

**EFFECT OF SOME FERTILIZERS ON IMPROVING
GROWTH AND OIL PRODUCTIVITY OF BASIL
(*Ocimum basilicum*, L.) CV. GENOVESE PLANT.**

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Key Words: Basil, chemical, bio and organic fertilization, Algreen600, growth, oil productivity, and chemical composition.

ABSTRACT

Two field experiments were conducted to evaluate the effect of bio-fertilizers (nitrobein + phosphorein) when used with half or full doses of chemical fertilizer in presence of Algreen 600 foliar spray at 1g/L and organic fertilizer (compost 10 m³/fed.) on some growth parameters, photosynthetic pigments ,minerls and oil yield of basil (*Ocimum basilicum*, L.) cv. Genovese plants during 2012/2013 and 2013/2014 seasons. Also, interaction effects between Algreen 600 and the applied fertilizer treatments on growth, chemical composition and oil productivity were studied as well. The results showed that, the applied treatments of fertilizers and Algreen 600 as well as their combinations significantly increased most growth parameters i.e. plant height, number of branches, fresh and dry weight of plant (g). Also, photosynthetic pigments i.e. chlorophyll a and b, minerals i.e. N, P and K, especially the treatments of bio-fertilizer or Algreen 600 in the two cuts in both seasons. Additionally. The treatment of 50% NPK+bio-fertilizer+Algreen 600 induced high significant increments in this concern in the two seasons Also, oil yield in leaves gave the maximum values when plants treated with bio-fertilizers, Algreen 600 and 50% NPK+bio-fertilizer+Algreen 600 treatments as compared with those of individual application of chemical fertilizer or untreated ones. Thereby, it could be recommended that the treatments of bio-fertilizer, Algreen600 and NPK at 50% +bio-fertilizer + Algreen600 could be used to improve growth and oil productivity of basil plant.

INTRODUCTION

Medicinal and aromatic plants use by 80% of global population for their medicinal therapeutic effects as reported by WHO (2008). Many of

these plants synthesize substances that are useful to the maintenance of health in humans and other animals. These include aromatic substances, most of which are phenols or their oxygen-substituted derivatives such as tannins. Others contain alkaloids, glycosides, saponins and many secondary metabolites (**Naguib, 2011**).

The *Ocimum* genus belonging to the Lamiaceae family is characterized by a great variability of both morphology and chemo types. This genus has more than 30 species. Among the species of this genus, *Ocimum basilicum* has the most economic importance and is grown and utilized throughout the world (**El-Gendy et al., 2001**).

O. basilicum is an annual plant, originated from the North-West India, North-East Africa and Central Asia. It is a valuable medicinal plant that not only has many applications in food, pharmacy, dentistry, perfumery and cosmetic industry, but also used extensively in traditional and modern medicine and traditionally consumed as a medicinal herb to treat headaches, coughs, diarrhea, constipation, kidney disorders and parasitic diseases. In addition, it is used externally as an ointment to treat insect bites, and its oil used directly on the skin to treat acne. Basil essential oil contains biologically active compounds that display insecticidal, anti-nematodes, anti-fungal and anti-bacterial effects (**Jacoub, 1999**). Recently, unconventional efforts are used to minimize the amounts of chemical fertilizers which applied to medicinal and aromatic plants in order to reduce production cost and environmental pollution without reduction of yield. Therefore, the trend now is using the bio and organic fertilizers. Bio-fertilizers are reasonably safer to the environment than chemical fertilizers and play an important role in decreasing the use of chemical fertilizers. Consequently, it causes a reduction in environmental pollution. Bio fertilizers are microbial inoculants consisting of living cells of micro-organism like bacteria, algae and fungi alone or combination which may help in increasing crop productivity. Bio fertilizers can influence plant growth directly through the production of phytohormones such as gibberellins, cytokinins and IAA that act as growth regulators and indirectly through nitrogen fixation and production of bio-control agents against soil-borne phytopathogens and consequently increase formation of metabolites which encourage the plant vegetative growth and enhance the meristematic activity of tissues to produce more growth (**Glick, 2003 and Ahmed and Kibret, 2014**). The effect of bio-fertilizers on vegetative growth, yield and oil productivity in several studied was revealed by **Badran and Safwat (2004)** on fennel. **Ismail (2007)** on dragonhead plants, **Amran (2013)** on *Pelargonium graveolens* plants, **El-Khyat (2013)** on *Rosmarinus officinalis* and **Mady and Youssef (2014)** on dragonhead plants. Organic fertilizers are obtained from animal sources such as animal

