EFFECT OF CHEMICAL FERTILIZATION, BIOFERTILIZER AND THIDIAZURON ON GROWTH AND YIELD OF CELERY (*APIUM GRAVEOLENS* L.) PLANT.

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Abstract

This study was conducted during two successive seasons of 2014-2015 and 2015-2016 at Biotechnology Department, Phytochemistry Department and Farm of Applied Research Center of Medicinal Plants (ARCMP) affiliated to the National Organization for Drug Control And Research (NODCAR). The present work aimed to investigate the effect of inoculation *Apium graveolens* L. seeds with arbuscular mycorrhizal fungi (my) and/or microbein (mi) biofertilizer and foliar spray plants with Thidiazuron (TDZ) combined with chemical fertilizer at half or full dose of NPK on number of spores Am fungi (kg soil^{-1}), AM fungi colonization , enzymatic activities (dehydrogenase activity [µg TPF/g dry soil/day] & Nitrogenase activity [nmol C_2H_4/g rhizosphere/ hour]), growth parameters (fresh weight of shoots per plant (g), fresh weight of roots per plant (g), dry weight of shoots per plant (g), dry weight of roots per plant (g), Plant height (cm), number of umbel per plant [at full flowering stage] & dry weight of fruits per plant [at harvest stage]) and chemical composition (plant pigments [chlorophyll a, chlorophyll b and carotenoides], macro elements content (%), total carbohydrates, and crude protein). The results in both seasons showed that, the highest values of number of AM fungi spores (kg soil^{-1}) in celery (*Apium graveolens* L.) roots, AM fungi colonization %, enzymatic activities, growth parameters and chemical composition obtained at inoculating seeds with mixture of mycorrhizal and mycrobein at full dose of NPK.

Keywords: biofertilizer, thidiazuron, *apium graveolens,* mycorrhizal**,** mycrobein

Introduction

Apium graveolens Linn. (Apiaceae) is commonly known as Celery (Norman and Max, 2001). It is an erect, annual or biennial herb. The roots are numerous, succulent and well developed. The stem branches are angular or fistular, and are conspicuously jointed. The leaves are oblong to obovate, pinnate or trifoliolate. The leaflets are ovate to suborbicular and 3-lobed. The flowers are white or greenish white and very small. The fruit is a schizocarp consisting of two mericarps, sub-orbicular to ellipsoid, greyish brown to brown with pale ridges, aromatic and slightly bitter (Teng *et al*., 1985). The primary phytochemical analysis on the seed extract of *Apium graveolens* indicates the

presence of carbohydrates, flavonoids, steroids, and glycosides in the methanolic extract. The plant included phenols and furocoumarins. Furocoumarins contained celerin, bergapten, apiumoside, apiumetin, apigravrin, osthenol, isopimpinellin, isoimperatorin, celereoside, and 5 and 8-hydroxy methoxypsoralen. Phenols included graveobioside A and B, apiin, apigenin, isoquercitrin, tannins and phytic acid. Celery seeds contain 2 to 3% essential oil. Its oil contains mostly limonene (usually 60 percent), selinene (10 %), frocoumarin and frocoumarin glycosides and their flavonoids (Khare, 2008). Celery (*Apium graveolens*) is a medicinal plant in traditional medicine with numerous health benefits. Celery involves in the prevention of cardiovascular disease (Sowbhagya, 2001), lowering blood glucose in diabetic mice (Gelodar and Nazify, 1997), lowering blood pressure and strengthening the heart (Lans, 2006). Experimental studies report antifungal (Momin and Nair, 2001) and anti-inflammatory effects of celery (Mencherini *et al*., 2007). Celery has an anticoagulant activity (Sowbhagya *et al*., 2001). It is root leads to an increase of calcium and decrease of potassium in the heart tissue (Bernard and Stiehl, 1986). Essential oil of celery has antibacterial effects. This plant has cooperation in the molecular mechanisms and cellular targets that have a significant effect on the treatment of human cancers (Atta, 1998). Celery root and leaves have the property of eliminating OH and DPPH radicals. It also reduces the severity of liposomal peroxidation that represents renewal and conservation activities of it (Zidorn *et al*., 2005).

The term biofertilizer or called 'microbial inoculants' can be generally defined as a preparation containing live or latent cells of efficient strains of nitrogen fixing, phosphate solubilizing or cellulytic microorganisms used for application of seed, soil or composting areas with the objective of increasing the numbers of such microorganisms and accelerate certain microbial process to augment the extent of the availability of nutrients in a form which can assimilated by plant (Board, 2004). In large sense, the term may be used to include all organic resources (manure) for plant growth which are rendered in an available form for plant absorption through microorganisms or plant associations or interactions (Board, 2004).

Biofertilizers are the products containing living cells of different types of microorganisms which have the ability to mobilize nutritionally important elements from a non-usable to a usable forms through biological processes. Although the advent of the phenomenon is more than a century old, the need of its commercial exploitation was not applied (Saber, 1993; Hegde *et al*, 1999). Microorganisms play an important role in various chemical transformations of soils and thus, influence the availability of major nutrients like nitrogen, phosphorus, potassium and sulphur to the plants. Cyanobacteria and phosphate-solubilizing bacteria were used as biofertilizers to increase crop production (Earanna and Govindan, 2002).

General growth and cell division stimulation becomes saturated at low levels of TDZ, making the chemical more effective than purine type cytokinins. Thidiazuron (N-phenyl-*N*'- 1,2,3,- thiadiazol-5-phenyl urea) , is a synthetic diphenylurea (DPU) type cytokinin that is thought to encourage the synthesis and /or accumulation of purine type cytokinins (Thomas and Katterman, 1986). In agriculture, TDZ is used as a defoliant particularly in cotton. It is sprayed on a field to defoliate the plants before the boll harvest. (Snipes and Cathey, 1992) found that a tank mix of TDZ and another defoliant (they tested ethephon, tribufos, and dimethinpin) worked well to negate the effect of

environmental conditions on the efficacy of the chemicals in promoting leaf abscission.

The aim of the present work was to study the effect of my, mi and TDZ combined with half or full dose of NPK on growth, yield and chemical composition of celery plant.

MATERIALS AND METHODS

This work was carried out during two successive seasons 2014-2015 and 2015-2016 at Biotechnology Department, phytochemistry Department and Farm of Applied Research Center of Medicinal Plants (ARCMP) affiliated to the National Organization for Drug Control And Research (NODCAR).

MATERIALS

Plant material

Seeds of *Apium graveolens* L. obtained from agriculture Research Center (EL gamma st. , giza, Egypt).

microorganisms material:-

1. mycorrhizal (contains *Gloums* spp., *Gigaspora* spp. and *Acaulospora* spp. V 1:1:1) obtained from soil, water and environment research institute.

2. mycrobein (biofertilizer containing N-fixing (such as *Azotobacter* and *Azospirillum*) and P-dissolving bacteria (Such as *Pseudomonas* and *Bacillus megatheium*) produced and distributed commercially by the general organization for agriculture equalization fund. Ministry of Agriculture, Egypt.

Mycorrhizal and microbein coated the seed of celery pre-planting by mixing with a fine mist of 10% sugar solution and mixing seed with the microbein and Mycorrhizal spores.

Thiduazoran growth regulators

Obtained from commercially compound named prop 50 WP (containing 50% TDZ).

Plants were sprayed with 10 ml of a solution containing (5 mg/l TDZ dissolving in water containing 0.01% tween 20%) using a hand atomizer. Weighing the plants before and after spraying showed that approximately 5 to 7 ml of the solution adhered to each plant. Control plants were sprayed with water containing 0.01% tween 20% but without TDZ.

