement with those obtained by Afify *et al*. (1994) who found that inoculation of sugar beet seed with *Azotobacter chroococcum*, *Bacillus megaterium* and *Bacillus ceruleans* caused a significant increase in root and sugar yield. Suckhovitskaya (1998) reported that sugar beet seed inoculation with *Bacillus megaterium* increased crop yield by 23%. Cakmakci *et al*. (1999) found that seed inoculation of sugar beet with biofertilization increased sugar beet root in comparison to mineral fertilizer. Yields of root and sugar usually increased by the application of biofertilizers (Ali 2003 and Badr 2004).

2.3. Quality parameters :

The results presented in (Table 6) showed that the maximum sucrose (20.05%) was obtained in treatment receiving Phosphorine combined with 70 kg N/fed. followed by Cerealine combined with 70 kg N/fed. (18.95%) then by mineral fertilization at a rate of 46 kg N/fed. (18.90%). The remaining treatments and control produced low sucrose percentages.

Total soluble solids percentage (T.S.S. %) (Table 6) were higher in the treatment receiving mixture of three biofertilizers combined with 70 kg N/fed. (24.5%) followed by Microbien combined with 23 kg N/fed. (24%) and Phosphorine combined with 46 kg N/fed. (23.7%).

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Statistical analysis showed highly significant differences between Phosphorine plus 70 kg N/fed. and control, for sucrose %, while significant differences were found between both Serealine + 70 kg N/fed and 46 kg N/fed. compared with control. Highly significant differences were found among mineral or biofertilizer compared with control in case of total soluble solid percentages.

These results are in agreement with those obtained by Nureldin *et al*. (2002) reported that inoculation of sugar beet with biofertilizer in form of Azotobacterine and Phosphobactrine together with 75 kg N/fed. as mineral fertilizer gave the highest sucrose %, and purity%. Ali (2003) indicated that the percentage of T.S.S. and sucrose significantly increased with biofertilizer only.

Sodium and Potassium ions play an important role in physiological equilibrium condition in cellular solution for sugar contents in sugar beet yield. Data in Table (6) showed that the highest value of potassium ion in sugar beet roots (6.91%) was recorded for Phosphorine + 23 kg N/fed., followed by 46 kg N/fed. (6.90%) then Cerealine + 23 kg N/fed. (6.83%). Also, the highest value of sodium ion was recorded in Cerealine + 23 kg N/fed. (3.52%) followed by Microbien or Phosphorine + 23 kg N/fed. (3.49% each). Highly significant differences among treatments for potassium and sodium ions compared with control were recorded.

Data in Table (6) showed no clear cut trend due to sources of fertilizers (mineral alone or bio-mineral fertilizer) for α-amino nitrogen. Results showed that 70 kg N/fed. or mixture of biofertilizer combined with 23 kg N/fed. highly significant increased the quality degree percentage compared with control treatment. The highest values (82.9 and 82.3%) were recorded in treatment receiving 70 kg N and mixture of three biofertilizer plus 23 kg N/fed. respectively. These results are in agreement with those reported by Abu El-Fotoh *et al*. (2000) and Nureldin *et al*. (2002).

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تأثير التسميد الحيوى والمعدنى على الآفات الحشرية الرئيسية وبعض صفات نباتات بنجر السكر.

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نظراً لما يسببه التسميد المعدنى من تلوث للبيئة وارتفاع أسعاره حالياً يتم الإتجاه لدراسة التسميد الحيوى كبدائل صديقة للبيئة وترشيد استخدام الأسمدة الكيماوية. ولهذا الغرض أجريت الدارسة الحالية فى المزرعه البحثية لكلية الزراعة – جامعة كفرالشيخ خلال موسمين متتاليين ٢٠٠٣/٢٠٠٤، ٢٠٠٤/٢٠٠٥ بهدف دراسة تأثير الأسمدة الحيوية المصرية الجديدة مثل السريالين – الميكروبين (كمثبت للأزوت الجوى) – الفوسفورين (ميسر لعناصر الفوسفور – البوتاسيوم)، الخليط الحيوى مضافاً معها التسميد المعدنى بجرعات ٧٠، ٤٦، ٢٣كجم نتروجين/فدان. وكذلك التسميد المعدنى فقط وبنفس الجرعات السابقة بالإضافة الى ٩٠كجم نتروجين/فدان وهو المعدل الموصى به على أهم الآفات الحشرية التى تهاجم نباتات بنجر السكر على مدار الموسمين وصفات النمو ومحصول الجذور والعرش الأخضر عند الحصاد للموسمين كما درست تأثير هذه الأسمدة على جودة المحصول عند الحصاد فى الموسم الثانى.

