

## **BIOCHEMICAL EVALUATION OF SOME FOLIARS ON YIELD AND QUALITY OF SOYBEAN SEEDS**

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### **ABSTRACT**

*A field experiment was carried out at the Agronomy Farm of Faculty of Technology and Development Zagazig University, Egypt, to Study the effect of Novatreen and potassen foliar on the grain yield and quality of soybean seeds.*

*Soybean plants were sprayed with two foliar nutrients, at concentrations were 0.2% and 0.4 % respectively. All treatments significantly increased the grain yield and plant performance (No, of pods per plant, No, of seeds per pods and weight of 100 seeds) .Insoluble nitrogen contents recorded a slight decrease by foliar potassen. Total nitrogen in seeds was increased with novatreen foliar. The potassen foliar was increased water soluble protein content , while decreased the protein fraction solubilized in both acetic acid and 0.1N NaoH solvents. Also, novatreen foliar slightly decrease of total protein content.*

*The pattern of soybean proteins showed two main fractions (7S and 11S globulins) with their constituting subunits. Oil content of soybean seeds slightly decreased with novatreen foliar, but potassen foliar increased the oil content of soybean seeds. A slight differences were noticed with acid values, saponification and iodine values. The highest values of both saponification and iodine were obtained by 0.2 % foliar potassen. Both foliars improved the contents of P , K and Na , but reduced the contents of Fe and Mn in seeds.*

***Conclusively,** It is recommended to spray the novatreen and potasen compound on the plants after 30 days of cultivation with a concentration of 0.4% to obtain the highest productivity of the seed yield as well as the quality of the protein content, oil and nutrients necessary for the process of metabolism in the plant.*

**Key words:** Biochemical Evaluation, Foliars, Yield & Quality, Soybean Seeds.

## INTRODUCTION

Soybean is one of the most important legume crops in the world, as well as, in Egypt, where considering a good source of oils and protein for human and animals nutrition. Foliar compounds are substances that influence physiological processes of plant at very low concentration. Heidarian *et al* (2011), found that foliar application of (Zn+Fe) had appositve effect on seed yield ,number of pods per plant and weight of 1000 seeds ,also, increased the protein content of seeds. Yosuf *et al* (2012) stated that N or N+Fe applications on soybean plant were recorded maximum values of seed yield. Potassen spray application on soybean plant slightly increased both yield and protein content of seeds as stated by Antonio (2012). Mudlagiri *et al* (2012) stated that seed protein, oil content, fatty acids and mineral contents were increased in soybean seeds by the foliar compounds (Ca+Fe ) and (Si +Fe) and they were noticed an increase of oleic acid ,but there was a decrease of linoleic acid among fatty acids composition of oil .Faisal *et al* (2013) noticed that Fe and Mo applications on soybean plant had a significant effect on seeds yield and its chemical composition ,where this application was increased protein content of seeds .

Foliar application of potassen at height level on soybean plants has no effect on protein ,oleic acid contents and total isoflavones of soybean seeds as evaluated by Nacer *et al* (2013). Mannan (20-14) found that the foliar of elements application at the pod stage of soybean plant growth was more effective on the yield , oil and protein contents of seeds. Manju *et al* (2014) found that potassen fertilizer, when applied as foliar on soybean plant at high level recorded an increase of protein content and percentages of linoleic, palmatic and stearic acids in soybean seeds compared with control.

Therefore, the aim of this investigation was to evaluate the effect of novatreen and potassen foliars on grain yield and quality of soybean crop.

## MATERIALS AND METHODS

The field experiment was carried out in the Agronomy farm of Faculty of Technology and Development, Zagazig university, Zagazig, in Gazala, Egypt, 2018. A complete randomized Block design was applied with three replicates of each treatment of Giza 111 variety of soybean plants . The area of each plot was 3m\* 3.5 m (1/ 400 per feddan) . The novatreen & potassen foliars which purchased from local market, were applied as follow :

- 1- Control
- 2- 0.2% Novatreen, containing 5% N, 5% P, 5 % K, 0.4 % Fe, 0.4% Zn, 0.3% Mn, 0.05% B.

- 3- 0.4 % Novatreen containing the same elements in treatment No.2.
- 4- 0.2 % Potassen, containing 30% K<sub>2</sub>O ,5% P.
- 5- 0.4% Potassen containing the same elements in treatment No.4.

The foliars were applied after 30 days from sowing date . At full maturity soybean crop was harvested. The grain yield was determined and stored under recommended condition for chemical analysis.

