Zagazig J. Agric. Res., Vol. 47 No. (3) 2020 751-761

Biotechnology Research

http:/www.journals.zu.edu.eg/journalDisplay.aspx?Journalld=1&queryType=Master

EFFECT OF SOME FOLIAR BIOFERTILIZERS ON SOME BIOCHEMICAL CONSTITUENTS OF SOYBEAN SEEDS

Ata E. Awad*, R. Saber, A.A. Abdel Ghany and A. Shraf

Soil and Water, Sci. Fac. Technol. Dev., Zagazig Univ., Egypt

Received: 30/03/2020; Accepted: 12/05/2020

ABSTRACT: A field experiment was carried out at the agronomy farm of Gazala village, Sharkia Government, Egypt season 2018 to study the effect of power mix, citrine and super blue green on some biochemical constituents of two varieties of soybean seeds. The following opteind results were summarized as the seed yield of Crawford variety was relatively greater than that of Giza111 variety. All treatments increased the seed yield, No. of pods per plant and weight of 100 seeds of both varieties. All treatments used decreased reducing and non-reducing sugars except citrine treatments which caused a slight increase. The percentage of total nitrogen fractions in Crawford seeds were higher than those of Giza111. Solubility of protein fractions from all treatments with water solutions on both varieties recorded the highest values as compared with solubility of protein fractions either with acetic acid or with sodium hydroxide. Oil content of soybean seeds was increased at the applications of all treatments. Acid value and free fatty acids of oil were not affected with treatment, while it can be noticed a slight increase in values of saponification and iodine value. Crawford variety recorded higher values of total amino acids than those of Giza111 variety and it can be noticed an increase in total amino acid content with all treatments. The percentage of sapontificated fatty acids in Crawford variety were higher than those of Giza111 variety. Unsaponifiables of Giza111 seeds were greater than those of Crawford seeds. All treatments gave slight increase of P and K percentages, but Na percentage of Giza111seeds was slightly decreased. Also, the percentage of Fe was increased, while the percentage of Na and Mn were not affected at foliar application on Crawford seeds.

Key words: Protein fraction, carbohydrate fractions, oil contents, fatty acids, amino acids, elements, soybean seeds.

INTRODUTION

Soybean is a major source of high-quality protein and oil. Soybean seeds quality is often determined by seed protein, oil and mineral contents, as well as with fatty acids composition. Therefore, improving soybean seed quality is a key to improve human and animal nutrition. Amplitude of research works has been forwarded to study plant response to biofertilizers applications, some have covered the effects of biofertilizers on the morphology and yield of the soybean seed **(Wilson, 2004)**.

Mekki and Amal (2005) indicated that application of biofertilizers had more plant height, seed yield, and pods weight (g /plant) as well as number of pods, and weight of 1000 seeds. Seed oil was increased either the plants treated by biofertilizers individually or with a mixture of biofertilizers. Also, protein content was increased. **Getta *et al.* (2008)** found that a significant increase of No. pods, seed yield and protein content of soybean plants by the biofertilizers foliar application.

Iraj *et al.* (2012) showed that biofertilizers levels had significant effect on the number of pods/plant and the high protein percentage. It therefore seems that biofertilizers can be considered as a replacement for a part of chemical fertilizers on soybean. Resulting **Praveen (2013)** showed that, the foliar application of sulphur, zinc and biofertilizer were increased the oil and protein contents of

***Corresponding author: Tel.:** +201155757151
E-mail address: ataalsaber1@gmail.com

soybean seeds. **Mahboobeh and Jahanfar (2012)** on their results showed that biofertilizers had a significant effect on seed number per silgues, seed yield and 1000 seeds weight.

Manal *et al.* (2014) studied the effect of biofertilizers on some soybean cultivars (Giza 35 and Crawford), wherein the obtained results showed that, biofertilizer recorded a significant increase in seed yield, weight of pods and 100-seed weight (g), concentration and uptake of macro and micronutrients, while Crawford cultivar recorded the highest value in each of protein and oil percentage. The inoculation of seeds for different cultivars of soybean gave the highest value for each of seed yield, weight of pods, protein and oil percentage in comparison to control seeds.

Raouf (2016) noticed that, the maximum grain yield, No. of pods, oil and protein contents of soybean seeds were increased by the application of biofertilizers and zinc oxide. Also, he found that, saturated fatty acids declined by inoculation with biofertilizers as compared with control, while the unsaturated fatty acids were increased.

The objectives of this research are to evaluate the effect of some foliar biofertilizers on seed yield, protein content, oil percentage, total amino acids, total fatty acids, soluble sugars and some macro and micro elements of Giza111 and Crawford varieties of soybean seeds.