وتم الحصول على النتائج التالية :

1- درجة الإصابة الحشرية بأهم حشرات بنجر السكر :

- أوضح التحليل الأحصائى أن التسميد المعدنى فقط أو التسميد الحيويى مختلطاً مع التسميد المعدنى يزيد بدرجة عالية المعنوية من الإصابة بذبابة البنجر (بيض، يرقات وأنفاق) مقارنة بالكنترول حيث وجدت أعلى كثافة عددية للحشرة (١٦٢٤ فرد، ١٣٥ نفق/٤٨نبات) فى معاملة ٩٠كجم نتروجين/فدان ثم تلاها معاملة السريالين + ٤٦كجم نتروجين/فدان (٦٦٦ فرد، ٩٩ نفق/٤٨ نبات) مقارنة بالكنترول (٢٩٥ فرد، ٤٢ نفق/٤٨ نبات).
- الكثافة العددية لخنفساء البنجر السلحفائية تزداد بدرجة عالية المعنوية على نباتات بنجر السكر المعاملة بالتسميد الحيوى مضافاً إلية ٢٣ أو ٤٦كجم نتروجين/فدان مقارنة بالتسميد المعدنى فقط أو الكنترول.

ومعاملة الخليط الحيوى (سريالين + ميكروبين + فوسفورين) + ٤٦كجم نتروجين/فدان أحتوت على أعلى كثافة عددية لخنفساء البنجر (٤٦٨ فرد/٤٨ نبات).

- سجلت أعلى كثافة عددية لفراشة البنجر (٧٣ يرقة/٤٨ نبات) فى معاملة الكنترول، تلاها التسميد الحيوى مضافا اليه ٢٣كجم نتروجين/فدان. بينما كان أقل تعداد لهذه الحشرة فى المعاملة ٩٠كجم نتروجين/فدان (١٨ يرقة/٤٨ نبات).
- الكثافة العددية للجاسيد ازدادت بدرجة عالية المعنوية على نباتات بنجر السكر المعاملة بكل النسب للتسميد المعدنى ثم تلاها معاملات التسميد الحيوى مقارنة بالكنترول حيث كان أعلى تعداد لهذه الحشرة (٤٦١فرد/٤٨نبات) فى معاملة ٤٦ كجم نتروجين/فدان.
- على العكس، الكثافة العددية للبقة الخضراء ازدادت بدرجة عالية المعنوية بمعاملة النباتات بالتسميد الحيوى مختلطاً بالتسميد المعدنى والتسميد المعدنى فقط حيث سجل أعلى تعداد للحشرة (١٢٤ فرد/٤٨ نبات) فى معاملة الخليط الحيوى مع ٤٦كجم نتروجين/فدان بينما كانت الفروق غير معنوية فى المعاملة ٩٠كجم نتروجين/فدان مقارنة بالكنترول.

2- **صفات النمو والمحصول :** أظهرت النتائج أن التسميد النتروجينى والتسميد الحيوى مختلطاً بالتسميد النتروجينى تزيد بدرجة عالية المعنوية طول الجذر، قطر الجذر، وزن الجذر والعرش الأخضر لنباتات بنجر السكر عند الحصاد فى كلا الموسمين مقارنة بمعاملة الكنترول. حيث وجد أعلى وزن لجذر النبات (٩٣٨,٢جم) ووزن العرش الأخضر (١٩٨,٤جم) فى معاملة السريالين مختلطاً مع ٧٠كجم نتروجين/فدان.

3- **صفات الجودة :** أوضحت النتائج أن معاملة التسميد الحيوى (فوسفورين + ٧٠كجم نتروجين/فدان) أدت الى زيادة نسبة السكر بدرجة عالية المعنوية (٢٠,٠٥%) فى جذور بنجر السكر. وبدرجة معنوية فى معاملة السريالين مختلطاً مع نفس نسبة التسميد المعدنى (١٨,٩٥%). ووجدت فروق عالية المعنوية بين معاملات التسميد المعدنى والحيوى لمحتوى المواد الصلبة الذائبة الكلية (T.S.S.%) .كما أظهرت النتائج أن بعض معاملات التسميد المعدنى والحيوى أدت الى جودة العصير فى جذور بنجر السكر من خلال تأثيرها على محتواه من أيونات البوتاسيوم والصوديوم وألفاً أمين نيتروجين.

