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Physiological Effect of Plant Growth Regulators IBA and NAA on Flowers Dropping of Broad Bean (*Vicia faba* L.)

Ayyub J. Abdl-Rahmaan Al-Bayaty
College of Women Education-Tikrit University

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Corresponding author:
Ayyub J. A. Al-Bayaty
E-mail:
Ayyub_albayaty@yahoo.com

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ABSTRACT

A study was conducted of the winter season 2012-2013 in Kifri city-Kurddistan Region- Iraq to study role of plant growth regulators IBA and NAA in reducing flower dropping two cultivars of faba bean (Local and Spanish).and its effect on seed yield and protein percentage. Split split plots design was used with three replicates. The main plots included the cultivars(Local and Spanish).While sub plots were the plant growth regulators(IBA and NAA).The sub-sub plots represented four dates of plant growth regulators application: Control (No application),Soaking of seed sowing in the solution of IBA (150 ppm) and NAA (150 ppm). spraying the plant at branching stage and beginning of flowering. Results indicated superior Spanish cultivar with NAA in the beginning of flowering in leaf content from total chlorophyll reached (12.25 mg/g dry weight) and lowest percentage of dropped flowers by(68.1%)and higher seed yield/plant reached (21.3gm).The local cultivar treated with IBA in the same stage gave higher leaf area index by(0.86) While Spanish cultivar treated with IBA at branching stage gave highest seed content percentage of protein by(20.63%).

التأثير الفسيولوجي لمنظمي النمو النباتية IBA وNAA في تساقط ازهار الباقلاء *Vicia faba* L.

ايوب جمعة عبد الرحمن
كلية التربية للبنات–جامعة تكريت–العراق

الخلاصــة

نفذت هذه التجربة في الموسم الشتوي 2012-2013 في قضاء كفري–اقليم كردستان–العراق، لدراسة دور منظمي النمو النباتية IBA وNAA في تساقط ازهار صنفين من الباقلاء(المحلي والاسباني) وتأثير هذه المنظمات في حاصل البذور ونسبة البروتين في البذور .استخدم تصميم الالواح المنشقة–المنشقة وبثلاث مكررات تضمنت الالواح الرئيسية الأصناف (المحلي والاسباني) بينما تضمنت الالواح الثانوية منظمي النمو (IBA وNAA) اما الالواح تحت الثانوية تضمنت مواعيد اضافة المنظمات: السيطرة (من دون معاملة) ،نقع البذور قبل الزراعة بمحلول منظم النمو IBA (150جزء من المليون) ومحلول NAA (150جزء من المليون)،رشت النباتات في مرحلة التفرعات والرش في بداية التزهير. اظهرت النتائج تفوق الصنف الاسباني لدى الرش بمنظم النمو NAA في بداية التزهير في محتوى اوراق النبات من الكلوروفيل الكلي بلغ (12.25 ملغم/غم وزن جاف) واقل نسبة ازهار متساقطة بلغت (68.1%) واعلى حاصل بذور/نبات بلغ (21.3غم) .بينما الصنف المحلي المعامل ب IBA في بداية التزهير اعطت اعلى دليل مساحة ورقية بلغ (0.68)في حين الصنف المحلي المعامل بالمنظم نفسه في مرحلة التفرعات اعطت اعلى نسبة للبروتين في البذور بلغت (20.63%).

الكلمات المفتاحية:
منظمات نمو نباتية، الباقلاء، *Vicia faba*

للمراسلة:
أيوب جمعة عبدالرحمن
البريد الالكتروني:
Ayyub_albayaty@yahoo.com

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Introduction:

Faba bean is consider one of the important crops follow fabaceae family because of its high content from protein (Ali *et al*.,1990).It consider the highest legume crop in protein producing because its high seed production which reached about 5 ton/ha(Schulz et al.,2009).the total seed production in Iraq reached (1.76 tons/ ha) for the period(1989-2010)(FAO,2010).There are many problem which reduce the yield production such as flowers and pods dropping and this is a big problem which farmer suffer because 70-80% of flowers and pods dropped before

maturity(Chapman and Peat,1983and Attia,1985) due to environments factors and the completion of sunlight and organic nutrients between vegetative and reproductive parts due to hormonal factors(Shibles *et al*.,1973).

