

EFFECT OF INDOL ACETIC ACID AND INDOL BUTRIC ACID ON THE YIELD AND BIOCHEMICAL CONSTITUENTS OF CORN GRAINS.

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ABSTRACT

A field experiment was conducted at Ghazala farm to study the effect of indol acetic acid (IAA) and indol butric acid (IBA) on the yield and some biochemical constituents in corn grains.

The results of this study can be summarized as following:-

All treatments increased the grain yield of corn, but using a mixture of both hormones is more effective than the use of a single one. Spraying IAA or IBA had an increase on non-soluble nitrogen fraction, but the soluble nitrogen was decreased. The highest increase of total and insoluble carbohydrates were recorded at 50 and 100 ppm IBA. All treatments decreased the percentage of oil in corn grains when was the mixture of 50 ppm IAA and IBA. The total free amino acids were slightly decreased by the used IBA treatments, whereas, the second level of IAA and a mixture of 50 ppm IAA. +50 IBA caused an increase of total amino acids in corn grains. Both IAA or IBA decreased the P and K content of corn grains, especially when, IBA applied.

In conclusion, *spraying corn plants with a mixture of (IAA) and (IBA) increase the yield, soluble ,insoluble nitrogen and slightly increase the total contents of amino acids, but decrease total content of carbohydrate, the percentage of oil contents. Also the net result recorded that spraying corn plants with 50, 100 ppm (IAA) increased yield, total nitrogen content, total carbohydrate content, total amino acid content in case of spray[ng by100 ppm ,but decease the total content of oils, while in case spraying by of 50 ,100 ppm (IBA) will increase yield, nitrogen contents, total carbohydrates, but decrease the total amino, and oil contents. All treatment application decreased (P) and (k) contents.*

Key words: *Indol acetic acid, indol butric acid, yield & biochemical constituents, corn grains.*

INTRODUCTION

Seeds have been of interest to man for along time. The early inters were largely of a practical nature since seeds are a major source of food in

most parts of world. Consequently, information on seeds concerns their nutritive value and chemical composition and so forth. As pressure has developed for increased food production throughout the world the use of improved and superior seeds has been stressed. Similarly, the needs for other seed products such as oils. Fibers and industrial chemicals have created additional demands for new seed varieties (Ingle *et al.*, 1965). So, corn plant is one of the fundamental sources of diet for human and animal consumption, therefore many attempts were done to increase the yield of grains or to improve the quality of its protein and carbohydrates.

Growth regulators have been used on a large scale in recent year in studying the development and productivity of plant. It has been established as a result of numerous studies, that plant hormone is a substance possessing high physiological activity and that it exercises multilateral influence on plants. In this connection, Allam (1983) found that some growth regulators and micronutrients increase the content of nitrogen, carbohydrates and grain yield of maize. Also, Taira *et al.* (1979) detected significant differences in seed protein and carbohydrate contents as affected by different rates of foliar hormones. Also, Amal *et al.* (2009) found that the application of ASA and IBA enhanced plant growth fresh ,dry weight and significant increase in 1000 seeds weight. Also found that ,the soluble protein ,total soluble carbohydrates and sugars were increased by ASA and IBA application. Exogenous IAA significantly increased Pb accumulation in roots, but decreased Pb accumulation in shoots over the culture period of five days, Huan *et al* (2007). Also, Jutta *et al.* (1997) found that the increase in IBA was accompanied by an increase of sythetase activity , but the enzyme activity was also enhanced at later stages infection .

Therefore, the aim of the present study was to evaluate the effect of IAA and IBA either applied individually or as a mixture on yield and some biochemical constituents of corn grains. Amin *et al.* (2007) reported that the foliar application of IBA and SA with different concentration led significant increases fresh, dry weight, photosynthetic pigments contents of leaves, yield and quality as will as biochemical constituents of onion bulb.