manure or plant sources like green manure. Continuous usage of inorganic fertilizer affects soil structure. Hence, organic manures can serve as alternative to mineral fertilizers for improving soil structure (Shahram and Ordoorkhani, 2011) and microbial biomass (Suresh *et al.* 2004). The addition of organic fertilizers to agricultural soils has beneficial effects on crop development and yields by improving soil physical and biological properties (Zheljazkov and Warman, 2004). Organic and bio fertilizers in comparison with the chemical fertilizers have lower nutrient content and are slow release but they are as effective as chemical fertilizers over longer periods of use (Naguib, 2011 and Mohamed *et al.*, 2012). In this respect, and Mady and Youssef (2014) show that organic fertilizers enhanced vegetative growth parameters and essential oil productivity of dragonhead plants.

The target of this work was to evaluate the benefits of supplementing organic and bio fertilizers with chemical fertilizer in presence of Algae on growth and essential oil productivity of basil plants and to minimize consuming of chemical fertilizers.

MATERIAL AND METHODS

Two field experiments were conducted at the Experimental Farm of the Moshtoher Faculty of Agriculture, Benha University during two successive seasons of 2012\2013 and 2013\2014 for studying the effect of mineral and bio-fertilization and Algreen 600 on growth and oil productivity of basil plant.

Plant materials: The *Ocimum basilicum* cv.Genovese seeds were obtained from Medicinal and Aromatic plants department, Horticulture Research Institute, Ministry of Agriculture and Land Reclamation, Dokki, Giza, Egypt.

Experimental procedure: In the two Experiments, seeds were sown in the outdoor nursery pots on 14th March in both seasons. Seedlings (15 cm in height with 6-8 leaves) were transplanted in the experimental plots on 22 of April in two seasons, the area of each plot was 1m² containing 6 plants in two rows, and each row contained 3 plants. The distance between rows were 60cm. in clay soil(the soil analysis in the present on Table(1a, 1b).

Table (1a).Soil mechanical properties.

Texture	Sand%		Clay%	Silt%
	Fine	Coarse		
Clay	5.59	7.43	54.57	33.41

Table (1b).Soil chemical properties (ppm).

pH	E.C	So ₄ ⁻	Cl ⁻	HCO ₃ ⁻	Mg ⁺⁺	Ca ⁺⁺	K ⁺	Na ⁺	N	P	K	Fe	Mn	Zn
7.34	0.62	0.80	3.4	2.00	1.20	2.50	1.23	1.27	918.7	17.9	431.7	9411.1	450.1	72.43

Ammonium Sulphate [(20.5%) N] was used as a source of nitrogen at 50% (150kg/fed) of the recommended dose according to (Ministry of Agric. and Land Reclam.).

Preparation of the experimental soil: A mixture of compost and sand with rate (1:1) were added to the clay soil on 25th of March at 10 cm depth from soil surface. The chemical analysis of compost applied to this experiment in Table (2).

Table (2). Chemical analysis of the used compost.

parameters	Season	
	2013	2014
Weight of 1m ³ (kg/m ³)	470	500
Moisture content %	6	8
Organic matter %	37	42
Organic carbon %	22	34.4
N %	1.3	1.4
C:N ratio	16.1	17.4
NO ₃ – N (ppm)	130	135
NH ₃ – N (ppm)	49	63
P %	0.60	0.50
K %	1.8	2.2
Zn %	93	98
Mn (ppm)	103	110
Fe (ppm)	110	112

Treatments:

***Chemical fertilizers:** Chemical fertilizers were ammonium sulphate (20.5N) at the rate of 300kg/fed, potassium sulphate (48.5%K₂O) at the rate of 250 kg/fed as a three doses, the first one was placed on 22th of April. The second dose was added after one month from planting, and the third was added after the first cut of the herb on 22th of July. While the calcium super phosphate (15%P₂O₅) was applied in one dose during preparing the soil before planting.

***Bio-fertilizers:** Highly efficient strains of plant growth promoting Rhizobacteria (PGRB) *Azotobacter chroococcum*, *Azospirillum brasilense*, phosphate solubilizing bacteria (*Basillus megaterium* var. *phosphaticum*) and potassium solubilizing bacteria (*B. cereus*) were obtained from cultural collocation of Agric. Microbiology Dep. National Research Centre, Egypt.