MATERIALS AND METHODS

The field experiment using soybean test crops was conducted during the growing season of 2018 at the experimental farm of the Faculty of Technology and Development in Ghazala valage, Zagzig District, Sharkia Government, Egypt. The experiment conducted in the form of a randomized complete block design with three replicants for each (Giza111 or Crawford) vareity. The seeds obtaind from Seed Testing Lab Ministry of Agric, Giza, Egypt. The area of each plot was 3m× 3.5 m (1/400 per faddan). Three folair of biofertelizers beside control were applied as follow:

Power Mix

Containing 2% amino acids, 3% riboflavin, 0.3% cytokinine, 0.001% gibberlic acids, 4.5% potassiam citrate and 3.5% micro elements.

Citrine

Containing 15% organic acids, 2% iron grapple, 2% zinc grapple and 2% manganese grapple.

Super Blue Green

Containing amino acids, vitamins, oxins, cytokinesis, and organic acids.

The foliar biofertilizers were obtained from sigma chemical company and sprayed with two concentrations 0.25% and 0.5% after 30 days from sowing. The yield and yield components of soybean seeds were determined and samples from seeds were taken and stored until the chemical analysis.

Methods of Analysis

1- Total soluble sugars (reducing and non-reducing) were determined according to **Smith *et al.* (1956)**.

2- Total nitrogen was determined by kjeldahel method as recorded in **AOAC (1970)**.

3- Soluble nitrogen was determined according to the method described by **Mengle and Helal (1968)**.

4- Protein fractions were opteind using three solvents, water, acetic acid 70% and sodium hydroxide 0.1 N., every fraction was fractionated using three solvents, Protein content of every fraction was determined using total nitrogen determination according to **Lammle (1970)**.

5- Determination of total amino acids was according to **AOAC (2000)**.

6- Oil extracted from the seeds with ether and oil content was determined according to the procedure reported in **AOAC (1990)**.

7- Saponification value, acid value and iodine value were determined using the procedure recommended by **AOAS (1990)**.

8- Total fatty acids were determined according the methods of **AOAC (2000)**.

9- The unsaponifiable matter was determind according to **Farag *et al.* (1981)**.

10- Phosphorus percentage was determined calorimetrically using ascorbic acid methods according to **Watanable and Olsen (1965)**.

11-Potassium and sodium contents were determined by flame photometer according to **Hamdia (2013)**.

12-Fe, Mn and Zn were determined according to the standard of procedure described by **Block *et al.* (1958)**.

13-The field experiment was grown in 3/5/2018 and the seed yield were collected in 28/12/2018.

Statistical Analysis

The experiment was in a complete randomized block design with 7 treatment and 3 replicates for each treatment with two varieties of soybean. Results were statistically analyzed using the LSD at probability level of 5% for comparisons according to **Gomez and Gomez (1983)**.

RESULTS AND DISCUSSION

Yield and Yield Components

The values representing No. of pods/plant, seed yield per plot (kg) and seed yield/faddan (ton) are showen in Tables 1.a and 1.b. The results purported a significant increase of No. pods per plant of both varieties, Giza111 and Crawford due to the applied of 0.5% super blue green treatments as compared with other treatments and control. In addition, results showed that the highest No. pods was obtained by foliar application of 0.5% citrine in Giza111 variety, but the least value of No. pods was recorded by Crawford variety under the application of 0.25% power mix. In this connection the results are in agreement with **Iraj *et al.* (2012), Raouf (2016) and Abdelmohsen (2016)**.

Results showed that, the seeds weight per plot (kg) and seed yield per faddan (ton) of both varieties were slightly increased by all treatments as compared with control. Also, it can be observed that the seeds yield of Crawford variety were relatively greater than those of variety Giza111. The highest seeds yield was obtained by foliar application of 0.25% and 0.5% super blue green treatments on Crawford variety. These results are in full agreement with those obtained by **Arshad and Naser (2010)** and **Abdelmohsen (2016)** who found that biofertilizer had a significant effect on number of pods per plant and seed yield of soybean plants.

The weight of 100 seeds are showen in Tables 1.a and 1.b. It was observed that all used treatments increased the weight of 100 seeds, that increasement valued as 0.5% and 0.25% due to Citrine and 0.25% super blue green application (17.08، 17.16 g), respectively. Also, it can be noticed that weight of 100 seeds/g of Giza111 variety was relatively higher than those of Crawford variety. These results are in agreement with those obtained by **Iraj *et al.* (2012) and Raouf (2016)**.