Soil used

The soil used in the present work are collected the from farm of Applied Research Center soil of Medicinal Plants (ARCMP) related to The National Orgnization for Drug Control And Research (NODCAR) and initially analyzed for chemical and

physical characters according to **Black *et al.* (1965).** These characters are presented in Table (1).

Table (1): Chemical and physical characteristics of experimental soil

EC mmohs/cm	SP	Ph	Soluble ions (meq/L)							
7.5	26	8.1	Ca^{++}	Mg^{++}	Na^{+}	K^{+}	CO_3^{--}	HCO_3^{-}	Cl^{-}	SO_4^{--}
			8.10	9.32	2.57	.80	----	2.6	4.24	13.93

Some physical characteristics of the experimental soil				
Particle size distribution (%)				Texture class
Coarse sand	Fine sand	Silt	Clay	Sand clay
47.15	23.17	19.91	9.77	

Experimental design and layout
Experimental design and layout

The experiment was laid out in randomized block design (RBD) (6X7m) with 3 replications; each block was prepared to contain 10 rows. Randomization of the treatments was done with the help of random number table as advocated by **Fisher, 1950**. The treatments were:-

1) Control (un treated plants with chemical and bio-fertilizer)
2) Recommended dose of chemical fertilizer .
3) Recommended dose of chemical fertilizer + mycorrhizal
4) Recommended dose of chemical fertilizer + microbein
5) Recommended dose of chemical fertilizer + TDZ
6) Recommended dose of chemical fertilizer + mycorrhizal + microbein
7) Recommended dose of chemical fertilizer + mycorrhizal + TDZ
8) Recommended doses of chemical fertilizer + microbein + TDZ
9) Half Recommended dose of chemical fertilizer .
10) Half recommended dose of chemical fertilizer + mycorrhizal
11) Half recommended dose of chemical fertilizer + microbein
12) Half recommended dose of chemical fertilizer + TDZ
13) Half recommended dose of chemical fertilizer + mycorrhizal + microbein
14) Half recommended dose of chemical fertilizer + mycorrhizal + TDZ
15) Half recommended doses of chemical fertilizer + microbein + TDZ

Recommended dose of chemical fertilizer were 200 Kg/Fadden superphosphate (12.5% P_2O_5) added before planting , while the plants were fertilizer with 200 Kg/Fadden ammonium sulphate (20.6 % N) and 50 Kg/Fadden potassium sulphate (50% KO_2) after 30 and 45 days from planting at two stage.

Seeds of celery planting in green house in August and transfer plantlet to farm in October the harvest were in May.
The data recorded were:-

1. Determination number of spores Am fungi (kg soil^{-1}) and AM fungi colonization

The percentage of AM fungi colonization in plant root tissues was determined as described by Philips and Hayman (1970)

2. Enzymatic activities determinations

a. dehydrogenase activity (µg TPF/g dry soil/day)

The dehydrogenase activity was estimated according to (Skujins and burns ,1976)

b. Nitrogenase activity (nmol C_2H_4/g rhizosphere/ hour)

The activity of nitrogenase enzyme was determined by the acetylene reduction technique according to **Hardy *et al* (1973).**

3. Growth parameters

The recorded data for the experiments at three periods (2 [December], 4 [February] and 6 [April] months) were as follows:

[fresh weight of shoots per plant (g), fresh weight of roots per plant (g), dry weight of shoots per plant (g), dry weight of roots per plant (g), Plant height (cm), number of umbel per plant (at full flowering stage) and dry weight of seeds per plant (at harvest stage)]

4. Chemical composition

a. Determination of plant pigments

Leaf samples were used to measure Chl. a , b **(Arnon 1949)** and Carotenoid contents **(Lichtenthaler and Wellburn, 1983).**

b. Determination of total carbohydrates in the dried herb

The content of total carbohydrates of the samples was determined by the phenol sulfuric acid method (Dubois *et al*., 1956 and Krishnaveni *et al*., 1984).

c. Crude protein content (%)

Sample of celery leaves were analysed separately for nitrogen content (%) by colorimetric method **(Snell and Snell, 1949).** Nitrogen content is multiplied with 6.25 factors to calculate crude protein content in head **(A.O.A.C., 1960)**.

d. Macro elements determination

1. Nitrogen

Nitrogen content was determined by the modified micro-Kjeldahl method as described by **Pregl, (1945).**

2. Phosphorus

The phosphorus content was estimated after wet ashing by using molybdic acid to form phosphomlybdate complex, and then reduced with aminoaphthosulphuric acid to complex molybdenum blue which was measured calorimetrically (at 660 µm) using a standard curve of potassium dihydrogen phosphate as recommended by **Murphy and Riley (1962).**

3. Potassium

Potassium was determined using a flame photometer as described by **(Jackson ,1965).**

Statistical analysis:

Data recorded on vegetative growth and chemical compositions were statistically analyzed, and separation of means was performed using the least significant difference (L.S.D.) test at the 5% level, as described by **(Snedecor and Cochran, 1967).**

RESULTS AND DISCUSSIONS

Microbiological parameters

a) number of AM fungi spores (kg soil^{-1})

Data concerning the effect of treated celery (*Apium graveolens* L.) plant with chemical , bio-fertilizer and TDZ on number of AM fungi spores (kg soil^{-1}) are presented in Table (2). Data showed that inoculation of celery (*Apium graveolens* L.) seeds with AM mycorrhizal led to significantly increase in number of AM fungi spores (kg soil^{-1}) compared to un-inoculated seeds.

Also the data showed that the highest values of number of AM fungi spores (kg soil^{-1}) were $3.2x10^4$ and $3.3x10^4$ in celery (*Apium graveolens* L.) roots obtained at inoculation of seeds with mixture of mycorrhizal and mycrobein at full dose of NPK in the first and second seasons, respectively.

These results were in accordance with the finding of Ramakrishnan and **Bhuvaneswari (2014)** on *Eleusine coracana* (L.) Gaertn, they investigated that combined inoculation of *AM Fungi* with *Azospirillium* and *Azotobacter* significantly increased number of AM spores in soil . In this connection **Edyta *et al*. (2015)** who concluded that treated strawberry with the bioproducts (mixture of AM fungi: *Glomus* species, *Trichoderma viride*, and rhizosphere bacterial species (*Bacillus subtilis*, *Pseudomonas fluorescens* and *Streptomyces* spp.) led to increase in the number of spores of AMF.

a) AM fungi colonization %

Data presented in Table (3) showed the response of celery (*Apium graveolens* L.) to inoculation of seeds with biofertilizer and/or foliar plants with TDZ at half or full recommended doses of NPK. The obtained results reported that inoculating of celery (*Apium graveolens* L.) seeds with mycorrhizal led to significant increase in AM fungi colonization % compared to un-inoculated seeds.

Data also recorded that inoculation of celery (*Apium graveolens* L.) seeds with a mixture of mycorrhizal plus microbein at full recommended dose of NPK gave the highest values of AM fungi colonization % were (100.10 and 100.18%) scored at the first and second seasons, respectively, but the lowest values obtained by zero treatment were (15.99% and 16%) scored at the first and second seasons, respectively.

Generally, the obtained results were in harmony with the finding of **Ramakrishnan and Bhuvaneswari (2014)** they found that combined inoculation of *AM Fungi* with *Azospirillium* and *Azotobacter* significantly increased percent root colonization in roots of *Eleusine coracana* (L.) Gaertn . Soliman *et al*. (2015) they indicated that inoculation of *Delonix regia* seedling with biofertilizer (Arbascular mycorrhizal fungi, *Azotobacter chroococum*, yeast strains and mixture of all inoculums) led to significant increase in AM fungi colonization % compared to the un-inoculated seedlings at the recommended dose of NPK chemical fertilizers under the same condition.

