Int. J. Adv. Res. Biol. Sci. 2(12): (2015): 154–162

International Journal of Advanced Research in Biological Sciences
ISSN: 2348-8069
www.ijarbs.com
Coden: IJARQG(USA)

Research Article

SOI: http://s-o-i.org/ 1.15/ijarbs-2-12-17

Effect of Indole butyric, Arginine, Cyanocobalamine (B12), Ascorbic acid and their interactions on growth, yield and some metabolic constituents of sunflower plants

Mohamed A. Amin and Mohamed A. Ismail

Botany and Microbiology Department, Faculty of Science, Al-Azhar University, Cairo, Egypt.
Corresponding author: mabdelal77@yahoo.com*

Abstract

The effect of foliar spray of Indole butyric acid (200 ppm), Arginine (200 ppm), Cyanocobalamine (B12) (200 ppm), Ascorbic acid (200 ppm) and their interactions on growth, yield and some physiological parameters of (*Helianthus annuus* var. Sakha 53). Application of ascorbic acid, indole butyric acid +ascorbic acid and arginine +B12 created significant stimulative effects on shoot length of sunflower plants. Application arginine caused significant increase in fresh and dry weight of shoot and root. The contents of chlorophyll a; b; total chlorophyll (a+ b); carotenoids and soluble protein of shoots and seeds showed significant increases in response to arginine, B12 and ascorbic acid. Whereas, combined between IBA, arginine and B12, ascorbic caused significantly increased total phenol contents of shoot as compared with the control. Indole butyric acid, arginine and ascorbic acid caused significant increase in the activities of amylase and proteases. The highest amylases activities were recorded by ascorbic, followed by B12. Foliar application of interaction between arginine and B12, ascorbic significantly increased diameter of head. Weight of 100 seeds was significantly increased with plants treated with IBA+B12. The increments of weight of 100 seeds estimated by 26.66% in response to treating with IBA+ (B12) compared with the control plants. The positive effect of arginine+ B12 on diameter of head followed also, the positive trend obtained previously on shoot growth. Carbohydrates contents of seeds were found to be significantly increased only in response to applying IBA+ ascorbic and arginine+ B12. Treatments with IBA, ascorbic and combined between IBA, arginine and ascorbic and caused significant increase in phenol contents of the seed yield. The total lipids showed significant increases only in response to B12. The highest value of carbohydrates, protein and phenol contents were recorded in response to IBA+ascorbic; ascorbic and IBA respectively. Stearic acid percent were found to be markedly increased only in response to applying Arg+B12 (4.70%) as compared with untreated plants (2.37%). It was also, found that treatments with Arg+B12 caused the contents of Oleic acid to be markedly increased (56.32%) as compared with control plants (32.7%). There is no marked change in Saponification number of fatty acids as compared with untreated plants. Iodine number was markedly decreased with plants treated with Arg. +B12

Keywords: Indole butyric acid, on growth, yield, *Helianthus annuus* var. Sakha 53, Saponification number

Introduction

Sunflower (*Helianthus annuus* L.) is an important crop and ornamental plant in the world. It is used for animal feed and also it is the second most important crop producing edible oil after soybean **(Shehata and El-Khawas, 2003; Fairless, 2007**). Growth regulators and vitamins are known to affect plant growth through primary and secondary metabolism (**Ewais *et al.*2003 and Reda *et al.*2007). Rafique, *et al.* (2011)** showed the best results on seedling growth, fresh and dry matter production of pumpkin seedlings due to 30 mg L^{-1} ascorbic acid treatments. Seedlings fresh weight, protein contents, protease and nitrate reductase activities were significantly affected by 30 mg L^{-1} ascorbic acid. Moreover, **Mazher *et al*. (2011)** found stimulatory effect of ascorbic acid (100 and 200 ppm) on all growth parameters (plant height, number of branches, number of leaves, stem diameter, root length as well as fresh and dry weights of all plant organs) of *Codiaeum variegatum* L. Arginine is one of the essential amino acids (considered the main precursor