Soluble Sugar Fractions Contents in Soybean Seeds

Results in Table 2 show the effect of applied biofertilizers on soluble sugar contents of both Giza111 and Crawford soybean. It can be noticed that biofertilizers generally, decreased non reducing and total soluble sugars content of Giza111, except treatment with citrine (0.25%), where it increased these fractions content. This can be due to the activation of sugar polymerization. The results in the same Table 2 showed that soluble sugars fractions of Crawford were slightly decreased compering with Giza111 or with control. This can be related to genetic characteristic of both Giza111 or Crawford variety and their response to biofertilizers application. These findings are in agreement with those reported by **Getta *et al.* (2008)**.

Nitrogen Fractions Contents in Soybean Seeds

The results presented in Table 3 indicate that, there was slight effect of biofertilizers on the concentration of soluble nitrogen of soybean seeds, except when applied 0.5% power mix and 0.5%super blue green in Giza111 and 0.25%and 0.5% power mix in Crawford variety. Similar results were previously obtained by **Iraj *et al.* (2012)** who observed that biofertilizers can be considered as a replacement for part of chemical fertilizers in soybean plant. Results of same Table 3 show that the spraying two doses of citrine and super blue green slightly increased the content of insoluble nitrogen and total nitrogen of Giza111 variety (6.58, 6.59, 6.64 and 6.74), respectively. While spraying 0.25%

Table 1.a. Effect of some foliar biofertilizers on seed yield of Giza 111 soybean plants

Treatment	Pod No. /plant	Seed Wt. (g. plant^{-1})	100-seed Wt. (g)	Seed Wt. (kg. plot^{-1})	Seed yield (Ton.fad. $^{-1}$)
Control	153.90^{c}	37.21^{d}	15.90^{c}	2.70^{c}	1.08^{c}
0.25% Power mix	188.10^{bc}	52.81^{a}	16.22^{b}	2.72^{c}	1.10^{bc}
0.5% Power mix	204.30^{b}	51.96^{a}	16.36^{b}	2.75^{c}	1.11^{bc}
0.25% Citrine	205.70^{b}	52.13^{a}	16.47^{ab}	2.83^{ab}	1.13^{b}
0.5% Citrine	207.30^{b}	48.51^{b}	17.08^{a}	2.92^{a}	1.17^{a}
0.25% Super blue green	165.80^{bc}	42.24^{c}	17.16^{a}	2.85^{ab}	1.14^{b}
0.5% Super blue green	281.40^{a}	52.59^{a}	17.04^{a}	2.91^{a}	1.17^{a}
LSD 0.05	0.33	0.09	0.006	0.002	1.06

Table 1.b. Effect of some foliar biofertilizers on seed yield of Crawford soybean plants

Treatment	Pod No. /plant	Seed Wt. (g.plant^{-1})	100-seed Wt.(g)	Seed Wt. (kg.plot^{-1})	Seed yield. (ton.fad.$^{-1}$)
Control	129.22^{c}	30.80^{c}	13.51^{c}	2.71^{c}	1.10^{c}
0.25% Power mix	130.22^{c}	33.93^{c}	14.14^{b}	2.79^{c}	1.12^{b}
0.5% Power mix	143.00^{b}	35.76^{bc}	13.62^{c}	2.82^{b}	1.13^{b}
0.25% Citrine	144.44^{b}	40.26^{b}	14.93^{b}	2.80^{b}	1.12^{b}
0.5% Citrine	153.11^{ab}	37.76^{bc}	13.98^{c}	2.81^{b}	1.12^{b}
0.25% Super blue green	164.78^{a}	37.46^{bc}	15.04^{a}	3.03^{a}	1.21^{a}
0.5% Super blue green	192.11^{a}	49.75^{a}	15.12^{a}	3.01^{a}	1.20^{a}
LSD 0.05	4.47	0.012	0.008	0.002	0.26

Table 2. Effect of some foliar biofertilizers on soluble sugars (g/100g) of soybean seeds

Treatment	Giza 111			Crawford		
	Reducing sugars	Non reducing sugars	Total soluble sugars	Reducing sugars	Non reducing sugars	Total soluble sugars
Control	0.81	4.82	5.63	0.71	4.75	5.46
0.25% Power mix	0.76	4.66	5.42	0.73	4.66	5.39
0.5% Power mix	0.78	4.63	5.41	0.65	4.34	4.99
0.25% Citrine	0.82	4.95	5.77	0.68	4.55	5.23
0.5% Citrine	0.74	4.77	5.51	0.88	4.81	5.69
0.25% Super blue green	0.69	4.69	5.38	0.91	4.52	5.43
0.5% Super blue green	0.72	4.55	5.27	0.70	4.44	5.14

Table 3. Effect of some foliar biofertilizers on nitrogen fractions (%) of soybean seeds

