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Enhancement of Soya bean (*glycine max l.)* Plants Growth, Yield and Seed Quality by using Putrescine, Benzyladenine and Yeast Extract

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Abstract

Two field experiments in randomized complete Block design (RCBD) were conducted at the experimental farm, Faculty of Agriculture Moshtohor, Benha university, Egypt during 2016 and 2017 seasons to study the effect of Putrescine at 5 and 10 mg/L, Benzyl adenine (BA) at 20 and 40 mg/L and yeast extract at 50 and 100 ml/L on growth, photosynthetic pigments, phytohormones content, anatomical structures, flowering, characteristics; seed fuelling and yield of Soybeans (*Glycine max L.*) plants. Results showed that different applied treatments increased growth characteristics i.e., (plant height, leaf number, leaf area, branches number, fresh & dry weights as well as the photosynthetic pigments and the endogenous phytohormones content. Also, stem and leaf anatomy measurements were increased especially (stem and leaf vascular and transporter tissues. In addition, flower setting was increased with putrescine, BA and yeast extract during 2016 and 2017 seasons. Also, yield and its characteristics were increased especially upper fully seeds, seed yield weight/plant during both seasons.

Key words: Soyabean, Putrscine, Benzyl adenine, Yeast extract, Growth, Phytohormones, anatomy.

Introduction

Soybean (*Glycine max* L.) is one from the most legumes widely grown crop and consumed oilseeds and the dairy alternative in the world. The large growth of soybean production can be attributed to various factors, with special mention of: High protein content (around 40%) of excellent quality, both for human and animal feeding; high oil content of the seeds (around 20%), which can be used for various purposes, especially for human feeding and biofuel production **(Lazzarotto and Hirakuri, 2011).** Through soyabean growth and development the plant loosing flower and new setting pods, by abortion and abscission may result in the reduction in number of pods and seeds **(Nonokawaet al., 2012).** Therefore, studies to increase soybean productivity have deserved much attention of researchers in recent years, Some researches show that, in normal conditions, the abscission of the reproductive structures of soybean can vary between 20 and 82% of the total number of flowers produced **(Yashimaet al., 2005; Peterson et al., 2005).** There aremany trials to decrease flower abscission and pod abortion through plant growth and developments. In this respect,benzyl adenine is an important plant hormone that regulates various processes of plant growth and development including cell division and differentiation, enhancement of leaf expansion and nutrient mobilization, improve crop quality and management **Davies, (1995).**Also, benzyl adenine (BA) belongs to a group of plant hormones called cytokinins and its role is connected with the growth and development of plants. It is also implicated in the vascular development and synthesis of secondary metabolites like indols, alkaloids and anthocyanins. It influences chloroplast differentiation and chlorophyll (Chl) biosynthesis **Duszka*et al.*, (2009).**In addition, Polyamines, mainly diamine putrescine (Put) are polycationic compounds of low molecular weight that are present in all living organisms reported by **Liu *et al.*, (2007)**. It has been proposed as a new division of plant growth regulators that are reported to be involved in a large spectrum of physiological processes, such as embryogenesis, cell division, morphogenesis, and plant development (**Bais and Ravishankar 2002; Liu *et al.*, 2006a).**Polyamines (Putrescine) play an important role in protecting plant against various a biotic stress, they are potent ROS scavengers and inhibitors of lipid peroxidation. The diamine Putrescine (Put) can alleviate harmful stress effects in plants by many ways including: polyamines (PAs) may be involved in free radical scavenging (**Drolet*et al.*, 1986**). It is modulators of stress - regulated gene expression and exhibit antioxidant properties **(Kuznetsov and Shevyakova, 2007 and Ahmed *et al.*, 2012).**Moreover, yeast extract is a natural component contains many of the nutrient elements and cytokinins, which is safe and non-pollutant. It has a considerable amounts of amino acids (**Abou Zaid, 1984);** mineral elements, carbohydrates, reducing sugars, enzymes and vitamins B1, 2, 3&12 (**Fathy and Farid, 1996 and Khedr and Farid, 2000).** Also it is a source of cytokinins and protein that enhance cell division and enlargement (**Barnett *et al.*, 1990).** Moreover, **Yeo *et al.*, (2000)** found that yeast extracts contain trehalose-6-phosphate synthase which is a key enzyme for trehalose bio synthesis. They suggested that production of trehalose not only effects on plant development but also improves drought tolerance. Many investigators reported that, spraying plants with yeast extract improved plant growth, yield and quality of many vegetable crops i.e. pea, tomato, potato,

pepper and cucumber (**Mohamed *et al.*, 1999; Yeo *et al.*, 2000; Abd-El-Hafez and Shehata, 2001 and Mahmoud, 2004).** Moreover, **El-Desuki and El-Gereadly (2006)** reported that, the vegetative growth of pea plant, leaves content of photosynthesis pigments, free amino acids, carbohydrates and cytokinins, pod yield and quality as well as nutritive value were increased by increasing the concentration of yeast extract in spraying solution from 1% up to 3%.Therefore, the present study amid toinvestigate the effect of some growth substances i.e., putrescine, benzyl adenineand yeast extract on growth performance, abscission and flower setting, pod fuelling in the terminal part, yield and yield components of soyabean *(Glycine maxL) plants*.

Material and Methods

Two field experiments in randomized complete block design (RCBD) were conducted at the experimental farm, Faculty of Agriculture Moshtohor, Benha University, Egypt during 2016 and 2017 seasons to study the effect of Putrescine at 5 and 10 mg/L, Benzyl adenine (BA) at 20 and 40 mg/L and yeast extract at 50 and 100 ml/L on growth, flowering, flower setting and abscission, pod fuelling and yield of soybeans (*Glycine max L.)* plants. Different material putrescine and BA were brought from Algomhoria Company. Also, yeast extracts was prepared according to **Abd EI-Rahim *et al.*, (1988).**The preparation of sowing land as recommended for soybean plants. All practical managements (fertilization, irrigation, pest control and etc….) were applied as recommended according to the Ministry of Agriculture. The seeds of soybean were sown on June 7th and May 22nd in 2016 and 2017 seasons, respectively. Soya bean seeds were drilled in rows, two seeds were sown and the distance between plant and other is 10 cm. The soybean variety was Giza 111. Through plant growth and development the growth substances treatments were applied as foliar spray three times starts at 25th days from sowing and after 20 days intervals for second and third one, respectively. The foliar spraying solution was added until the runoff from the plant.