of polyamines which produced by decarboxylation of arginine via arginine decarboxylase to form putrescine **(Bocherueu, 1999)**. Amino acids are well known as bio-stimulants, which have positive effects on plant growth and yield **(Kowalczyk and Zielony, 2008).**
Polyamines and their precursor arginine have been implicated as vital modulators in a variety of growth, physiological and developmental processes in higher plants **(Glastone and Kaur-sawhny, 1990). Fawzy *et al*., 2012)** showed that, foliar spraying of Chinese garlic plants with bio-stimulants especially amino acids compound had a significant effect on vegetative growth, yield and quality. The application of arginine significantly promoted the growth and increased the fresh and dry weights in bean **(Nassar *et al*., 2003);** in wheat (**El-Bassiouny *et al*., 2008**). Application of auxin, particularly indole-3-butyric acid (IBA), is one of the most common and effective means to enhance rooting of cultures **(Han *et al*. 2009).**

Therefore in the light of such findings, the present study was undertaken to investigate the effect of indole butyric, arginine, B_{12}, ascorbic acid and their interactions on growth, yield and some metabolic constituents of sunflower plants grown under field conditions.

Materials and Methods

Seeds of sunflower "*Helianthus annuus*" (Sakha 53) were obtained from Agricultural Research Centre, Ministry of Agriculture, Giza, Egypt. Uniform sunflower seeds were planted in natural loamy soil conditions in Botanical garden, Botany and Microbiology Dept., Fac. of Sci., Al- Azhar Univ., Nasr City, Cairo, Egypt, in a plot (10m width and 5m length) containing 10 ridges representing the following treatments: distilled water (as controls), indole butyric acid (200 ppm), Arginine (200 ppm), Cyanocobalamine (B12) (200 ppm), Ascorbic acid (200 ppm), and their interactions(indole butyric acid+ B12, indole butyric acid+ Ascorbic acid, Arginine+ B12 and Arginine+ Ascorbic acid). The seeds were sown on one side of the ridge, with 20 cm apart between the hills. The developed plants were irrigated whenever required. Concentrations of the used plant growth regulators were chosen according to a preliminary experiment in which they caused a maximum germination percentage. The plants were sprayed twice with the above mentioned treatments. The first treatment was made when the age of plants was 33 days, while the second treatment was made when the age of plants was 65 days. The plant samples were collected for analysis when the plants were 40 (Stage I) and 72 (Stage II) days old. At the end of the growth season, analysis of the seeds yielded from the different treatments and the control were done. Contents of chlorophylls were estimated using the method of **Vernon and Selly (1966)**. Contents of carotenoids were carried according to **Lichtentahler (1981).** Contents of soluble carbohydrates were measured according to the method of **Umbriet *et al*. (1969).** Contents of soluble proteins were estimated according to the methods of **lowery *et al*. (1951).** Phenolic compounds were estimated according to the methods of **Daniel and George (1972).** Activities of amylases were determined using the method of **Afifi *et al*. (1986).** Proteases activities were estimated using the method of **Ong and Guacher (1972).** total lipids determined by using a soxhlet apparatus according to **Guenther (1972).** Fractionation of fatty acid methyl esters was carried out by GLC according to **Kates (1972).** Iodine and saponification number were estimated according to A.O.A.C. (1975). Statistical analysis of the obtained results was done using (L.S.D.) according to **Snedecor and Cochran (1982).**

Results and Discussion

1- Growth parameters:

The obtained results (Tables 1&2) revealed that application of ascorbic acid, indole butyric acid +ascorbic acid and arginine +B12 created significant stimulative effects on shoot length of sunflower plants. Application ascorbic caused significant effects on dry weight of shoot and root .These findings are in accordance with **Ewais (2003)** reported that application of ascorbic acid improved growth and yield characteristics of broad bean plants. Recently, **Rafique *et al*. (2011)** found that the best results on seedling growth, fresh and dry matter production of pumpkin seedlings by 30 mg L-1 ascorbic acid treatments. Indole butyric acid +ascorbic acid were more effective than other treatments in enhancing shoot growth. While arginine +B12 was most effective on fresh and dry weight of roots in (table 2). Application arginine caused significant increase in fresh and dry weight of shoot and root. With respect to arginine, many investigators obtained similar positive effects on the growth of other plants such as **(Ibraheem, 2006)** showed that external supply of wheat shoots with arginine induced increases in the fresh and dry weights of shoots and roots of wheat plants than the control throughout the experimental period**.** Indole butyric acid +ascorbic acid and arginine +B12 created significant effects on fresh of shoot as well, fresh and dry weight of root of sunflower plants. In this concept **Yousif *et al*. (2012)** observed that 0.5 g l^{-1} sucrose + 150 g l^{-1} ascorbic acid increased fresh and dry weight in snapdragon cut spike flowers.