Treatment	Giza 111				Crawford			
	Sol. N.	Insol. N.	Total. N.	Sol/In sol (%)	Sol. N.	Insol. N.	Total. N.	Sol/In sol (%)
Control	0.42	6.14	6.56	6.84	0.46	6.28	6.74	7.32
0.25% Power mix	0.42	6.15	6.57	6.83	0.47	6.39	6.86	7.36
0.5% Power mix	0.45	6.13	6.58	7.34	0.47	6.31	6.78	7.45
0.25% Citrine	0.40	6.16	6.56	6.49	0.43	6.17	6.60	6.97
0.5% Citrine	0.39	6.20	6.59	6.29	0.44	6.22	6.66	7.07
0.25% Super blue green	0.43	6.21	6.64	6.92	0.46	6.29	6.75	7.31
0.5% Super blue green	0.44	6.30	6.74	6.98	0.45	6.30	6.75	7.14

power mix gave the highest values of insoluble and total nitrogen of Crawford variety (6.39and 6.86) respectively. It can be noticed that conversion of soluble nitrogen to insoluble nitrogen in Giza111recorded highest value (7.34) with power mix application (0.5%), as well as in Crawford (7.45). similar results were previously obtained by **Nacer *et al.* (2010)** who found that the total production of protein and fatty acids was the lowest in continues soybean and **Abdelmohsen (2016)** reported that, the different levels of biofertilizer treatments effect on crude protein percentage followed the same trend as the percentage of seed nitrogen.

The results, also, indicated that the percentage of nitrogen fractions (sol., insol. and total) in Crawford seeds were higher than those of Giza111 seeds. Hence the variation in the soluble/insoluble nitrogen ratio were slight and did not manifest a clear trend. So, it can be concluded that the unhanded ratio of sol/insol nitrogen was not an indication of some defect in protein synthesis other the yield slight has been recorded.

Solubility of Protein Fractions

The results in Table 4 show the change in solubility of protein fractions (Water solution, Acetic acid 70% and sodium hydroxide 0.1 N) as affected by power mix, citrine and super blue green biofertilizers application at two doses 0.25% and 0.5%. It can be observed that the percentage of solubility of protein recorded higher value in water solution for Giza111 or Crawford varieties as compared with percentage of solubility in acetic acid or sodium hydroxide solutions. This meaning that protein of soybean seeds has hydrophilic characteristic. Attributed to its composition mainly of hydrophilic amino acids, as well as higher percentage of basic amino acids than acidic amino acids. Also, from these results, it can be noticed that there were slight differences in amino acid composition of protein seeds affected by biofertilizers applications. These results are in accordance with those obtained by **Sitohy and Osman (2010)** and **Sitohy *et al.* (2017)**.

Seed Oil Content and Some Constants of Giza111 Variety

The oil percentage of Giza111 seeds and some their constants are shown in Table 5. Oil contents were increased by all treatments and the high concentration of citrine (0.5%) gave the highest increase of oil content (21.62%) as compared with the control, the lowest percentage of oil recorded by the low concentration (0.25%) of power mix application (19.47%) as compared with oil percentages of other applications. In this respect, **Raouf (2016)** reported that, the maximum oil content was obtained by applying nano zinc oxide and biofertilizers. The saturated fatty acids (palmitic and stearic acids) declined by application of biofertilizers in comparison with the control, while unsaturated fatty acids (linolenic, linoleic and oleic acid) were increased. The same results were obtained by **Manal *et al.* (2014)**.

Table 4. Effect of some foliar biofertilizers on protein fractions (%) of soybean seeds

Treatment	Giza 111			Crawford		
	H_2O	CH_3COOH 70%	NaOH 0.1N	H_2O	CH_3COOH 70%	NaOH 0.1N
Control	69.7	23.2	7.1	71.6	22.6	7.8
0.25% Power mix	69.3	23.7	7.0	71.1	22.9	8.0
0.5% Power mix	69.1	23.4	7.5	70.4	23.1	8.5
0.25% Citrine	68.7	23.1	8.2	71.3	22.5	8.2
0.5% Citrine	68.9	23.2	7.9	71.2	22.4	8.4
0.25% Super blue green	68.3	23.6	8.1	70.9	23.1	8.0
0.5% Super blue green	68.6	23.9	7.5	70.4	23.2	8.4

Table 5. Effect of some foliar biofertilizers on physicochemical analysis of oil of Giza 111 soybean seeds

Treatment	Oil content (%)	Acid value	Saponification value	Iodine value	Free fatty acids (%)
Control	19.19	2.22	185.42	135.73	1.17
0.25% Power mix	19.47	2.04	184.63	154.37	1.03
0.5% Power mix	19.83	2.16	196.63	149.73	1.08
0.25% Citrine	21.35	2.02	189.90	144.42	1.02
0.5% Citrine	21.62	2.17	199.69	156.72	1.09
0.25% Super blue green	20.60	2.20	189.80	147.42	1.10
0.5% Super blue green	20.97	2.11	190.26	144.45	1.06

The results from Table 5 show that there were no differences in acid value or free fatty acids percentage of soybean oil as compared with control and this led to high stability of oil and delated storage time. On the other hand, it can be noticed that slight differences in saponification values and iodine values between treatments and result of control. This means that fatty acids incorporated into triglycerides synthesis **Abed (2017)**.