وبصفة عاملة يمكن الإستنتاج بأن التسميد الحيوى لنباتات بنجر السكر بأحد الأسمدة الأتية: الفوسفورين أو السريالين أو الخليط الحيوى الثلاثى مضافاً إليه ٧٠كجم نتروجين/فدان يمكن التوصية به لخفض الإصابة الحشرية بأهم الحشرات التى تهاجم نباتات بنجر السكر (ذبابة البنجر، خنفساء البنجر و فراشة البنجر) وزيادة وزن الجذور ـ نسبة السكروز ـ ترشيد استخدام الأسمدة الكيماوية وتقليل تلوث البيئة.

Table (2): Effect of Bio and mineral fertilization on the main insect pests population which attacking sugar beet at Kafr El-Sheikh during season 2003/04.

Insect infestation		Mineral nitrogen (kg)				Cerealine + mineral N (kg)			Microbien + mineral N (kg)			Phosphorine + mineral N (kg)			Three biofertilizers + mineral N (kg)			Control	L.S.D 5/% 1%
		90	70	46	23	70	46	23	70	46	23	70	46	23	70	46	23		
Pegomyia mixta	Eggs	1030	590	630	348	200	341	145	150	250	110	155	167	144	132	220	158	107	
	Larvae	520	415	325	230	240	335	210	240	286	200	169	220	315	225	300	243	168	
	Total	1550k	1005j	955i	578g	440e	676h	350f	390d	536f	310b	324b	387d	459e	357c	520f	401d	275a	22.68 30.26
	Blotches	140k	115j	101i	80efg	84g	98i	72cd	83fg	99i	64b	69bc	78ef	103i	65b	92h	76de	42a	5.31 7.08
Cassida vittata	Larvae	52	120	150	142	100	115	168	170	175	189	125	192	210	240	248	260	163	
	Pupae	12	16	20	40	30	38	46	42	32	49	38	41	56	58	64	52	25	
	Adults	75	100	110	127	80	117	143	96	125	145	119	124	134	131	137	155	103	
	Total	139a	236bc	280c-f	309efg	210b	270cde	357gh	308efg	332fg	383hi	282c-f	357gh	400hij	429ijk	449jk	467k	291def	47.88 63.87
Scrobipalpa. ocellatella (Larvae)		22a	29cd	39e	48g	24ab	31d	43f	28cd	39e	52h	26bc	51gh	68j	31d	42ef	63i	76k	3.45 4.60
Jassids (nymphs+adults)		480m	420L	391k	342i	296g	349j	301g	258d	352j	315h	193a	277f	228c	206b	269e	223c	129a	5.63 7.51
N. viridula (nymphs+adults)		51a	93f	68c	57b	102g	80e	72d	210n	179m	110h	105g	145k	91f	141j	164L	115i	48a	3.67 4.90

Means followed by a common letter are not significantly different at the 5% level by DMRT.

Table (3): Effect of Bio and mineral fertilization on the main insect pests population which attacking sugar beet at Kafr El-Sheikh during season 2004/05.

Insect infestation		Mineral nitrogen (kg)				Cerealine + mineral N (kg)			Microbien + mineral N (kg)			Phosphorine + mineral N (kg)			Three biofertilizers + mineral N (kg)			Control	L.S.D 5% 1%
		90	70	46	23	70	46	23	70	46	23	70	46	23	70	46	23		
Pegomyia mixta	Eggs	1217	666	744	431	175	352	135	96	127	278	87	187	121	118	234	147	99	
	Larvae	481	392	318	218	257	303	220	189	275	271	178	214	329	208	276	222	216	
	Total	1698k	1058j	1062j	649i	432f	655i	355d	285b	402e	549h	265a	401e	450f	326c	510g	369d	315c	19.73 26.32
	Blotches	129h	102g	90f	63c	72d	100g	60c	52b	72d	81e	47a	60c	91f	54b	79e	61c	54b	3.97 5.29
Cassida vittata	Larvae	43	101	174	34	117	133	152	189	189	216	103	175	185	325	238	291	200	
	Pupae	5	12	6	2	20	22	32	31	27	45	22	28	40	48	40	43	29	
	Adults	69	85	119	107	97	91	135	106	143	136	90	106	94	114	126	113	117	
	Total	117a	198c	299g	143b	234e	246f	319i	326j	359L	397m	215d	309h	319i	404n	487p	447o	346k	5.67 7.56
Scrobipalpa ocellatella Larvae		14a	17b	29d	35e	25c	33e	44f	26c	35e	58i	34e	46fg	60i	25c	48g	51h	69j	2.83 3.77
Jassids nymphs+adults		418m	456n	530o	333k	326j	284i	204d	227f	275h	372L	157a	246g	185b	193c	233f	186b	213e	6.75 9.00
Nezara viridula nymphs+adults		33b	76h	47c	45c	73gh	28a	63de	130k	183L	60d	80i	64e	69f	82ij	84j	71fg	33b	3.49 4.65