Table (1) Effect of indole butyric, Arginine, B12, Ascorbic acid and their interactions on shoot length, root length and number of leaves of sunflower *(Helianthus annuus* (var. Sakha 53)) plants. Values given are means of ten replicates.

Treatment (ppm)	Shoot length (cm)	Root length (cm)	Number of leaves
Control 1	107	15.66	18.33
IBA(200 ppm)	93.66*	16.50	17.33
Arg (200 ppm)	109.33	14.66	20.33
B12(200 ppm)	109.33	10.46*	16.00
Asc (200 ppm)	119.33*	9.66*	19.33
LSD at 0.05	9.49	3.98	2.54
Control 2	127.66	14.16	17.33
IBA+ B12	118.00	14.40	16.66
IBA+ Asc	151.66*	12.00	18.00
Arg +B12	142.33*	15.40	18.66
Arg + Asc	125.66	14.83	17.66
LSD at 0.05	13.51	3.09	3.43

*significantly different ($P \leq 0.05$) .

Table (2) Effect of indole butyric, arginine, B12, ascorbic acid and their interactions on fresh weight and dry weight of shoots and roots of sunflower *(Helianthus annuus* (var. Sakha 53)) plants.. Values given are means of ten replicates.

Treatment (ppm)	F. wt. of shoots (g.)	D. wt. of shoots (g.)	F. wt. of roots (g.)	D. wt. of roots (g.)
Control 1	109.47	13.82	10.55	2.42
IBA(200 ppm)	71.69*	10.92	9.69	4.15*
Arg (200 ppm)	137.09	19.99*	14.45	4.84*
B12(200 ppm)	113.43	17.63	9.94	2.44
Asc (200 ppm)	113.97	20.63*	12.25	4.29*
LSD at 0.05	13.21	4.25	3.21	1.01
Control 2	108.05	24.92	11.99	3.89
IBA+ B12	86.81	15.49*	12.70	4.46
IBA+ Asc	184.08*	28.89	28.00*	10.77*
Arg +B12	162.73*	26.53	31.16*	14.02*
Arg + Asc	120.08	22.76	16.23	6.15
LSD at 0.05	38.36	8.33	10.60	6.57

***** significantly different ($P \leq 0.05$) .

2- Photosynthetic Pigments:

The contents of chlorophyll a; b; total chlorophyll (a+ b) and carotenoids of sunflower plants (Table 3) showed significant increases in response to arginine, B12, ascorbic acid, indole butyric acid + ascorbic acid and arginine + B12. Indole butyric acid +ascorbic acid were more effective followed by B12. The obtained results agree with those observed by a number of investigators. **Abdel Aziz *et al*. (2009)** found that ascorbic acid at 100 ppm significantly increased chlorophyll a, b, a+b and carotenoids of gladiolus plants. **Fouda (2013)** showed that, at both normal and saline conditions, contents of chlorophyll (a) and (b) as well as total chlorophyll (a + b) were, mostly, increased due to the application of arginine. Also, contents of carotenoids were significantly increased throughout the two stages of growth.

Table (3): Effect of indole butyric, arginine, B12, ascorbic acid and their interactions on chlorophyll and carotenoids contents (mg/g. F. wt) of sunflower plants. Values given are means of three replicates.

Treatment (ppm)	Chlorophyll a	Chlorophyll b	Chlorophyll a+ b	Carotenoids
Control 1	1.895	0.736	2.631	0.509
IBA(200 ppm)	1.858	0.772	2.630	0.540
Arg (200 ppm)	2.827*	1.140*	3.967*	0.666*
B12(200 ppm)	3.207*	1.561*	4.768*	0.870*
Asc (200 ppm)	2.625*	1.173*	3.798*	0.588*
LSD at 0.05	0.325	0.254	0.587	0.068
Control 2	1.307	0.769	2.077	0.339
IBA+ B12	2.032*	0.790	2.821	0.571
IBA+ Asc	3.919*	1.777*	5.696*	0.857*
Arg +B12	3.060*	0.941*	4.001*	0.825*
Arg + Asc	1.103	0.727	1.830	0.071
LSD at 0.05	0.521	0.156	0.721	0.079

* significantly different ($P \leq 0.05$) .