Seed oil Content and some Constants of Crawford Variety

The effect of studied biofertilizers on the oil content and on physiochemical properties of Crawford soybean seeds are presented in Table 6. Which clearly shows that the percentage of oil seeds Crawford variety were relatively lowest than those of Giza 111 variety. It can be noticed that the use of 0.25% and 0.5% citrine gave the highest value of oil content (21.06% and 21.27%). While the use of 0.25% super blue green gave the lowest value of oil content of Crawford seeds (19.78) as compared with values of other treatments. It is worth to mention that **Manal *et al.* (2014)** recorded that Crawford variety gave the highest values in oil percentage as affected with biofertilizers. Also, **Mekki and Amal (2005)** reported that seed oil percentage was increased at foliar application

Table 6. Effect of some foliar biofertilizers on physicochemical analysis of oil of Crawford seeds

Treatment	Oil content (%)	Acid value	Saponification value	Iodine value	Free fatty acids (%)
Control	18.81	1.96	197.41	157.53	0.53
0.25% Power mix	20.80	1.83	199.71	133.39	0.67
0.5% Power mix	19.95	1.80	195.01	135.09	0.60
0.25% Citrine	21.06	1.86	209.98	149.17	0.73
0.5% Citrine	21.27	1.79	193.68	130.26	0.88
0.25% Super blue green	19.78	1.76	194.72	133.47	0.89
0.5% Super blue green	20.46	1.79	203.97	142.22	0.90

with individual biofertilizers. In the same Table 6, all application gave lower acid values than control (1.96, 1.83, 1.80, 1.86, 1.79, 1.76 and 1.79), respectively. Meaning that power mix, citrine, and super blue green application in this study improved storage time of oil and saponification values with 0.25% citrine and 0.5% super blue green application recorded the highest values (209.98 and 203.97) respectively compering with control (197.41).

Iodine values of all treatment application were decreased compering with control and the least iodine value was recorded by 0.5% citrine (130.26) as compared with control (157.53). Also, results from Table 6 show that free fatty acids as oleic acid that values of all treatments were higher than those obtained with control (0.53) and the highest value of free fatty acids was obtained by the application of 0.5%citrine and 0.25% super blue green (0.88 and 0.89), respectively, as reported by **Manal *et al*. (2014) and Mudlagiri *et al.* (2012)**.

Total Amino Acids and Total Fatty Acids

The effect of some biofertilizer treatments on all total amino acids of soybean seeds is presented in Table 7. It is indicated that Crawford variety recorded relatively greater total free amino acids than Giza111 variety. From these results nearly all treatments were increased the total amino acids in Crawford variety, while the application of the same treatments did generally induce some slight changes in the content of total amino acids in Giza111 variety seeds. It is obvious that spraying 0.5% power mix and 0.25% citrine gave the greatest increase effect on total free amino acids in Crawford variety (22.89 and 22.62) respectively, but the highest value of total free amino acids in Giza111 was recorded by 0.5% citrine treatment (22.13) and the least value was recorded by the application of 0.5% super blue green treatment (20.20%) as compared with control (20.31%). Hence, it can be concluded that biofertilizers treatment did not affect the total free amino acid of soybean seeds .This can be due to that the three biofertilizers used are known to stimulate and enhance protein synthesis. In this regard **Manal *et al.* (2014)** found that amino acid content in soybean seeds was significantly response to inoculation with biofertilizer in Giza35 and Crawford varieties and gave lower values than the other cultivars.

From Table 7, it can be noticed that the percentage of total fatty acids in Crawford variety was higher than Giza111 variety and the content of total fatty acids of soybean seeds oil were increased under all treatments of Crawford variety. The superiority in this regard was referred to the application of 0.5% super blue green treatment followed by 0.5% power mix treatments. On the other hand, the application of 0.25% citrine and 0.5% citrine recorded the least values (43.31 and 50.01%) respectively in Giza111 variety.

