Paclobutrazol as modulator of growth some metabolic activities and reproductive development of *Solanummelongena*plants.

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Abstract: Growth, yield and some metabolic activities of *Solanummelongena* plants were studied in response to the treatment with paclobutrazol. The obtained results revealed that, treatments with spermidine (50 & 100 ppm) generally enhanced most of the growth and yield characteristics (shoot length, root length, fresh and dry weights of shoots and roots/ plant, number of flowers / plant, number of fruits / plant and fruits weights) of *Solanummelongena* plants. Results indicated that, significant increases in contents of chlorophyll (a), (b) & (a + b), carbohydrates, soluble proteins, nitrogen, phosphorus, and potassium throughout the experimental period. Treatment with paclobutrazol caused significantly increases in GA_3, IAA and ABA.

[Sofy MR and Nosary ME**. Paclobutrazol as modulator of growth, some metabolic activities and reproductive development of *Solanummelongena* plants.** *Rep Opinion* 2015;7(11):19-29]. (ISSN: 1553-9873). http://www.sciencepub.net/report. 3. doi:10.7537/marsroj071115.03.

Keywords: Paclobutrazol; *Solanummelongena*; metabolic activities

1- Introduction

Growth, yield and some metabolic activities of *Solanummelongena* plants were studied in response to the treatment with paclobutrazol. Paclobutrazol is against hemorrhoids, ulceration, diabetes, asthma, cholera, bronchitis, dysuria, high blood cholesterol level, otitis and toothache **(Sutarno, *et al.*, 1993).**

Table (1) chemical composition of eggplant (Lawande and Chaven, 1998).

Constituent	Content	Constituent	Content
Oxalic acid	18 mg	**Sodium**	3 mg
Calcium	18 mg	**Copper**	0.17 mg
Magnesium	16 mg	**Potassium**	2 mg
Phosphorus	47 mg	**Sulphur**	44 mg
Iron	0.9 mg	**Chlorine**	52 mg
Moisture content	92.7 %	**Vitamin A**	124 U
Carbohydrates	4 %	**Thiamine**	0.4 mg
Protein	1.4 %	**Riboflavin**	0.11 mg

Paclobutrazol is against hemorrhoids, ulceration, diabetes, asthma, cholera, bronchitis, dysuria, high blood cholesterol level, otitis and toothache **(Sutarno, *et al.*, 1993).**

2-material and method

2-1- Methods of planting, treatments and collection of samples:

Uniform eggplant seedling were planted in Botanical farm, Tahrahemiad, Zagizag, Sharkia in a farm (10 m width and 30 m. length) containing 15 ridges representing the following treatments:

- Control.
- PBZ (50 ppm)
- PBZ (100 ppm)

The seedlings of each group were sown on one side of the corresponding ridge; the developed plates were treated twice with the above mentioned treatments (as foliar spraying).

The plants were sprayed twice with the above mentioned treatments. The first treatment was made when the age of plants was 40 days, while the second treatment was made when the age of plants was 77 days.

The plant samples were collected for analysis when the plants were 47 (Stage I) and 84 (Stage II) days old, at the end of the growth season (120 days of yield (eggplant) analysis of the yielded from the different treatments as well as the control were done.

2-2 Measurement of growth parameters

Plant height (m),root length (cm), number of leaves per / plant, fresh and dry weights of shoots (Kg/plant), fresh and dry weights of roots (g/plant), number of tubers, weight of tuber were determined at different growth stages.

2-3- Chemical analysis

Three plant samples were taken during the growing season, at vegetative growth stage, flowering stage and yield stage. Photosynthetic pigments were estimated using the method of **Vernon and Selly (1966).** 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**). nitrogen were estimated according to the methods of **Kjeldahl**. phosphorus and potassium were estimated according to the methods of colormetric. And phytohormones were estimated according to the methods of **Knegt and Brunima (1973)**.

2-4- Statically analysis

The data were subjected to the proper statistical analysis of variance of a randomized complete block design as recommended by Snedecor and Cochran (1989). For comparison between treatments means ± SE using LSD, (Spss® Advanced Statistics 20, 2010) at 5% level was used.The values recorded in the values of the biochemical analysis are means of three replicates. Discriminant analysis is used to classify several observations, into these known groups (Härdle and Simar, 2007).

growth. These results are in agreement with those observed by **Zedan** (2000) on coriander and **Zhang et al.,** (2006) on soybean, they reported that PBZ treatments caused significant reductions in plant height, internodes length, leaf length and leaf area/plant, while dry weight per plant was increased.

Pepin (2014) found that foliar spraying of bee balm (Monardadidyma) with PBZ at concentration 0,2,4,6 or 8 ppm significantly induced reducing plant growth.

Shuijiet al., (2014) stated that foliar spraying of Canola plants with PBZ at stalk heights of 10, 20, 30, 40 and 50 cm, plant height was reduced by 27% with PBZ applied at 10 cm stalk height as compared with the control.

3- <u>Result and discussion</u>

3-1 Growth response

The obtained results revealed thatapplication of PBZ at (50 & 100 ppm) created significant stimulative effects on growth parameters of eggplant plants. These effects were clear with the resulted induced decreases in shoots and root lengths; but increases the number of leaves/plant, fresh and dry weight of shoots. These findings are in accordance with **Dewdar, *et al.,*** (2013) found that Seedlings produced from sprayed with Asc at rates of 0, 200, 400 and 600 mg Significant positive influences of Asc rates were observed on growth traits (number of leaves, leaf area and leaf dry weight per plant), chemical analysis (photosynthetic pigments, photosynthesis and nutrients) and seed cotton yield when compared with the control. Best results pretreated seedlings sprayed with 400 mg Asc.