3- Carbohydrates, Proteins and phenols in shoot:

Results of the present work (Table 4) revealed that, total soluble carbohydrates contents of sunflower shoots were tended to increase, in response to the treatment with ascorbic acid or arginine +B12. Application of indole butyric acid, arginine, B12, ascorbic acid and IBA+ B12 markedly increased total soluble proteins contents of shoot. In this regard, **El-Bassiouny *et al.*, (2008)** indicated that arginine was the most effective compound in increasing soluble carbohydrate and protein contents of wheat plants and grains under normal or stressed condition. **Shalaby and Ahmed (1994)** studied the effect of IAA on the protein contents of faba bean (*Vicia faba*) plants where they observed marked increases in protein contents in response to IAA (100 and 200 ppm) application.

Whereas, interaction between IBA, arginine and B12, ascorbic caused significantly increased total phenol contents of shoot as compared with the control. The highest increment in protein contents was observed in as a consequence of applying IBA+ B12. On the other hand, arginine tended to significant decrease in both soluble carbohydrates and phenol contents in shoots of sunflower plants. Also, application of B12 and ascorbic significantly decreased in total phenol contents of shoot. In agreement with these results a number of investigators observed stimulating effect regarding the effect of ascorbic acid (**Abdel Aziz *et al*. 2006; Farahat *et al*. 2007; Eid *et al*. 2010**).

Table (4): Effect of indole butyric, arginine, B12, ascorbic acid and their interactions on total water soluble carbohydrates contents (mg/g. dry weight) of sunflower plants. Values given are means of three replicates.

Treatment (ppm)	Shoots		
	soluble carbohydrates	soluble proteins	total phenols
Control 1	8.94	83.98	44.16
IBA(200 ppm)	9.33	91.01*	44.05
Arg (200 ppm)	1.08*	95.10*	18.83*
B12(200 ppm)	7.5	99.11*	25.36*
Asc (200 ppm)	14.17*	93.76*	24.14*
LSD at 0.05	4.214	6.546	8.024
Control 2	3.48	21.72	26.57
IBA+ B12	3.16	98.61*	41.84*
IBA+ Asc	4.01	9.52	37.64*
Arg +B12	6.60*	28.74	30.01
Arg + Asc	2.98	10.27	30.11
LSD at 0.05	1.012	15.247	2.965

*significantly different ($P \leq 0.05$) .

4- Enzymes Activities:

The obtained data (Table 5) indicated that application indole butyric acid, arginine, B12 and ascorbic acid, with one exception, caused significant increase in the activities of amylase and proteases. The exceptional case was represented by insignificant decrease in protease activities in responses to B12. The most amylases activities were recorded by ascorbic, followed by B12. The stimulating effect of ascorbic acid on protease activity, obtained in the present study, are harmony with those observed by **Rafique *et al.* (2011)** who found that protease activity was higher in pumpkin seedling from seeds treated with $15mgL^{-1}$ Asc. Concerning the interaction between indole butyric acid, arginine and B12, ascorbic caused significant decrease of activities of amylases. It was also observed (Table 5) that (arginine +B12) treatment showed significantly increased the protease activities of sunflower plants.

Table (5): Effect of indole butyric, arginine, B12, ascorbic acid and their interactions on activities of proteases, amylases and lipases enzymes (mg/g. dry weight equivalent) of sunflower plants. Values given are means of three replicates.

Treatments	Amylases	Proteases
Control 1	0.034	0.019
IBA(200 ppm)	0.434*	0.024*
Arg (200 ppm)	0.646*	0.036*
B12(200 ppm)	1.794*	0.016
Asc (200 ppm)	1.896*	0.025*
LSD at 0.05	0.354	0.05
Control 2	1.122	0.031
IBA+ B12	0.399*	0.023
IBA+ Asc	0.723*	0.010*
Arg +B12	0.918*	0.054*
Arg + Asc	0.689*	0.018*
LSD at 0.05	0.201	0.012

*significantly different ($P \leq 0.05$) .