The results in Table 7 clearly show that the percentage of unsaponifiables in seeds of Giza111 variety were relatively greater than those of Crawford variety. Also, it can be noticed that all treatments were decreased the percentage of unsaponifiables in Crawford variety (36.67, 25.64, 38.68, 29.30, 27.64 and

Table 7. Effect of some foliar biofertilizers on total fatty acids, Un sap. matter of soybean oil and free amino acids (%) of soybean seeds

Treatment	Giza 111			Crawford		
	Total fatty acids	Un sap. matter	Total free amino acids	Total fatty acids	Unsap. matter	Total free amino acids
Control	51.12	48.88	20.31	58.90	41.10	17.75
0.25% Power mix	66.60	33.40	20.32	63.33	36.67	22.28
0.5% Power mix	65.26	34.74	21.29	74.36	25.64	22.89
0.25% Citrine	43.31	56.69	20.81	61.32	38.68	22.62
0.5% Citrine	50.01	49.99	22.13	70.70	29.30	22.01
0.25% Super blue green	61.33	38.67	20.49	72.36	27.64	22.31
0.5% Super blue green	62.76	37.24	20.20	78.80	21.20	21.95

21.20%) respectively as compared with control (41.10%), while the application of 0.5% super blue green gave the least value of unsaponifiables to Giza111 oil variety. In this regard **Raouf (2016)** reported that, the saturated fatty acids (palmitic and stearic acids) declined by inoculation with biofertilizers in comparison with control, but he stated that unsaturated fatty acids (linoleic linolenic and oleic acid) were increased.

Macro Elements of Soybean Seeds

Phosphorus content

Table 8 clearly show that the percentage of phosphorus in seeds of Giza 111 variety was slightly higher than that of Crawford variety. All treatments were slightly increased the percentage of phosphorus in both varieties, and the greatest percentage of phosphorus in Giza111 variety was recorded by 0.25% power mix treatment (0.26%) and the lowest value resulted by the application of 0.25% super blue green (0.22%) as compared with control (0.23%). While in Crawford variety the greatest value was obtained by the application 0.25% citrine (24%) treatment and the least value of phosphorus content in soybean seeds was recorded by 0.5% super blue green (0.21%) as compared with control (0.21%) these results are in line with those obtained by **Mekki and Amal (2005)** and **Manal *et al.* (2014)**.

Potassium content in soybean seeds

Concerning the macronutrients percentage in seeds of soybean cultivars, the results in Table 8 indicate that Giza 111 variety recorded higher percentage of potassium in seeds than Crawford variety. It can be noticed that, all treatments were slightly increased the percentage of potassium in both varieties' soybean seeds. The highest values were obtained at 0.5% super blue green of Giza111 variety (3.92%) and of 0.5% power mix and (3.47%) in Crawford variety as compared with other treatments and control. The same results were obtained by **Manal *et al.* (2014)** and **Abdelmohsen (2016)**.

Sodium content in soybean seeds

As shown in Table 8 the foliar application of biofertilizers slightly decreased the percentage of sodium in soybean seeds in Giza111 verity. While the same treatments were slightly increased the percentage of sodium in soybean seeds except when apply 0.5% super blue green on Crawford variety. These results indicated that the mobilization of assimilated elements to the seeds and its accumulation were slightly affected according the reports **Antonio (2012)**.

Micronutrients Concentration in Soybean Seeds

The results presented in Table 9 indicated to study of the effect of some biofertilizers on the

Table 8. Effect of some foliar biofertilizers on the macro elements (g/100g) of soybean seeds

Treatment	Giza 111			Crawford		
	P	K	Na	P	K	Na
Control	0.23	3.29	0.31	0.21	2.09	0.31
0.25% Power mix	0.26	3.88	0.29	0.23	2.28	0.35
0.5% Power mix	0.25	3.78	0.27	0.21	3.47	0.33
0.25% Citrine	0.25	3.91	0.27	0.24	2.58	0.37
0.5% Citrine	0.24	3.76	0.27	0.23	2.83	0.39
0.25% Super blue green	0.22	3.88	0.31	0.23	2.84	0.31
0.5% Super blue green	0.23	3.92	0.25	0.21	2.16	0.29

Table 9. Effect of some foliar biofertilizers on the micro nutrients (g/100g) of soybean seeds

