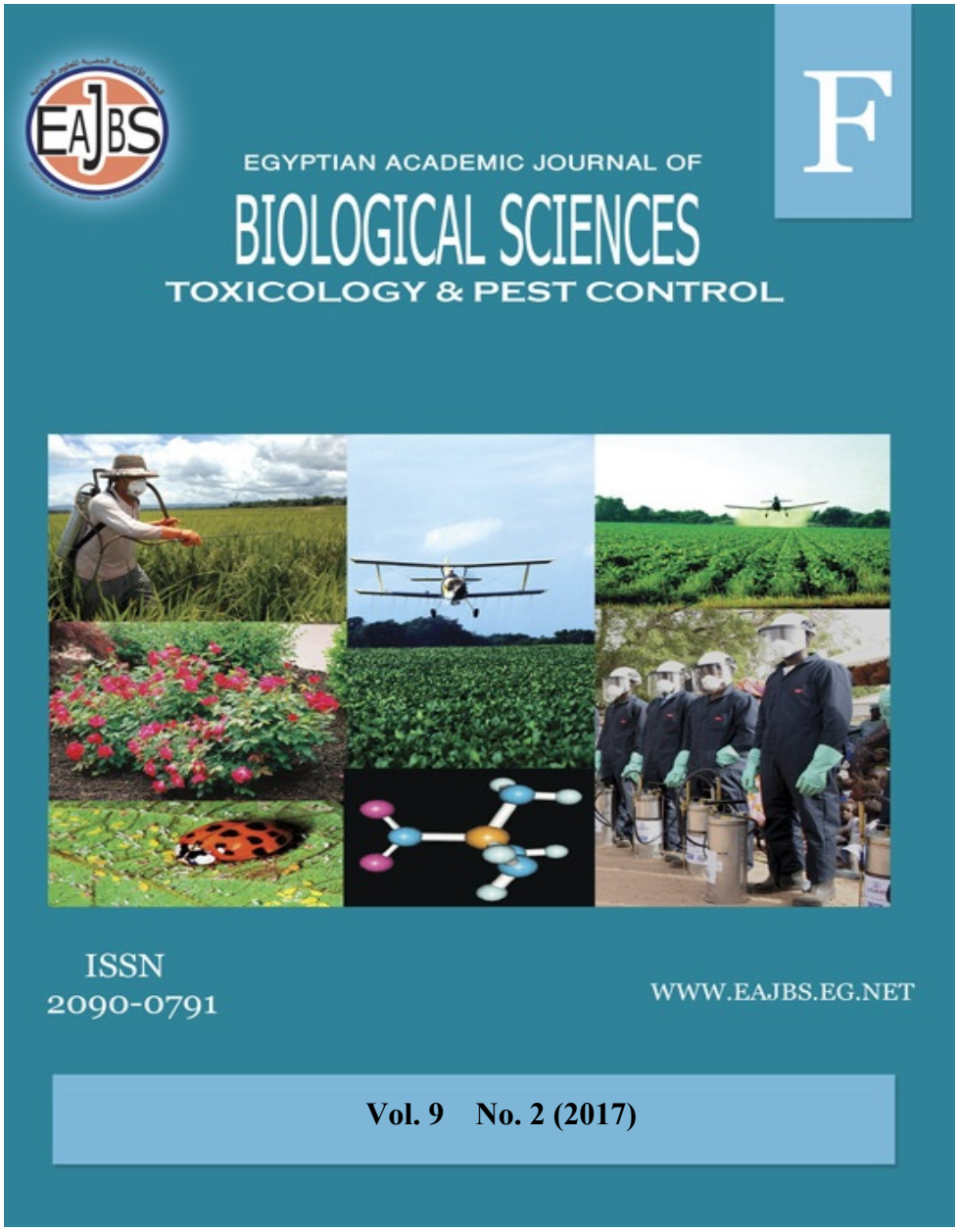


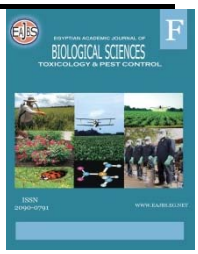
The journal of Toxicology and pest control is one of the series issued twice by the Egyptian Academic Journal of Biological Sciences, and is devoted to publication of original papers related to the interaction between insects and their environment.