5- Yield components and nutritional value of the yielded seeds:

Results recorded in table (6) indicated that foliar application of interaction between arginine and B12, ascorbic significantly increased diameter of head of sunflower plants. The highest value was obtained with plants treated with arginine+ ascorbic. The use of arginine to improve the yield and yield components was recommended by other investigators. In this regard, **Abdul Qados (2009 and 2010)** on wheat and mung bean indicated that the sprayed plants with arginine showed a marked increase in the number of pods/ plant, weight of pods/ plant and seed index.

Weight of 100 seeds was significantly increased with plants treated with IBA+ (B12). The increments of weight of 100 seeds estimated by 26.66% in response to treating with IBA+ (B12) compared with the control plants. The positive effect of arginine+ B12 on diameter of head followed also, the positive trend obtained previously on shoot growth.

The obtained results (Table 7) showed that carbohydrates contents were found to be significantly increased only in response to applying IBA+ ascorbic and arginine+ B12. Treatments with IBA, arginine, B12 and ascorbic caused significant decrease in these contents of the seed yield.

It was also observed (Table 7) that arginine, B12, ascorbic and IBA+ascorbic caused significant increase of protein contents of the yielded seeds. These results could be supported by the results obtained by **El-Bassiouny *et al.*, (2008)** who indicated that arginine was the most effective compound in increasing soluble carbohydrate and protein contents of wheat plants and grains under normal or stressed condition.

Treatments with IBA, ascorbic and combined between IBA, arginine and ascorbic caused significant increase in phenol contents of the seed yield.

Table (6): Effect of indole butyric, arginine, B12, ascorbic acid and their interactions on yield components of sunflower plants. Values given are means of ten replicates.

Treatment (ppm)	Diameter of head (cm)	Weight of head (g.)	Weigh of seeds/plant (g.)	Weight of 100 seeds (g.)
Control 1	8.00	16.65	11.59	3.22
IBA(200 ppm)	7.33	6.31*	5.14*	2.84
Arg (200 ppm)	9.33	18.32	12.91	3.23
B12(200 ppm)	8.50	21.60	12.53	2.87
Asc (200 ppm)	7.77	10.20	4.42*	3.33
LSD at 0.05	1.835	7.942	5.997	0.792
Control 2	8.10	21.16	11.59	3.30
IBA+ B12	8.67	20.28	11.18	4.18*
IBA+ Asc	8.33	15.28	7.41	2.43*
Arg +B12	9.83*	13.79*	6.37*	3.00
Arg + Asc	10.00*	12.77*	6.19*	3.55
LSD at 0.05	1.436	6.597	4.589	0.827

***** significantly different ($P \leq 0.05$)

Table (7): Effect of indole butyric, arginine, B12, ascorbic acid and their interactions on soluble carbohydrates, proteins, phenols and total lipids of the seed yield of sunflower plants. Values given are means of three replicates.

Treatment (ppm)	Seeds			
	soluble carbohydrates	soluble proteins	total phenols	Total lipids (%)
Control 1	14.10	94.35	31.66	24.4
IBA(200 ppm)	6.42*	77.30*	81.88*	24.8
Arg (200 ppm)	7.96*	113.32*	23.59	21.6
B12(200 ppm)	9.97*	113.98*	23.03	30*
Asc (200 ppm)	8.25*	164.38*	59.87*	24
LSD at 0.05	3.12	15.54	19.35	3.45
Control 2	5.16	129.19	60.87	25.2
IBA+ B12	6.96	104.54*	46.04*	11.2*
IBA+ Asc	12.02*	144.32*	83.54*	18.4*
Arg +B12	9.76*	98.94*	56.77	18.4*
Arg + Asc	7.06	110.73*	110.8*	24.4
LSD at 0.05	3.68	13.78	14.25	6.21

***** significantly different ($P \leq 0.05$) .

The total lipids showed significant increases only in response to B12.

The highest value of carbohydrates, protein and phenol contents were recorded in response to IBA+ascorbic; ascorbic and IBA respectively. In this concept **Yousif *et al*. (2012)** observed that 0.5 g l^{-1} sucrose + 150 g l^{-1} ascorbic acid increased total carb ohydrates percentage in snapdragon cut spike flowers.