Treatment	Giza 111			Crawford		
	Fe	Zn	Mn	Fe	Zn	Mn
Control	0.11	0.01	0.04	0.19	0.02	0.04
0.25% Power mix	0.10	0.01	0.04	0.18	0.02	0.04
0.5% Power mix	0.10	0.01	0.05	0.19	0.01	0.05
0.25% Citrine	0.12	0.01	0.07	0.26	0.01	0.05
0.5% Citrine	0.12	0.01	0.08	0.26	0.01	0.06
0.25% Super blue green	0.15	0.02	0.04	0.15	0.02	0.07
0.5% Super blue green	0.17	0.02	0.04	0.11	0.02	0.04

percentage of micronutrients (g/100g) in soybean cultivars. It can be observed that the percentage of Fe in soybean seeds of Crawford was slightly greater than in Giza111 variety. Also, it found that the application of two doses from super blue green slightly increased the content of Fe in Giza 111 as compared with the other treatments 0.5 super blue green (0.17 g/ 100g) while the application of two doses from citrine recorded the highest values to Crawford variety (0.26, 0.26 g/100g) as compared with the other treatments. Also, it noticed that super blue green application caused slight increase in the percentage of Fe in Crawford variety .At the same time, percentage of Zn in both varieties did not affected by all treatments except two doses of super blue green caused slight increase of Zn in seeds (0.02, 0.02 g/100g) from Giza111 and Crawford variety .There was no effect on Mn percentage in soybean seeds in both varieties by all treatments. These results were in agreement with those reported by **Mekki and Amal (2005)** and **Manal *et al.* (2014)**.

REFERENCES

AOAC (1970). Official Methods of Analysis of Association of Official Analysis Agriculture Chemists.5th, (Ed) .Washington, DCSA.

AOAC (1990). Method 988.05. Helrich. (Ed). Official Methods of Analysis (15th). The Association of Official Analytical Chemists Inc.

AOAC (2000). Official Methods of Analysis, the Association of Official Agriculture Chemists. Washington D. C., 10th Ed. USA.

Abdelmohsen, R.K. (2016). Effect of biofertilizer, Nitrogen and phosphorus on irrigated soybean in Gezira Sudan. ARRN J. Agric. and Biol. Sci., 11: 9.

Abed, V. (2017). The effect of micronutrient application on soybean seeds and on seed oil and protein content. J. Ame. Sci., 6.672-677.

Antonio, M. (2012). Potassium effects on yield corn and soybean on potassium uptake and relaying to the oil law slate, Ag Engineering. Agronomy Central Iowa And Bio Century Reach Farms.

Arshad, J. and M. Naser (2010). Growth, nodulation and yield response of soybean to biofertilizers and organic minerals. P.J. Bol., 42 (3): 863 - 871.

Block, R.J., E.L. Durf and G. Zewing (1958). Amanal of Paper Chromatography and Paper Electrophoresis, 2nd Ed. Academic. Inc. Publishers, Ng.

Farag, R.S., A.M. Youssef, K.A. Sabet, M.M. Fahim and F.A. Khalil (1981).Behavioral Ecology and Socibiology.54:36-43.

Getta, G., M. Mudenoor and G. Savalgi (2008). Effect of micronutrient supplemented by add rhizobium biofertilizers on nodulation, dry matter production and yield of soybean. legume. Res., 31 (1): 20:25.

Gomez, K.A. and A.A. Gomez (1983). Statistical Analysis Procedure of Agricultural Research. John Wiley and Sons, New York, 25-30.

Hamdia, A.S.M. (2013). The physiological response of wheat to exogenous application of GA3 or IAA. Int. J. Plant Physiol. and Biochem., 5 (4): 58-64.

Iraj, Z., S. Yousef, H. Gholan, J. Ali and M. Khosro (2012). Effect of biofertilizers on grain yield and protein content of soybean. Afr. J. Biotechnol., 11: 7028-7037.

Lammle, U.K. (1970). Nature (London) 2276. CC. F. Keres, 1, 1984.Methouds of protein analysis arcade miacid Budapest.

Mahboobeh and Jahanfar (2012). Effect of different nitrogen and biofertilizers on growth and yield of *Braccia napus*. italic J. Agric. and Crop Sci., 4 (8): 478-482.

Manal, A., H. Amal, A. Shaban and Abdelmohsen (2014). Influence of applied biofertilizer on productivity quality and nutrients content of some soybean cultivars under saline soil conditions. J. Soil and Agric. Eng., Mansoura Univ., 5 (12): 1647-1666.

Mekki, B.B. and G.A. Amal (2005). Growth, yield and seed quality of soybean as affected by organic biofertilizer and yeast application. Res. J. Agric. and Biol. Sci., 1 (4): 320-324.

Mengle, K. and M. Helal (1968). The effect of varied nitrogen and potassium nutrition on the content of soluble amine compounds in serial parts of outs. Z.P flan Zener nacher. Bodenk,120 (1): 12-20.

Mudlagriri, B.G., P. Manju and B. Nace (2012). Effect of chelating agents on protein, oil, fatty acids and minerals in soybean seeds. Agric. Sci., 3 (4): 514-523.