Sampling and Collecting Data:

I-Morphological Measurements:

Different morphological Characteristics of soybean plants at 60 and 80 days after sowing were measured or estimated during 2016 and 2017 seasons. Nine plants from each treatment were randomly taken for the following measurements. Plant height, Stem diameter cm/plant., Number of leaves /plant, Number of branches/plant., Leaf area/plant. (by using disk methods according to **Derieux *and Montalanty*., (1973).** And fresh and dry weights of shoots.

II- Photosynthetic Pigments:-

Chlorophyll a, b and carotenoids were calorimetrically determined in the 4th apical leaves of soybeans plant at 60 and 80 days after sowing according to the methods of **Wettstein (1957)** and calculated as mg/g fresh weight.

III- Phytohormones Determination:

Endogenous phytohormones were quantitatively determined in soybean leaves at 60 days after sowing during 2017 season. According to the method of **Koshioka *et al.*, (1983)** used for HPLC {High-Performance Liquid Chromatography} for the determination of auxin (IAA), gibberellic acid (GA_3) and abscisic acid (ABA). Meanwhile, cytokinins were determined by HPLC according to **Nicander *et al.*, (1993)**.

IV-Anatomical studies

It was intended to carry out a comparative anatomical characteristics on stems and leaves of treated plants and those of the control at 60 days after sowing (flowering stage).Specimens of stems were taken from the 2 apical internode of the main stem while, those of the leaves were taken from the certain leaflet of the 2 apical leaf on the main stem. Anatomical studied were measured and calculated according to **(Johanson, 1940)**.

V- Flowering, Yield and yield component measurements:

At flowering stage the flowers number, flower setting and abscission percentages, pods number/ plant were recorded and calculated. At harvest time, nine randomly plants from each plot were taken for estimation of the following parameters: plant height, number of branches, whole plant weight, number of pods/plant, number and weight of pods in the terminal part, number and weight of pods in the lower part, number of seeds in 10 pods, weight of seeds in pods, weight of 100 seeds, seed weight g/plant.

VI-Statistical analysis:

Data of morphological, flowering and yield characteristics were statistically analyzed and the means were compared using the Least Significant Difference test (L.S.D) at 5% according to **Snedecor and Cochran (1980)**.

Results & Discussions

I- Growth characteristics:-

Growth characteristics of soya bean plants (*Glycine maxL*) at 60 and 80 days after sowing as affected by different applied Putrscine at 5, 10 mg/L, Benzyl Adenine at 20 and 40 mg/L and yeast extract at 50 &100 ml/Lare shown in **Table (1).**With regard to the plant height, stem diameter, leaves number /plant, number of branches and the total leaf area there were significantly increased with different applied treatments at 60 and 80 days after sowing during 2016

and 2017 growing seasons. Also, it could be noticed that the highest increase of leaves number was obtained with Putrscine at 10 mg/L followed by Benzyl adenine at 40 mg/L. Meanwhile, the lowest significant increase was existed with yeast extract at 100 ml/L at 60 & 80 days after sowing during both seasons. Here, the highest value of the number of branches existed with Benzyl Adenine at 40 mg/L at 60 and 80 days during 2016 and 2017 seasons. For the total leaf area the yeast extract at 100 ml/Lgave the greatest and highest significantly increase at 60& 80 days after sowing during 2016 and 2017 seasons. As for the shoots fresh and dry weights g/ plant were increased as the rest of characteristics. But the yeast extract at 50 ml/L gave the highest value of both weights when compared with the control at 60 and 80 days after sowing during 2016 and 2017 seasons.

In this respect, the obtained increase of growth parameters could be attributed to the beneficial effects of the applied growth substances i.e., Putrscine, Benzyl adenine and yeast extract on cell division, elongation and differenation. Also, yeast extract treatments are not only building blocks of proteins but also participate in many metabolic networks that control growth and adaptation to the environment **Zewail *et al.*, 2011 and Zewail (2014).** Also**,** They are important in many biological molecules, such as forming parts of coenzymes, or as precursors for the biosynthesis of molecules such as glutamine and ornithine, which are precursors for nucleotides and polyamines, respectively **(Alcázar*et al,* 2010)** and also serve as major transport molecules of nitrogen from vegetative to reproductive tissues. Stimulate biosynthesis of endogenous cytokinins from roots**.** Enhancing leaf water status, some plant nutrients uptake, shoot growth and root pull strength (**Demir *et al.* 2004)** altering hormonal balances and favor cytokinins and auxins production **(Schmidt 2005).**

II-Photosynthesis pigments content:

Data in **Table (2)** indicate that different applied treatments were significantly increased chlorophyll A, b and carotenoids concentration at 60 and 80 days after sowing during first and second seasons. The highest treatment of chlorophyll a, b and cartnoides it was BA at 20 and 40 mg/L at 60 and 80 days after sowing during 2016 and 2017 seasons.In the context chl a+b and chl a+b / carotenoids ratio also, increased with different applied treatments in leaves of soyabean plants during first and second growing season (2016&2017). In this respect, increased of chlorophyll contents could be attributed to that stimulation of putrscine, Benzyl adenine and yeast extract to protect photosynthetic apparatus of PSII **(Zhang and Schmidt 2000).** Also, protection of plant cells from lipid peroxidation and in activation of enzymes that occur under stress. Many biological molecules, such as forming parts of coenzymes, or as precursors for the biosynthesis of molecules such as glutamine and ornithine, which are precursors for nucleotides and polyamines, respectively.

III-Endogenous phytohormones content:

In Fig (5) data indicated that endogenous phytohormones content (i.e. Auxins, Gibberellins and Cytokinins were increased with Putrscine at 5& 10 mg/L, Benzyl adenine at 20 &40 mg/L and yeast extract at 50 and 100 ml/L at 60 days of plant age during second growing season. Meanwhile, abscisic acid was decreased. In the context, the BA applications at 40 mg/L gave the highest concentration for auxins, cytokinins and gibberellins). Also, total promoters and total promoters /inhibitors ratio were increased when compared with control treatment.