Dehydrogenase activity (µg TPF/g dry soil/day)

Table (4) proved the extended effect of chemical, bio-fertilizer and TDZ on dehydrogenase activity (µg TPF/g dry soil/day) in rhizosphere of celery (*Apium graveolens* L.) plant. The obtained results showed that inoculation of celery (*Apium graveolens* L.) seeds with a mixture of mycorrhizal plus microbein at full recommended dose of NPK gave the highest values of dehydrogenase activity (µg TPF/g dry soil/day) were (119.50 and 126.90) scored at the first and second seasons respectively compared to control and other treatments. On the other hand, the lowest values obtained by zero treatment were (19.80 and 25.20) scored at the first and second seasons respectively.

These results were in accordance with the findings of **Amal *et al*. (2014)** revealed that dehydrogenase activity (µg TPF/100 g soil Day^{-1}) under different inoculation treatments of *Thiobacillus* A1, A2 and/or AM fungi were higher than those of un inoculated treatments, after 60 and 90 days of planting. In this respect, **Haddad *et al*. (2014)** showed that the highest significant increase in percentages of enzyme activity (dehydrogenase) was recorded in the treatment inoculated *Eucalyptus camaldulensis* with the mixed microbial treatment (*Azotobacter chroococcum*, *Bacillus circulans* and Arbuscular mycorrhizal fungi AMF) a rather than that of individual and dual treatments in two seasons.

Nitrogenase activity (nmol C_2H_4/g rhizosphere/ hour)

Data concerning the effect of chemical, bio-fertilizer and TDZ on nitrogenase activity (nmol C_2H_4/g rhizosphere/ hour) in rhizosphere of celery (*Apium graveolens* L.) plant are presented in Table (5). Data showed that inoculation of celery (*Apium graveolens* L.) seeds with microbein led to significantly increase of nitrogenase activity (nmol C_2H_4/g rhizosphere/ hour) compared to control or other treatments.

Also the data cleared that the highest values of nitrogenase activity were (558.18 and 572.90 nmol C_2H_4/g rhizosphere/ hour) obtained with inoculation of celery (*Apium graveolens* L.) seeds with a mixture of mycorrhizal plus microbein at full recommended dose of NPK scored at the first and second seasons respectively, but the lowest values obtained by zero treatment were (88.60 and 89.90) scored at the first and second seasons respectively.

These results were in agreement with the findings of **Hadad *et al*. (2014)** They showed that the highest significant increase in percentages of enzyme activity (nitrogenase) was recorded in the treatment inoculated *Eucalyptus camaldulensis* with the mixed microbial treatment (*Azotobacter chroococcum*, *Bacillus circulans* and

Arbuscular mycorrhizal fungi AMF) a rather than that of individual and dual treatments in two seasons. Nitrogenase activity (N_2-ase) was used as a criterion of atmospheric nitrogen fixation by diazotrophs. Three different types of nitrogen fixing bacteria *viz*, *Azotobacter vinelandii*, *Paenibacillus polymyxa* and *Pseudomonas fluorescens* were isolated from rhizosphere of field-grown sugarcane in Barak Valley, Assam.

Growth parameters

As for the effect of chemical, bio-fertilizer and TDZ on [fresh weight of shoots per plant (g), fresh weight of roots per plant (g), dry weight of shoots per plant (g), dry weight of roots per plant (g), Plant height (cm), number of umbel per plant (at full flowering stage) and dry weight of seeds per plant (at harvest stage)], the obtained results in Tables (6, 7, 8, 9, 10, 11and12) indicated that all treatments significantly increased growth parameters as compared to zero in two season.

Data also showed that the highest values of growth parameters [fresh weight of shoots per plant (80.00, 255 and 850 g/plant) and (93.00 , 269.00 and 863.00 g/plant), fresh weight of roots per plant (8.00, 16.20 and 60.00 g/plant) and (9.00, 17.20 and 62.00 g/plant), dry weight of shoots per plant (9.30, 35.00 and 165.00 g/plant) and (11.00, 38.00 and 170.00 g/plant), dry weight of roots per plant (1.40, 2.75 and 10.00 g/plant) and (1.60, 3.40 and 11.20 g/plant), Plant height (32.00, 64.70 and 159.00 cm) and (35.20, 70.00 and 164.00 cm), number of umbel per plant (392.00 and 402.00) and dry weight of seeds per plant (128.80 and 132.42 g/plant)] obtained by treated celery (*Apium graveolens* L.) plants with full NPK plus mycorrhizal and microbein at three periods (2, 4 and 6 months) during in the first and second seasons, respectively.

However, the lowest values of growth parameters [fresh weight of shoots per plant (36.25, 130.60 and 300.00 g/plant) and (37.80, 170.00 and 380.00 g/plant) , fresh weight of roots per plant (3.30, 6.90 and 38.00 g/plant) and (3.80, 7.20 and 40.00 g/plant), dry weight of shoots per plant (3.90, 18.30 and 57.00 g/plant) and (4.20, 19.00 and 58.00 g/plant), dry weight of roots per plant (0.60, 1.55 and 6.50 g/plant) and (0.67, 1.70 and 6.50g/plant), Plant height (12.00, 25.00 and 70.00 cm) and (14.50, 28.00 and 73.00 cm), number of umbel per plant (185.00 and 190.00) and dry weight of seeds per plant (40.30 and 45.90g/plant)] obtained by zero treatment at three periods (2, 4 and 6 months) during in the first and second seasons, respectively.

The results were in accordance with the finding of **Kundu *et al*. (2011)** reported that all the inorganic and biofertilizer combinations exhibited profound effect on growth, yield and fruit quality than inorganic fertilizer alone on pruned mango orchard cv. Amrapali , and concluded that the treatments 100% NPK + Azotobacter + VAM and 75% NPK + Azotobacter + VAM were effective and may be adopted to improve the vegetative growth and productivity with quality fruits. In this respect, Harb *et al*., (2011) on *Nigella sativa* L. plants, indicated that the biofertilization (*Glomus macrocarpus* fungus or Nitrobein bacteria) or organic manure alone or in combination with half or full NPK fertilizer increased plant height (cm), No. of branches and leaves, root length (cm) as well as herb and root dry weight when compared with un inoculated plants (control). Also, the best significant results of herb and root dry weight were found with mycorrhizal fungus and *Azotobacter* with full NPK fertilizers treatment as compared to the other treatments under study. Also, *G. macrocarpus*

fungus+Nitrobein+organic manure with full NPK fertilizer treatment were more effective in increasing the seed yield per plant and fadden than the other treatments under study.

Similar results were recorded by **Singh *et al*. (2011)** recorded that treated stevia *(Stevia rebaudiana* Bertoni) with 100% NPK + *Azotobactor* gave higher fresh and dry herb yield per hectare as compared to other treatment combinations. In this respect, Agamy *et al.,* (2012) showed that the application of Bio and/or FM in combination with NPK on wheat (*Triticum aestivum* L.) significantly increased all growth characters i.e., plant height, number of spikes/plant, leaf area and fresh and dry weights of both shoot and spikes / plant. These results agree with the finding of El-Aal and El-Rahman (2014) found that, the best results of vegetative growth on sweet ananas melon plant, photosynthetic pigments content total fruiting/plant and chemical composition of leaves and fruits were obtained with the application of biofertilizer+full chemical fertilization dose. In this connection, **Soliman *et al* . (2015)** indicated that inoculation of *Delonix regia* seedlings with bio-fertilizers (Arbascular mycorrhizae fungi, *Azotobacter chroorcoccum*, yeast strains and mixture of all inoculum) led to significant increase in growth characters (plant height, root length, number of branches/plant, total fresh and dry weights/plant), microbial populations and AM fungi colonization (%), enzymatic activities, compared to the un-inoculated seedlings (as control) at the recommended dose of NPK chemical fertilizers under the same conditions.