There is a relationship between growth regulators such as Auxins , Gibberellins, Ethylene, Cytokinins and Abscisic Acid with flowers drop through increasing photosynthesis efficiency and decreasing respiration and effecting on synthetic materials distribution to pods. The growth regulators are very important factors in completing formation processes(Mohammed,1983). Plant growth regulators used to improve the production of most crops because of important agriculture application with high advantages specially after synthetic fertilizer and plant breeding uses. The purpose of growth regulators use to increase seed yield due to its relationship in increasing pods number and reducing flower and pods dropping (Abou-Elleil and Al-Wazeeri,1978).Plant growth regulators when used with law concentration can inhibit or modified the physiological process of plant(Atiia and Jaddoh,1999).

Plant pigments such as chlorophyll a and b are essential for photosynthesis process which provides the plant with its requires from nutrient material possible for growing and production and decreasing effect of external factors by keeping the chlorophyll in the leaves for long time, The foliar application of growth regulators such as Gibberellin (GA) and Indol acetic acid (IAA) on many plant species rise in plant pigments from chlorophyll a and b and carotenoids(Pilet and Hofer, 2009)Other studies reported increase leaves content in corn, lentil and faba from pigments (chlorophylls and carotenoids) when they sprayed with GA3,IAA and kinetin at 50 ppm(Jaddo,1999).

The leaf is the main organ which photosynthesis process will happen, the leaf and its index consider a parameter of photosynthesis volume. Dry matter production depends largely on amount of the light which received by the leaf(Montith,2007).The intercept light depend on leaf area which affected by growth regulators due to changes of leaf area (Attia and Jaddoh,1999and Khider,1983)There are differences among faba cultivars in the rate of leaf area at two locations Duhok and Hammaam Al Aleel.Other studies indicated that GA application lead to increase in the leaf area and the number of branches of faba plants (Abdool and Salih,1984)

A comparison study of 40 cultivars of faba bean appeared significant differences in flowers and pods dropping percentage among the cultivars under studying (Zeng,2007).Other studies conducted by Khider(1983) represented four cultivar of faba bean showed Acudlus cultivar has less flower drop percentage in compare with FAO 21 mosuli and Spanish cultivars ,Alkaisse(1996)reported treating faba bean plant growing in pots befor flowering with GA lead to decrease flower dropped percentage from 74% to 60% and dropped pods from 68% to 39%,While the plants in the field treated with GA the dropped flower decreased from79% to59% and pods from 85% to39%.

Seed yield consider produce of a number parts called yield components and this components is affected by genotype, environmental factors and crop managements processes(Issa,1990). Results of studies for two years showed superior Troy cultivar significantly in the seed yield in compare with other cultivar under study by given 2.56 and 2.41 ton/ha in the first and second years respectively, on the other hand the study in the Syria to evaluate to cultivars showed superior the ILB-1814 cultivar(Dithelmit *et al*.,2006).Using GA 200 ppm on faba bean proved an increase in seed yield by 42%(Atiia *et al*.,1998)While Brassinosteroides has positive effect in increasing faba bean growth and yield (Kamura and Takatsu,2009).

Plant protein is considered as cheap protein source because of high fakes of animal protein.(Ali *et al*.,1990).The cultivars of faba bean differ in their seed content and yield from protein because the difference in the genetic type, environmental conditions, date of sowing and crop management processes. The chemical analysis of faba bean cultivars showed seed content from protein ranged between (26%-39%)(barrate,2002).While other studies reported(24%-30%)(Abdel,1997)and 32..44%-22.66%(Abdulrahmaam,2005).

Growth regulators can redistribute nutrient actively for fruits, Results of studies appeared spraying faba plant with IAA accumulate soluble protein on the plant parts due to role of growth

regulators in increasing gene expression and direct increasing in many mRNA after auxin addition(Gaddalla,2010).

Materials and methods:

Afield experiments was conducted in winter season 2012-2013 in Kifri city- Garmian -Iraq Kurdistan region to study the role of plant growth regulators IBA and NAA in reducing flower dropping of two cultivars (Local and Spanish)and its effect on seed yield.

A split split plots design was used with three replications. The main plots included the cultivars (Local and Spanish).The sub plots were plant growth regulators (IBA and NAA).The sub sub plots represented four dates of plant growth regulators application: Control(no application).soaking of seeds presowing in the solution of IBA 150 ppm and NAA 150 ppm, spraying the plant at branch stage and beginning of flowering which signed as S0,S1,S2 and S3. The soaking continued for 8 hours then seeds dried at room temperature. the soil was drown by Mold board plow, leveled and divided to plots. The area of each plots 8 m^2 containing 6 rows with 4 m length, The distance between rows was0.3m and between hole and other 0.3m while the distance between block and other 1m.The seed was sown 1st of November in plots 2*4 m contain 4 rows with 0.3m distance between plants, Nitrogen fertilizer(N 46%)added at dose 60 kg/ha half of it added with 60 kg/ha($P_2O_4$45%) fertilizer in the soil preparation and the second half of nitrogen fertilizer added after 45 days from sowing. Seedling was transplanted after 2 weeks from growing. Plants of middle rows harvested for each experiment unit on 20 April to estimate vegetative growth properties, The soil was analyzed to determine its physical and chemical properties. The E.C.3.35,PH 7.61,organic matter 1.41%,water salinity 4.88 decisemenes $m^{-1}$the experiment irrigated by well water while climatic data was fixed in the table (1).