In this respect, increasing of phytohormones content with different exogenous applied treatments it could be noticed that, Putrscine, BA, and yeast extract enhance biosynthesis of amino acids and different phytohormones during plant growth and development, thereby, increasing different growth charactractics, Table1), flowering and fruit setting, yield and yield components (Table 5) as well.The obtained results in case of yeast extract may be due to that yeast extract is considered as a natural source of cytokinins that stimulates cell division and enlargement as well as the synthesis of protein, nucleic acids and chlorophyll, also it contains sugar, proteins, amino acids and vitamins, especially B which may play an important role in improving growth and development **(Fathy and Farid, 1996).** In addition, exogenously applied of cytokinins increased endogenously cytokinins that stimulates cell division and enlargement as well as the synthesis of protein , nucleic acids and chlorophylls, also it contains sugar, proteins, amino acids. Thereby increased growth behavior Table (1), yield and yield components Table (5) and chlorophyll contents Table (2) could be expected.

IV-Anatomical study:-

IV-A-Stem anatomy:-

Data in **Table (4)** and **Figs. (1 &2)** indicate the effect of different applied treatments(i.e., Putrescine 5& 10 mg/L, benzyl adenine 20& 40 mg/L and yeast extract50& 100ml\L compared with the control(distilled water) on different anatomical features of *Glycine max* stem and leaf.

Data in Table (4) and **Figs. (1& 2)** clearly indicate that all applied treatments increased the most stem anatomical features compared with the control. Obvious increase recorded in the thickness of many anatomical features especially with Putrescine at 10 mg/L.Here, number of vascular bundles, number of xylem rows in vascular bundle; number of xylem vessels in the row , the widest vessel thickness and thickness of xylem in large vascular bundle were reached their maximum values with Putrescine at 10 mg/L. While, the thickness of phloem were reached to 180, 135, 126, 153, 180 and 171 M with Putrescine at 5 mg /L, Putrescine at 10 mg/L,Benzyl adenine at 20

mg/L, Benzyl adenine at 40 mg/L, Yeast extract at 50 ml/L and Yeast extract at 100 ml/L, respectively, yet it was only 126M in control. Also, of interest it to note that the thickness of cambium region was reached to 80,90, 85,79,81 and 81 M with Putrescine 5 mg/L, putrescine 10 mg/L, BA at 20 mg/L, BA at 40 mg/L , yeast extract at 50 ml/L and yeast extract at 100 ml/L , respectively, yet it was only 45 m in the stem of control. Generally, stem anatomical features increased with all treatments, Putrescine at 10 mg/L recorded the highest values in the important studied anatomical characteristics than the control or other treatments. Our results are in harmony with those reported by **Nassar *et al.*, (2011)** on bean plants. **Nofal *et al.*, (2016)** on marigold plant

IV-b-Leaf anatomy:-

Data in Table (5) and Figs. (3 & 4) indicated that the effect of different applied treatments(i.e., Putrescine 5& 10 at mg/L, benzyl adenine at 20& 40 mg/L and yeast extract at 50& 100ml\L compared with the control(distilled water) on different anatomical features of *Glycine max L.* Leaflet. Thickness of midrib, thickness of blade, No of vascular bundles in midrib, length and width of large midrib vascular bundle, thickness of fiber in vascular bundle, thickness of phloem and xylem , number of xylem rows and vessel in vascular bundle and thickness of widest xylem vessel in vascular bundle. Numbers of vascular bundles were increased with some treatments compared with the control especially; benzyl adenine at 20 mg/Land yeast extract at 100ml\L.As for the dimensions (its length and width) of the large vascular bundle of the midrib was increased with most treatments compared with the control especially, with putrescine at 10 mg/L. Other treatments showed increase or decrease in one of these two characters. Also, of interest is to be note that the increase of transductory tissues i.e., xylem and phloem are of great importance since these tissues respent the passage of raw materials from roots to leaves through xylem tissue as well as the passage of different photsynthetase from leaves (source) to different plant parts (sinks) through phloem tissue.

The obtained results are in harmony with those reported by Nassar ***et al.*, (2011)** on bean plants. **Nofal *et al.*, (2016)** on marigold plan

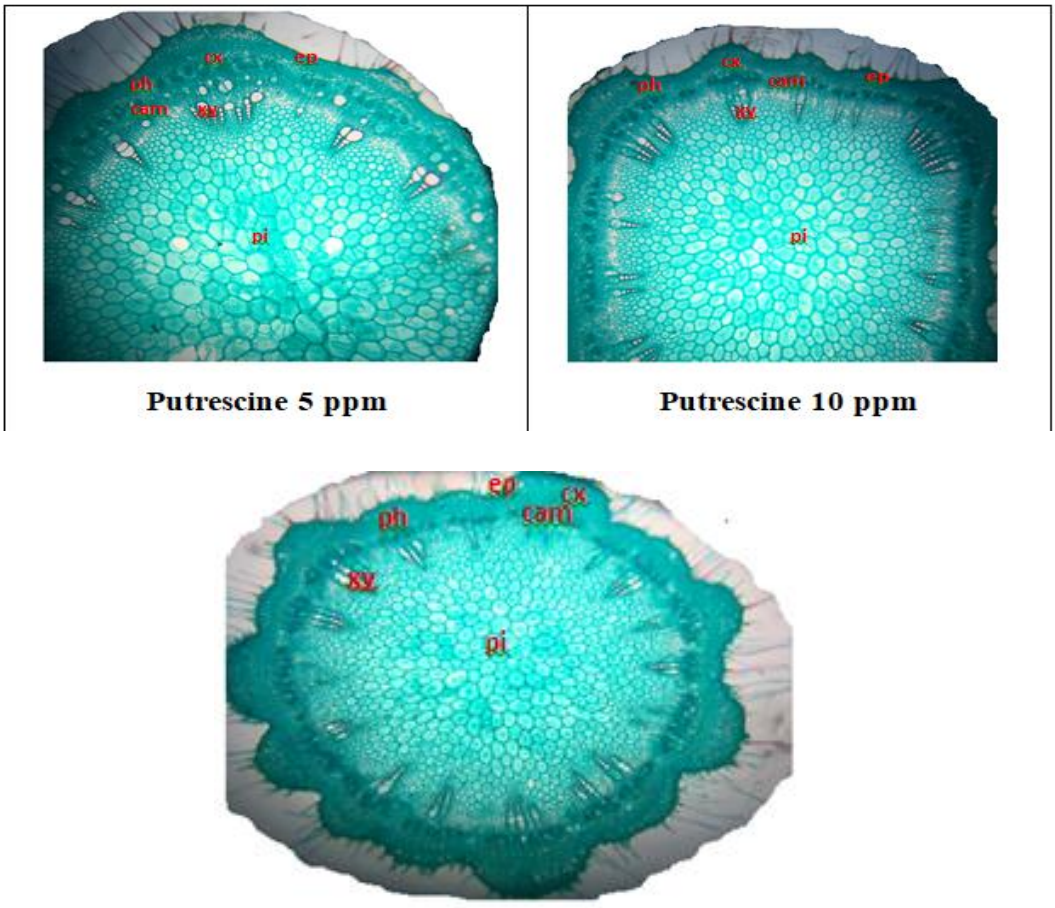


Fig. (1): Transverse sections (X = 24) through 2nd internode of the main stem of soyabean plants at 60 days after sowing as affected by the different applied treatments.