Results shown in tables (8) revealed that total lipids of sunflower seeds contained five saturated fatty acids and six unsaturated ones. The saturated fatty acids were palmitic (c16), margaric (c17), stearic (c18), arachidic (c20) and behenic (c22). The unsaturated fatty acids were palmitoleic, heptadecenoic, oleic, linoleic, linolenic and eicosenoic. As regards the saturated fatty acids margaric, arachidic and behenic showed low levels. Stearic acid percent were found to be markedly increased only in response to applying Arg+B12 (4.70%) as compared with untreated plants (2.37%). It was also, found that treatments with Arg+B12 caused the contents of Oleic acid to be markedly increased (56.32%) as compared with untreated plants (32.7%). ***Many investigators showed the effect of vitamins on oils for example*, Emam, *et al* (2011)** showed that foliar application vitamin C improved the quality of flax seeds that induced oil yield per feddan.

Table (8): Effect of indole butyric, Arginine, B12, ascorbic acid and their interactions on percent (%) of fatty acids of seed yield ofsunflower plants.

Number of carbon	Fatty acids	Control 1	IBA	Arg.	B12	Asc.	Cont rol 2	IBA+ B12	IBA+ asc.	Arg.+ B12	Arg.+ asc
c16:0	Palmitic	5.73	5.79	5.96	6.5	6.22	6.32	5.39	7.43	8.05	6.63
c17:0	margaric	0.04	0.09	0.12	0.04	0.10	0.07	ND	0.08	0.41	0.36
c18:0	Stearic	2.13	2.28	2.12	2.32	1.98	2.37	2.41	2.94	4.70	3.45
c20:0	Archidic	0.23	0.21	0.16	0.24	0.26	0.29	0.32	0.46	0.68	0.74
c22:0	Behenic	0.66	0.05	0.63	0.53	0.55	0.24	0.84	0.08	1.95	0.42
Total sat. fatty acids		8.79	8.42	8.99	9.63	9.11	9.29	8.96	10.99	15.79	11.6
c16:1	palmitoleic	ND	0.11	0.21	ND	ND	0.30	ND	ND	0.12	ND
c17:1	heptadecenoic	0.04	0.03	0.16	0.04	0.09	0.06	0.12	0.05	ND	0.18
c18:1	Oleic	38.49	43.49	42.28	43.87	40.26	32.70	43.81	32.67	56.32	43.67
c18:2	Linoleic	52.25	47.60	48.06	46.17	50.23	57.36	46.68	55.87	27.32	43.82
c18:3	Linolenic	0.18	0.10	0.06	0.04	0.06	0.05	0.12	0.13	0.17	0.32
c20:1	Ecosenic	0.22	0.23	0.20	0.23	0.22	0.23	0.30	0.27	0.25	0.38
Total unsat. fatty acids		90.96	91.33	90.77	90.12	90.64	90.47	90.73	88.72	83.93	87.99
Total fatty acids		99.75	99.75	99.76	99.75	99.75	99.76	99.69	99.71	99.72	99.59

Tables (9) showed that there is no marked change in iodine number of fatty acids as compared with untreated plants. Saponification number was markedly decreased with plants treated with Arg. +B12.

Table (9): Effect of indole butyric, arginine, B12, ascorbic acid and their interactions on **Iodine number** and **Saponification number** of fatty acids of seed yield of sunflower plants.

Treatments	Iodine number	Saponification number(mg KOH/g Oil)
Control 1	129.82	199.74
IBA(200 ppm)	125.79	199.94
Arg (200 ppm)	125.50	199.80
B12(200 ppm)	123.27	199.87
Asc (200 ppm)	127.42	199.86
Control 2	133.82	200.17
IBA+ B12	124.42	199.54
IBA+ Asc	131.04	200.29
Arg +B12	100.83	199.35
Arg + Asc	119.73	199.79

From the bulk of data obtained in the present investigation, it can be suggested that treatment of combined between Indol butyric acid , arginine and B12 , ascorbic acid had a beneficial effect on growth and chemical constituents as well as yield quality of sunflower plants.