### **Chemical analysis**

Nitrogen fractions was determined by Microkjeldhal method as stated by A.O.A.C.( 1970). Protein fractions were fractionated successively using three solvents, dionized water, 70% acetic acid and 0.1N NaoH, then every fraction was determined using total nitrogen method as previously mentioned. The electrophoresis analysis of seed proteins was carried out according to Laemmle (1970). Oil was extracted from the seeds and acid value, saponification value ,Iodine value and free fatty acids were determined as stated by A.O.A.C. (1970). Phosphorus was determined according to the method of Agiza *et al* (1960). Potassium and sodium were determined according to the methods applied by Hamdia (2013). Microelements were determined using the atomic absorption apparatus according to the method Chapman and Parker(1961 ).

## **RESULTS AND DISCUSSION**

Some plant performance of soybean plant was recorded in Table (1). It can be noticed that novatreen application significantly increased pods per plant either with 0.2% or with 0.4% (158.80 and 167.81 respectively , as well as Potassen application increased pods per plant at the same concentrations (179.22 and 194.25 respectively ) and Potassen was recorded highest values compared with novatreen application or with control . Grain per plant values in the same table showed that highest value was recorded by novatreen application at 0.4%(2.99)followed by potassen values (2.96),(2.97) with concentration (0.4 and 0.2% respectively) and novatreen (0.2%), which recorded (2.95) compared with value of control (2.83).

Weight of 100 seeds values were tabulated on Table (1). It showed that both applications of novatreen and potassen at 0.2% gave highest values (19.95 and 18.53, respectively) followed by values of 0.4% for both two foliars (17.95 and 17.35 respectively) . Result of grain yield was showed on Table (1), where potassen and novatreen with 0.4% were 0gave highest values (42.60 and 41.53, respectively), while values of two folairs with 0.2%were 41.00 and 33.08, respectively). These results were in agreement with those reported by Heidrain

**Table (1):**-Effect of novatreen and potassen foliars on yield characteristics crop.

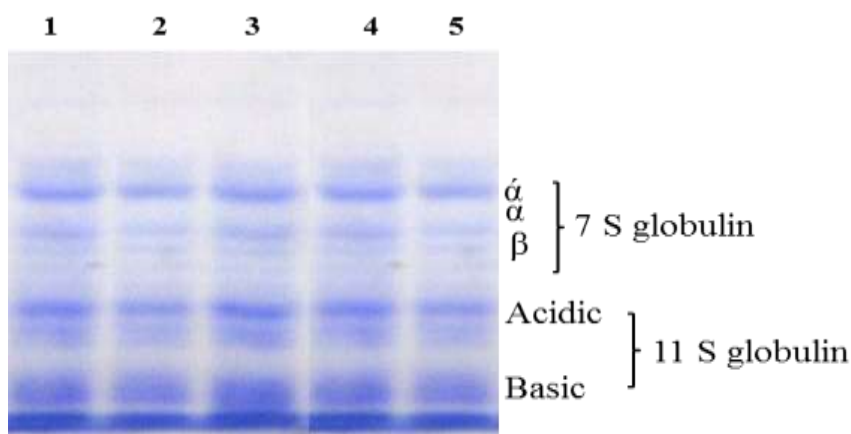
Treatments	No. of pods Per plant	No. of grain Per pods	Weight of 100 grain (g)	Grain yield Per plant (g)
<b>1- Control</b>	123.51	2.83	16.68	32.14
<b>2- 0.2% novatreen</b>	158.80	2.95	19.95	33.08
<b>3- 0.4% novatreen</b>	167.81	2.99	17.95	41.53
<b>4- 0.2% potassen</b>	179.22	2.96	18.53	41.00
<b>5- 0.4% potassen</b>	194.25	2.97	17.35	42.60
F-test	* *	*	* *	* *
L.S.D > 0.05	13.76	0.081	1.233	3.509
L.S.D > 0.01	20.08	0.118	1.799	5.121