cx= Cortex ph= Phloem tissue ep= Epidermis
cam=Cambium xy= Xylem tissue pi= Pith

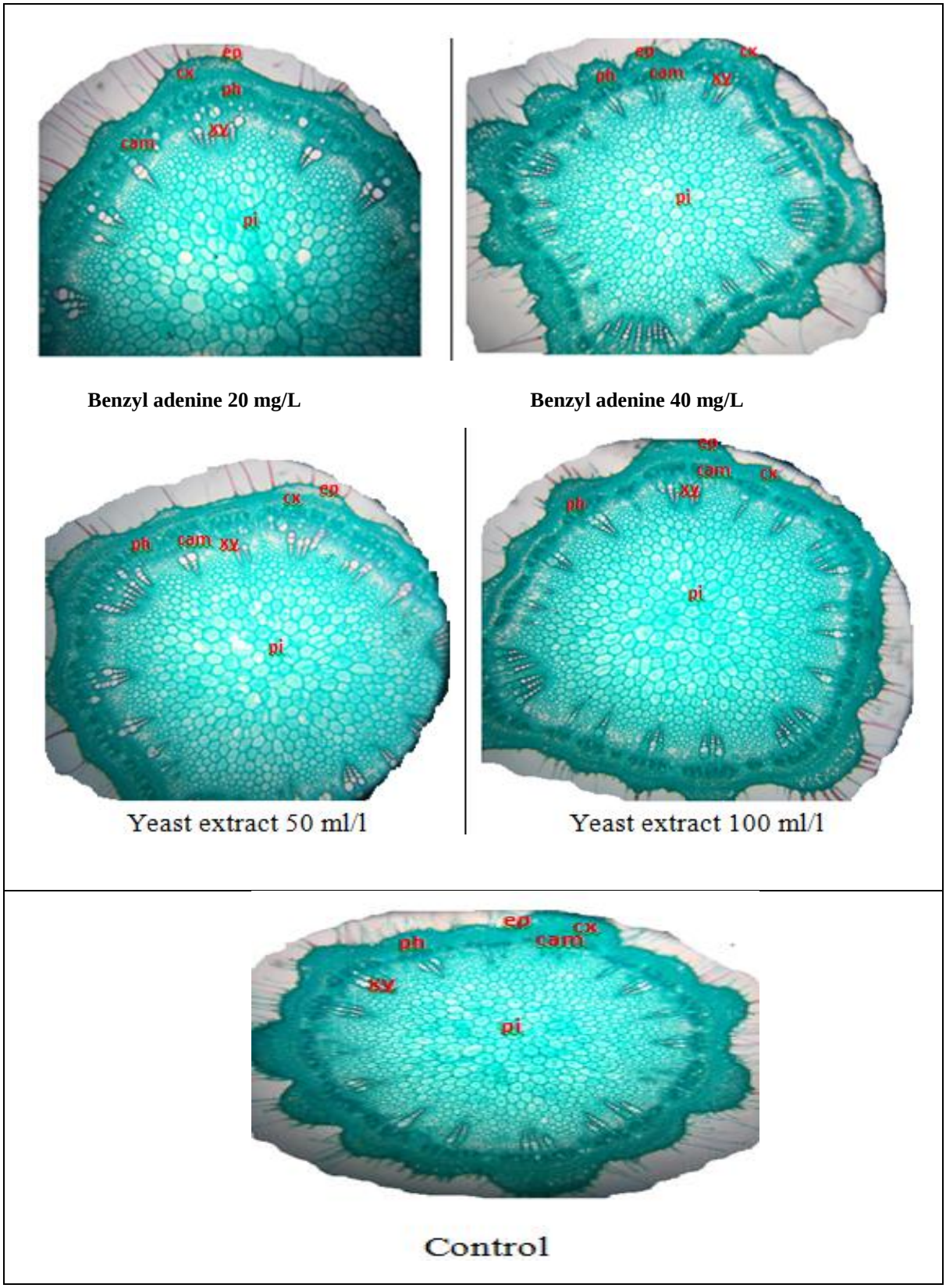


Fig. 2. Transverse sections (X = 24) through 2nd internode of the main stem of soyabean plants at 60 days after sowing as affected by the different applied treatments.

