



INFLUENCE OF POTASSIUM FERTILIZATION ON THE INCIDENCE OF SUCKING INSECT PESTS ON CUCUMBER

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ABSTRACT

Experiments were conducted in Fayoum Governorate, to study the effect of potassium (K) fertilization on the incidence of *Aphis gossypii* (Glover), *Bemisia tabaci* (Gennadius), *Nezara viridula* (L), *Phenacoccus solenopsis* (Tinsley), *Thrips tabaci* (Lindeman), *Myzus persicae* (Sulzer), *Empoasca decedens* (Paoli), and *Empoasca decipiens* (Paoli) in cucumber during March planting season of 2018 and 2019. Three levels of potassium (25, 50 and 75 kg/ feddan) were used with a fertilizer containing 24% K₂O. The control had no potassium (0 kg). The incidence rates of all the pests was observed to be maximum with nil potassium (0 kg) fields (30.8% and 30.6%). The least incidence was observed with 75 kg potassium (19.3% and 19.1%) indicating that increased potassium reduced incidence of some sucking pests.

Key words: Cucumber, *Aphis gossypii*, *Bemisia tabaci*, *Nezara viridula*, *Phenacoccus solenopsis*, *Thrips tabaci*, *Myzus persicae*, *Empoasca decedens*, *Empoasca decipiens*, potassium levels, fertilizer, Egypt

Piercing-sucking insect pests pose a significant threat in cucumber crop, as they can cause both direct and indirect economic damage. These pests, including *A. gossypii*, *M. persicae*, *E. decipiens*, *E. decedens* and *B. tabaci* have a feeding mechanism that involves piercing the plant tissues and extracting the sap, resulting in weakened and damaged plants. Additionally, they can transmit plant viral diseases, further exacerbating the economic impact on cucumber crops (Fereses and Moreno, 2009). The study found effect the different rates of potassium fertilization on population of *Rhopalosiphum maidis* (Fitch), *Rhopalosiphum padi* (Linnaeus), *A. gossypii* (Glover), the leafhoppers were *E. decipiens* (Paoli), *E. decedens* (Paoli), *Cicadellina chinai* (Ghau), *Cicadellina bipunctella zea* and *Balclutha hortensis* (Lindberg) and the planthoppers were *Sogatella vibix* (Haupt) and *Sogatella furcifera* (Horváth). The highest numbers of insects were observed at the zero potassium fertilization rate (F1), while the lowest numbers were recorded at the highest rate (F4) K₂O/ feddan (an Egyptian unit of land measurement).

Moreover, chemical analyses demonstrated a positive correlation between total protein, carbohydrate content, k values, and epidermal cell thickness with the potassium fertilization rates. Conversely, a negative relationship was found between pH values and potassium fertilization. The fertilization also had a significant impact on six amino acids (aspartic acid, glutamic acid, glycine, alanine, isoleucine, and

leucine), which affected the attractiveness of the insect species. This may explain the decrease in insect numbers with increasing rates of fertilization. Based on these findings, potassium fertilization is recommended as an effective component in IPM for maize (Ata et al., 2022; Hegab and Hegab, 2020), and barley (Elsamed and Eisa, 2017)

In cucumber and squash increasing the amount of potassium fertilizer caused a reduction in the population density of *A. gossypii*, *B. tabaci* and *Earias insulanain* in cotton (Hegab and Hegab, 2009) Awad (2022) investigated the influence of potassium fertilizer and organic nutrient (Reef Amirich) on the population density of *B. tabaci* and *T. tabaci*. Results showed that potassium sulphate fertilization rates (50, 100 and 150 kg/ ha) and organic nutrient (0.8 and 1.6ml/ l) reduced the population of *B. tabaci* and *T. tabaci*. The treatment of 150 kg/ ha from potassium fertilizer and 1.6 ml/ l from organic nutrient led to the highest density of nymphs (Al-Khazraji et al., 2018). Increasing the potassium fertilization rates between 25 and 75 kg/ feddan led to a significantly decrease in the population density of *Rhopalosiphum padi* (Awadalla et al., 2019). The population density of *Empoasca* spp. increased significantly with nitrogen fertilization. She also found that with increasing potassium fertilization significant decrease in the population density of *Empoasca* spp. was detected (Mansour, 2017). The present study aims to evaluate the effect of potassium fertilization on the

sucking insect pests as fertilizers can influence the nutritional status of plants.

MATERIALS AND METHODS

The present experiments were carried out in an area of approximately 800 m². The area was carefully selected and divided into 16 plots, which considered as replicates (each replicate was 42 m²) and was used to grow cucumber during March planting season in both 2018 and 2019. To study the effects of potassium fertilization (K), three levels of potassium were applied using a fertilizer containing 24% K₂O. The three levels used were 25 kg/ feddan (a unit of land area), 50 kg/ feddan and 75 kg/ feddan. The control group received no potassium treatment, representing a zero potassium level. Phosphorus (P) was applied in the form of calcium superphosphate (containing 15% P₂O₅) with 150 kg/ feddan. Nitrogen was supplied as urea (with 46% N) with 200 kg/ feddan. The potassium fertilizer was applied three times: first during the cultivation stage, then with the first irrigation, and finally with the second irrigation. The phosphorus fertilizer was added during soil preparation before planting, and all the nitrogen fertilizer was applied at the time of planting. All recommended agricultural practices were followed, excluding the use of pesticides. Four replicates were used for each potassium level and they were distributed randomly in a complete block design. After two weeks

of the cucumber seeds were planted sampling began and continued until the end of the growing season.