*et al.*, (2011);Yosef *et al.* (2012) and Abd-elmohsin (2016). Data responded effect of novatreen and potassen foliars application on nitrogen fractions illustrated on Table (2). It can be noticed that potassen application had positive effect on soluble nitrogen with 0.4% and 0.2% concentrations (0.494 and 0.485 g/100g respectively) comparing with control (0.469)and highest than novatreen application with the same concentration (0.441 and 0.454 g/100g respectively).Insoluble nitrogen percentages highly affected with novatreen application either with 0.2% or with 0.4% (6.23 and 6.31 % respectively) comparing with control (6.15%),but higher than those values of potassen applications (6.11% and 6.08% for two concentrations respectively).Also it can be noticed that total nitrogen percentages were positively affected with novatreen application, where two concentrations were recorded higher values than control and potassen application (6.68 ,6.75 ,6.62, 6.60 and 6.75% respectively), Table (2). These results showed that novatreen applications improved accumulation of insoluble nitrogenous compounds were accordance with obtained by Mudlagiri *et al.* (2012) and Manan (2014). Also, it can be noticed that accumulation of insoluble nitrogen fraction due to an increase in protein synthesis as stated by Abd-elmohsin ,(2016).

The data in Fig (1) showed electrophoretic pattern of soybean seed protein as affected by two concentrations of novatreen or of potassen foliar ,where lane 1 is control ,lane 2 is 0.2 % novatreen, lane 3 is 0.4 novatreen, lane 4 is 0.2 % potassen lane 5 is 0.4 % potassen. The pattern of soybean proteins shows main fractions (7S and 11S globulins) with their constituting subunits. The molecular masses of 11 S globulin subunits are 21 and 34 KD ,corresponding the basic and acidic subunits. The molecular mass of 7S.

**Table(2):** Effect of novatreen and potassen foliar on nitrogen fractions of soybean seeds .

Treatments	Sol. nitrogen g/100g	Insol nitrogen %	Total nitrogen %	Sol /insol. Ratio
Control	0.469	6.15	6.62	0.077
0.2% novatreen	0.454	6.23	6.68	0.073
0.4% novatreen	0.441	6.31	6.75	0.070
0.2% potassen	0.485	6.11	6.60	0.079
0.4% potassen	0.494	6.08	6.57	0.081



**Figure 1.** SDS-PAGE of different soybean protein samples Lane (1):..., Lane (2):.....

globulin subunits ranges from 50 to 65 KD. 11 S globulin showed pure band with the two main subunits ,basic and acidic These results were in accordance with those obtained by Sitohy and Osman (2010); Sitohy *et al* (2017).

Results of protein fractionation according to solubility in different solvents (water, acetic acid and NaOH) at ratio of 1:25 w/v for each solvent, were illustrated on Table (3). Solubility percentage of all applications and control recorded highest values (75.9, 75.6, 75.2, 77.0 and 78.4 %, respectively) compering with solubility in acetic acid solution (15.1, 14.9,

**Table(3):** Effect of novatreen and potassen foliar on the percentages of different soluble protein fractions of soybean seeds .

Treatments	Water sol. fractions 1:25 w/v	Acetic acid 70% 1:25 w/v	Sodium hydroxide 0.1N 1:25 w/v
Control	75.9	15.1	8.4
0.2% novatreen	75.6	14.9	9.3
0.4% novatreen	75.2	14.7	10.1
0.2% potassen	77.0	13.9	8.2
0.4% potassen	78.4	13.2	8.3

14.7, 13.9 and 13.2 %respectively) and solubility percentages in sodium hydroxide solution (8.4, 9.3, 10.1, 8.2 and 8.3%, respectively). These meaning that protein of soybean seeds has hydrophilic characteristics attributed to its composition mainly of hydrophilic amino acids ,as well as higher percentage of basic amino acids than acidic amino acids (Table 3) .These data were in accordance with those obtained by Sitohy and Osman,(2010) and Sitohy *et al* . (2017).

Some characteristics of soybean oil (yield, acid value ,saponification value ,iodine value and free acid percentages ) were showed in Table (4). It can be noticed that potassen applications ,either with 0.2% or with 0.4% gave higher values of oil yield (19.32 and 19.85% respectively) than both control or novatreen applications ,which had in significant effect on soybean oil yield (18.52 ,18.26 and 18.42 % respectively). In the same table (4) all application gave oil with lower acid values than control (2.24 , 2.06 ,2.15 ,2.01 and 2.10 ),that meaning ,both novatreen and potassen applications in this study improved storage time of oil .Saponification values of novatreen and potassen application with 0.2% were increased the incorporation of short chain fatty acids in oil (193.32 and 198.23 respectively) comparing with control (185.25).