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-1Asc treatments.

On the contrary, results revealed that growth characteristics were significantly lowered by PBZ treatments in most cases, this was the case throughout the two stages of plant.

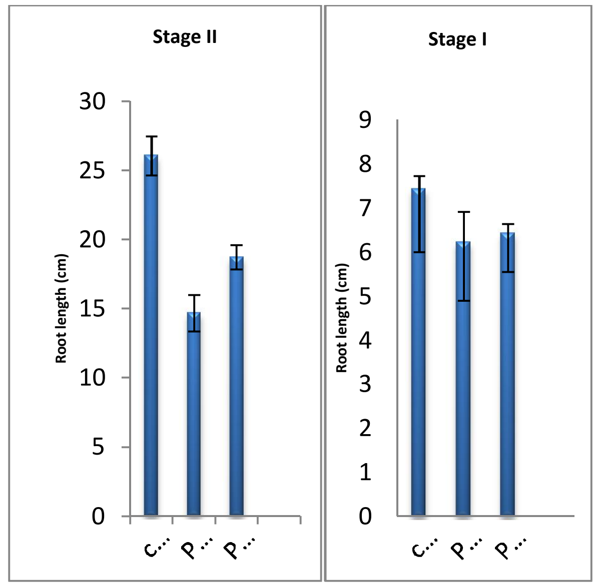

Figure (1): Effect of PBZ on root length of eggplant.

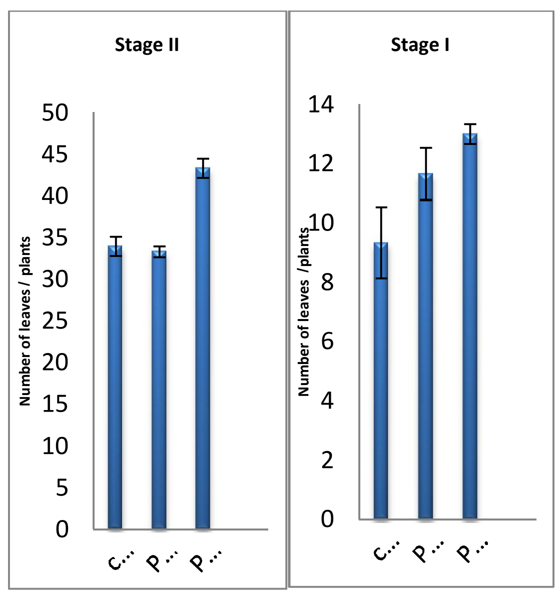

Figure (2): Effect of PBZ on no. of leaves of eggplant.

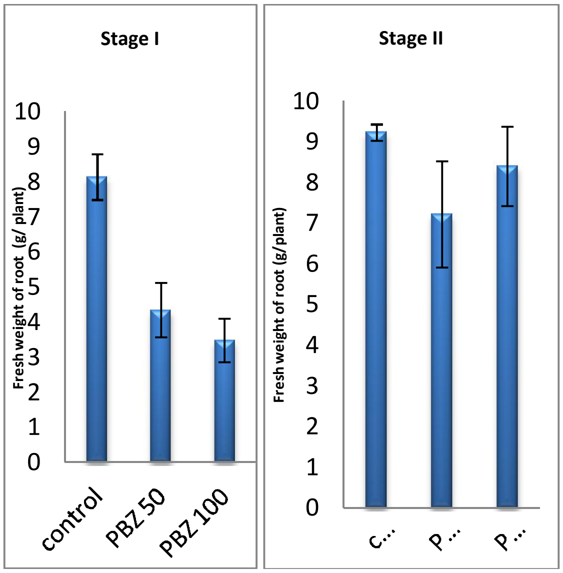

Figure (3): Effect of Asc and PBZ on fresh weight of root (g) of eggplant.

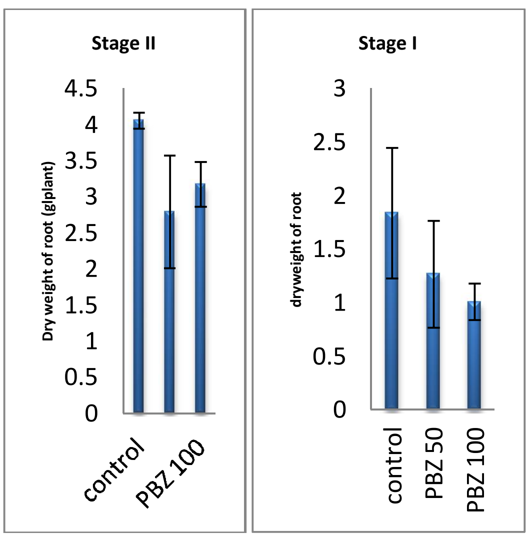

Figure (4): Effect of PBZ on dry weight of root (g) of eggplant.

3-2- Photosynthetic Pigments:

The contents of chlorophyll a, b and total chlorophyll (a+ b) of eggplant showed, in most cases, consistent and gradual increases in response pbz applied. and The contents of carotenoids eggplant showed, in most cases, consistent and gradual increases in response to pbz applied. PBZ 100 ppm was more effective than PBZ 50 ppm treatments in enhancing carotenoids contents. The obtained results agree with those observed by a number of investigators.

Abolfazl et al., (2013) recorded that treating plants of banana with PBZ increase the total leaf chlorophyll content when compared with the control treatment.