Effect of chemical , bio-fertilizer and TDZ on chemical composition of celery (*Apium graveolens* L.) Plant

Data concerning the effect of inoculation celery (*Apium graveolens* L.) seeds with mycorrhizal and/or microbein and sprayed plants with TDZ combine chemical fertilizer at half or full dose of NPK on plant pigments [chlorophyll a, chlorophyll b and carotenoides], total carbohydrates, crude protein, content (%) and Macro elements are presented in Tables (13- 20) .

Data showed that inoculation celery (*Apium graveolens* L.) seeds with mixture of mycorrhizal and microbein at full dose of NPK gave the highest values of plant pigments [chlorophyll a were (0.85, 1.30 and 1.80 mg/g F.W.) and (1.42, 1.40 and 2.00 mg/g F.W.) , chlorophyll b (0.35, 0.49 and 0.60 mg/g F.W.) and (0.37, 0.51 and 0.63 mg/g F.W.) , carotenoides (0.48, 0.66 and 0.82 mg/g F.W.) and (0.50, 0.75 and 1.00 mg/g F.W.)], total carbohydrates (30, 37 and 43%) and (32, 40 and 45%), crude protein (21.25, 28.75 and 33.75%) and (23.13, 28.44 and 41.88%), and Macro elements (nitrogen [3.40, 4.60 and 5.40%] and [3.70, 4.55 and 6.70%], phosphorus [0.45, 0.66 and 0.70 %] and [0.55, 0.70 and 0.77 %], potassium [1.92, 2.65 and 3.00%] and [2.20, 2.80 and 3.50%]) at three periods (2, 4 and 6 months) in the first and second seasons respectively. On the other hand, zero treatment gave the lowest values of plant pigments [chlorophyll a were (0.39, 0.50 and 0.60 mg/g F.W.) and (0.42, 0.55 and 0.64 mg/g F.W.), chlorophyll b (0.15, 0.20 and 0.25 mg/g F.W.) and (0.17, 0.23 and 0.29 mg/g F.W.), carotenoides (0.22, 0.25 and 0.28 mg/g F.W.) and (0.26, 0.29 and 0.34 mg/g F.W.)], total carbohydrates (15, 18 and 21%) and (16, 19 and 21%), crude protein (6.88, 7.06 and 7.50%) and (7.63, 8.63 and 9.06%), and Macro elements (nitrogen [1.10, 1.13 and 1.20%] and [1.22, 1.38 and 1.45%], phosphorus [0.15, 0.19 and 0.26%] and [0.17,

0.21 and 0.29%], potassium [(0.65, 0.87 and 1.20%] and [0.72, 1.00 and 1.20%]) at three periods (2, 4 and 6 months) in the first and second seasons, respectively.

Suke *et al*. (2011) reported that treated maize (*Zea mays* L.) with recommended dose fertilizer + *Azotobacter* + PSB led to increased in chlorophyll content ,nitrogen, phosphorus and potassium content in leaves, Protein and starch content in grain. The NPK-bacterial fertilizer combinations influenced positively the educed phosphorus and potassium by ryegrass (*Lolium perenne* L.). plant , these results were reported by **(Jakab *et al*., 2011)**. **El-Quesni *et al*. (2013)** reported that chlorophyll a, b and carotenoids were increased with mixed biofertilizers application. Total carbohydrates content significantly increased in leaves and roots of Jatropha seedlings treated with phosphorien, microbien. Such increment in photosynthetic pigments, which reflect in photosynthesis processes and led to increase in carbohydrate contents.

El-Aal and El-Rahman (2014) found that the best results of photosynthetic, pigments content, total fruiting/plant and chemical composition of leaves and fruits on sweet ananas, melon plant, were obtained with the application of biofertilizer+full chemical fertilization dose. **Soliman *et al* . (2015)** showed that inoculation *Delonix regia* seedlings with bio-fertilizers (Arbascular mycorrhizae fungi, *Azotobacter chroorcoccum*, yeast strains and mixture of all inoculums) led to significant increase chemical composition (plant pigments, total carbohydrates, proline content, N, P, K) besides antioxidant enzymes such as catalase (CAT),and peroxidase (POD) compared to the un-inoculated seedlings (as control) at the recommended dose of NPK chemical fertilizers under the same conditions.

Table 2. Effect of Mycorhhiza,microbin and TDZ on mean number of spores (Kg soil $^{-1}$) after 50 days of planting celery grown under two levels of NPK during 2014/2015 and 2015/2016 seasons .

Treatment	Growing season		
	2014-2015	2015-2016	Mean
Control	0.78 X 10^4	0.74 X 10^4	0.76 X 10^4
full dose	0.95 X 10^4	0.97 X 10^4	0.96 X 10^4
full + my	2.90 X 10^4	3.00 X 10^4	2.95 X 10^4
full + mi	1.30 X 10^4	1.38 X 10^4	1.34 X 10^4
full + TDZ	0.93 X 10^4	0.92 X 10^4	0.92 X 10^4
full + my + mi	3.20 X 10^4	3.30 X 10^4	3.25 X 10^4
full + my + TDZ	2.80 X 10^4	2.92 X 10^4	2.86 X 10^4
full + mi + TDZ	1.20 X 10^4	1.40X 10^4	1.30 X 10^4
half dose	0.87 X 10^4	0.94 X 10^4	0.90 X 10^4
half + my	2.22 X 10^4	1.95 X 10^4	2.08 X 10^4
half + mi	1.78 X 10^4	1.30 X 10^4	1.54 X 10^4
half + TDZ	0.90 X 10^4	0.89 X 10^4	0.89 X 10^4
half + my + mi	2.10 X 10^4	2.35 X 10^4	2.22 X 10^4
half + my + TDZ	1.90 X 10^4	2.20 X 10^4	2.05 X 10^4
half + mi + TDZ	1.00 X 10^4	1.00 X 10^4	1.00 X 10^4
Mean	1,65X 10^4	1.68X 10^4	

Table 3 Effect of Mycorhhiza,microbin and TDZ on soil mycorhhizal colonization (%) cultivated with celery plants(50 days after transplanting) grown under two levels of NPK during 2014/2015 and 2015/2016 seasons .

Treatment	Growing season		
	2014-2015	2015-2016	Mean
Control	15.99	16.00	15.99
full dose	28.99	30	29.495
full + my	95.6	100.16	97.88
full + mi	30.15	36.9	33.525
full + TDZ	25	25	25
full + my + mi	100.1	100.18	100.14
full + my + TDZ	80.2	88.9	84.55
full + mi + TDZ	40.22	42.8	41.51
half dose	16.9	17.9	17.4
half + my	59.3	65.7	62.5
half + mi	29	30	29.5
half + TDZ	17.5	18.9	18.2
half + my + mi	73	78.3	75.65
half + my + TDZ	62.18	68.33	65.255
half + mi + TDZ	31.7	35	33.35
Mean	54.68	58.00	

Table 4. Effect of Mycorhhiza,microbin and TDZ on soil dehydrogenase activity (µg TPF/g dry soil/hr) cultivated with celery plants(50 days after transplanting) grown under two levels of NPK during 2014/2015 and 2015/2016 seasons