***Seaweeds extracts:** Seaweeds extract under the trade name Algreen 600 as product of (100% water soluble concentrated organic seaweed extract from cold water brown algae of best guaranteed quality). With composition: Dry substances at least 96%, 1% N, 6% PO, 18 % KO, 10pH, and 0.23-0.55 Spec weight. Algreen was obtained from HumintechGmbH, Heerdterlandstrosse 1891DD-4054, Dusseldorf-Germany. Algreen 600 was applied as a foliar spray on plant leaves 4 times, first one was added after 15 days from transplant. The second time

was after 15 days from the first, while the third was applied after cutting the herbs and the fourth was after 15 days from the third at the rate of 1gm/liter per dose. Spraying was done to the run from the plant foliage.

The treatment were conducted as follows:

1-Control without any additions, 2-NPK 100% (ammonium sulphate (20.5N) at the rate of 300kg/fed, potassium sulphate (48.5%K₂O) at the rate of 250 kg/fed calcium super phosphate (15%P₂O₅), 3-Bio-fertilizer at 2L/Fed.. 4- Algreen600, 5-NPK 50% + Bio-fertilizers, 6-NPK 50% + Algreen, 7-NPK 50% + Bio-fertilizers + Algreen and 8-NPK 100% + Bio-fertilizers + Algreen.

The experimental design was CRD (Complete Randomized Block Design) (Snedecor and Cochran, 1989) as 8 treatments for each treatment replicated three times and each replicate continued 3 plots (each plot containing 6 plants). Irrigation and agricultural practices were done whenever plants needed.

Recorded data:

The vegetative growth parameters:1-Plant height above the 10 cm of soil surface,2-Branch number per plant, 3-Herbs fresh weight (g/plant), 4-Herbs dry weight (g/plant), 5-Essential oil yield / plant (g) .

Chemical composition:Total nitrogen, phosphorus and potassium were determined in basil leaves at the flowering stage according the methods described by Horneck and Miller (1998), Sandell (1950) and Horneck and Hanson,(1998) respectively.

Photosynthetic pigments: chlorophyll a and b were calorimetrically determined in leaves of basil according to the method described by Inskeep and Bloom (1985) and calculated as mg/g fresh weight. The essential oil in the basil leaves of each treatment was extracted by hydro-distillation according to Guenther (1961).

RESULTS AND DISCUSSION

I- Effect of NPK, bio-fertilizer and Algreen 600 on vegetative growth of *Ocimum basilicum* cv.Genovese plants :

I-1-Plant height (cm):

Data presented in Table(3) indicated that the plant height was greatly affected by the all kind of fertilizer treatments (Bio, chemical fertilizer and Algreen(600) as compared to control in both seasons .However, bio-fertilizer produced the maximum plant height at the two both cuts in the two seasons.

Table (3). Effect of NPK mineral, bio-fertilizer and Algreen 600 on plant height (cm) of *Ocimum basilicum* during two seasons (2012/2013- 2013/2014)

Treatments	1 st season		2 nd season	
	1 st Cut	2 nd cut	1 st Cut	2 nd cut
Control	34.17	46.21	36.40	48.44
Biofertilizer	84.85	103.33	87.70	106.18
Algreen 600	72.15	90.38	74.75	92.99
NPK100%	43.36	50.07	48.45	48.44
NPK50% + Biofertilizer + Algreen 600	66.51	84.99	69.53	88.20
NPK50% + Biofertilizer	62.72	81.20	65.57	84.05
NPK100% + Biofertilizer + Algreen 600	60.12	72.60	62.97	81.45
NPK50% + Algreen 600	58.57	77.05	61.92	79.90
LSD 5%	18.22	24.55	19.43	25.69

Whereas, Algreen 600 gave the next value in this concern, while the combination between(NPK at 50%,bio-fertilizer and Algreen600) produced the third results in two cuts of both seasons.On the reverse, control (without any addition)gave the lowest plant height at both cuts in the first and second seasons.

I-2-Number of branches/ plant:

According to data presented in Table (4) on mean number of branches per plant as affected by using some kind of fertilizers treatments, it could be concluded that bio-fertilizer gave the greatest mean number of branches per plant, whereas Algreen 600 gave the next results, while the control plants gave the minimum number of branches per plant, but NPK at 50% with bio-fertilizer and Algreen 600 produced the third value in this concern, at both seasons in both cuts.

Table(4).Effect of NPK mineral, bio-fertilizer andAlgreen 600 on branches number/plant of *Ocimum basilicum* during the two seasons (2012/2013- 2013/2014).