Samani (2014) he results showed that PBZ concentration had significant effect on leaf chlorophyll content, average leaf area and trunk radial growth.

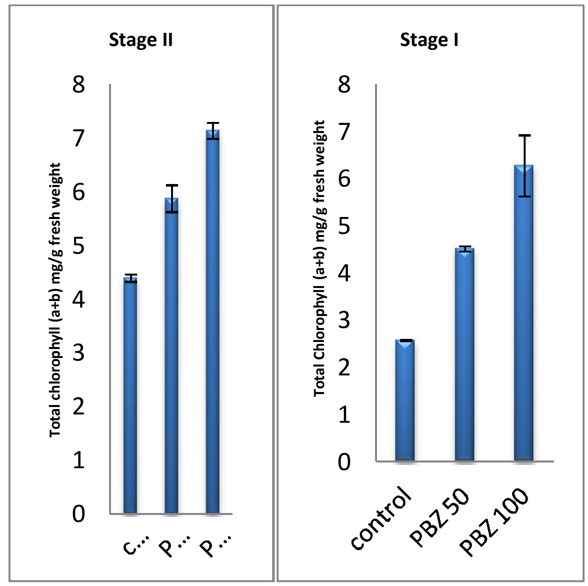

Figure (5): Effect of PBZ on chlorophyll a+b content of eggplant.

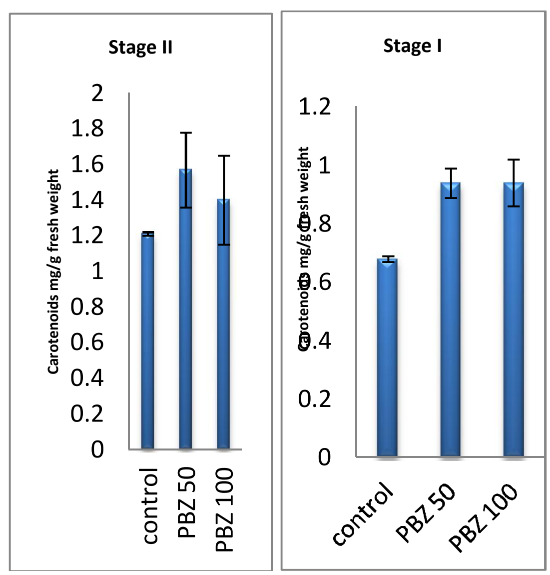

Figure (6): Effect of PBZ on Carotenoids content of eggplant.

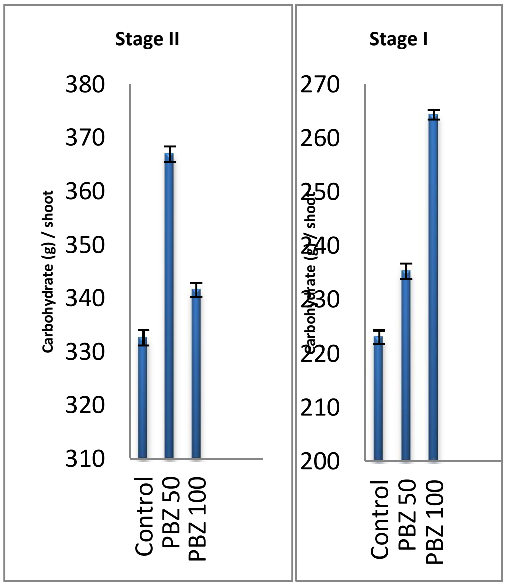

Figure (7): Effect of PBZ on carbohydrate content (shoot) of eggplant.

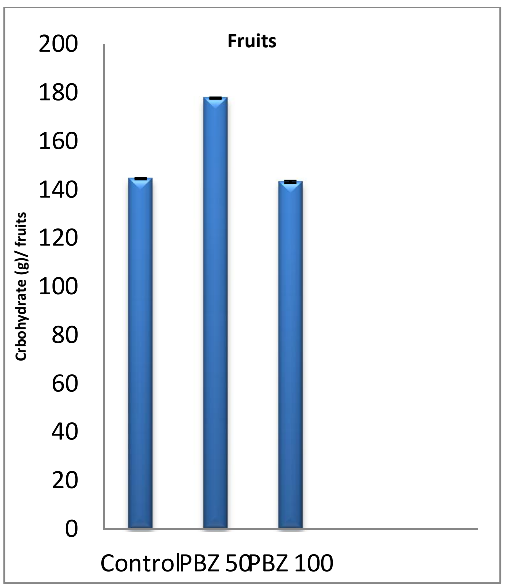

Figure (8): Effect of PBZ on carbohydrate content (fruits) of eggplant.

3-5 Protein

In the present study, it was found that protein contents in shoot of eggplant, mostly, were significantly increased in response to all doses applied of PBZ with protein.

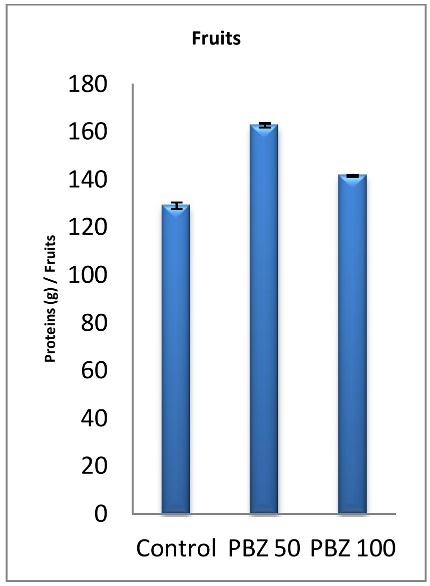

Figure (9): Effect of PBZ on protein content (fruits) of eggplant.