Two methods were employed to collect the samples: Leaf sample method, with 25 leaves randomly selected from each plot on a weekly basis. During this method, various stages of pests such as *A. gossypii* and *M. persicae* nymphs and pupae of *B. tabaci*, nymphs of *T. tabaci*, and nymphs and pupae of *P. solenopsis* were recorded. Sweep net method, involved taking 25 double strokes with a sweep net from each plot on a weekly basis. The strokes were made in two diagonal directions, resulting in a total of 100 double strokes. This method focused on capturing the adult stage of *E. decipiens* and *E. decedens* and the nymphal and adult stages of *N. viridula*. Once collected, the samples were carefully placed in plastic bags and transported to the laboratory for identification and counting purposes. The results were analyzed by one-way ANOVA and means separated using Duncan's Multiple Range Test. All analyses were performed using CoStata software.

RESULTS AND DISCUSSION

The results in Table 1 show the influence of potassium fertilization rates on the number of the major sucking insects. Lowest number was recorded in fields fertilized by 75 kg of potassium; *N. viridula* followed by *P. solenopsis* and the *T. tabaci* had the lowest numbers

Table 1. Effect of potassium on the incidence of major sucking pests in cucumber (2018, 2019), Fayoum Governorate, Egypt

Insect Pests	Year	Potassium levels			
		zero kg	25 kg	50 kg	75 kg
<i>A. gossypii</i>	2018	526.2± 98.42 a	492.4± 91.33 b	446.7± 86.13 c	397.8± 72.50 d
	2019	646.8± 107.5 a	617.3± 109.4 b	575.2± 102.6 c	481.4± 86.46 d
<i>M. persicae</i>	2018	229.2± 36.71 a	185.1± 31.62 b	146.2± 28.35 c	107.6± 19.37 d
	2019	245.8± 36.98 a	216.3± 33.51 b	151.1± 27.49 c	114.4± 17.82 d
<i>B. tabaci</i>	2018	456.1± 113.4 a	418.6± 98.92 b	374.2± 92.22 c	331.7± 68.19 d
	2019	538.5± 123.6 a	494.8± 115.6 b	447.2± 111.8 c	396.4± 88.35 d
<i>T. tabaci</i>	2018	163.7± 26.51 a	137.2± 23.70 b	118.5± 19.97 c	99.3± 18.34 c
	2019	124.1± 23.15 a	96.8± 22.41 b	79.6± 18.97 c	51.2± 16.83 d
<i>P. solenopsis</i>	2018	88.2± 16.83 a	64.7± 12.66 b	50.4± 11.96 c	32.1± 06.48 d
	2019	127.1± 20.66 a	93.7± 19.13 b	69.5± 15.00 c	45.3± 11.57 d
<i>E. decipiens</i>	2018	194.2± 32.44 a	163.4± 29.37 b	121.1± 30.54 c	102.3± 13.92 d
	2019	165.3± 34.28 a	131.1± 33.71 b	106.4± 28.89 bc	88.7± 16.49 c
<i>E. decedens</i>	2018	233.8± 46.12 a	197.1± 41.91 b	162.9± 36.46 c	121.3± 19.75 d
	2019	197.3± 35.19 a	150.2± 31.84 b	137.8± 32.79 bc	103.1± 24.56 c
<i>N. viridula</i>	2018	52.1± 10.34 a	39.2± 08.23 b	33.5± 08.29 bc	27.6± 05.92 c
	2019	37.9± 08.52 a	31.4± 06.83 b	25.7± 06.90 bc	18.9± 04.37 c

Number for each insect in a row followed by the same letters not-significantly different (p=0.05)

and presented by 27.6 ± 5.92 , 32.1 ± 6.48 , and 99.3 ± 18.34 individuals/ sample, respectively. The effect of potassium fertilization rates on the major sucking insects in cucumber growing in March sowing date during 2019 also revealed similarity less number of pests with 75 kg of potassium fertilizer / feddan-*N. viridula* followed by *P. solenopsis* and *T. tabaci* recorded the lowest numbers.

The occurrence rate for the target insects on cucumber in relation to potassium fertilization treatments during 2018 and 2019 when analysed reveal that occurrence pests was more in fields which did not receive potassium. The least occurrence for all insects was recorded in fields which received 75 kg of potassium. *A. gossypii* and *B. tabaci* showed the largest numbers at each potassium treatment. While, *N. viridula*, *P. solenopsis* and *T. tabaci* had the lowest numbers. Thus, occurrence of insect pests decreased with increasing potassium fertilization levels. The statistical analysis revealed that there were significant differences in the incidence of pest in the different levels of potassium fertilization during 2018 and 2019. These results agree with earlier ones (Yousef, 2006; Al-Habashy, 2008; Mansour, 2017) on wheat; Hasham et al. (2009) on broccoli; Abou-Zaid (2011) on kidney-bean, and Awadalla et al. (2020) on eggplant. The high level of K fertilizer minimizes the magnitude of accumulated amino acids that in turn can reduce the population of sucking insects (Jansson and Ekbohm, 2002).

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AUTHOR CONTRIBUTION STATEMENT

Wahsh conducted the experiments and wrote the paper. Awadalla, El-Serafi and El-Hariry discussed the results and reviewed the paper.

CONFLICT OF INTEREST

No conflict of interest.

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