Treatment	Growing season		
	2014-2015	2015-2016	Mean
Control	19.80	25.20	22.50
full dose	70.8	75.3	73.05
full + my	93.92	98.16	96.04
full + mi	77.7	83.5	80.6
full + TDZ	65.85	69.5	67.675
full + my + mi	119.5	126.9	123.2
full + my + TDZ	100.18	115.2	107.69
full + mi + TDZ	95.9	99.8	97.85
half dose	32.2	38	35.1
half + my	54.8	58.9	56.85
half + mi	49.6	53.12	51.36
half + TDZ	40.3	44.3	42.3
half + my + mi	74.7	79.8	77.25
half + my + TDZ	61.4	64.9	63.15
half + mi + TDZ	55.9	59.8	57.85
Mean	72.73	78.01	75.40

Table 5. Effect of Mycorhhiza,microbin and TDZ on soil nitrogenase activity (nmol C_2H_4/g soil/ hr) cultivated with celery plants(50 days after transplanting) grown under two levels of NPK during 2014/2015 and 2015/2016 seasons

Treatment	Growing season		
	2014-2015	2015-2016	
Control	88.60	89.90	89.25
full dose	171.9	175.3	173.6
full + my	273.16	278.3	275.73
full + mi	488.2	492.2	490.2
full + TDZ	158.7	161.1	159.9
full + my + mi	558.18	572.9	565.54
full + my + TDZ	299.4	303.6	301.5
full + mi + TDZ	469.27	476.2	472.735
half dose	104.9	112.8	108.85
half + my	233.37	269	251.185
half + mi	392	399	395.5
half + TDZ	131.33	136.4	133.865
half + my + mi	388.9	395.8	392.35
half + my + TDZ	227.2	239.8	233.5
half + mi + TDZ	437.5	442.2	439.85
Mean	331.19	340.79	

Table 6. Effect of Mycorhhiza, microbin and TDZ on shoot fresh weight (g) of celery plants sampled 2,4 and 6 monthes after transplantinig and grown under two levels of NPK during 2014/2015 and 2015/2016 seasons. .

Treatment (A)	Growing season							
	2014-2015				2015-2016			
	Sampling data (month) (B)							
	2	4	6	mean	2	4	6	mean
Control	36.25	130.6	300	155.6	37.80	170	380	195.9
full dose	40	128	545	237.6	41.2	190	555	262.07
full + my	47	215	610	290.6	50	220	615	295.00
full + mi	42	195	580	272.3	45	200	590	278.33
full + TDZ	41	185	550	258.66	42	197	564	267.67
full + my + mi	80	255	850	395	93	269	863	408.33
full + my + TDZ	60	245	720	341.66	35	243	740	339.33
full + mi + TDZ	50	230	630	303.33	55	235	650	313.33
half dose	40.5	150	330	173.5	45	159	380	194.67
half + my	47	162	380	196.33	48.5	163	400	203.83
half + mi	46	155	370	190.33	47	160	410	205.67
half + TDZ	45	153	350	182.66	46.8	157	400	201.27
half + my + mi	49.8	170	420	213.26	55	180	450	228.33
half + my + TDZ	48.9	168	412	209.63	50	175	430	218.33
half + mi + TDZ	47.5	165	400	204.16	48	170	420	212.67
Mean	51.65	189.733	535.80		54.16	199.56	550.88	

L.S.D.0.05 a=6.71 b=3.21 ab= 11.o1 a=7.2 b=3.30 ab=12.2

Table 7. Effect of Mycorhhiza, microbin and TDZ on root fresh weight (g) of celery plants sampled 2,4 and 6 monthes after transplantinig and grown under two levels of NPK during 2014/2015 and 2015/2016 seasons. .

Treatment (A) **Growing season**

	2014-2015				2015-2016			
	Sampling data (month) (B)							
	2	**4**	**6**	**mean**	**2**	**4**	**6**	**mean**
Control	3.3	6.9	38	16.1	3.80	7.20	40	17
full dose	7	14.7	49	23.57	7.4	15.3	50	32.65
full + my	7.8	15.9	50	24.57	8	16.2	50	33.1
full + mi	7.5	15.6	48	23.70	7.9	15.8	52	33.9
full + TDZ	7.2	14.8	40	20.67	7.8	15.5	50	32.75
full + my + mi	8	16.2	60	28.07	9	17.2	62	39.6
full + my + TDZ	7.8	15.4	55	26.07	8.8	17.3	58	37.65
full + mi + TDZ	7.5	15.5	54	25.67	8.3	17.9	56	36.95
half dose	4	9.4	40	17.80	5	9.2	43	26.1
half + my	4.4	9	49	20.80	5.2	11	50	30.5
half + mi	4.2	8.6	46	19.60	5.1	9.4	48	28.7
half + TDZ	4.1	8.5	45	19.20	4.8	9.6	40	24.8
half + my + mi	5	10.4	50	21.80	5.7	10.9	52	31.45
half + my + TDZ	4.8	10.2	48	21.00	5.5	10.5	50	30.25
half + mi + TDZ	4.7	10	46	20.23	5.3	10	49	29.5
Mean	6.15	12.71	49.47		6.86	13.55	51.67	

L.S.D.0.05 a=0.95 b=0.43 ab=1.63 a=1.22 b=0.64 ab=1.96

Table 8. Effect of Mycorhhiza, microbin and TDZ on mean dry weight of shoots (g/plant) of celery plants sampled 2,4 and 6 monthes after transplantinig and grown under two levels of NPK during 2014/2015 and 2015/2016 seasons.

Treatment (A)	Growing season							
	2014-2015				2015-2016			
	Sampling data (month) (B)							
	2	**4**	**6**	**mean**	**2**	**4**	**6**	**Mean**
Control	3.90	18.30	57.00	26.4	4.20	19.00	58.00	27.06
full dose	4.20	24.65	100.00	42.95	4.60	26.00	104.00	44.86
full + my	5.00	31.15	119.00	51.71	5.50	32.00	122.00	53.1
full + mi	4.70	27.80	113.00	48.5	5.40	29.00	116.00	50.13
full + TDZ	4.50	36.40	107.00	49.3	5.20	28.00	118.00	50.4
full + my + mi	9.30	35.00	165.00	69.76	11.00	38.00	170.00	73
full + my + TDZ	7.80	32.80	140.00	59.93	9.00	37.00	145.00	63.66
full + mi + TDZ	6.70	21.40	123.00	50.36	7.80	33.00	126.00	55.6
half dose	4.00	23.30	63.00	30	5.00	23.00	70.00	32.66
half + my	4.70	22.00	74.00	33.56	5.80	25.00	77.00	35.93
half + mi	4.50	21.25	71.00	32.25	5.20	24.00	74.00	34.4
half + TDZ	4.30	24.00	67.00	31.76	5.20	23.00	71.00	33.06
half + my + mi	5.80	24.00	81.00	36.93	6.20	25.00	84.00	38.4
half + my + TDZ	5.50	23.50	79.00	36	6.00	24.00	82.00	37.33
half + mi + TDZ	5.30	24.8	77.00	35.7	6.00	24.00	80.00	36.66
Mean	5.78	27.60	101		6.55	26.75	105.32	

L.S.D.0.05 a=2.44 b= 1.22 ab=4.63 a=3.10 b=1.7 ab=5.10

Table 9. Effect of Mycorhhiza, microbin and TDZ on root dry weight (g) of celery plants sampled 2,4 and 6 monthes after transplantinig and grown under two levels of NPK during 2014/2015 and 2015/2016 seasons.