3-6 Minerals

In the present study, it was found that nitrogen, potassium and phosphorus contents in fruits of eggplant, mostly, were significantly increased in response to all doses applied of PBZ.

In the present study, it was found that nitrogen (N) contents in shoot of eggplant, mostly, were significantly increased in response to PBZ (50 & 100ppm) while, application of PBZ at 100ppm markedly significantly decreased nitrogen (N) contents in shoot at stage II.

In the present study, it was found that phosphorus (P) contents in shoot of eggplant, mostly, were significantly increased in response to PBZ (50 & 100).

In the present study, it was found that potassium (K) contents in shoot of eggplant, mostly, were significantly increased in response to PBZ (50 & 100 ppm) at stage I, while at stage II, it was found that as aubergine and brinjal (**Lester and Hasan, 1991; Lawanda and Chavan 1998**), is one of the most widely distributed and cultivated species of the solanaceae family.

Eggplant (*solanummelongena L*) is one of the most important crops in the summer season of Egypt. Eggplant fruits contain a considerable amount of carbohydrate, protein, vitamins and some minerals. As a biennial crop, eggplant will require high quantity of nutrients to sustain its growth. These nutrients can easily be made available through the use of inorganic fertilizers but there are problems associated with its use which include: leaching, soil degradation, underground water pollution, fast release of nutrients..

Eggplant fruits characterize low – calorie content and high nutritional value.

Brinjal eggplant is known to have medicinal properties **(Lawande and Chaven, 1998),** it is widely use in traditional medicine A great attention was recently focused for exogenous application of Chemical compound to improve plant growth and production, due to their advantages of being natural products (paclobutrazol).

Plant growth retardants have been used in many field crops to control the vegetative growth and reduce the risk of lodding. In recent years, growth regulators in general and growth retardants in particular become important treatments to agriculture as they affect growth and metabolism of many plant species. **(Leopold and Kriedmann 1975).** PBZ, is a well-known growth retardants, is a triazol that inhibits gibberellin biosynthesis **(Hedden and Graebe 1985)** changes assimilate partitioning; with more assimilate toward buds and fruits **(Davis 1988).** PBZ notonly controls growth, but also influences cropping and fruit characteristics **(Green and Murray 1983)**.

PBZ [(2S, 3S)-1-(4-chlorophenyl)-4, 4-dimethyl-2-(1, 2, 4-triazol-1-yl) pentan-3-ol] is traditionally used in crop field management with many purposes, often have a beneficial effect on quantity and quality of harvestable products **(Tsegaw and Hammes, 2005).**

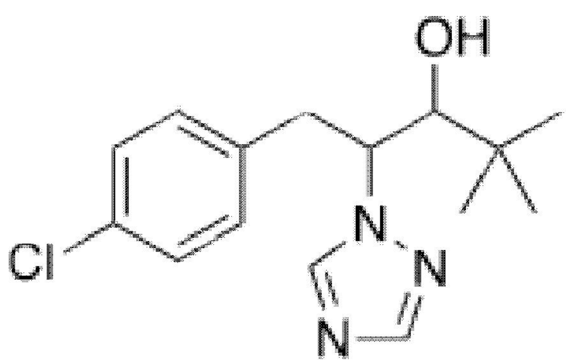

Figure (10): structure of PBZ

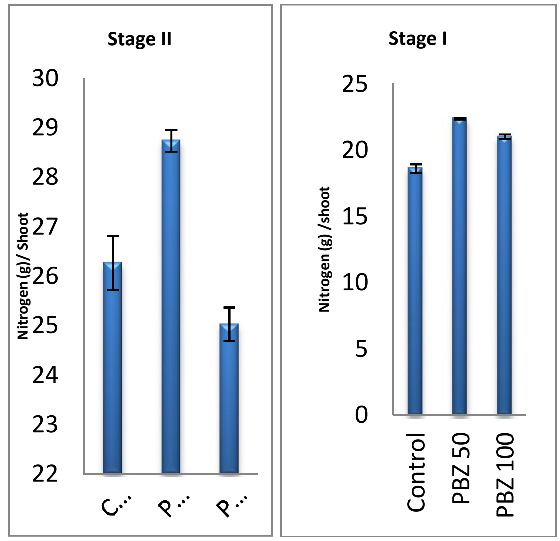

Figure (11): Effect of PBZ on nitrogen content (shoot) of eggplant.

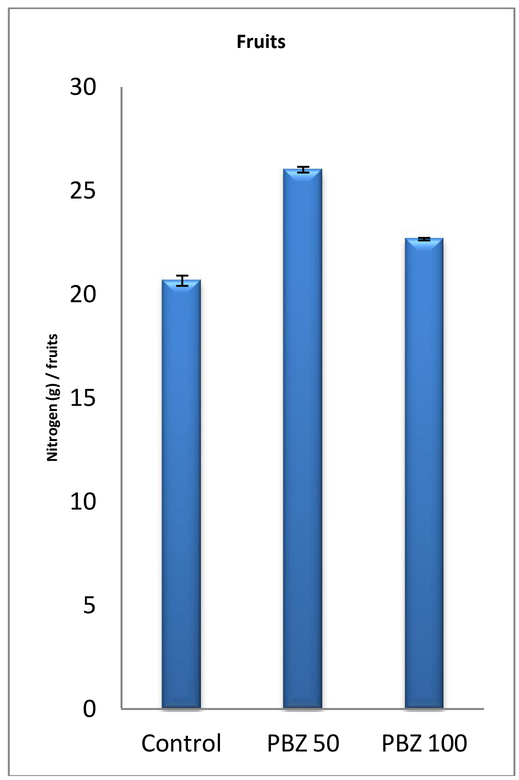

Figure (12): Effect of Asc and PBZ on nitrogen content (fruits) of eggplant.