MATERIALS AND METHODS

The field experiment was conducted in the Agronomy farm of Ghazala, Zagazig, Sharkia Governorate at 2010 / 2011 season. A complete randomized block design was applied. Each treatment was replicated three times. Foliar hormones were applied as follow:

- 1- Control
- 2- 50 ppm IAA
- 3- 100 ppm IAA
- 4- 50 ppm IBA
- 5- 100 ppm IBA
- 6- 50 ppm + 50 ppm IBA
- 7- 100 ppm IAA+100 ppm IBA.

- The growth hormones under investigation were applied as foliar after 25 days of sowing date. At full Maturity, the yield was determined, and samples were collected dried at 70c the grounded and stored until chemical analysis.

Methods of analysis

- Total nitrogen in samples of corn grains was determined according the method described by A.O.A.C. (1970).
- Soluble nitrogen was determined in the samples according to the method described by Mengle and Helal (1968).
- Carbohydrates were determined according to the method of Magnetski *et al.* (1959).
- Phosphorus determined according to the method adapted by Agiza *et al.* (1960).
- Potassium was determined using the atomic absorption apparatus in the acid dighest according to the method of Chapman and Parker (1961).
- The oil percentage was determined by extracting the oil in sixhelt apparatus by petroleum either according to the method described by A.O.A.C. (1970).
- The free amino acids were extracted, fractionated and determined by Block and Durn (1958).

RESULTS AND DISSCUSSION

As illustrated in Table 1, the application of indole acetic acid (IAA) has an increasing effect on corn grains yield. On the other hand, the interaction effect of IAA and IBA on the grain yield is more effective on grain yield than the application of each hormone. Also, the data in the same Table (1) showed that the first level (50 ppm) and second level (100 ppm) of IBA slightly decreased the grain yield when compared with control. The results could be due to the biological effect of IAA on the Photosynthesis activation during growth. The same conclusion was stated by Amin *et al.* (2007) and Vahid *et al.* (2012) reported that application of IBA and increased the grain yield and yield

Table 1. Effect of Indol Acetic and Indol Buteric Acid On the yield of Corn Grains

Treatments	Gm/plant	Kg/plot 1/300 fedd	Kg/fedd	Weight of 100 kernel Gm
1-Control	210	16.90	5070	24.88
2-50 ppm IAA	227	18.43	5553	27.42
3-100 ppm IAA	236	19.78	5934	26.82
4-50 ppm IBA	205	16.45	4935	24.66
5-100 ppm IBA	212	17.08	5124	25.12
6-50 ppm IAA+IBA	243	19.92	5976	27.16
7-100 ppm IAA+IBA	235	19.22	5766	26.99
L.S.D 5%		0.685		
1%	-	0.960	-	-

components of corn plant.

The weight of 100 kernels the data revealed that it was generally increased as a result of all treatments except treatment with 50 ppm of IBA. The highest weight of 100 kernels was obtained by a mixture of 50 ppm IAA & 50 ppm IBA.

Data presented in Table (2) indicated that there was a slight increase in insoluble and total nitrogen in corn grains from plants treated with IBA at the low and high levels. The highest increase noticed with second level of IAA (100 ppm), when compared with other treatment. This is probably due to that IAA induced protein synthesis. These results agree with those reported by Sharaf and El-Saadany (1982) and Amal *et al* (2009) who found that the protein content in wheat grains was increased with foliar application of plant hormones.

Table 2. Effect of indol acetic and indol buteric acid on the content of nitrogen fraction in corn grains

Treatments	Sol. N	Insol N	Total N	Ratio Sol./Insol
1- Control	0.168	1.325	1.493	0.127
2- 50 ppm IAA	0.150	1.534	1.684	0.098
3- 100 ppm IAA	0.146	1.846	1.992	0.079
4- 50 ppm IBA	0.184	1.316	1.500	0.139
5- 100 ppm IBA	0.188	1.397	1.585	0.126
6- 50 ppm IAA+IBA	0.175	1.611	1.786	0.108
7- 100 ppm IAA+IBA	0.192	1.566	1.758	0.123