Means followed by a common letter are not significantly different at the 5% level by DMRT.

Table (4): Effect of Bio and mineral fertilization on the average numbers of the main insect pests population which attacking sugar beet at Kafr El-Sheikh during two seasons 2003/04 and 2004/05.

Insect infestation			Mineral nitrogen (kg)				Cerealine + mineral N (kg)			Microbien + mineral N (kg)			Phosphorine + mineral N (kg)			Three biofertilizers + mineral N (kg)			Control
			90	70	46	23	70	46	23	70	46	23	70	46	23	70	46	23	
Pegomya. mixtra	Eggs + larvae	2003/2004	1550	1005	955	578	440	676	530	390	536	310	324	387	459	357	520	401	275
		2004/2005	1698	1058	1062	649	432	655	355	285	402	549	265	401	450	326	510	369	315
		Mean	1624	1032	1009	614	436	666	443	338	469	430	295	394	455	342	515	385	295
	Blotches	2003/2004	140	115	101	80	84	98	72	83	99	64	69	78	103	65	92	76	42
		2004/2005	129	102	90	63	72	100	60	52	72	81	47	60	91	54	79	61	54
		Mean	135	109	96	72	78	99	66	68	86	73	58	69	97	60	86	69	48
Cassida. vittata (Larvae + pupae + adults)		2003/2004	139	236	280	309	210	270	357	308	332	383	282	357	400	429	449	467	291
		2004/2005	117	198	299	143	234	246	319	326	359	397	215	309	319	404	487	447	346
		Mean	128	217	290	226	222	258	338	317	346	390	249	333	360	417	468	457	319
Scrobipalpa cellatella (Larvae)		2003/2004	22	29	39	48	24	31	43	28	39	52	26	51	68	31	42	63	76
		2004/2005	14	17	29	35	25	33	44	26	35	58	34	46	60	25	48	51	69
		Mean	18	23	34	42	25	32	44	27	37	55	30	49	64	28	45	57	73
Jassids (nymphs +adults)		2003/2004	480	420	391	342	296	349	301	258	352	315	193	277	228	206	269	223	192
		2004/2005	418	456	530	333	326	284	204	227	275	372	157	246	185	193	233	186	213
		Mean	449	438	461	338	311	317	253	243	314	344	175	262	207	200	251	205	203
Nezara viridula (nymphs + adults)		2003/2004	51	93	68	57	102	80	72	210	179	110	105	145	91	141	164	115	48
		2004/2005	33	76	47	45	73	28	63	130	183	60	80	64	69	82	84	71	33
		Mean	42	85	58	51	88	54	68	170	181	85	93	105	80	112	124	93	41

Table (5): Effect of Bio and mineral nitrogen fertilization on growth and yield characters of sugar beet plants at Kafr El-Sheikh during 2003/04 and 2004/05 seasons (Average of two seasons).