Table (1): Climate data for season 2012-2013

Month	Year	Temperature (C^0)		Humidity (%)	Rain(ml)
		High	Low		
November	2012	19.1	4.7	58.0	30.1
December	2012	16.2	3.1	61.2	38.2
January	2013	15.7	5.0	65.0	67.2
February	2013	16.4	9.9	64.0	34.3
March	2013	21.4	11.2	52.0	44.4
April	2013	31.8	18.4	47.0	29.9

Plant growth regulators IBA and NAA were from growth promoting group(Auxins) enhance the growth shoot length by elongation the cells. Times of growth regulators addition were:

Soaking the seeds in water for 24 hours(Control) (S0).−

Soaking the seeds in IBA solution (150 ppm)and NAA(150 ppm) for 8 hours then dried in shade (S1).−

-Spraying plants on branching stage (S2).

Spraying plants at less one flower opening stage (S3).−

Spraying process was carried out at morning by using aplastic barrier to avoid volatile growth regulator to other plots and the properties below studied :

* **Leaves content from chlorophylls**:

Was estimated according to Linchter thaler which motioned by (Zhang and Kirknan,1996).by using the equations

Chl a =$12.25A_{663.2}$-$2.79A_{646.8}$

Chl b=$21.5A_{646.8}$-$5.10A_{663.2}$

Total Chl =Chl a+Chl b

Were as:

Chl a=Chlorophyll a mg/g dry weight.
Chlb= Chlorophyll b mg/g dry weight
*the small number refer to wave lengths measured by spectrophotometer apparatus.

***Leaf area index(LAI):**

Estimated by using the equation :

LAI=LA(1/GA) (Isaa,1990)

Note:-
LAI=leaf area index
Were as:
LA=leaf area (Cm^2) estimated by disc method.
GA=The area utilization by the plant.

***Percentage of flowers dropping :**

Estimated by using the equation: Dropped flowers percentage = Number of dropped flowers/ Number of dropped flowers + Number of pods.(Al-bayaty,2006).

Seed yield / plant (gm) :*

Plants for each Experiment unit at crop maturity then taken the range (Al-bayaty,2006).. Estimated by harvesting the middle

***percentage of seed protein :**

Estimated by using Microkchildal apparatus according to the method of (Scheflen et al.,1961).The seed protein percentage calculated by the equation :
Seed protein percentage = Nitrogen percentage x 6.25 .

RESULTS AND DISCUTION :

Data in table (2) indicted superior of the local cultivar leaves content from chlorophyll a and total chlorophyll significantly by given(7.19) and(11.63) mg/g dry weight respectively, while Spanish cultivar superior in chlorophyll b content reached (4.43) mg/g dry weight and Less percentage of dropped flowers reached (78.91%) .The same table refer to superior plant growth IBA in the leaves content from chlorophyll a and total chlorophyll by given (7.22)and (11.76) mg/gm dry weight respectively and gave highest leaf area index reached (0.84),Less dropped flowers percentage by (78.48%) and highest seed yield reached (13.14) gm/plant, The difference between cultivars attributed to the genotype and the difference in the response to the growth regulators by plants.

Table (2): Effect of cultivars in leaves content from chlorophyll a,b and total chlorophyll and some vegetative and Quantitative characters.

Characters	Cultivars			Growth regulators		
	Local	Spanish	L.S.D 0.05	IBA	NAA	L.S.D 0.05
Chlorophyll a (mg/g dry weight)	7.19	7.04	0.041	7.22	7.10	0.036
Chlorophyll b (mg/g dry weight)	4.41	4.43	0.020	4.38	4.3	N.S
Total chlorophyll (mg/g dry weight)	11.63	11.49	0.011	11.76	4.38	0.09
Leaf area index after 120 days	0.62	0.62	N.S	0.84	0.58	0.02
Flower dropping percentage(%)	76.91	78.91	0.78	78.47	80.52	0.37
Seed yield/ plant(gm)	14.59	12.49	0.26	13.14	11.94	0.14
Protein Percentage (%)	18.53	18.47	N.S	18.40	18.61	N.S