Treatments	1 st season		2 nd season	
	1 st Cut	2 nd cut	1 st Cut	2 nd cut
Control	22.93	32.10	25.90	35.10
Bio-fertilizer	61.43	82.50	63.93	86.00
Algreen 600	50.33	71.06	53.73	74.40
NPK100%	40.08	30.59	22.60	31.30
NPK50% + Bio + Algreen 600	45.79	66.40	48.13	68.90
NPK50% + Bio-fertilizer	44.68	66.06	47.60	68.70
NPK100% + Bio +Algreen600	42.44	61.88	44.30	63.70
NPK50% + Algreen 600	41.29	59.94	43.70	62.40
LSD 5%	11.89	16.90	12.30	17.30

I-3-Fresh weight of herbs/plant(g)

The main fresh weight of herbs per plant of *Ocimum bacillicum* cv. Genovese was greatly affected by using bio-fertilizer which gave the heaviest fresh weight of herbs/plant as 439.6, 556.89 in the first and

second cut, respectively, in the first season, (Table,5).While Algreen 600 produced the next value in this concern.

Table (5). Effect of NPK mineral, bio-fertilizer and Algreen 600 on fresh weight/ plant(g) of *Ocimum basilicum* during two season (2012/2013- 2013/2014).

Treatments	1 st season		2 nd season	
	1 st Cut	2 nd cut	1 st Cut	2 nd cut
Control	198.20	203.40	187.50	212.40
Biofertilizer	439.60	556.80	460.31	577.50
Algreen 600	333.40	427.83	353.07	447.90
NPK100%	239.90	307.20	279.80	215.30
NPK50% + Biofertilizer + Algreen 600	278.80	377.21	297.50	396.06
NPK50% + Biofertilizer	273.60	374.60	292.20	394.40
NPK100% + Biofertilizer + Algreen 600	269.70	361.30	289.30	381.04
NPK50% + Algreen 600	269.00	344.00	286.70	371.70
LSD 5%	7.22	7.28	8.89	11.31

On the other hand NPK at 50% +biofertilizer and algreen 600 produced the third value in this concern in both season.Generally the second cut in both seasons produced the maximum fresh weight of herbs /plant. On the reverse, control plants gave the least fresh weight of herb /plant in both cuts in the two seasons.

I-5-Dry weight of herbs/plant(g):

According to data tabulated in Table (6) it could be concluded that the bio-fertilizer compound progressively induced the highest dry weight of herbs /plant as compared with control in both cuts and in the two seasons.

Table (6). Effect of NPK mineral, bio-fertilizer, Algreen 600 and some their combination on *Ocimum basilicum* during two season (2012/2013- 2013/2014) on dry weight/ plant (g).

Treatments	1 st season		2 nd season	
	1 st Cut	2 nd cut	1 st Cut	2 nd cut
Control	33.97	37.15	32.90	40.80
Biofertilizer	85.18	137.80	117.07	141.90
Algreen 600	64.50	81.12	70.35	95.23
NPK100%	46.60	59.43	37.90	41.97
NPK50% + Biofertilizer + Algreen 600	54.11	76.40	60.08	80.20
NPK50% + Biofertilizer	53.29	73.64	57.97	77.55
NPK100% + Biofertilizer + Algreen 600	51.66	65.50	56.40	69.70
NPK50% + Algreen 600	50.12	62.90	53.80	66.18
LSD 5%	7.24	4.50	17.63	22.12

On the other hand, Algreen 600 gave the next value in this concern in the first and second cuts. Moreover, the combination between NPK50% +Bio-fertilizer +Algreen 600 produced the third value in this respect. This trend was true in both seasons.The effect of organic and bio-fertilizer (nitroben and phosphorein) on root morphology and development, uptake of nitrogen, phosphorous and other minerals and hormone supply to plants have been suggested as factors are responsible

for growth responses (Abou El-Ghait *et al.*, 2012, Gendy *et al.*, 2013 and Mady and Youssef, 2014). The obtained results were confirmed by Dobbelaere *et al.* (2003) and Gendy *et al.* (2013) they reported that bio-fertilizer can promote plant growth directly through fixation of nitrogen, facilitation of mineral uptake, solubilization of phosphorus, production of siderophores that solubilize and sequester iron, production of phytohormones, or reduction in soil levels of ethylene. Moreover, Amran (2013) and El Khyat (2013) revealed that bio and organic fertilizers improved plant height, number of branches and fresh and dry weights of leaves/plant as compared with chemical fertilizer treatment of *Pelargonium graveolens* and *Rosmarinus officinalis*, respectively.

II. Effect of NPK, biofertilizer and Algreen 600 on chemical composition of *Ocimum bacillicum* cv. Genovese.

II.1. Chlorophyll "a and b" (mg/g.fw) of leaves:

Data shown in Table (7&8) indicated that, the content of chlorophyll "a and b" in the fresh leaves of *Ocimum bacillicum* cv. Genovese was greatly increased by bio-fertilizer treatment as it gave the highest values as compared to control at the both cuts in the two seasons. Also, Algreen 600 produced the second highest values of chlorophyll "a and b" at the two cuts in both seasons. While NPK 50 % + Biofertilizer + algreen 600 gave the third values in this concern at the two cuts in both seasons.