References

Abd El-Aziz, N. G.; Mazher, A. A. M. and El-Habba, E. (2006): Effect of foliar spraying with ascorbic acid on growth and chemical constituents of *Khya senegalensis* grown under salt condition. American-Eurasian J. Agric. & Environ .Sci, 1(3): 207-214

.

Abdel Aziz, N. G.; Taha, L. T. and Ibrahim, S. M. M. (2009): Some studies on the effect of putrescine, ascorbic acid and thiamine on growth, flowering and some chemical constituents of gladiolus (*Gladiolus communis L*) Plants at Nubaria. Ozean Journal of Applied Sciences 2(2).

Abdul Qados A. M. S. (2009): Effect of arginine on growth,yield and chemical constituents of wheat grown under salinity condition. Academic Journal of Plant science 2(4): 267-278, 2009.

Abdul Qados A. M. S. (2010): Effect of arginine on growth, nutrient composition, yield and nutritional value of mung bean plants grown under salinity stress. Nature and Science 2010; 8(7).

Afifi, W.M.; Ahmed, M.I.; Moussa, Z.A. and Abd El-Hamid, M.F. (1986): Effect of gamma irradiation and GA_3 on amylase activity of pea seedlings. Ann. Agric. Sci., Moshtohor. 24(4):2047-2057.

A.O.A.C. (1975). Official methods of analysis. Association of official analytical chemistis. 13ed . Washington, D.C. USA.

Bouchereau, A.; Aziz, A.; Larher, F. and Murting-Tanguy, J. (1999): Polyamines and **development challenges recent development. Plant Sci., 140: 103-125.**

Daniel, H.D. and George, C.M. (1972): Peach seed dormancy in relation to endogenous inhibitors and applied growth substances. J. Amer. Soc. Hort. Sci. 97:651-654.

El-Bassiouny, H. M. S.; Mostafa, H. A.; El-Khawas, S. A.; Hassanein, R. A.; Khalil, S. I. and Abd El-Monem, A. A. (2008): Physiological responses of wheat plant to foliar treatments with arginine or putrescine. Austr. J. of Basic and Applied Sci., 2(4): 1390-1403.

Emam, M. M.; El-Sweify, A. H. and Helal1, N. M. (2011): Efficiencies of some vitamins in improving yield and quality of flax plant. African Journal of Agricultural Research, 6(18): 4362-4369.

Ewais, A, E. (2003): Physiological responses of broad bean plants to cadmium and lead and their antagonism by the antioxidant ascorbic acid and calcium. Journal of the Faculty of Education. Ain shams university, 28.: 207-224.

Ewais, A.E.; Farghal, I.I. and Tobal, Y.F. (2003): Effect of Kinetin, riboflavin and zinc on gowth, flowering and biochemical constituents of *Zinnia elegans* and *Celosia argentea* plants. Journal of the Faculty of Education, Ain shams university, 28: 189-205.

Fairless, D., 2007. Biofuel: the little shrub that could – maybe. Nature, 449: 652– 655.

Farahat, M.M.; Ibrahim, S.M.M.; Taha, L.S. and El-Quesni, F.E.M. (2007): Response vegetative growth and some chemical constituents of *Cupressus sempervirens* L. to foliar application of ascorbic acid and zinc at Nubaria. World J. of Agric Sci., 3(3): 282-288.

Fawzy Z.F.; El-Shal, Z.S.; Yunsheng, L.; Zhu, O. and Sawan O.M. (2012) Response of garlic (*Allium Sativum* L.) plants to foliar spraying of some bio- stimulants under sandy soil condition. Appl Sci Res. 8 (2): 770-776.

Fouda H. M. (2013): The physiological responses of spermidine and arginine to *Helianthus tuberosus* L. under salt stress. MS. Thesis, Botany and microbiology department. Plant Physiology, Faculty of Science, Al- azhar University.

Galston, A.W. and Kaur-Sahney (1990): Polyamines in plant physiology. Plant Physiol. 94,406.

Guenther, E. (1972): *The essential oils*. Vol. 1, Robert, E.; Kreiger Publishing Co. Huntington, New York.

Han, H., Zhang, S. and Sun, X. (2009): A review on the molecular mechanism of plants modulated by auxin. African Journal of Biotechnology 8(3): 348–353.