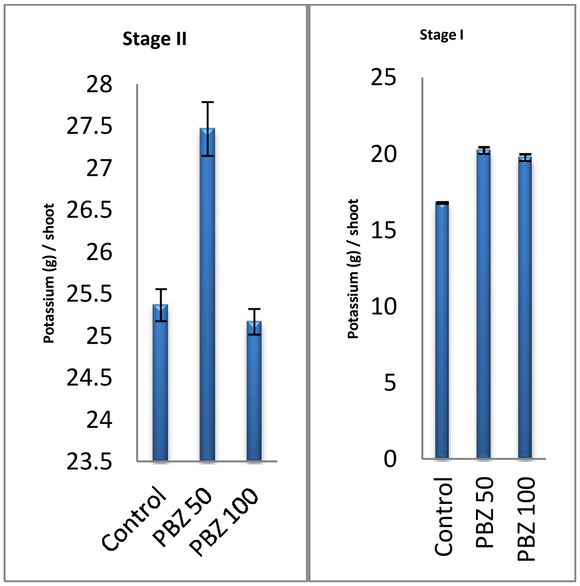

Figure (13): Effect of PBZ on potassium content (shoot) of eggplant.

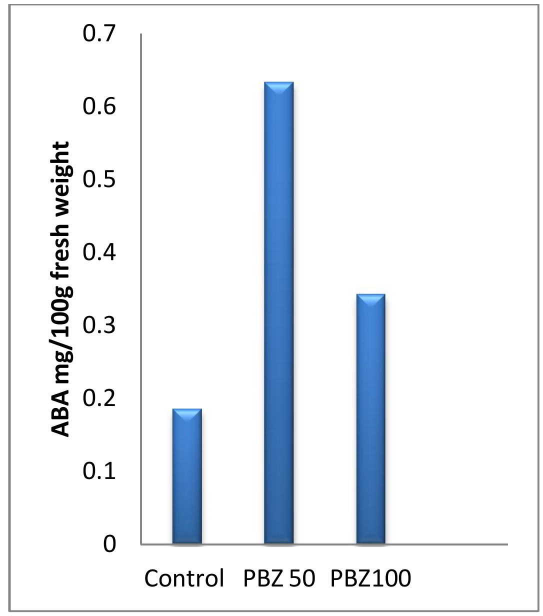

Figure (15): Effect of PBZ on ABA of eggplant. Eggplant (*Solanummelongena*), also Known

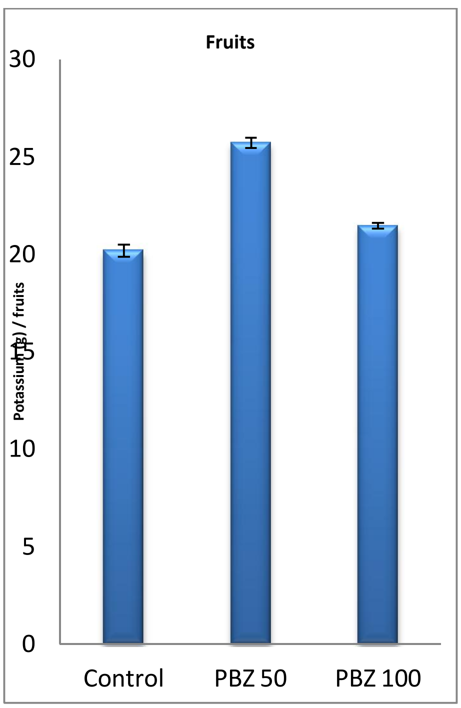

Figure (14): Effect of PBZ on potassium content (fruits) of eggplant.

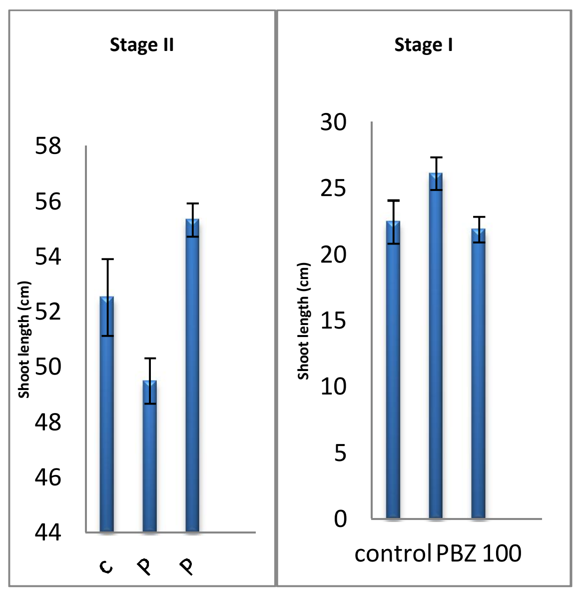

Figure (16): Effect of Asc and PBZ on shoot length of eggplant.