cx= Cortex ph= Phloem tissue ep= Epidermis
cam=Cambium xy= Xylem tissue pi= Pith

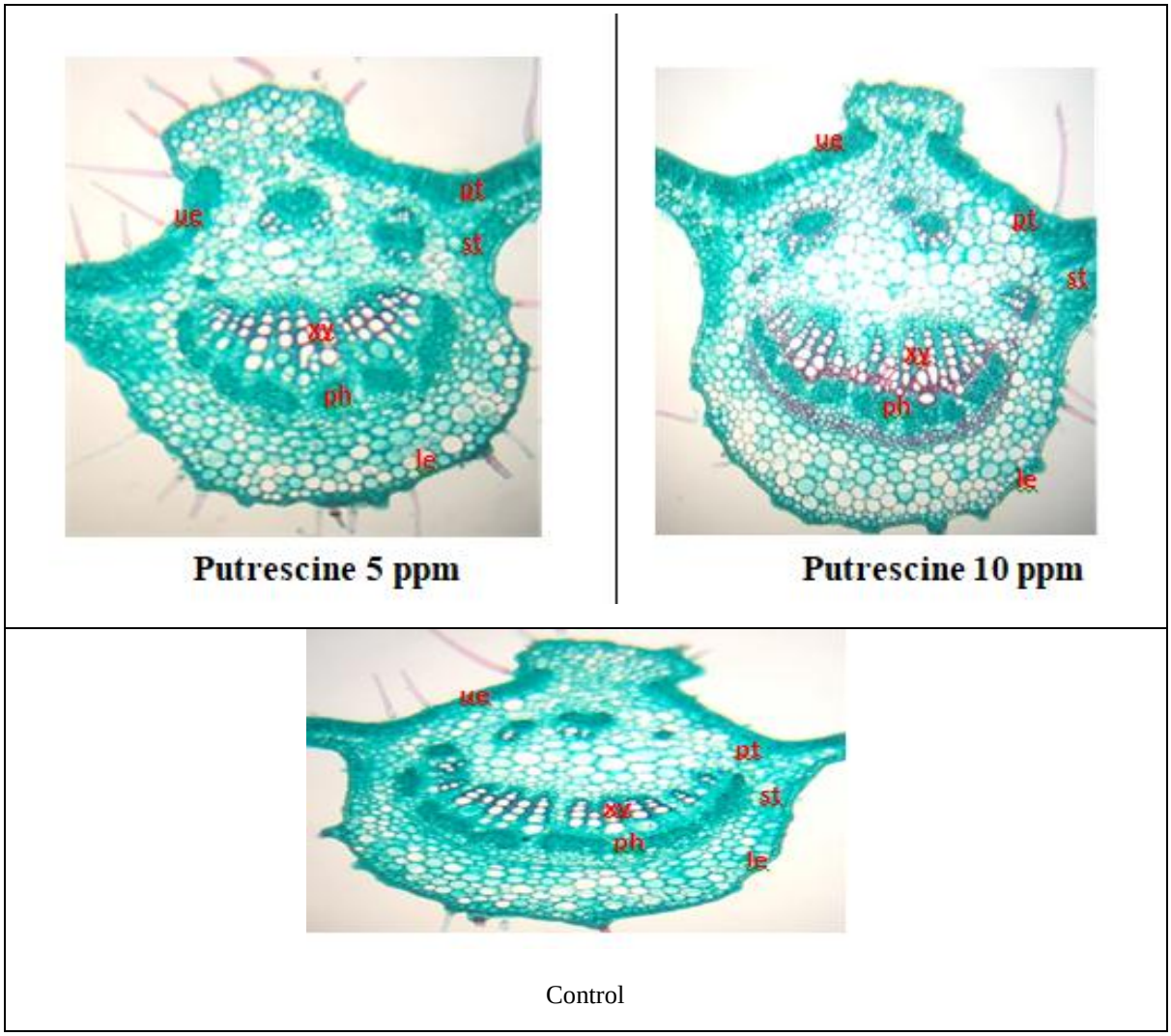
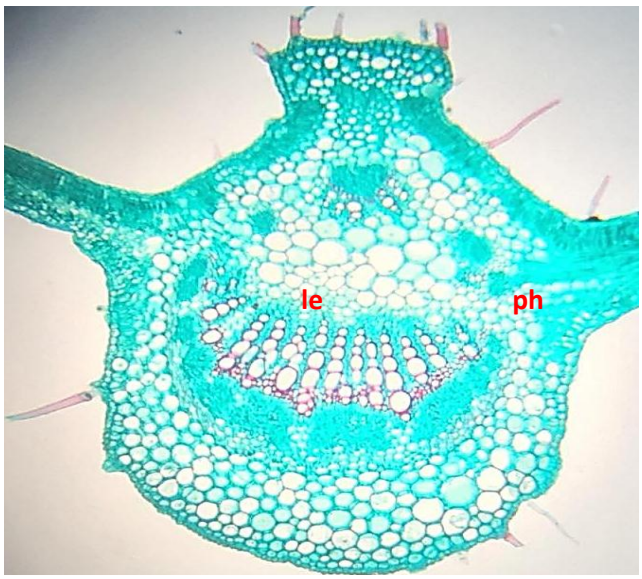
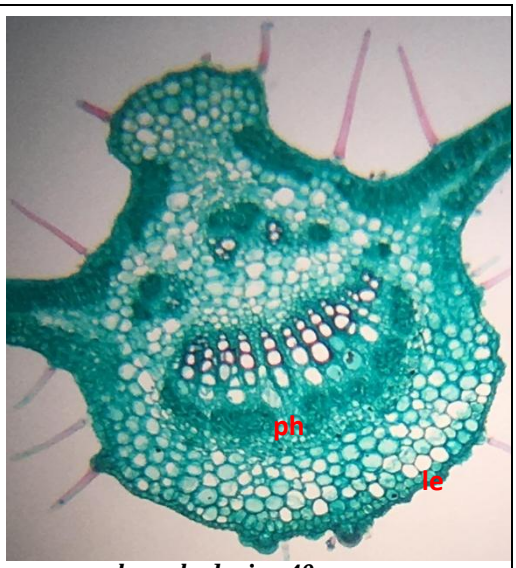


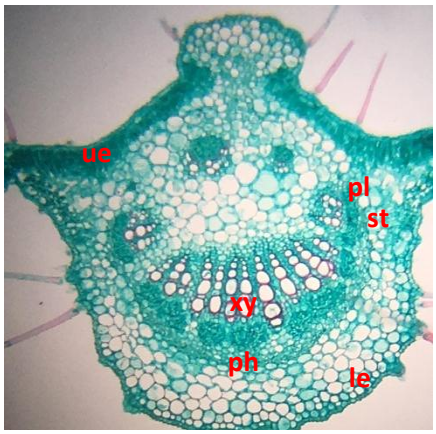
Fig. (3): Transverse sections (X = 24) through 2nd apical leaf of cucumber plants at 30 days after transplanting as affected by the different applied treatments.
ue = Upper epidermis pt= Palisade tissue st= Spongy tissue
le= Lower epidermis ph= Phloem tissue xy= Xylem tissue



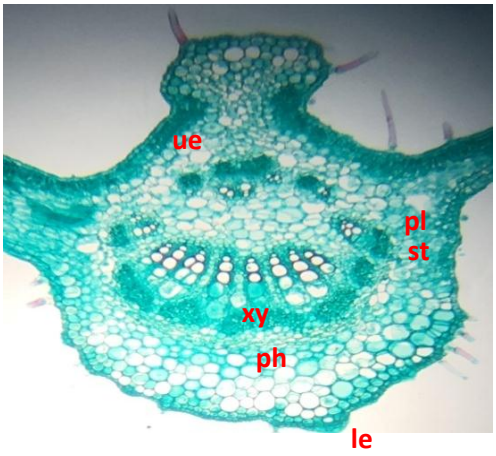
benzyl adenine 20 ppm



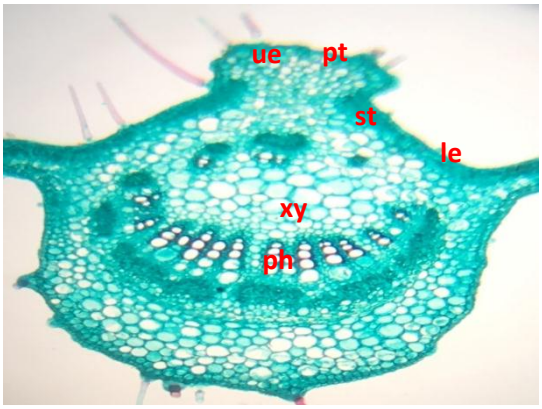
benzyl adenine 40 ppm



Yeast extract 50 ml/L



Yeast extract 100 ml/L



Control

Fig. (4): Transverse sections (X = 24) through 2nd apical leaf of soyabean plants at 60 days after transplanting as affected by the different applied treatments.
ue= Upper epidermis pt= Palisade tissue st= Spongy tissue
le= Lower epidermis ph= Phloem tissue xy= Xylem tissue