Table (3) data showed the significant effect of plant growth regulators date addition, The addition in the beginning of flowers stage(S3) gave highest leaf content from chlorophyll a and total chlorophyll by given (7.33) and 4.50 mg/gm dry weight. The same treatment gave highest leaf area index(0.61) ,Less dropped flowers percentage by (75.55%)and highest seed yield plant reached (15.81) gm/plant while highest protein percentage of seeds was in the branching(S2) stage by (19.6%). This treatment in chlorophyll content increased leaf area index and lessened dropped

flowers percentage and this lead to increase the seeds yield per plant The results are agree with Alkaisse (1996) which sprayed faba plant after flowering stage and Seeta Ram *et al*(2002) Whom referred to increase in the flowers content from chlorophylls pigments when sprayed plants with plant growth regulators in the flowering stage .

Table (3): Effect of date IBA and NAA addition on leaves content from chlorophyll a ,b and total chlorophyll , some vegetative and quantitative characters.

Characters	Date of addition				
	S0	S1	S2	S3	L.S.D. 0.05
Chlorophyll a (mg/g dry weight)	7.22	6.94	6.98	7.33	0.033
Chlorophyll b (mg/g dry weight)	4.40	4.40	4.29	4.50	0.058
Total Chlorophyll(mg/g dry weight)	11.62	11.34	11.27	11.81	0.030
Leaf area index after 120 days	0.55	0.57	0.59	0.61	0.01
Flower dropping percentage(%)N	81.20	80.8	80.1	75.55	0.92
Seed yield/ plant(gm)	11.95	10.99	12.46	15.81	0.47
Protein Percentage (%)	18.44	18.71	19.6	17.3	0.51

From table (4) we can see the significant effect for interaction among cultivars, growth regulators and addition date, Spanish cultivars treated with NAA beginning of flowering stage(S3) gave highest leaf content from chlorophyll a and total chlorophyll reached (7.67) and(12.15) mg/gm dry weight, The same interaction gave highest leaf area index (0.88),Less dropped flowers percentage by(68.1%) and highest seed yield reached 21.30 gm/plant. The plants are differ in their response to the type and date of plant growth regulators addition (Atiia and Jaddoh,1999).Our results are agree with Burkhard and Killer(2003) whom refer to decrease in the dropped flowers and pods and increase in the seed yield of soy bean plant treated with plant growth regulators at flowering stage and Alwaan et al., (2003) whom sprayed plants with promoting plant growth regulators .

Table (4): Effect of interaction among cultivars, growth regulators and addition date on leaves content from chlorophyll a ,b ,total chlorophyll , some vegetative and quantitative properties.

Cultivars	Growth Regulator	Addition date	Chlorophyll a	Chlorophyll b	Total chlorophyll	leaf area index	flower dropping (%)	seed yield gm/plant	protein percentage (%)
		S0	7.49	4.46	11.95	0.48	83.0	14.73	18.4
		S1	7.38	4.49	11.87	0.53	77.5	10.78	17.19
Local	IBA	S2	6.54	4.08	10.61	0.49	74.1	18.7	19.67
		S3	6.89	4.43	11.31	0.86	74.8	18.12	17.65
		S0	7.41	4.71	12.12	0.48	83.6	8.53	18.5
		S1	7.27	4.50	11.17	0.48	81.1	11.26	19.4
	NAA	S2	7.28	4.34	11.62	0.70	84.4	9.50	19.69
		S3	7.24	4.50	11.74	0.50	78.7	13.13	16.95
		S0	7.38	4.49	11.87	0.71	79.37	11.73	18.11
		S1	6.95	4.30	11.26	0.61	77.5	12.36	19.14
Spanish	IBA	S2	6.89	4.34	11.09	0.56	77.4	11.31	20.63
		S3	7.20	4.47	11.98	0.48	80.6	10.67	15.67
		S0	6.59	3.95	10.54	0.54	81.0	12.78	18.57
		S1	6.14	4.30	10.44	0.64	84.3	9.59	18.29
	NAA	S2	7.20	4.51	11.71	0.61	81.6	10.30	18.40
		S3	7.67	4.58	12.25	0.88	68.1	21.30	18.0
	L.S.D. 0.05		0.12	0.12	0.060	0.02	1.86	0.92	1.04

References:

Abdel,C.G.(1997).Physiological studies on growth, flowering, fruit setting and yield of faba bean *(Vicia faba* L.) .Ph.D.Thesis Mosul University - Iraq.

Abdool,K.S.,and Mohammed,S.S.(1984).Effect of cycoceyl and gibberellic acid on faba bean seedling .Iraqi Journal of Agriculture Science (Zanco),l,45-75.