Iodine values of treatments showed that potassen application was increased unsaturated fatty acid content of soybean oil either at 0.2% or 0.4% (183.20 and 180.25, respectively) as comparing with control and novatreen application results (179.42 , 176.25 and 173.4 respectively ). Results of fatty acids percentages (Table 4 ) stated that values of potassen application were lower than those obtained with control or with novatreen treatments (1.01 ,1.06, 1.17 1.03 and 1.18 respectively) and it can be noticed that these results were in accordance with those reported for acid values in

**Table(4):** Effect of novatreen and potassen foliars on the oil constant and some constants of soybean oil.

Treatments	Oil content %	Acid value	Saponification value	Iodine value	Free fatty acids %
<b>Control</b>	18.52	2.24	185.25	179.42	1.17
<b>0.2% novatreen</b>	18.26	2.06	193.32	176.25	1.03
<b>0.4% novatreen</b>	18.42	2.15	182.29	173.40	1.18
<b>0.2% potassen</b>	19.32	2.01	198.23	183.20	1.01
<b>0.4% potassen</b>	19.85	2.10	184.40	180.25	1.06

this study ,also obtained results were in agreement with those reported by Mudlagiri *et al.* , (2012) and Manju *et al.* (2014).

The effect of foliar application on the content of some elements in soybean seeds are shown in Table (5). It seems that all treatments improved

**Table(5):** Effect of novatreen and potassen foliars on the contents of some elements of seeds .

Treatments	Phosphorus %	Potassium %	Sodium %	Ferrous Mg /100gm	Zinc Mg /100gm	Manganese Mg /100gm
<b>Control</b>	0.136	2.98	0.91	183.9	3.3	52.97
<b>0.2% novatreen</b>	0.165	2.98	1.50	181.2	3.5	42.28
<b>0.4% novatreen</b>	0.161	3.58	1.70	148.9	3.7	37.53
<b>0.2% potassen</b>	0.155	4.18	1.70	146.2	4.5	31.54
<b>0.4% potassen</b>	0.155	4.48	2.00	154.3	3.4	30.40

the content of P , K ,and Na in seeds. The highest values of K and Na were recorded by 0.4 % potassen, foliar treatment while the highest value of P was obtained by 0.2% novatreen treatment. These results indicated that the

mobilization of assimilated elements to the seeds and its accumulation there were increased. Similar results were previously reported by Antonio (2012).

The content of Fe and Mn of seeds reduced by all treatments as compared with control, but the content of Zn increased. These results are in agreement with those obtained by Soheil *et al* (2013) who found that Zn application, Zn/ Fe and Zn /Mn increased the content of nutrients of soybean seeds.

*Conclusively, It is recommended to spray the novatreen and potasen compound on the plants after 30 days of cultivation with a concentration of 0.4% to obtain the highest productivity of the seed yield as well as the quality of the protein content, oil and nutrients necessary for the process of metabolism in the plant.*

## REFERANCES

- Abd-elmohsin ,R.K.(2016).** Effect of Biofertilizer, nitrogen and Phosphorus on irrigated soybean (Glycin max) in Gezera-sudan, . *Journal of Agricultural and Biological Science*, 11(9): 351-359.
- Agiza, A. A.; El-Henidy, M. and Elbrahim, M.(1960).** The determination of the different fractions of phosphorus. *Fac of Agric., Cairo Univ., Bull.*, 1(2)2-7.
- Antonio ,M. (2012).** Potassium effects on yield corn and soybean on potassium uptake and recycling to the oil low slate, Ag Engineering , Agronomy. *Central Iowa And Bio Century Research Farms*.
- A.O.A.C.(1970).** *Association Of Official Analytical Chemts.* Official Methods Of Analysis. the ed Washington's, USA.
- Chapman, H. D. and Parker, P. P. (1961).** *Methods Of Analysis Of Soil ,Plant And Water.* University of California, USA.
- Faisal, Z. ; Mansor, M.; Azini, M. and Khuram, M. (2013).** Soybean response to micro nutrients. *Turkish Journal Of Field Crops*, 18 (2):134-38.
- Hamdia,A. S. M. (2013).** The physiological response of wheat plants to exogenous application of GA3 or IAA. *International Journal Of Plant Physiology And Biochemistry*, 5(4):58-64.2013.
- Heidarian, A. R.;Khodad, M.; Anir, P. L. and Faezeh, A. M.(2011).** Investigation Fe and Zn foliar application on yield and its components of soybean at different growth stages. *J. of Agricultural Biotechnology Developments*, 2(9):189.