From the same Table (2), treating plants with I.B.A increased the soluble nitrogen fractions but slightly decreased the insoluble nitrogen in corn grains as compared to control. On the other hand, spraying corn plants with a mixture of both hormones caused an increase in the nitrogen fraction as compared with control. This may be explained on the bases that plant hormones the nitrogen fixation as well as the synthesis of insoluble nitrogen fractions such results agree with those obtained by Doheem *et al*. (1982), who found that the nitrogen fractions were increased by GA₃ and Kinetin hormones applied. Also, Amal *et al* (2009) found that IBA stimulate and promote plant protein. The sol. N/insol. N ratio was reduced by spraying two levels of IAA and mixture of two hormones used on corn plant. Also, the ratio sol. /insol. N was increased by IBA treatments, it can not be taken as an evidence of reduced protein synthesis since the increase in soluble protein did not occur on the expense of the insoluble. These results are in agreement with those obtained by Vahid *et al*. (2012) and Amal *et al*.(2009).

Results in Table (3) concerning with the effect of IAA and IBA spraying on the content of amino acids in corn grains affected by some plant hormones are shown in Table 3. The free amino acids in corn grains were,

alanine, glycine, valine, tyrosine, phenyl alanine, glutamic, aspartic, lysine and methionine.

The data in Table (3) showed that, spraying corn plant with IBA at different concentrations the total free amino acids in corn grains except when sprayed plants with (100 ppm IAA+100 ppm IBA). While, it can be noticed from the same Table that all treatments with IAA increased the total free amino acids in corn grains. Also, it can be noticed that, the aliphatic amino acids showed comparatively the highest values among the other amino acids. As well as, the phenylalanine content was higher than tyrosine content in grains. These results are in full agreement with those obtained by Huan *et al.* (2007) and Jutta *et al.* (1997)

The results in Table (4) show that, the foliar hormones increased the carbohydrate content of corn grains. The greatest increase of insoluble or total carbohydrates were recorded at 100 ppm IBA. While, the lowest increase was obtained at 50 ppm. IAA. This means that the used of IBA increased the photosynthetic processes and finally reflected on carbohydrates content. These results are in agreement with those obtained by Amal *et al.* (2009).

Table 4. Effect of indol acetic acid and indol buteric acid on the content of carbohydrate fractions in corn grains

Treatments	Soluble Carbohydrate	Insoluble Car.	Total Car.	Ratio Sol./Insol
1- Control	12.93	64.49	77.42	0.200
2- 50 ppm IAA	11.73	66.52	78.25	0.176
3- 100 ppm IAA	11.84	67.14	78.98	0.176
4- 50 ppm IBA	11.29	69.34	80.68	0.162
5- 100 ppm IBA	12.13	68.75	80.88	0.176
6- 50 ppm IAA+IBA	12.71	67.77	79.48	0.178
7- 100 ppm IAA+IBA	12.71	66.95	79.66	0.189

Data in Table (5) indicated that oil content of corn grains was decreased at treatments of IAA or IBA as compared with control. The highest decrease in oil content of corn grains was recorded at the first level of IBA or the first level of a mixture IAA and IBA. These results are in agreement with those obtained by Doheem *et al.* (1985). Also, the oil properties of corn grains, Acid value, saponification value and Iodine values did not show any effects except at 100 ppm IBA or a mixture of two hormones showed a slight increase of acid value in the oil of corn grains.

The results in Table (6) showed the effect of IAA and IBA treatments on the content of P and K, in corn grains. Phosphorus and Potassium content in corn grains decreased by foliar application of all treatments, when compared with control.