Nacer, B., H.B. Ahmold, G. Anne, K. Hamed, M. Robert and L.P. Robert (2010). Soybean seed protein, oil, fatty acids and mineral composition as influenced by soybean and corn rotation. Agric. Sci., 8 (3): 102-109.

Praveen, K.J. (2013). Effect of sulphur, zinc and biofertilizers on soybean. An Asian J. Saif Sci., 8 (2): 305-309.

Raouf, S.S. (2016). Application of biofertilizer and zinc increases yield, nodulation and un saturated fatty acids of soybean. Zemdirbirbyste, Agric., 103 (3): 251-258.

Sitohy, M. and A. Osman (2010). Antimicrobial activity of native and esterified legume protein against gram negative and gram-positive bacteria. Food Chem., 120: 66-75.

Sitohy, M, S.A. Mahgoub and A. Osman (2017). *In vitro* and inset antimicrobial action and mechanism of glycinin and its basic subunits. Int. J. Food Microbial., 154: 14-29.

Smith, F., M. Dubois, R. Gilles, J. Hamilton and P. Rpers (1956). Colorimetric methods for determination of sugars and related substances. Anal Chem.., 28:350.

Watanable and Olson (1965). Test of an ascorbic acid methods for determine phosphorus in water and Nattco, extracts from soil. J. Soil Sel. Soc. Ame. Proc., 19: 677-675.

Wilson, R.F. (2004). Seeds composition, in ur Boerma, JE. Specht, eds. Soybean improvement, production and uses. Ed. Ame. Soc. Agron., Madison, 3: 621-677.

تأثيـــر بعـض الأســـمدة الحيـــويـــة علـــى المكـــونـات البيـوكيميـائيـة لبـــذور فـول الصـويـا

عطا الصابر عوض - رفعت احمد صابر - عبد الغنى عبد الحكيم عبد الغنى - عبد العزيز شرف

قسم علوم الأراضي والمياه – كلية التكنولوجيا والتنمية – جامعة الزقازيق – مصر

تم إجراء التجربة الحقلية بمزرعة كلية التكنولوجيا والتنمية، محافظه الشرقية، جمهوريه مصر العربية وذلك لدراسة تأثير أسمده (بور ميكس، والسترين، وسوبر بلو جرين) على بعض المكونات البيوكيميائية لصنفين من بذور فول الصويا (جيزة ١١١ وكراوفورد)، تم الحصول على النتائج التالية: كان محصول البذور لصنف كراوفورد أكبر نسبيًا من محصول صنف جيزة ١١١ وزادت جميع المعاملات من محصول البذور وعدد القرون لكل نبات ووزن ١٠٠ بذره لكلا الصنفين مقارنه بالكنترول، أدى استخدام جميع المعاملات الى تقليل السكريات المختزلة وغير المختزلة باستثناء معاملات السترين التي تسببت في زيادة طفيفة، كانت نسبة النيتروجين الكلى في بذور كراوفورد أعلى من نسبة النيتروجين الكلى في بذور الصنف جيزة ١١١، قابلية ذوبان البروتين في الماء في كلا الصنفين سجلت أعلى القيم بالمقارنة مع قابلية ذوبان البروتين إما مع حمض الخليك أو مع هيدروكسيد الصوديوم، زادت نسبه الزيت في كلا الصنفين باستخدام جميع المعاملات، لم يتأثر رقم الحامض والأحماض الدهنية الحرة باستخدام المعاملات، بينما هناك زيادة طفيفة في قيم التصبن وقيمة الرقم اليودى، نسبة الأحماض الأمينية الحرة في صنف كراوفورد أعلى من تلك الموجودة في صنف جيزة ١١١ ويمكن ملاحظة زيادة في إجمالي محتوى الأحماض الأمينية بجميع المعاملات، نسبة الأحماض الدهنية القابلة للتصبن في صنف كراوفورد أعلى من تلك الموجودة في صنف جيزة ١١١، المواد غير القابلة للتصبن في بذور الزيت في صنف جيزة ١١١ كانت أكبر من تلك الموجودة في صنف كراوفورد، أدى استخدام جميع المعاملات الى زيادة طفيفة في نسبة الفوسفور والبوتاسيوم، لكن محتوى الصوديوم في جيزة ١١١ انخفض بشكل طفيف أيضا، كانت هناك زيادة في نسبة الحديد دون أي تأثير على محتوى الصوديوم والمنجنيز في بذور الصنف كراوفورد.

المحكمـــــون:

١- أ.د. نجـــاح الشـــحات علـــي أستاذ الكيمياء الحيوية الزراعية – كلية الزراعة – جامعة عين شمس.

٢- أ.د. رجب عبدالفتاح المصري أستاذ الكيمياء الحيوية الزراعية المتفرغ – كلية الزراعة – جامعة الزقازيق.