V-Flowering, Yield and yield components:-

Data in **Table (5)** showed the effect of Putrscine at 5, 10 mg/L, Benzyl adenine at 20 and 40 mg/L and yeast extract at 50 &100 ml/L on flower number, flower setting percentage , flower abscissions percentage, plant height cm/plant; pod number/plant (upper& lower);pod weight/plant (upper& lower); seed number/ pod (upper &lower) ; weight of 100 seed (upper& lower) and seed weight g/plant at harvest time during 2016 and 2017 seasons. Here, different applied treatments increased these traits (flowering and yield characteristics) during both seasons. In this respect, yeast extract at 100 ml/L gave the highest value with pod number (upper and lower; pod weight g/plant (upper and lower seeds number/pod (upper and lower , seeds weight g/pod compared with control plants during 2016 and 2017 seasons. Other applied treatments gave significant increase in these traits but did not reach the value of yeast extract treatment during both seasons. The enhancing effects of yeast extract application might be due to their contents of cytokinins enhance the accumulation of soluble metabolites. Yeast treatments were suggested to play a beneficial role in cell division and cell enlargement. Yeast as a natural stimulator is also characterized by richness in protein, carbohydrates, nucleic acid, lipids and different minerals and Li in addition to thiamin, riboflavin, pyridoxine, hormones and other growth regulating substances, biotin, B_{12} and folic acid **(Nagodawithana,1991).** In the same time increasing of growth aspects in Tables (1) especially with leaf area, leaf number, dry weight and accompanied with increasing of photosynthetic pigments as in **Table (2)** these are good indicators for improving soya bean yield and quality especially fully seeds in the upper part (fully seeds number and weight) as **in Table (5).**

Fig 5. Effect of different applied treatments on endogenous phytohormones content in shoots of Soyabean plants at 60 days after sowing during 2017 the second growing season.

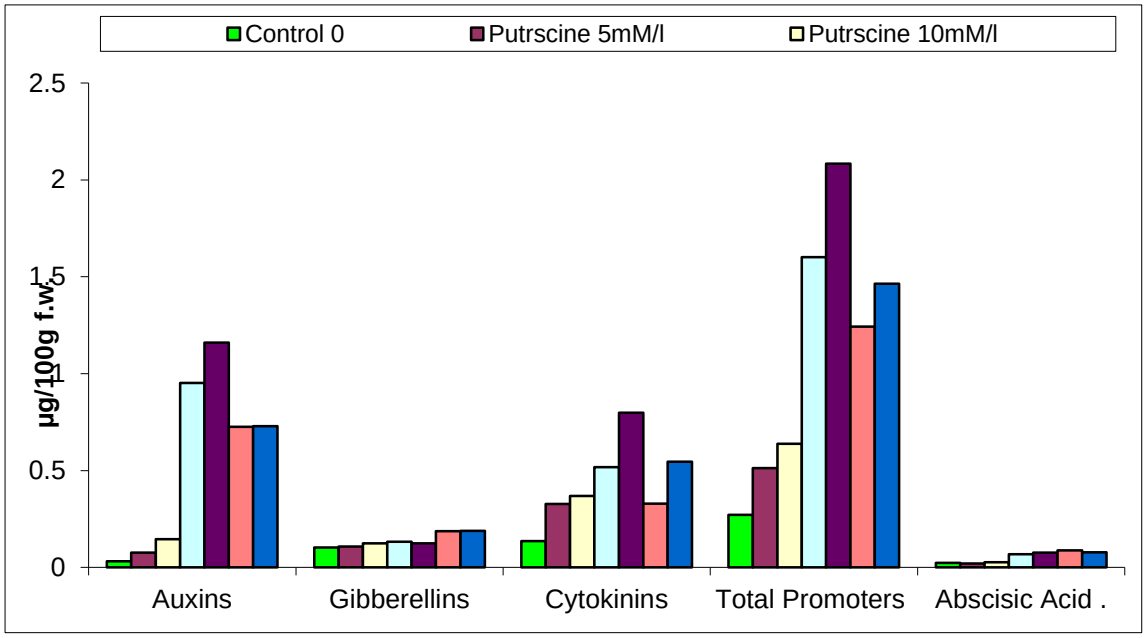


Table 1. Effect of different applied treatments on some morphological characteristics of soybean *(*Glycinemax L.) plants at 60 and 80 days after sowingduring 2016 and 2017seasons.

Characteristics	Plant height cm./plant				Stem diameter cm./plant				Number of leaves /plant				Number of branches /plant			
	At 60 days		At 80 days		At 60 days		At 80 days		At 60 days		At 80 days		At 60 days		At 80 days	
Treatments	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
Control	73.33	63.00	80.83	75.33	0.42	0.47	0.68	0.57	16.17	26.33	50.17	41.00	4.83	4.83	7.33	7.67
Putrscine 5 mg /L.	85.33	58.67	86.67	86.00	0.82	0.73	0.72	0.73	21.83	33.67	87.50	59.67	7.00	7.00	10.00	11.33
Putrscine 10 mg/L.	80.67	65.00	101.00	88.00	0.62	0.53	0.88	0.77	29.50	36.00	88.33	86.33	6.67	6.67	9.83	7.33
Benzyl adenine 20mg/L	78.33	52.33	109.50	83.33	0.75	0.53	0.98	0.87	25.67	31.67	71.33	81.33	7.83	7.83	11.17	13.33
Benzyl adenine 40mg/L	89.83	59.00	101.00	95.67	0.63	0.50	1.00	0.67	28.00	34.66	64.67	76.67	9.67	8.67	12.33	12.67
yeast extract 50 ml/L	82.00	55.67	86.50	92.00	0.72	0.73	0.92	0.97	20.00	31.00	65.83	78.67	7.83	7.83	8.17	7.00
yeast extract 100 ml/L	81.83	61.67	101.00	99.33	0.53	0.60	0.92	0.93	19.50	29.67	64.17	71.00	6.50	6.50	10.33	9.67
LSD at 0.005 %	4.53	3.25	4.23	4.15	0.12	0.15	0.22	0.29	2.50	2.66	2.75	2.33	0.321	0.325	0.564	0.569