Table 5. Effect of indol acetic and indol buteric acid on the content and some properties of oil in corn grains

Treatments	Oil Content		Some Properties		
	%	mgm/plant	Acidic value	Sapon.value	Iodine value
1- Control	0.045	9.45	0.65	182.6	143.6
2- 50 ppm I.A.A	0.034	7.72	0.65	182.8	148.7
3- 100 ppm I.A.A	0.040	9.44	0.65	184.1	148.6
4- 50 ppm I.B.A	0.029	5.95	0.66	183.2	148.5
5- 100 ppm I.B.A	0.024	6.15	0.68	183.4	148.8
6- 50 ppm I.A.A+I.B.A	0.026	6.32	0.67	183.6	148.8
7- 100 ppm I.A.A+I.B.A	0.032	7.52	0.68	183.4	148.6

Table 6. Effect of indol acetic and indol buteric acid on the content of phosphorus and potassium on corn grains (mg/plant)

Treatment	Phosphorus		Potassium	
	%	mgm/plant	%	mgm/plant
1- Control	1.965	454.65	3.689	774.69
2- 50 ppm IAA	1.405	318.94	3.175	722.99
3- 100 ppm IAA	1.481	349.75	3.221	760.36
4- 50 ppm IBA	1.405	258.03	3.625	743.12
5- 100 ppm IBA	1.342	284.57	3.444	708.99
6- 50 ppm IAA+IBA	1.689	410.43	3.067	760.59
7- 100 ppm I.A.A+I.B.A	1.785	419.47	3.246	762.75

The highest decrease of phosphorus or potassium content in corn grains was noticed at 100 ppm IBA. In this connection, Gaber, *et al.* (1983), found that plant hormones decreased the percentage of phosphorus in plants. Also, the spraying plants with IB.A either at 50 ppm or at 100 ppm gave the highest decrease of P contents in corn grains when compared with the control and other applications.

In conclusion, spraying corn plants with a mixture of (IAA) and (IBA) increase the yield, soluble ,insoluble nitrogen and slightly increase the total contents of amino acids, but decrease total content of carbohydrate, the percentage of oil contents. Also the net result recorded that spraying corn plants with 50, 100 ppm (IAA) increased yield, total nitrogen content, total carbohydrate content, total amino acid content in case of spray[ng by100 ppm ,but decease the total content of oils, while in case spraying by of 50, 100 ppm (IBA) will increase yield, nitrogen contents, total carbohydrates, but decrease the total amino, and oil contents. All treatment application decreased (P) and (k) contents.

REFERENCES

- Agiza, A.H., El-Henedy, Y. and Ibrahim, M. (1960).** The determination of the different fractions of Phosphorus. Faculty Of Agric., Cairo Univ., Bill No. 121- 127.
- Allam, S.A. (1983).** Study on the effect of some growth regulators and Micronutrients on growth and yield of Maize. M. Sc. Thesis, Zagazig Univeristy, Zagazig, Egypt.
- Amal M. El- Shraiy and Amira M. Hegazi(2009).** Effect of Acetylsalicylic Acid, Indole-3- Bytric Acid and Gibberellic Acid on Plant Growth and Yield of Pea (*Pisum Sativum L.*). *Australian Journal of Basic and Applied Sciences*, **3**(4): 3514-3523.
- Amin A. A., EL-Sh. 1 1 M. Rashad and 2H.M.H. EL-Abagy (2007).** Physiological Effect of Indole - 3 - Butyric Acid and Salicylic Acid on Growth, Yield and Chemical Constituents of Onion Plants. *Journal of Applied Sciences Research*, **3**(11): 1554-1563,
- A.O.A.C. (1970).** Official and Tentative methods of analysis. *Association of official Agricultural Chemists*. Washington, D.Ci, 11 ed.
- Block, R.J. and Durrm, S.L (1958).** *Chromatography And Electrophoresis*. Acad. Press Inc. New York.
- Chapmann, H.D. and Parker, F.P. (1961).** *Methods Of Analysis Of Soil, Plant And Water*. Univ. of California. August, 1981 2nd, printing.
- Doheem, M., Sharaf, A., El-Massry, R. and Youssef. A. (1982).** Effect of some plant hormones on protein metabolism in *Phaseotus vulgaris*. *Zagazig Jour. Agric. Res.*, **7**:388- 409.
- Doheem, M., Sharaf, A., Sotohom, and Abd-Elmaksod, H., (1985).** Biochemical effect of Antitanspirant on some biochemical constituents of seeds plant. *Zagazig Jour. Agric. Res.*, **9** (2) 373 -391
- Gabr, S., Sharaf, A. and El-Saadany, S. (1983).** Effect of cycocyl and alar on some Biochemical constituents in tomato plants. *Annals of Agric. Sci, Moshtohor*, **20**: 61-71.
- Huan-hua.W,Xiao.Q,S;Bei.W; Gary.O,J.F and Shu-Z.Z.(2007).** Effect of indol -3-acetic acid on lead accumulation in maize(*Zea mays*) L).*Environmental and Experimental Botany*, **61**:246-253.
- Ingle , J . D . Beitz and R .H. Hageman (1965).** Changes in composition during development and maturation of maize seeds. *Plant Physiol.*,**40**:835-839 .
- Jutta ,L.M.; Michael,K.; Ellen,G.S. and Ephraim,E.(1997).** Indole -3- butric acid(IBA) is enhanced in young maize (*Zea –mays-L.*) roots colonized with the arbuscular mycorrhizal fungus *Glomus intrardices*. *Plant Science*, **125**:153-162.