- Lamli, U. K. (1970).** *Methods Of Protein Analysis*, Nature (London) 227680.(C.F.Keres,I.1984). Akademia Arkado, Budapest.
- Manju.P.; Mudgiri. B. and Nacer, B. (2014).** Effect of foliar and soil application of potassium fertilizer on soybean seeds, protein ,oil , fatty acids and minerals. *American Journal Of Plant Science*, (5):541-548.
- Mannan,M,A.(2014). Foliar and soil fertilization effect on seed yield and protein content of soybean. *Bangludesh Agrron. J.*, 62-72.
- Mudlagiri,B.G;Manju,Pand Nacer,B.(2012).** Effect of chelating agentson on protein, oil, fatty acids and minerals in soybean seed. *Agricultural Sciences*, 3 (4):517-523.
- Nacer, G.; Xinbua, Yoalemu, M. ; Angeid, M. ;Don, D.J Tyler ;A. and Krishua, N. R.(2013).** Soybean seed protein, oil, fatty acids and iso – *Sciences*, 4:976-988
- Sitohy, M. and Osman, A. (2010).** Antimicrobial activity of native and esterified legume proteins against gram negative and gram positive bacteria. *Food Chemistry*, 120: 66-75.
- Sitohy, M.; Mahgoub, S. A and Osman, A. (2017).** *In vitro* and in situ antimicrobial action and mechanism of glycinin and its basic subunits. *International Journal Of Food Microbiology*, 154:14-29.
- Soheil, K.; Ghorban, N.; Hosein, H.; Farokh, D. and Badak, D.(2013).** Micronutrients distribution in soybean plant with Zn, Fe and Mn application. *Annual Review And Research In Biology*, 3(2):83-91.
- Yosef,S.; Azam, H.; Khosro,M.; Mansour, S.; Gholamereza, H.; Shiva, K. and Masomeh, K. (2012).** Effect of N fertilizer and foliar applied fertilizer at various reproductive stage on yield and chemical composition of soybean seed. *African Journal Biotechnology*, 11(40): 9599-9605.

## دراسات كيميائية حيوية علي تأثير بعض مركبات الرش علي محصول بذور فول الصويا ونوعيته

عبدالعزیز لطفی شرف

قسم علوم الاراضي والمياه- كلية التكنولوجيا والتنمية – جامعة الزقازيق- مصر.

- اجريت تجربة حقلية في مزرعة كلية التكنولوجيا والتنمية – جامعة الزقازيق ، بمصر . لدراسة التأثير البيوكيميائي لمركبات الرش ( نوفاترين ، بوتاسين ) علي المحصول ونوعية بذور فول الصويا .
- تم رش نباتات فول الصويا بمركب النوفاترين والبوتاسين بتركيزات 0.2% و 0.4% عند ٣٠ يوم بعد زراعه البذور ، وتم الحصول على النتائج التاليه :
- ١- ادت جميع المعاملات علي زيادة معنوية في محصول البذور لنبات فول الصويا وكذلك عدد القرون للنبات وعدد البذور في كل قرن بالاضافة الي زيادة وزن المائة بذرة .
  - ٢- ادي رش النباتات بمركب البوتاسين الي زيادة محتوى البروتين الذائب في الماء بينما نقص محتوى البروتين الذائب في حمض الخليك او في ايدروكسيد الصوديوم ، كما ادي رش النباتات بمركب النوفاترين الي زيادة البروتين الكلي .
  - ٣- اظهر التحليل الاليكتروفيرييس وحدتين رئيسيتين من البروتين هما (globulin 11S , 7S)
  - ٤- ادي رش النباتات بمركب النوفاترين الي انخفاض طفيف في محتوى بذور فول الصويا من الزيت بينما ادي رش البوتاسين الي زيادة في محتوى البذور من الزيت .
  - ٥- لوحظ اختلاف طفيف في قيم رقم الحامض ورقم التصبن ورقم اليود ، وكانت اعلي القيم عند تركيز ٢ ، % بوتاسين .
  - ٦- ادي رش النباتات بالنوفاترين والبوتاسين الي تحسن محتوى البذور من الفوسفور والبوتاسيوم والصوديوم ولكنها ادت الي انخفاض في محتوى البذور من الحديد والمنجنيز .
- التوصية:** ينصح برش مركب النوفاترين والبوتاسين على النباتات بعد ٣٠ يوم من الزراعه بتركيز ٠.٤% للحصول على اعلى انتاجيه من محصول البذور وكذلك نوعيته من محتوى البروتين والزيت والعناصر الغذائية اللازمه لعملية التمثيل الغذائي في النبات .