Ibraheem, A.A.A. (2006): Polyamines as Modulators of Wheat Growth, Metabolism and Reproductive Development under High Temperature Stress. Ph.D. thesis, Botany department, Faculty of Science, Ain Shams University, Cairo, Egypt.

Kates, M. (1972): Techniques of lipidology, isolation, analysis and identification of lipids. In: Laboratory Techniques in Biochemistry and Molecular Biology. Work TS and Work E (eds.), North Holland, Amsterdam, pp. 347-390.

Kowalczyk K, Zielony T (2008): Effect of amino plant and asahi on yield and quality of lettuce grown on rockwool. Proc. Conf. of Bio stimulators in Modern Agriculture, 7-8 Febuary, Warsaw, Poland

Lichtenthaler, H.K. (1981): Photosynthesis IV. Philadelphia. Balaban Internat Science Service. p. 273–285.

Lowry, O.H.; Rosebrough, N.J.; Furr, A.I. and Randall, R.J. (1951): Protein measurement with folin phenol reagents. J. Biol. Chem, 193: 265-275.

Mazher, A A.M.; Zaghloul, S. M. Mahmoud, S. A.; and Siam, H. S. (2011): Stimulatory effect of kinetin, ascorbic acid and glutamic acid on growth and chemical constituents of *Codiaeum variegatum* L. plants. American-Eurasian J. Agric. & Environ. Sci., 10 (3): 318-323.

Nassar A. H.; El – Tarabily K. A. and Sivasithamparam K. (2003): Growth promotion of bean (*Phaseolus vulgaris* L.) by a polyamine – producing isolate of Streptomyces griseoluteus. Plant Growth Regul. Kluwer Academic Publishers, Dordrecht, Netherlands 40: (2) 97 – 106.

Ong, P.S. and Gaucher, G.M. (1972): Protease production by thermophillic fungi. Can. J. Microbiology, 19:129-133.

Rafique, N.; Raza, S. H.; Qasim, M. and abd Iqbal, N. (2011): Pre-sowing application of ascorbhc acid and salicylic acid to seed of pumpkin and seedling to salt. Pak. J. Bot., 43(6): 2677-2682.

Reda F.; Baroty, G.S.A.; Talaat, I.M.; Abdel-Rahim, I.A. and Ayad, H.S. (2007): Effect of some growth regulators and vitamins on essential oil, phenolic contents and activity of oxidoreductase enzymes of *Thymus vulgaris* L. World Journal of Agricultural Sciences 3 (5): 630-638.

Shalaby, M. A. F. and Ahmed, M. A. (1994): Yield response of faba bean to some foliar fertilizers in relation to IAA treatment. Egypt. J. Agron. ((1-2): 113-125.

Shehata, M.M.and El-Khawas, S.A., (2003): Effect of two biofertilizers on growth parameters, yield characters, nitrogenous components, nucleic acids content, minerals, oil content, protein profiles and DNA banding pattern of sunflower (*Helianthus annuus* L. cv. Vedock) yield. Pak. J. Biol. Sci. 6, 1257–1268.

Snedecor, G.M. and Cochran, W.G. (1982): *Statistical methods* 7 edition, lowa state Univ., Press, Ames., thlowa U.S.A., pp: 325-330.

Umbriet, W.W.; R.H. Burris, J.F.; stauffer, P.P.;Cohen, W.J.; Johsen, L. G.A.; page, V.R.; and W.C. Schneicter, 1969. Manometric techniques, manual describing methods applicable to the studs of tissue metabolism. Burgess publishing Co., U.S.A., pp: 239.

Vernon, L.P. and Selly, G.R. (1966): *The chlorophylls*. Acad. Press, New York, London.

Yousif A. A.; Sarfaraz F. A. and Hadar S. F. (2012): Effect of sucrose and ascorbic acid concentrations on vase life of snapdragon (*Antirrhinum majus* L.) cut flowers. Int. J. Pure Appl. Sci. Technol., 13(2): 32-41.

How to cite this article:
Mohamed A. Amin and Mohamed A. Ismail (2015). Effect of Indole butyric, Arginine, Cyanocobalamine (B12), Ascorbic acid and their interactions on growth, yield and some metabolic constituents of sunflower plants,Int. J. Adv. Res. Biol. Sci. 2(12): 154–162