The goal of the journal is to advance the scientific understanding of mechanisms of toxicity. Emphasis will be placed on toxic effects observed at relevant exposures, which have direct impact on safety evaluation and risk assessment. The journal therefore welcomes papers on biology ranging from molecular and cell biology, biochemistry and physiology to ecology and environment, also systematics, microbiology, toxicology, hydrobiology, radiobiology and biotechnology.

www.eajbs.eg.net

Egypt. Acad. J. Biolog. Sci., 9(2): 15-20 (2017)

Egyptian Academic Journal of Biological Sciences
F. Toxicology & Pest control
ISSN: 2090 - 0791
www.eajbs.eg.net



Influence of Potassium, Micronutrients, and Their Combinations as Foliar Applications to Suppress Soybean Stem Fly, *Melanagromyza sojae* (Diptera: Agromyzidae) on Four Soybean Common Varieties

Hanan Alfy

Plant Protection Research Institute, Field Crop Pests Department, ARC, Giza, Egypt
E.Mail : Hanan_isaac1@yahoo.com

ARTICLE INFO

Article History
Received: 10/6/2017
Accepted: 20/8/2017

Key words:
Potassium, micronutrients, soybean stem fly, Qalubiya Governorate

ABSTRACT

The present studies followed the main study which was carried out at the experimental farm of the Faculty of Agriculture Benha University, Qalubiya Governorate, during two successive seasons: 2014 and 2015. The influence of potassium, micronutrients, and their combinations as foliar applications to suppress soybean stem fly, *Melanagromyza sojae* (Zehnt.) (Diptera: Agromyzidae) on four soybean common varieties was studied. The experimental design was a spilt plot with four replications, main plots (i.e., the cultivars Crowford, Giza-22, Giza-35, and Giza-111) and sub plots were assigned to eight. Four soybean cultivars and eight foliar application treatments (potassium silicate, potassium sulphate, potassium hydroxide, micronutrients (Fe, Zn, and Mn), potassium silicates + micronutrients, potassium sulphate + micronutrients, potassium hydroxide + micronutrients and control) were evaluated. The study showed that (potassium silicates + micronutrients) reduced the most impact from the soybean stem fly as indicated by the tunneling length and the number of larvae inside the plant with no significant differences among varieties. There were significant differences in relative increases of seed and stover yield with potassium silicates + micronutrients (25% of the seed yield and 0.30% as an average per two seasons compared to the control). Results also showed a significant increase in the total uptake of potassium with micronutrients for the rest of the treatments; especially with potassium silicate, and perhaps for this reason micronutrients increase the absorption of potassium allowing the plant to build the restoration after the infection. The percentage of lignin content in soybean dry plants resulted in significant increase in all treatments compared with control especially in potassium silicates + micronutrients. Increasing in lignin contents lead to the increase in the secondary xylem and decrease in the pith diameter and then lead to hamper the growth of larva in the pith.

INTRODUCTION

Soybean is the world's most grown oilseed, grown on over 95 million ha. worldwide, representing 60% of the world annual production of the 530.6 million MT of all oil crops (FAO, Food outlook May 2015) 90% of its production is concentrated in the US, Brazil, Argentina, China, and India (FAOSTAT 2013). Egypt cultivates about 8.000.00 ha of soybeans per year, and its average productivity is 3.5 Mt/ha versus the world average of 2.38 Mt/ha (FAOSTAT 2013).