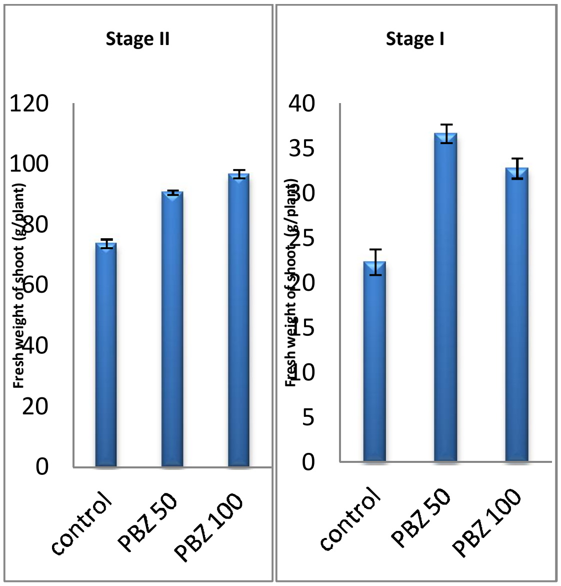

Figure (17): Effect of PBZ on fresh weight of shoot (g) of eggplant.

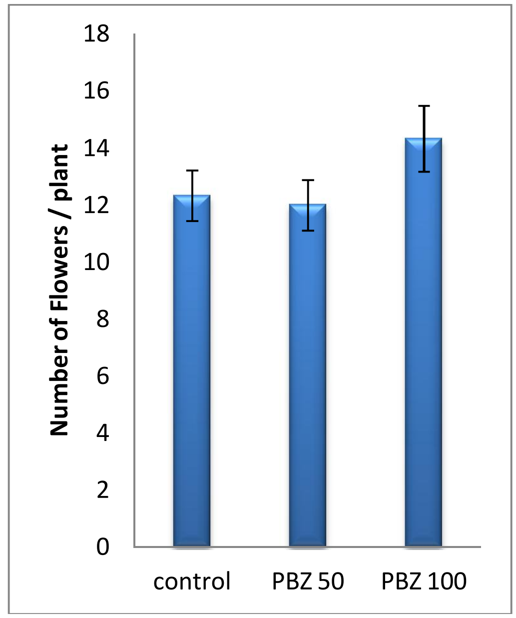

Figure (19): Effect of PBZ on no. of flowers of eggplant.

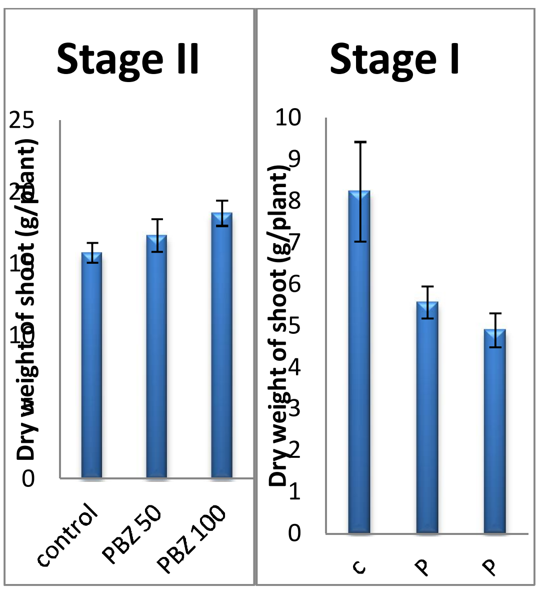

Figure (18): Effect of PBZ on dry weight of shoot (g) of eggplant.

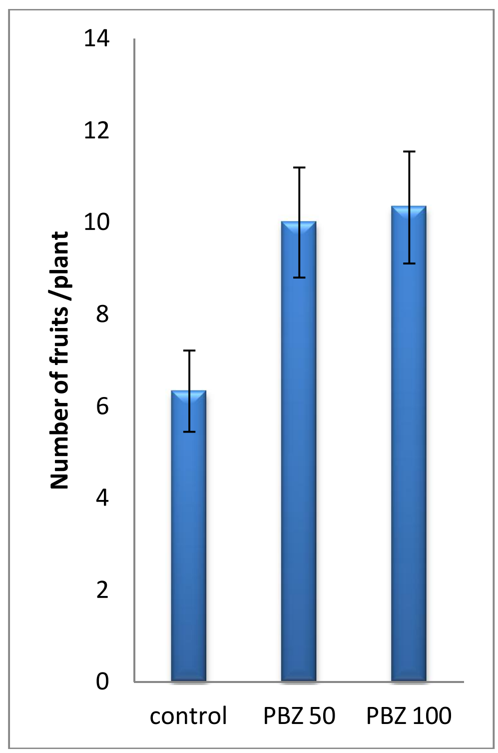

Figure (20): Effect of PBZ on no. of fruits of eggplant.

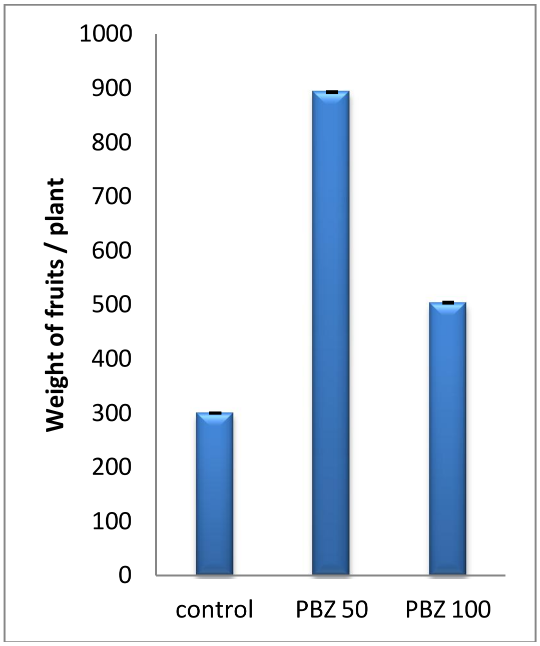

Figure (21): Effect of PBZ on fruits weight of eggplant.