- Magnetski, K.P., Tsugarov, Y.A. and Malkov, B.K. (1959).** *New Methods For Plant And Soil Analysis*. U.M.B. Rell – Paris – Stauffer.
- Mengle, K. and Helal, M. (1968).** The effect of varied nitrogen and Potassium nutrition on the content of soluble amino compounds in serial parts of oats. *Z.flanzener nacher Bodenk*, **122** (1): 12-20.
- Sharaf, A. and El-Saadany, S.S. (1982).** Effect of different levels of Kinetin and GA₃ on some biochemical constituents of wheat. *Zagazig Jour. Agric. Res.*, **9** (1): 280-299. .
- Taira, H., Asahi, Y. and Iguch, T. (1979).** Report of National food institute No. 35: 42-47.
- Vahid, G., Mohammad J., Mohammad, S. and Abbas K. (2012).** Yield and Yield Components of Corn (*Zea mays* L.) In Responseto Folia Application with Indole Butyric Acid and Gibberellic Acid, *American-Eurasian J. Agric. & Environ. Sci.*, **12** (9): 1246-1251.

تأثير اندول حمض الخليك واندول حمض البيوتيريك علي بعض المكونات البيوكيميائه في حبوب الذره الشاميه

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اجريت تجربة حقلية في مزرعة كلية التكنولوجيا والتنمية بقرية غزاله التابعة لمركز الزقازيق شرقية وذلك لدراسة تأثير اندول حمض الخليك واندول حمض البيوتيريك علي المكونات البيوكيميائه في حبوب الذره.

ووضحت النتائج الاتي :-

- زيادة محصول الحبوب من الذره برش جميع الهرمونات المستخدمة في البحث ووجد ان استخدام مخلوط من اندول حمض الخليك واندول حمض البيوتيريك كان اكثر تأثيرا.
- إضافة كل من اندول حمض الخليك واندول حمض البيوتيريك كان لهما تأثير ايجابي علي محتوى حبوب الذره من النيتروجين الكلي والنيتروجين الغير ذائب، بينما أدت نفس المعاملات المستخدمة الي نقص النيتروجين الذائب.
- لوحظ أن اعلي زيادة في الكربوهيدرات الغير ذائبة والكلية في حبوب الذرة كانت عند استخدام معاملات اندول حمض البيوتيريك.
- أدي استخدام جميع المعاملات من الهرموني الي نقص محتوى الزيت في حبوب الذره وخاصة عند اضافة مخلوط من الهرموني.
- لوحظ نقص خفيف في محتوى الاحماض الامينية في الحبوب عند استخدام اندول حمض الخليك بينما ادت اضافة مخلوط من الهرموني الي زيادة في محتوى الاحماض الامينية في حبوب الذره.
- أدت إضافة كل من اندول حمض الخليك واندول حمض البيوتيريك الي نقص محتوى الحبوب من الفوسفور والبوتاسيوم.