Soybean stem fly *Melanagromyza sojae* (Zehnter),(Diptera: Agromyzidae), is a serious pest in Asia, North East Africa, Russia, and South East Asia, frequently causing 100% infestation of soybean and other cultivated legumes and heavy economic losses especially as a vector of virus diseases. The redescribtion of *Melanagromyza sojae* was done as follows: *Agromyza sojae* Zehntner (1900); *Agromyza squamata* (Becker,1903); *gromyza prolific* (Malloch, 1914); *Agromyza product* (Malloch, 1914; Singh & Ipe, 1973); and *Melanagromyza sojae* (Zehntner) (de Meijere 1922; Sasakawa, 1961; Singh & Ipe,1973; Thapa, 1991). (Thapa 2012).

Potassium deficiency can lead to the reduction of both the number of leaves produced and the size of individual leaves and finally on yield and quality production where the pods had the greatest impact on yield but seed mass was also an important constituent as effectuation macronutrient William *et al.* (2008) and Andrew *et al. (2009).*

Anuradha and Sharma (1995) found that the application of supplementary potassium increased the chlorophyll content, nitrate reductase activity, seed protein, and oil content in soybean. Several other studies have evaluated response of soybean to foliar fertilizer mixtures (Garcia and Hanway, 1976; Mallarino *et al.,* 1991, Haq and Mallarino, 1998; Parker and Boswell, 1980; Mortezaiefard, 2010; and hanan alfy *et al.,* 2016). At the same time, Hoeft *et al*., (2000) noted that high potassium levels will reduce yield by inducing a shortage of magnesium. In addition, the attacks of insects like blue beetle, grey semilooper, girdle beetle, and stem fly were clearly reduced with potassium applications, increasing yield (Bansal *et al*.., 2001).

Therefore, my study sought to investigate the role of potassium silicate and other micronutrients as foliar applications to suppress soybean stem fly.

MATERIALS AND METHODS

In this experiment, the drier powder of the previous samples of eight treatments - which were carried out at experimental farm of the Faculty of Agriculture, Benha University, Qalubiya Governorate inside the compass, throughout 2014 and 2015 seasons with the title "Suppress Of Soybean Stem Fly, *Melanagromyza Sojae* (Zehnt)". By Spraying Of Potassium, Micronutrients, And Their Combination As Foliar Application On Four Soybean Varieties". The percentage of lignin contents was used to know how the nutrients affect the plant to make recovery after the damage causes by *M. sojae*. Determination of lignin by the method of **(Browning 1967).**

Statistical Analysis:

Because there was no significant difference between four varieties in infection (Crowford, Giza-22, Giza-35, and Giza-111) as in Hanan Alfy *et al.,* 2016, the variety Giza 111 was taken as a common recommended one. Lignin levels associated with the various treatments were analyzed by analysis of variance for a randomized complete block design. The obtained results were statistically analyzed according to (ANOVA).

RESULTS AND DISCUSSION

Data in the first experiment Hanan Alfy *et al.,* 2016 showed that foliar application of potassium and micronutrients especially potassium silicate has a great effect in decreasing the damage occurred by *M. sojae*. Many benefits can be gained by using a good Potassium Silicate product in the feeding program. Increased tolerance of environmental stress, heat, cold, drought, water, and soil toxicity or deficiency improved growth rate in both the root zone and in the plant and its foliage. By using Potassium Silicate increase secondary xylem, which specifically reduces the diameter of the pith cavity, and the differentiation and development of lignified xylem fibers are associated with overall physical hindrance effects which seem to contribute significantly to soybean resistance to the beanfly species, *Melanagromyza sojae*, which feeds exclusively in the pith. Potassium Silicate is a natural fungicide, it helps build the plants defense from attacks by insects and fungi. Potassium Silicate helps the plant growth by depositing itself epidermal cell walls and enhancing the plant's ability to keep the leaves pointed towards the light source. It also increases the stem strength, making it easier to hold up more weight. As the plant builds itself up with Potassium Silicate, it helps with balancing nutrient uptake and distribution, and increased concentration of chlorophyll and RUBP carboxylase in leaves. Manganese aids in chlorophyll production, Synthesis of phenols (Plants natural defense) and Biosynthesis of Lignin also " nutrition, always has been an important factor in disease control" Don Huber (Purdue) 2004.