Treatment (A)	Growing season	
	2014-2015	2015-2016

	Sampling data (month) (B)							
	2	**4**	**6**	**mean**	**2**	**4**	**6**	**Mean**
Control	0.60	1.55	6.50	2.88	0.67	1.70	6.50	2.95
full dose	1.20	2.50	8.20	3.96	1.40	3.00	9.20	4.53
full + my	1.35	2.70	8.40	4.15	1.50	3.20	9.40	4.7
full + mi	1.25	2.60	8.00	3.95	1.40	3.10	9.00	4.5
full + TDZ	1.20	2.46	6.60	3.42	1.40	3.00	7.90	4.1
full + my + mi	1.40	2.75	10.00	4.71	1.60	3.40	11.20	5.4
full + my + TDZ	1.37	2.60	9.90	4.62	1.50	3.20	10.30	5.00
full + mi + TDZ	1.30	2.58	5.50	3.12	1.10	3.00	10.00	4.7
half dose	0.70	1.40	6.00	2.7	1.20	2.00	7.40	3.53
half + my	0.75	1.50	8.20	3.48	1.30	2.20	9.00	4.16
half + mi	0.73	1.43	7.30	3.15	1.10	2.00	7.50	3.46
half + TDZ	0.70	1.40	7.00	3.03	1.4	2.00	7.30	3.56
half + my + mi	0.83	1.73	7.50	3.35	1.30	2.80	8.00	4.03
half + my + TDZ	0.80	1.68	7.40	3.21	1.30	2.90	7.80	4.00
half + mi + TDZ	0.79	1.65	7.20	3.2	1.38	2.60	7.60	3.86
Mean	1.46	1.98	8.07		1.39	2.86		

L.S.D.0.05 a=0.51 b=0.27 ab=0.72 a=0.55 b=0.30 ab=0.78

Table 10. Effect Myco, micro and TDZ on plant height (cm) of of celery at different sampling periods and grown under two levels of NPK during 2014/2015 and 2015/2016 seasons. Effect of Mycorhhiza, microbin and TDZ on shoot height(cm)of celery plants sampled 2,4 and 6 monthes after transplantinig and grown under two levels of NPK during 2014/2015 and 2015/2016 seasons.

Treatment (A)	**Growing season**							
	2014-2015				**2015-2016**			
	Sampling data (month) (B)							
	2	**4**	**6**	**mean**	**2**	**4**	**6**	**mean**
Control	12.00	25.00	70.00	35.66	14.50	28.00	73.00	38.5
full dose	25.00	52.00	140.00	72.33	28.00	58.00	146.00	77.33
full + my	25.00	58.00	148.00	77	32.40	64.00	152.00	82.66
full + mi	28.00	56.00	147.00	77	31.00	62.00	150.00	81
full + TDZ	27.00	54.00	145.00	75.33	30.00	60.00	150.00	80
full + my + mi	32.00	64.70	159.00	85	35.20	70.00	164.00	89.66
full + my + TDZ	30.00	62.00	156.00	82.66	33.00	68.00	160.00	87
full + mi + TDZ	29.00	61.00	155.00	81.66	35.00	67.00	158.00	86.66
half dose	15.00	30.00	79.00	41.33	18.00	34.00	79.00	43.66
half + my	17.00	34.00	84.00	44.66	20.00	38.00	84.00	47.33
half + mi	17.00	33.00	83.00	44.33	21.00	37.00	83.00	47
half + TDZ	16.00	32.00	80.00	42.66	20.00	36.00	80.00	46.33
half + my + mi	19.00	38.00	90.00	49	24.00	42.00	92.00	52.66
half + my + TDZ	18.00	37.00	88.00	47.66	23.00	41.00	88.00	50.66
half + mi + TDZ	17.00	35.00	85.00	46.66	23.00	39.00	83.00	48.33
Mean	23.13	47.38	114.3		31.68	52.26	122.13	

L.S.D.0.05 a=6.63 b=3.09 ab=12.12 a=7.22 b=3.61 ab=13.10

Table 11. Effect of Mycorhhiza , microbin and TDZ on number of umbel /plant of celery plants grown under two levels of NPK during 2014/2015 and 2015/2016 seasons.

Treatment	Growing season		
	2014-2015	2015-2016	mean
Control	185.00	190.00	187.5
full dose	312.00	322.00	317
full + my	373.00	377.00	375
full + mi	356.00	361.00	358.5
full + TDZ	342.00	347.00	344.5
full + my + mi	392.00	402.00	397
full + my + TDZ	380.00	384.00	382
full + mi + TDZ	377.00	380.00	378.5
half dose	226.00	230.00	228
half + my	238.00	244.00	241
half + mi	236.00	240.00	238
half + TDZ	230.00	235.00	232.5
half + my + mi	268.00	272.00	270
half + my + TDZ	252.00	263.00	257.5
half + mi + TDZ	252.00	260.00	256
Mean	284.2	319	
L.S.D.0.05	**7.95**	**9.15**	

Table 12. Effect of Mycorhhiza , microbin and TDZ on seed yield(g/plant) of celery plants grown under two levels of NPK during 2014/2015 and 2015/2016 seasons.

Treatment	Growing season		
	2014-2015	2015-2016	mean
Control	40.30	45.90	43.1
full dose	58.60	108.12	83.36
full + my	118.40	122.70	120.55
full + mi	112.20	118.20	115.2
full + TDZ	105.90	115.50	110.7
full + my + mi	128.80	132.42	130.61
full + my + TDZ	125.70	127.00	126.35
full + mi + TDZ	123.50	125.60	124.55
half dose	52.90	57.80	55.35
half + my	59.90	63.90	61.9
half + mi	56.40	61.90	59.15
half + TDZ	55.50	61.30	58.4
half + my + mi	70.70	59.50	65.1
half + my + TDZ	66.30	77.00	71.65
half + mi + TDZ	60.40	72.30	66.35
Mean	86.43	95.14	
L.S.D.0.05	**7.27**	**8.97**	

Table 13. Effect of Mycorhhiza , microbin and TDZ on chlorophyll (a) concentration (mg/g f.wt.)| in leaves of celery plants sampled 6 monthes after transplanting grown under two levels of NPK during 2014/2015 and 2015/2016 seasons.

Treatment (A)	Growing season							
	2014-2015				2015-2016			
	Sampling data (month) (B)							
	2	4	6	mean	2	4	6	mean
Control	0.39	0	0	0.49	2	5	4	0.53
full dose	0.59	0.90	1.30	0.93	0.65	1.20	1.50	1.11
full + my	0.67	1.10	1.60	1.12	0.89	1.28	1.90	1.35
full + mi	0.67	0.98	1.5	1.05	0.85	1.20	1.80	1.28
full + TDZ	0.66	0.93	1.45	1.01	0.89	1.20	1.80	1.29
full + my + mi	0.85	1.30	1.80	1.31	1.42	1.40	2.00	1.6
full + my + TDZ	0.77	1.20	1.72	1.23	1.29	1.30	1.90	1.49
full + mi + TDZ	0.75	1.15	1.52	1.14	1.20	1.20	1.50	1.3
half dose	0.49	0.72	0.94	0.71	0.55	0.90	1.40	0.95
half + my	0.54	0.79	1.10	0.81	0.67	0.98	1.30	0.98
half + mi	0.50	0.73	1.00	0.74	0.60	0.88	1.20	0.89
half + TDZ	0.50	0.65	0.99	0.71	0.65	0.85	1.10	0.86
half + my + mi	0.55	0.72	1.20	0.82	0.65	0.85	1.20	0.90
half + my + TDZ	0.53	0.72	1.18	0.81	0.62	0.80	1.20	0.87
half + mi + TDZ	0.51	0.75	1.15	0.80	0.60	0.80	1.20	0.86
Mean	0.59	0.92	1.35		0.83	1.08	1.45	

L.S.D.0.05 a=0.37 b=0.22 ab=0.57 a=0.43 b=0.19 ab=0.71

Table 14. Effect of Mycorhhiza , microbin and TDZ on chlorophyll (b) concentration (mg/g f.wt.)| in leaves of celery plants sampled 6 monthes after transplanting grown under two levels of NPK during 2014/2015 and 2015/2016 seasons.