Characteristics	Total Leaf area cm^2/plant				Shoots fresh weight g/plant				Shoots dry weight g/plant			
	At 60 days		At 80 days		At 60 days		At 80 days		At 60 days		At 80 days	
Treatments	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
Control	1625.90	2496.93	3910.96	2973.26	78.11	87.74	154.3	118.72	19.36	24.72	44.39	42.59
Putrscine 5 ml/L.	2834.47	3148.57	4476.82	4339.33	139.2	108.98	202.29	185.95	32.75	33.74	89.03	73.55
Putrscine 10 ml/L.	2687.22	2725.50	4018.22	3179.55	137.53	108.38	187.14	139.57	30.94	32.68	56.25	73.12
Benzyl adenine 20mg/L	2007.97	2798.83	5762.02	4372.71	117.14	103.38	226.91	202.47	23.83	31.36	69.08	64.83
Benzyl adenine 40mg/L	2533.77	3065.33	5069.92	3384.57	120.28	135.34	228.1	223.61	26.12	36.54	70.96	67.3
yeast extract 50 ml/L	2840.13	4210.33	5963.82	5649.78	152.74	172.29	249.14	242.83	38.2	47.7	96.79	99.34
yeast extract 100 ml/L	2938.91	3591.67	5669.26	5447.67	75.42	152.62	221.13	218.04	36.31	42.63	93.06	97.78
LSD at 0.005 %	122.13	110.25	105.22	123.17	1.35	1.65	1.36	1.45	0.511	0.455	0.645	0.487

Table 2. Effect of different applied treatments on photosynthetic pigments content of soybean *(Glycinemax* L.) plants at 60 and 80 days after sowingduring 2016 and 2017seasons**.**

Characteristics	Chlorophyll a				Chlorophyll b				Chlorophyll a + b			
	At 60 days		At 80 days		At 60 days		At 80 days		At 60 days		At 80 days	
Treatments	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
Control	0.988	1.140	0.886	1.109	1.054	0.686	0.705	0.631	2.042	1.826	1.591	1.74
Putrscine 5 ml/L.	1.389	1.777	0.907	1.365	1.193	0.958	0.977	0.703	2.582	2.735	1.884	2.068
Putrscine 10 ml/L.	1.427	1.496	0.952	1.466	1.269	1.029	0.848	0.739	2.696	2.525	1.800	2.205
Benzyl adenine 20mg/L	1.582	1.778	0.822	1.306	1.136	1.100	0.822	0.875	2.718	2.878	1.644	2.181
Benzyl adenine 40mg/L	1.341	1.889	0.750	1.500	1.243	0.880	0.992	0.837	2.584	2.769	1.742	2.337
yeast extract 50 ml/L	1.255	1.844	0.793	1.427	1.203	1.119	0.771	0.965	2.458	2.963	1.564	2.392
yeast extract 100 ml/L	1.104	1.819	0.815	1.540	1.205	0.969	0.730	0.938	2.309	2.788	1.545	2.478
LSD at 0.005 %	0.025	0.035	0.0125	0.0356	0.028	0.035	0.0250	0.0125	0.112	0.222	0.156	0.135

Charactractics	Carotenoids				Chl a + b / cart.			
	At 60 days		At 80 days		At 60 days		At 80 days	
Treatments	2016	2017	2016	2017	2016	2017	2016	2017
Control	1.089	0.904	1.031	1.080	1.875	2.020	1.543	1.611
Putrscine 5 ml/L.	1.264	1.033	1.228	1.140	2.043	2.648	1.534	1.814
Putrscine 10 ml/L.	1.479	1.221	1.154	1.206	1.823	2.068	1.560	1.828
Benzyladenine 20mg/L	1.727	1.040	1.009	1.220	1.574	2.767	1.629	1.788
Benzyladenine 40mg/L	1.335	1.168	0.891	1.245	1.936	2.371	1.955	1.877
yeast extract 50 ml/L	1.627	1.137	0.919	1.294	1.511	2.606	1.702	1.849
yeast extract 100 ml/L	1.543	1.099	0.993	1.226	1.496	2.537	1.556	2.021
LSD at 0.005 %	0.168	0.212	0.139	0.148	0.225	0.238	0.178	0.239

Table 4. Effect of different applied treatments on the mean counts and measurements of certain histological features of Soya bean (***Glycine max*** L) main stem and leaf at 60 days after sowing.

Treatments / Characters (micron)	Putrescine 5mg/L	Putrescine 10mg/L	BA 20mg/L	BA 40mg/L	Yeast 50ml\ l	Yeast 100ml\ l	Control
Stem measurements							
Stem diameter.	4845.80	5382.00	5182.20	4048.20	4676.40	4541.40	**3067.20**
No. of vascular bundle.	15.00	18.00	16.00	16.00	16.00	16.00	**16.00**
Thickness of fibers layers in large vascular bundle.	73.80	81.00	117.00	99.00	76.50	81.00	**45.00**
Thickness of phloem in large vascular bundle.	180.00	135.00	146.00	153.00	180.00	171.00	**126.00**
Thickness of cambium layers in large vascular bundle.	80.00	90.00	85.00	79.50	81.00	81.00	**45.00**
Thickness of xylem in large vascular bundle.	549.00	616.50	495.00	315.00	477.00	360.00	**270.00**
No. of xylem rows in large vascular bundle.	8.00	9.00	8.00	8.00	7.00	6.00	**4.00**
No. of vessels in the xylem row in large vascular bundle.	7.00	9.00	7.50	6.00	5.00	6.00	**5.00**
Thickness of widest xylem vessel in large vascular bundle.	90.00	108.00	99.00	67.50	85.50	76.50	**40.50**
Leaf measurements							
Thickness of midrib of leaf.	1291.50	1458.00	1350.00	1359.00	1530.00	1440.00	**1449.00**
Thickness of blade.	156.60	241.20	203.40	183.60	195.30	153.90	**81.00**
No. of vascular bundles in midrib.	3.00	5.00	5.00	3.00	4.00	5.00	**4.00**
Length of large midrib vascular bundle.	398.70	432.00	414.00	368.5	441.00	351.00	**346.50**
Width of large midrib vascular bundle.	720.00	855.00	720.00	720.00	594.00	720.00	**900.00**
Thickness of fibers in vascular bundle.	96.20	91.00	85.00	85.00	81.00	83.00	**76.50**
Thickness of phloem in vascular bundle.	99.00	99.00	93.00	94.00	92.00	94.00	**90.00**
Thickness of xylem in vascular bundle.	283.50	252.00	279.00	274.50	270.00	198.00	**180.00**
No. of xylem rows in vascular bundle.	15.00	15.00	12.00	13.00	10.00	12.00	**10.00**
No. of vessels in the xylem row.	8.50	6.00	7.00	6.00	5.00	5.00	**4.50**
Thickness of widest xylem vessel in vascular bundle	**72.00**	**81.00**	**67.50**	**57.00**	**72.00**	**49.50**	**45.00**