All four varieties had no significant difference by infection because varieties indicate that the underlying tissue contains specific traits for resistance to the agromyzid bean fly. The anthocyanidin malvidin was identified as the cause of the purple color. This situation demonstrates interrelationships among this flavonoid and lignins and polyphenols which contribute to insect resistance in the stem of soybean (Hsih-Shin Chiang and Dale M. Norris 1984). So that the height of lignin value is one of indictors of the plant's resistance against *M. sojae*. Table (1) reveals the value of lignin in all treatment

Table (1): Comparison between the different studied groups according to the percentage of lignin

Treatments	Percentage of lignin		
	Min. – Max.	Mean ± SD.	Median
P1 (Potassium silicate)	7.19 – 7.33	$7.27^{b} \pm 0.06$	7.28
P2 (Potassium sulphate)	6.34 – 6.57	$6.48^{c} \pm 0.11$	6.50
P3 (Potassium hydroxide)	6.23 – 6.45	$6.34^{c} \pm 0.10$	6.34
M (Fe, Zn and Mn)	6.42 – 6.73	$6.52^{c} \pm 0.14$	6.47
P1 +M	7.99 – 8.90	$8.66^{a} \pm 0.45$	8.88
P2 +M	7.14 – 7.37	$7.27^{b} \pm 0.10$	7.29
P3 +M	7.09 – 7.29	$7.20^{b} \pm 0.10$	7.21
P0M0 (control)	6.15 – 6.21	$6.19^{c} \pm 0.03$	6.20
F (p)	77.945^{*} ($<0.001^{*}$)		

F: F value for ANOVA test

Different superscripts are statistically significant at $p<0.05$.