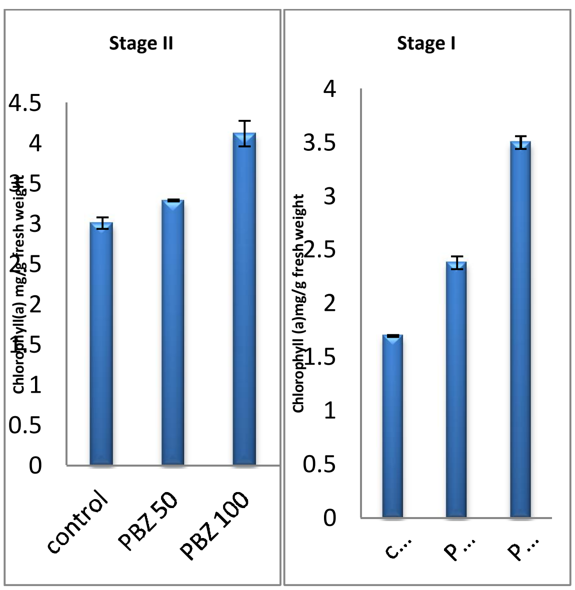

Figure (22): Effect of PBZ on chlorophyll a content of eggplant.

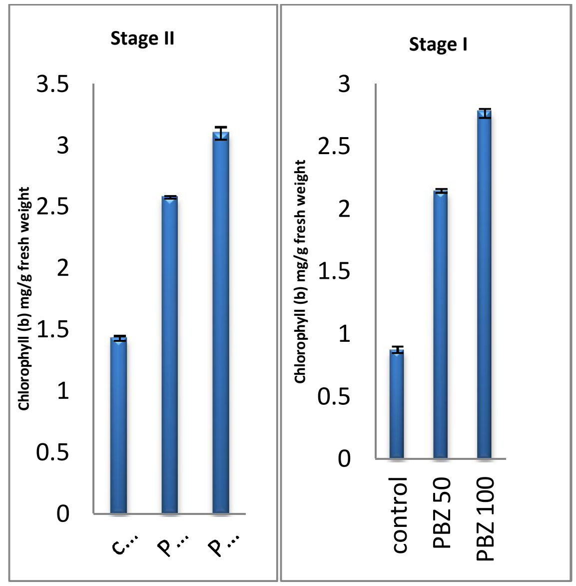

Figure (23): Effect of PBZ on chlorophyll b content of eggplant.

3-3 Soluble carbohydrate

Application of PBZ at (50&100 ppm) markedly increased total soluble carbohydrates contents in shoot at stage I& II. Application of PBZ at 50 ppm markedly increased total soluble carbohydrates contents in fruits. While, application of PBZ at 100 ppm markedly decreased total soluble carbohydrates contents in fruits.

In agreement with these results a number of investigators observed stimulating effect regarding the effect of paclobutrazol shoot of eggplant, mostly, were insignificant in response to PBZ (100 ppm).

These obtained results are in harmony with those reported by **Ahmed *et al.*, (2007)** stated that, in the first season, all concentration of PBZ led to more accumulation of nitrogen than control plants. However, there was a gradual decrease in nitrogen percentage with increasing PBZ rate. In the second season, nitrogen percentage in the herb of Peperomiaobtusifolia L. plants decreased in response to all treatments of PBZ compared to considerably increased the levels of N, P, K and crude protein in leaves of treated faba bean plants compared with those of untreated ones in both seasons. Different applied seed-soaking treatments obviously increased N, P, K, and crude protein in seeds of treated plants compared with those of untreated ones. Increases were also in proportional to the applied concentration PBZ.

Nassar, (2013) Found that foliar spraying of mungbean Kawmy at concentration of 450 0r 600 ppm) induced significant promotive effect on seed protein and total carbohydrates, and El-Bably reported that spraying of Jacobiniacamara plant with PBZ, decreased total carbohydrate with raising PBZ concentration.

Karimi, et al., (2014) found that foliar spraying of Stevia (Stevia rebaudiana Bertoni). With PBZ at a concentration 12 ppm increased total glycoside contents, glycoside yield.

one exaptation, Application of PBZ at (100 ppm) markedly decreased protein contents in shoot at stage II.

These obtained results are in harmony with those reported by Wanas (2007) indicated that application of PBZ considerably increased the levels of crude protein in leaves of treated faba bean plants compared with those of untreated ones.

Bekheta, et al., (2008) study the influence of PBZ at the rate of (25 & 50ppm) or (100 ppm) on gerbera (Gerbera jasmonii L.) plants. Generally, all the used levels of PBZ led to the appearance of a new amino acid methionine, the increase in the content of endogenous amino acids which in turn led to positive changes in the picture of protein electrophoresis. These changes were accompanied by appearance and disappearance of some protein bands.