Table 5. Effect of different applied treatments on flowering measurements, yield and yield components of soybean *(Glycine max* ,L) plants at harvest time during 2016 and 2017seasons**.**

Characteristics	No. of flowers/plant		Flower setting %		Flower Abscissions %		Plant height cm./plant		Pods number/plant				Pods weight/plant	
									Upper part		Lower part		Upper part	
Treatments	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
Control	161.00	189.00	62.79	60.85	37.21	39.15	82.83	84.33	11.67	14.33	108.17	107.33	6.87	9.61
Putrscine 5 ml/L.	156.33	252.40	74.24	74.64	25.76	25.36	88.16	87.00	22.83	25.33	115.50	151.00	13.69	15.45
Putrscine 10 ml/L.	169.66	218.00	80.73	74.13	19.27	25.87	86.83	89.67	24.33	26.00	166.67	165.00	14.81	16.88
Benzyl adenine 20mg/L	207.00	290.00	81.93	79.45	15.07	20.55	84.33	92.00	23.50	32.00	165.17	231.67	13.79	17.46
Benzyl adenine 40mg/L	187.66	248.60	80.28	82.95	19.72	17.05	88.17	88.00	27.83	33.33	168.50	148.00	16.44	18.06
yeast extract 50 ml/L	289.66	297.40	82.49	83.23	19.51	21.77	92.67	88.00	25.50	33.33	140.83	183.33	15.20	17.58
yeast extract 100 ml/L	298.00	298.60	82.64	83.32	17.36	17.68	88.33	89.00	28.00	35.33	181.00	275.33	17.22	19.50
LSD at 0.005 %	10.15	15.11	1.31	1.25	2.25	2.02	1.322	1.423	0.259	0.349	0.625	0.679	0.125	0.214

Charactractics	Pods weight/plant		Seeds number/pod				Seeds weight g/ pod				100 seeds weight		Seeds weight/plant	
	Lower part		Upper part		Lower part		Upper part		Lower part					
Treatments	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
Control	48.52	46.86	1.37	2.03	2.67	2.77	2.45	3.67	4.23	4.31	18.36	18.18	30.11	32.05
Putrscine 5 ml/L.	56.21	63.59	2.20	2.80	2.97	3.03	4.71	6.02	5.76	5.67	20.87	21.85	43.96	51.98
Putrscine 10 ml/L.	84.11	84.18	2.77	2.87	3.10	3.07	5.09	5.71	5.96	6.04	19.38	21.13	60.99	61.18
Benzyl adenine 20mg/L	80.72	102.36	2.78	2.90	3.03	3.03	5.49	6.14	5.84	6.09	19.98	21.35	59.96	86.99
Benzyl adenine 40mg/L	90.08	67.00	2.52	2.90	3.02	3.03	5.52	6.35	5.99	6.15	20.96	21.45	58.96	55.50
yeast extract 50 ml/L	63.26	99.33	2.60	2.87	2.95	3.07	5.75	6.71	5.73	5.92	20.24	21.77	60.05	88.15
yeast extract 100 ml/L	91.05	132.17	3.73	3.90	4.07	4.10	5.69	6.44	6.92	6.21	21.67	22.46	86.99	97.14
LSD at 0.005 %	0.369	0.397	0.110	0.121	0.095	0.123	0.146	0.159	0.197	0.138	0.248	0.269	3.25	4.66

Conclusion

For maximizing the final yield of soyabean plants with good quality it could be achived with applying each of putrescine, at 5 and 10 mg/L , Benzyl adenine at 20 and 40 mg/L and yeast extract at 50 and 100 ml/Lthree times during soya bean growth and development.

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تعظيم النمو،المحصول وجودته لنباتات فول الصويا بإستخدام البترسين،البنزيل ادينين ومستخلص الخميرة

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قسم النبات الزراعى- كلية الزراعة – جامعة بنها

أجريت تجربتان حقليتان بمزرعة كلية الزراعة بمشتهر خلال موسمى النمو 2017/2016 لدراسة تأثير بعض مواد النمو (بترسين 5، 10 ملجم/ لتر ، ، (السيتوكين) بنزيل ادينين 20 ،40 ملجم/لتر، مستخلص الخميرة 50 ، 100 مل/ لتر) على نمو والخصائص الموفولوجية وتساقط الازهار والمحصول ومكوناتة لاجزاء النبات المختلفة فى نبات فول الصويا.وأظهرت النتائج الاتى:-ادت المعاملات المختلفة الى زيادة خصائص النمو الخضرى عند 60 و80 يوم من الزراعة خلال موسمى النمو. كما ادت المعاملات المختلفة الى زيادة فى صبغات البناء الضوئى وخاصة كلورفيل أ كما زادت النسبة بين الكلورفيل والكارونتويدات. ادت المعاملات المختلفة الى زيادة محتوى المجموع الخضرى من الهرمونات الداخلية خاصة منشطات النمو عند عمر 60 يوم من الزراعة خلال موسم النمو الثانى. زادت الخصائص التشريحية للسيقان والاوراق خاصة الانسجة الوعائية (الخشب واللحاء)وخصائصهم المختلفة عند عمر 60 يوم من الزراعة خلال موسم النمو الثانى. بالاضافة الى ماسبق زادت نسبة العقد للازهار وعدد القرون وعدد البذور بالقرن ووزن القرون والبذور الطرفية فى النبات ومحصول النبات ونسبة امتلاء القرون خلال موسمى النمو 2016 ،2017.