Treatment (A)	Growing season							
	2014-2015				2015-2016			
	Sampling data (month) (B)							
	2	4	6	mean	2	4	6	mean
Control	0.15	0.20	0.25	0.20	0.17	0.23	0.29	0.23
full dose	0.30	0.39	0.50	0.39	0.32	0.41	0.54	0.42
full + my	0.31	0.46	0.55	0.44	0.33	0.48	0.58	0.46
full + mi	0.29	0.40	0.52	0.40	0.31	0.42	0.55	0.42
full + TDZ	0.28	0.38	0.50	0.38	0.30	0.40	0.53	0.41
full + my + mi	0.35	0.49	0.60	0.48	0.37	0.51	0.63	0.50
full + my + TDZ	0.33	0.43	0.58	0.44	0.34	0.45	0.60	0.46
full + mi + TDZ	0.32	0.42	0.58	0.44	0.35	0.44	0.58	0.45
half dose	0.20	0.30	0.36	028	0.23	0.32	0.40	0.30
half + my	0.23	0.36	0.40	0.33	0.26	0.38	0.44	0.36
half + mi	0.20	0.32	0.40	0.30	0.22	0.34	0.44	0.33
half + TDZ	0.20	0.30	0.40	0.30	0.22	0.32	0.45	0.33
half + my + mi	0.27	0.37	0.47	0.37	0.30	0.39	0.50	0.39
half + my + TDZ	0.27	0.36	0.45	0.36	0.30	0.38	0.48	0.38
half + mi + TDZ	0.25	0.34	0.43	0.34	0.27	0.36	0.47	0.36
Mean	0.28	0.39	0.49		0.30	0.41	0.53	

L.S.D.0.05 a=0.10 b=0.06 ab=0.14 a=0.20 b=0.12 ab=0.27

Table 15. Effect of Mycorhhiza , microbin and TDZ on carotenoid concentration (mg/g f.wt.)| in leaves of celery plants sampled 6 monthes after transplanting grown under two levels of NPK during 2014/2015 and 2015/2016 seasons.

Treatment (A)	Growing season							
	2014-2015				2015-2016			
	Sampling data (month) (B)							
	2	4	6	mean	2	4	6	mean
Control	0.22	0.25	0.28	0.25	0.26	0.29	0.34	0.29
full dose	0.41	0.54	0.70	0.55	0.44	0.60	0.84	0.62
full + my	0.45	0.60	0.75	0.60	0.47	0.71	0.86	0.68
full + mi	0.43	0.58	0.74	0.58	0.45	0.69	0.87	0.67
full + TDZ	0.42	0.56	0.762	0.58	0.44	0.66	0.85	0.65
full + my + mi	0.48	0.66	0.82	0.65	0.50	0.75	1.00	0.75
full + my + TDZ	0.47	0.64	0.80	0.63	0.49	0.77	0.97	0.74
full + mi + TDZ	0.46	0.62	0.79	0.62	0.48	0.70	0.95	0.71
half dose	0.30	0.37	0.40	0.35	0.33	0.42	0.46	0.40
half + my	0.32	0.39	0.50	0.40	0.34	0.43	0.59	0.45
half + mi	0.31	0.37	0.49	0.39	0.33	0.42	0.57	0.44
half + TDZ	0.30	0.36	0.47	0.37	0.37	0.41	0.55	0.44
half + my + mi	0.35	0.36	0.46	0.38	0.35	0.42	0.54	0.43
half + my + TDZ	0.34	0.35	0.45	0.38	0.35	0.41	0.53	0.43
half + mi + TDZ	0.33	0.35	0.45	0.37	0.35	0.40	0.50	0.41
Mean	0.37	0.47	0.62		0.42	0.56	0.73	
L.S.D.0.05 a=0.13	b=0.07	ab=0.20			a=0.18	b=0.15	ab=0.27	

Table 16. Effect Myco, micro and TDZ on nitrogen % in dry shoots of celery at different sampling periods and grown under two levels of NPK during 2014/2015 and 2015/2016 seasons.

Treatment (A)	Growing season							
	2014-2015				2015-2016			
	Sampling data (month) (B)							
	2	4	6	mean	2	4	6	mean
Control	1.10	1.13	1.20	1.14	1.22	1.38	1.45	1.35
full dose	2.50	3.10	3.65	3	2.40	3.40	3.90	3.2
full + my	2.80	3.50	4.30	3.5	2.90	3.78	4.50	3.7
full + mi	2.60	3.30	4.17	3.3	2.70	3.60	4.30	3.5
full + TDZ	2.50	3.20	4.00	3.2	2.60	3.50	4.10	3.4
full + my + mi	3.40	4.60	5.40	4.4	3.70	4.55	6.70	4.9
full + my + TDZ	3.00	4.20	4.90	4	3.50	4.43	6.20	4.71
full + mi + TDZ	1.90	4.00	4.50	3.4	3.20	4.20	5.90	4.4
half dose	1.35	1.70	2.15	1.7	1.48	1.80	2.20	1.82
half + my	1.68	2.00	2.30	1.99	1.76	2.22	2.40	2.1
half + mi	1.63	1.80	2.10	1.84	1.70	2.12	2.30	2.04
half + TDZ	1.52	1.60	1.90	1.67	1.65	2.00	2.16	1.93
half + my + mi	1.91	2.30	2.60	2.27	2.45	2.75	2.50	2.56
half + my + TDZ	1.85	2.20	2.50	2.18	2.29	2.60	2.80	2.56
half + mi + TDZ	1.72	2.10	2.40	2.17	2.21	2.50	2.70	2.47
mean	2.00	2.87	3.7		2.55	3.17	3.79	
L.S.D.0.05	**a= 0.37**	**b=0.16**	**ab=0.50**		**a=0.40**	**b=0.20**	**ab=0.58**	

Table 17. Effect of Mycorhhiza , microbin and TDZ on phosphorus concentration (%)| in shoot of celery plants sampled 6 monthes after transplanting grown under two levels of NPK during 2014/2015 and 2015/2016 seasons.

Treatment (A)	Growing season							
	2014-2015				2015-2016			
	Sampling data (month) (B)							
	2	4	6	mean	2	4	6	mean
Control	0.15	0.19	0.26	0.2	0.17	0.21	0.29	0.22
full dose	0.33	0.50	0.55	0.46	0.40	0.54	0.56	0.50
full + my	0.38	0.58	0.65	0.53	0.46	0.62	0.63	0.57
full + mi	0.36	0.56	0.68	0.53	0.43	0.60	0.60	0.54
full + TDZ	0.35	0.54	0.62	0.50	0.41	0.58	0.60	0.53
full + my + mi	0.45	0.66	0.70	0.60	0.55	0.70	0.77	0.67
full + my + TDZ	0.42	0.60	0.68	0.56	0.53	0.66	0.75	0.64
full + mi + TDZ	0.40	0.58	0.66	0.54	0.50	0.62	0.70	0.60
half dose	0.23	0.29	0.36	0.29	0.27	0.32	0.38	0.32
half + my	0.25	0.33	0.34	0.30	0.31	0.36	0.42	0.36
half + mi	0.25	0.31	0.36	0.31	0.30	0.33	0.42	0.35
half + TDZ	0.29	0.29	0.35	0.31	0.29	0.32	0.40	0.33
half + my + mi	0.24	0.39	0.41	0.33	0.35	0.40	0.4	0.38
half + my + TDZ	0.27	0.36	0.38	0.33	0.33	0.38	0.42	0.37
half + mi + TDZ	0.26	0.35	0.36	0.32	0.32	0.36	0.40	0.36
Mean	0.32	0.46	0.52		0.39	0.49	0.54	
L.S.D.0.05	**a=0.08**	**b=0.04**	**ab=0.14**		**a=0.10**	**b= 0.08**	**ab=0.18**	

Table 18. Effect of Mycorhhiza , microbin and TDZ on potassium concentration (%)| in shoot of celery plants sampled 6 monthes after transplanting grown under two levels of NPK during 2014/2015 and 2015/2016 seasons.