*: Statistically significant at $p \leq 0.05$

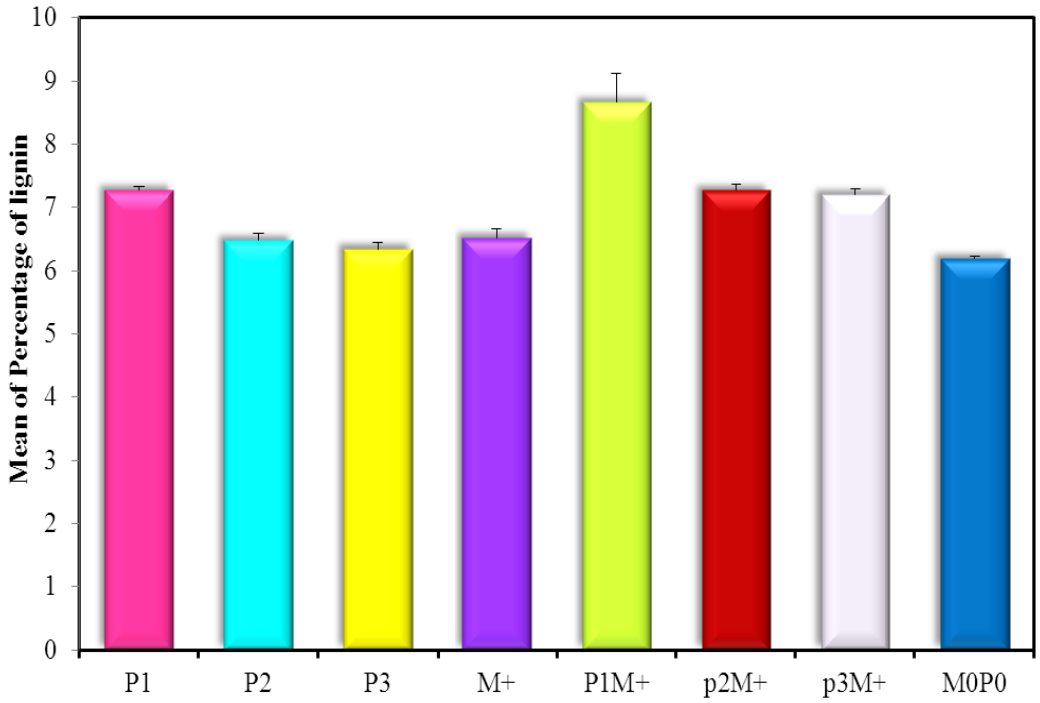


Fig. (1): Comparison between the different studied groups according to the percentage of lignin.

From the data in Figure (1), we can determine that lignin value is the highest in treatment of (P_1M). So, increasing in lignin contents lead to the increase in the secondary xylem and decrease in the pith diameter and then lead to hamper the growth of larva in the pith.

As a conclusion, it has been shown that Potassium silicate is an active ingredient to be used as an insecticide and also as an excellent foliar nutrition application tool to deliver micronutrients when the Soybean plant needs it the most.

REFERENCES

Andrew T. L.;H.Y. Tsai and R. Menon (2009).Confining Light to Deep Subwavelength Dimensions to Enable Optical Nanopatterning. Published Online April 9 2009 Science 15 May 2009: Vol. 324 no. 5929 pp. 917-921DOI: 10.1126/science.1167704

Anuradha, K. and Sarma, P. S.(1995).Effect of moisture stress and applied potassium on yield and biochemical parameters of soybean in vertisols. Journal of Oilseeds Research 12(2): 275-278.

Bansal, S.K. et al.. 2001.The effect of potassium application on yield and quality of soybean and wheat in Madhya Pradesh. Fertilizer News 46: 51-52.

Browning, B. L. 1967: Methods of wood chemistry. Vol, 2, Chap. 5, pp. 79–81, Chap. 19, pp. 394–408. New York: J. Wiley

Don Huber (Purdue), Proceedings of Indiana Crop Adviser Conference 2004

FAO, Food outlook May 2015.

FAO,STAT 2013.

Garcia, R.L. and J.J. Hanway. 1976. Foliar fertilization of soybeans during the seed-filling period. Agron. J. 68:653-657.

Hanan Alfy ; Rasha A. Elosary; Sh. S. Yacoub ; A.E. Abd El-all and Mervat, S. Alshaabeny.2016. Suppress of soybean stem fly, Melanagromyza sojae (ZEHNT.)

by spraying of potassium, Micronutrients and their combination as foliar application on four soybean varities. J. Plant Prot. and Path., Mansoura Univ.7(2): 105-114

Haq, M.U. and A.P. Mallarino. 1998. Foliar fertilization of soybean at early vegetative stages. Agron. J. 90:763-769.

Haq, M.U. and Mallarino, A.P. 2005. Response of Soybean Grain Oil and Protein Concentrations to Foliar and Soil Fertilization.Agronomy Journal 97:910– 918.

Hoeft, R.G., Nafziger, E.D., Johnson, R.R. and Aldrich, R. 2000. Modern Corn and Soybean Production, MCSP Publications, USA, pp 353.sicaly and mineralogical methods. ASA-SSSA-Agronomy, Madison, Wisconsin USA.

Hsih-Shin Chiang and Dale M. Norris. 1984. Purple Stem, a New Indicator of Soybean Stem Resistance to Bean Flies (Diptera: Agromyzidae). Journal of Economic Entomology Feb 1984, 77 (1) 121-125

Mallarino, A. P.; Webb, J. R. and Blackmer, A. M. 1991. Corn and soybean yield during 11 years of phosphorus and potassium fertilization on a high-testing soil. Journal of Production Agriculture 4(3): 312-317.