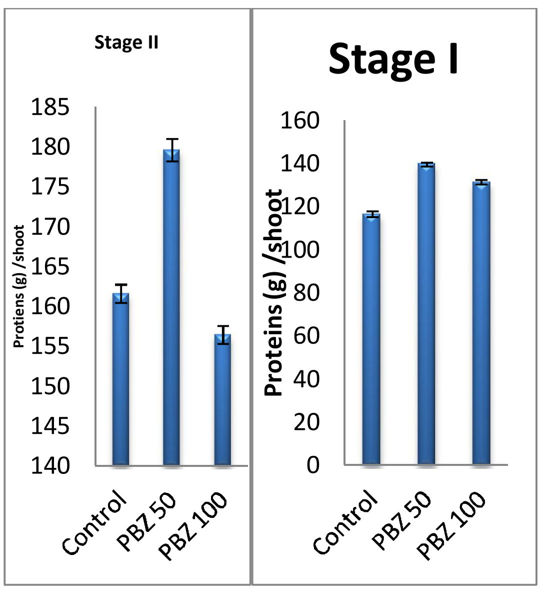

Figure (24): Effect of PBZ on protein content (shoot) of eggplant.

Youssef (2013) Reported that spraying potted Tabernaemontanacoronaria Stapf plant with PBZ significantly increased leaf N, P, K, total carbohydrates and total chlorophylls contents as compared with unsprayed plants.

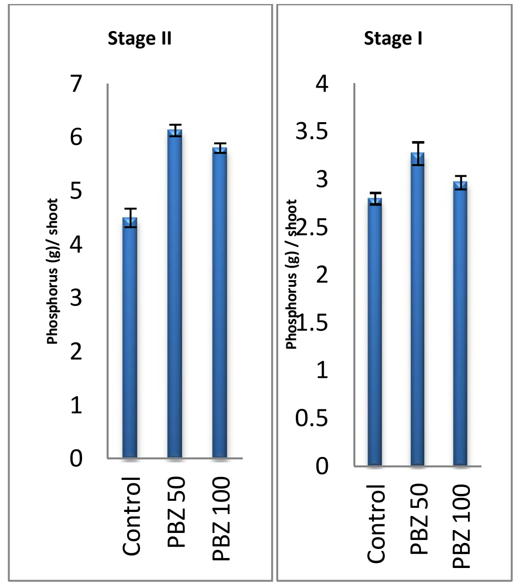

Figure (25): Effect of PBZ on phosphorus content (shoot) of eggplant.

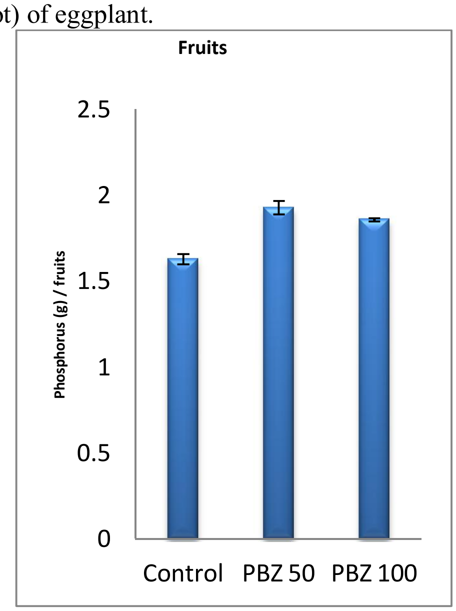

Figure (26): Effect of PBZ on phosphorus content (fruits) of eggplant.

3-7 Phytohormones

The obtained data indicated that contents of endogenous GA_3, IAA and ABA were increased in fresh weight of eggplants due to the treatment with PBZ (50 and 100 ppm).These findings are in accordance with of **Gopi, *et al.* (2009)** which reported that PBZ at 15 ppm inhibit gibberellic acid biosynthesis in *Ocimum sanctum* plants when compared to control.

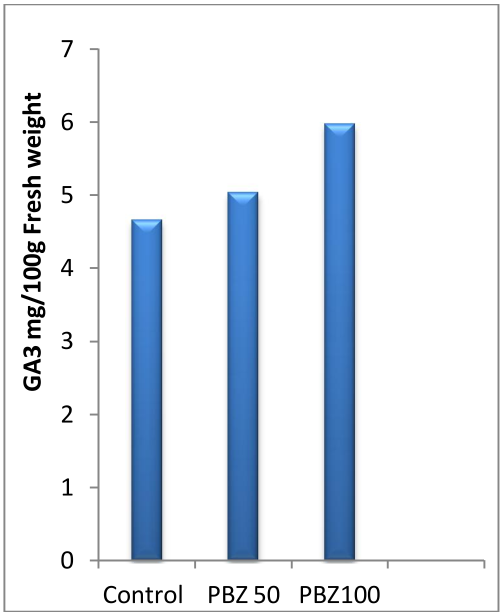

Figure (27): Effect of PBZ on GA3 of eggplant.

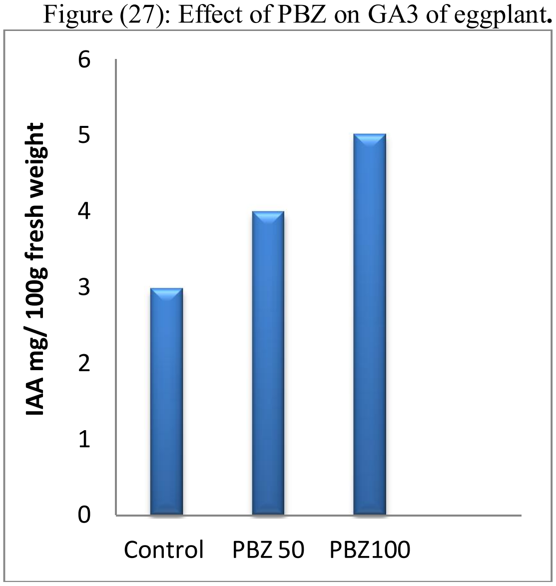

Figure (28): Effect of PBZ on IAA of eggplant.

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11/5/2015