Treatment (A)	Growing season							
	2014-2015				2015-2016			
	Sampling data (month) (B)							
	2	4	6	mean	2	4	6	mean
Control	0.65	0.87	1.20	0.90	0.72	1.00	1.20	0.97
full dose	1.45	2.00	2.60	2.01	1.75	2.30	2.70	2,25
full + my	1.55	2.50	3.00	2.35	1.85	2.56	3.10	2.46
full + mi	1.50	2.30	2.80	2.2	1.80	2.53	3.00	2.44
full + TDZ	1.46	2.10	2.70	2.08	1.75	2.20	3.10	2.35
full + my + mi	1.92	2.65	3.00	2.52	2.20	2.80	3.50	2,50
full + my + TDZ	1.75	2.47	2.90	2.37	2.20	2.70	3.10	2.66
full + mi + TDZ	1.63	1.34	2.78	1.91	1.90	2.68	3.00	2.52
half dose	0.85	1.15	1.50	1.16	0.90	1.20	1.40	1.16
half + my	0.92	1.30	1.65	1.29	0.95	1.36	1.52	1.27
half + mi	0.88	1.20	1.55	1.24	1.00	1.40	1.60	1.33
half + TDZ	0.86	1.20	1.55	1.20	1.00	1.40	1.62	1.34
half + my + mi	1.10	1.50	1.90	1.50	1.10	1.60	1.85	1.51
half + my + TDZ	0.95	1.40	1.75	1.36	1.10	1.50	1.75	1.45
half + mi + TDZ	0.87	1.32	1.70	1.29	1.00	1.43	1.70	1.37
Mean	1.28	1.79	2.29		1.35	2.016	2.53	
L.S.D.0.05 a=0.57	**b=0.24**		**ab=0.94**		**a=0.74**		**b=0.34**	**ab=1.34**

Table 19. Effect of Mycorhhiza , microbin and TDZ on carbohydrate concentration (%)| in shoot of celery plants sampled 6 monthes after transplanting grown under two levels of NPK during 2014/2015 and 2015/2016 seasons.

Treatment (A)	Growing season							
	2014-2015				2015-2016			
	Sampling data (month) (B)							
	2	4	6	mean	2	4	6	mean
Control	15	18	21	18	16	19	21	18.66
full dose	25	31	35	30.33	27	33	36	32
full + my	26	34	39	33	30	38	39	35.66
full + mi	24	32	37	31	28	36	36	33.33
full + TDZ	22	30	35	29	26	35	40	33.66
full + my + mi	30	37	43	36.66	32	40	45	39
full + my + TDZ	28	35	42	35	30	38	41	36.33
full + mi + TDZ	25	34	40	33	27	36	39	34
half dose	17	19	21	19	20	23	28	23.66
half + my	20	24	26	23.33	22	25	28	25
half + mi	17	22	24	21	20	23	26	23
half + TDZ	17	22	24	21	19	21	25	21.66
half + my + mi	25	30	32	29	27	32	35	31.33
half + my + TDZ	23	28	30	27	25	30	34	29.66
half + mi + TDZ	23	26	28	25.66	25	28	31	28
Mean	24.2	30.26	34		26.73	32.66	35.8	
L.S.D.0.05	**a=6.30**	**b=2.40**	**ab=9.10**		**a=7.12**	**b=2.94**	**ab=10.32**	

Table 20. Effect of Mycorhhiza , microbin and TDZ on crude protein concentration (%)| in shoot of celery plants sampled 6 monthes after transplanting grown under two levels of NPK during 2014/2015 and 2015/2016 seasons.

Treatment (A)	Growing season							
	2014-2015				2015-2016			
	Sampling data (month) (B)							
	2	4	6	mean	2	4	6	mean
Control	6.88	7.06	7.50	7.14	7.63	8.63	9.06	8.44
full dose	15.63	19.38	22.81	19.27	15.00	21.25	24.38	20.21
full + my	17.50	21.88	26.88	22.08	18.13	23.63	28.13	23.29
full + mi	16.25	20.63	26.06	20.98	16.88	22.50	26.88	22.08
full + TDZ	15.63	20.00	25.00	20.21	16.25	21.88	25.63	21.25
full + my + mi	21.25	28.75	33.75	27.91	23.13	28.44	41.88	31.15
full + my + TDZ	18.75	26.25	30.63	25.21	21.88	27.69	38.75	29.44
full + mi + TDZ	11.88	25.00	28.13	21.67	20.00	26.25	36.88	27.71
half dose	8.44	10.63	13.44	10.83	9.25	11.25	13.75	11.41
half + my	10.50	12.50	14.38	12.46	11.00	13.88	15.00	13.29
half + mi	10.19	11.25	13.13	11.52	10.63	13.25	14.38	12.75
half + TDZ	9.50	10.00	11.88	10.46	10.31	12.50	13.50	12.10
half + my + mi	11.94	14.38	16.25	14.19	15.31	17.19	15.63	16.04
half + my + TDZ	11.56	13.75	15.63	13.64	14.31	16.25	17.50	16.02
half + mi + TDZ	10.75	13.13	15.00	12.96	13.81	15.63	16.88	15.44
mean	13.92	17.97	21.13		15.95	19.85	23.69	
L.S.D.0.05 a=3.35	**b=1.23**	**ab=4.22**		**a=4.45**	**b=1.75**	**ab=5.80**		

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الملخص العربى

تأثير التسميد الحيوى والكيماوى والرش بالTDZ على نمو ومحصول نبات الكرفس الافرنجى

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أجريت تجربتان حقليتان بمزرعة مركز الدراسات التطبيقيه لبحوث النباتات الطبيه التابع للهيئه القوميه للرقابه والبحوث الدوائيه خلال موسمى ٢٠١٥/٢٠١٤ و ٢٠١٦/٢٠١٥ لدراسة تأثير معاملة بذور نبات الكرفس الافرنجى بالتسميد الحيوى (الميكروبين والميكرهيزا) والتسميد الكيماوى بأستخدام نصف الجرعه الموصى بها أوالجرعه كامله من النيتروجين والفسفور والبوتاسيوم وكذلك رش النباتات بمنظم النمو TDZ على نشاط بعض الانزيمات (النيتروجينيز واليهيدروجينيز) ونسبة اصابة جذور الكرفس الافرنجى بالميكورهيزا وعدد جراثيمها فى التربه وعلى بعض صفات النمو الخضرى (الوزن الطازج والجاف للجزء الخضرى والجذور لكل نبات، طول النبات) وعلى بعض الصفات المحصوليه (عدد النورات لكل نبات ، ووزن البذور لكل نبات) وعلى محتوى النبات من بعض المركبات الكيماويه النباتيه (صبغات نباتيه [كلورفيل أ ، ب، الكاروتينات] وبعض العناصر الكبرى [نيتروجين، فوسفور، بوتاسيوم] وأيضا الكربوهيدرات والبروتينات الكليه) . وأوضحت نتائج الدراسه أن أعلى زياده معنويه لنشاط الانزيمات ونشاط الميكورهيزا و صفات النمو الخضرى و بعض الصفات المحصوليه تم الحصول عليها من معاملة بذور نباتات الكرفس الافرنجى بالميكورهيزا والميكروبين ورش النباتات بالTDZ معا مع إضافة جرعة التسميد الكيماوى الموصى بها .