Abdulrahmaan, A.M,(2005).Effect of Cobalt addition and spraying with Manganese on physiology and growth o f faba bean *(vicia faba* L.). .Thesis, College of Agriculture, University of Tikrit.

Abou-Elleil,G.A, and El-Wazeeri.S.M.(1978).Significance of foliar application with certain growth substances for controlling seeding in faba beans (*Vicia faba* L.)Agric Res.Rev.56(8):59-63.

Ali, H.j.,Taleeb, A.,and hamed,M.J.(1990). Legums Crops. Ministry of Higher Education and Scientific Research:Baghdad University.

Alkaisse,W.A.M. (1996).Effect of some growth regulators on difference cultivars of faba bean *(Vicia faba* L.).Ph.D.Thesis College of Agriculture, University of Baghdad.

Alwaan.A.A.,Razak,K.F.and Thamer,K.M.(2003).Effect of spraying different concentrate of Atonik on herbage and yield of Opalin on in heated green house.J.of Karblaa University,1(4):1-8.

Attia,H.J.(1985).The effect of plant population growth regulators and irrigation development and yield of spring sowing field bean *(Vica faba*L.)Ph. D. Thesis, Canterburry University .New Zealand.

Attia,H.J., and Jaddo,K.A.(1999).Plant growth regulators The Theory and application. dar Al-Kutub for typing and application Baghdad.

Attia,H.J.,Alyunis,M.A.,and Alkaisse,W.A. (1998).Effect of some plant growth regulators on flowering and faba bean yield Joamaz of Agriculture Scfeace:29,l.

Burkhard,J.,and Keller,E.R.(2003).Influence of plant density, gibberellic acid and site on the yield and yield components of different faba growing types. FABIS 7:37-39.

Chapman,G.D.and W.F.Peet(1983). Procurment of yield and broad beans. Outlook on Agriculture 9:131-138.

Diethlem,R.,Keller,E.R.,and Bangerth,F.(2006).Interactions between the application of growth regulators,Yield compenents and content of photohormones in the fruits of (*Vicia faba* L.) *FABIS.Ngws fetter*,No 1.

FAO.(2010).data base: Rome Italy.

Gaddallah,M.A.A., (2010).Effects of indol-3- acetic acid and zinc on the growth, osmotic potential and soluble carbon and nitrogen components of soybean plants growing under water deficitJ.Arid.Environ.44:451 -467.

Isaa,T.A. (1990) .Crop Plants Pysiology.Translated for (F.B.Gardener,R.B.Pers and R.L.Mejtel),College of Agriculture,University of Baghdad.

Kamuro,Y.,and Takatsuto,S.(2006).In Brassinosteroides plant hormones (Sakural, A., Y okota,T. ,andClose,S .Deds). Springer,okyo,pp.223-241 .

Khider, A.A.(1983).Effect of nitrogen and phosphate fertilizer on growth and yield chracters of four faba bean cultivars under rainfall condition in north of Iraq.Ms.Thesis College of Agriculture and forest, Mosul University.

Mohammed. A. A.(1983).Plant Hormones Its physiology and Biochemical. translationed for (Tomas Mor)College of Science: Baghdad University, Iraq.

Monteith,J.L(.2007).Climate and the efficiency of crop production in Britain. Phil. Trans. R.Soc., 281:277-294.

Pilet,P.E, and Hofer,R.M.(2009).action de kinetin sural crossance at la teneur en chlorophyles des raciness,Physiol.Plant.19,1026-1037.

Scheffelen, AQ.C. ,Muller, A. ,and Vanschouenburg, J.G.(1961).Quick test for soil and plant analysis used by small laboratories.Neth.J.Agric.Sci.9:2-16.

Schluz,S.,Keathning,J.D.and Weals (2009).Productivity and residual of legumes, rice – based cropping awarm temperature environment legume biomass production and N fixation Field crop Prees61:23-35.

Seetaram,S.,B.viday Vardhini,E.E.SujathaS. Anurdaha(2002).Brassinosteroides: Anew class of photo hormones. Current Sci.India 82(10):1239-1245.

Shibles, R.M. Anderson, I.C., and A.H. Gibson (1973). In crop physiology, ed.L.T.Evans, Cambridge University Press, London. 151-189.

Zeng,C.C.(2007).Investigation of flowering and pod setting of different *Vicia faba* cultivar. Guangdon . Agric. Sci. China,:3i-33.

Zhang,J., and Kirknan , M.B., (1996).Antioxidant responses to drought in sunflower and sorghum seedling. New phytol.132:361-373.