Mortezaiefard, SH., Kalatejari,S.,Baniameri,V.andBasirat,M.(2010). Effect of sources and concentrations of potassium foliar application on yield quality and leafminer infestation (liriomyzatrifolii)in gerbera (Gerbera janesonii). ActaHortic. 937, 511-518

Parker, M.B. and F.C. Boswell. 1980. Foliage injury, nutrient intake, and yield of soybean as influenced by foliar fertilization. Agron. J. 72:110-113.

Snedecor, G.W. and Cochran, W.G. (1980). Statistical Methods, 2nd Ed. Iowa State University Press Iowa,USA.

Thapa, R.B.(2012). Redescription of Melanagromyza sojae (Zehntner) from India and Nepal. Nepalese Journal of Biosciences 2: 64-70

Williams, A.; S. Sarkar; P. Cuddon; E.K. Ttofi; S. Saiki; F.H. Siddiqi; L. Jahreiss; A. Fleming; D. Pask; P. Goldsmith; C.J. O'Kane; R.A. Flotoand D.C. Rubinsztein (2008). Novel targets for Huntington's disease in an mTOR-independent autophagy pathway.NatChem Biol. 2008 May;4(5):295-305. doi: 10.1038/nchembio.79.

Williams,K. D.; W. J. Ingram and J. M. Gregory (2008). Time Variation of Effective Climate Sensitivity in GCMs. J. Climate, 21, 5076–5090.

ARABIC SUMMERY

تأثير البوتاسيم والعناصر الصغرى والدمج بينهما كمغذيات ورقية على الحدمن الاصابة بذبابة صانعة انفاق فول الصويا على اربعة اصناف من فول الصويا

حنان الفى

معهد بحوث وقاية النبات – مركز البحوث الزراعية

تأتى الدراسة الحالية كبحث ثانى مترتب على دراسة اجريت بالمزرعة التجريبية لكلية الزراعة –جامعة بنها – محافظة القليوبيةخلال الموسمين المتتاليين2014، 2015 وذلك لدراسة تاثير الرش الورقى للبوتاسيم فى صور مختلفة وبعض العناصر الصغرى والدمج بينهما على الاصابة بذبابة ساق فول الصويا على اربعة اصناف من فول الصويا هى (كراوفورد- جيزة 22- جيزة 35- جيزة 111)وذلك من خلال ثماني معاملات هم (سليكات البوتاسيم – كبريتات البوتاسيم – هيدروكسيد البوتاسيم – خليط من العناصر الصغرى{حديد، منجنيز، زنك} - سليكات البوتاسيم+ العناصر الصغرى – كبريتات البوتاسيم+ العناصر الصغرى – هيدروكسيد البوتاسيم+ العناصر الصغرى-الكنترول). اوضحت النتائج ان المعاملة بسليكات البوتاسيم والعناصر الصغرى معاً ادت الى تقليل الاصابة الى اقصى حد كما تبين من خلال طول الانفاق وعدد اليرقات داخل النبات مع عدم وجود فروق معنوية بين الاصناف.و اوضحت النتائج وجود زيادة معنوية فى محصول البذرة والقش بنسبة تصل الى 25%، 30% على التوالى كمتوسط للموسمين مقارنة بالكنترول . كما اوضحت النتائج زيادة معنوية فى اجمالى امتصاص البوتاسيم عند الخلط بالعناصر الصغرى عن باقي المعاملات ويرجع ذلك الى ان العناصر الصغرى تعمل على زيادة امتصاص البوتاسيم مما يسمح باستعادة بناء النبات بعد الاصابة. كما اوضحت الدراسة الحالية النسبة المئوية لمحتوى النباتات الجافة من اللجنين اسفرت عن زيادة معنوية فى جميع المعاملات مقارنة بالكنترول خاصة المعاملة بسليكات البوتاسيم والعناصر الصغرى معاً وتؤدي الزيادة فى محتوى اللجنين فى النبات الى زيادة الخشب الثانوى ويقلل من لب النبات مما يعيق نمو اليرقات داخل الساق.