Growth characters		Mineral nitrogen (kg)				Cerealine + mineral N (kg)			Microbien + mineral N (kg)			Phosphorine + mineral N (kg)			Three biofertilizers + mineral N (kg)			Control	LSD 5% 1%
		90	70	46	23	70	46	23	70	46	23	70	46	23	70	46	23		
Root Length (cm)	2003/2004	26.5g	24.2d	22.6c	21.2b	25.8efg	25.9efg	24.2d	22.6c	22.8c	22.2bc	24.0d	26.3fg	24.9de	26.3fg	26.5g	25.2def	17.8a	1.13 1.50
	2004/2005	26.5def	26.8def	24.5c	21.8b	29.2i	28.4ghi	28.7hi	26.0de	26.0de	24.8c	28.3ghi	27.7fgh	27.3fg	26.5def	26.9ef	25.6cd	19.8a	1.11 1.48
	Mean	26.5	25.5	23.6	21.5	27.5	27.2	26.1	24.3	24.4	23.5	26.2	27.0	26.1	26.4	26.7	25.4	18.8	
Root diameter (cm)	2003/2004	10.3ef	9.4d	8.8c	8.1b	10.9g	10.5fg	9.8de	9.8de	9.8de	8.0b	10.6fg	10.0e	9.9de	11.1g	10.7fg	10.3ef	6.9a	0.53 0.70
	2004/2005	11.8ef	11.4def	8.2b	8.6b	11.0cde	10.9cde	10.4cd	10.2c	10.6cd	8.6b	12.1f	10.5cd	10.7cd	10.3c	10.1c	9.1b	6.9a	0.87 1.17
	Mean	10.05	10.4	8.5	8.4	11.0	10.7	10.1	10.0	10.2	8.3	11.4	10.3	10.3	10.7	10.4	9.7	6.9	
Root Weight (g)	2003/2004	882.7fg	828.7e	769.7c	623b	983.3j	933.7i	878f	940.7i	872f	778.7e	900gh	837.7e	904.3gh	943.3i	940i	931i	480.3a	23.11 30.83
	2004/2005	983b	876b	893b	624ab	893b	939b	934b	880b	890b	860b	974b	909b	916b	929b	803ab	744ab	454a	344.8 459.9
	Mean	932.9	852.4	831.4	623.5	938.2	936.4	906	910.4	881	819.4	937	873.4	910.2	936.2	871.5	837.5	467.2	
Foliage Weight (g)	2003/2004	188i	161c	172.3e	156.3b	199h	195.3i	192k	197.3m	181.7f	170.3d	189j	186.3h	185.3g	213.7p	213o	197.7m	145.7a	0.62 0.82
	2004/2005	187.4a	160.1a	156.4a	157.6	197.7a	192.3a	155.1a	165.3a	176.3a	193.4a	183.9a	188.9a	195.3a	165.4a	153.1a	188.3a	123.0	299.7 399.9
	Mean	187.7	160.6	164.4	157	198.4	193.8	173.6	181.3	179	181.9	186.5	187.6	190.3	189.6	183.1	193	134.4	

Means followed by a common letter are not significantly different at the 5% level by DMRT.

Table (6):Effect of Bio and mineral nitrogen fertilization on quality parameters of sugar beet roots (at harvest) at Kafr El-Sheikh during 2004/05 season.

Quality parameters	Mineral nitrogen (kg)				Cerealine + mineral N (kg)			Microbien + mineral N (kg)			Phosphorine + mineral N (kg)			Three biofertilizers + mineral N (kg)			Control	LSD 5% 1%
	90	70	46	23	70	46	23	70	46	23	70	46	23	70	46	23		
Sucrose %	17.65abc	18.60def	18.90ef	17.70a-d	18.95f	18.80ef	17.75a-d	17.25ab	18.60def	17.15a	20.05g	18.50gf	17.60ab	18.50gf	18.0a-e	18.70ef	18.10b-f	0.80 1.06
Total soluble solid %	23.5de	23.0cd	23.0cd	22.5bc	22.5bc	23.0cd	23.5de	23.0cd	23.0cd	24.0ef	23.5de	23.7e	22.5bc	24.5f	22.5bc	22.0ab	21.5a	0.58 0.77
Potassium ion %	6.04bcd	5.66ab	6.90f	6.46gf	6.79ef	6.13bcd	6.83ef	6.67def	5.76ab	6.57def	6.24b-e	5.89bc	6.91f	5.78b	6.14bcd	5.76b	5.14a	0.55 0.74
Sodium ion %	3.11cde	2.31a	3.10cde	2.44ab	3.23de	2.95b-e	3.52e	3.26de	2.68a-d	3.49e	3.09cde	2.64a-d	3.49e	3.23de	3.0b-e	2.49abc	2.27a	0.54 0.72
α-amino nitrtogen %	1.95abc	1.66a	3.24e	2.61d	2.25c	1.99abc	3.18e	2.78d	1.97abc	2.77d	2.66d	1.88ab	3.21e	2.16bc	2.10bc	1.97abc	2.23bc	0.31 0.41
Quality %	79.5cd	82.9h	78.7bc	79.7cde	79.2cd	78.6bc	76.7ab	77.1ab	81.9fgh	76.7ab	81.3d-h	81.7e-h	76.4a	80.6c-g	79.9c-f	82.3gh	79.4cd	1.88 2.51

Means followed by a common letter are not significantly different at the 5% level by DMRT.