Moreover, increase of chlorophyll a and b content may be enhanced photosynthesis efficiency and that is a good explain to the increasing of growth parameters. In this respect, Abou-Aly and Gomaa (2002), Abou-Aly and Mady (2009), Hellal *et al.* (2011), Abou El-Ghait *et al.*, (2012) and Gendy *et al.*, (2013) stated that mixed bio fertilizers and organic fertilizers increased both leaf chlorophyll a, b and carotenoids concentration more than control.

Table (7). Effect of NPK mineral, bio-fertilizer, Algreen 600 on chlorophyll a (mg/g.fw) of *Ocimum basilicum* during two the seasons (2012/2013- 2013/2014)

Treatments	1 st season		2 nd season	
	1 st Cut	2 nd cut	1 st Cut	2 nd cut
Control	0.191	0.234	0.193	0.236
Biofertilizer	0.531	0.672	0.533	0.674
Algreen 600	0.402	0.516	0.404	0.518
NPK100%	0.289	0.369	0.290	0.370
NPK50% + Biofertilizer + Algreen 600	0.335	0.454	0.337	0.456
NPK50% + Biofertilizer	0.328	0.452	0.330	0.454
NPK100% + Biofertilizer + Algreen 600	0.325	0.436	0.327	0.438
NPK50% + Algreen 600	0.324	0.415	0.326	0.417
LSD 5%	0.006	0.006	0.008	0.008

Table (8). Effect of NPK mineral, bio-fertilizer, Algreen 600 on chlorophyll b(mg/g.fw) of *Ocimum bacillium* during the two seasons (2012/2013- 2013/2014)

Treatments	1 st season		2 nd season	
	1 st Cut	2 nd cut	1 st Cut	2 nd cut
Control	0.168	0.216	0.170	0.218
Biofertilizer	0.470	0.622	0.472	0.624
Algreen 600	0.356	0.477	0.358	0.479
NPK100%	0.255	0.343	0.257	0.345
NPK50% + Biofertilizer + Algreen 600	0.297	0.423	0.299	0.425
NPK50% + Biofertilizer	0.292	0.421	0.294	0.423
NPK100% + Biofertilizer + Algreen 600	0.287	0.404	0.289	0.406
NPK50% + Algreen 600	0.286	0.385	0.288	0.387
LSD 5%	0.006	0.005	0.008	0.007

II-3- Nitrogen percentage:

Data presented in Table (9) indicated that N% in leaves of *Ocimum bacillicum* cv. Genovese plants was more affected by using all the fertilizer treatments as compared to control in both cuts and in the first and second seasons. However using bio-fertilizer was the most effected fertilizer for increasing leaf nitrogen percentage, followed by Algreen 600 treatment which ranked the second in this concern in both cuts of the two seasons. Besides, the treatment of NPK 50% +biofertilizer+algreen600 gave the third value in this respect in both seasons. On the reverse, control plants scored the lowest values in this regard in the two seasons.

Table (9). Effect of NPK mineral, bio-fertilizer, Algreen 600 on nitrogen% of *Ocimum basilicum* during the two seasons (2012/2013- 2013/2014).

Treatments	1 st season		2 nd season	
	1 st Cut	2 nd cut	1 st Cut	2 nd cut
Control	0.60	1.04	0.62	1.06
Bio-fertilizer	1.68	2.12	1.70	2.14
Algreen 600	1.27	1.75	1.29	1.77
NPK100%	0.91	1.27	0.93	1.29
NPK50% + Bio-fertilizer + Algreen 600	1.06	1.53	1.08	1.55
NPK50% + Bio-fertilizer	1.06	1.50	1.08	1.52
NPK100% + Bio-fertilizer + Algreen 600	1.03	1.47	1.05	1.49
NPK50% + Algreen 600	1.02	1.46	1.04	1.48
LSD 5%	0.059	0.197	0.061	0.199

II-4- Potassium percentage

Results of potassium percentage presented in Table (10) cleared that, all fertilizers treatments resulted in highly increments in leaf potassium percentage as compared with un treated plants in the two seasons.

Table (10). Effect of NPK mineral, bio-fertilizer, Algreen 600 on potassium% of *Ocimum basilicum* during the two seasons (2012/2013- 2013/2014).

Treatments	1 st season		2 nd season	
	1 st Cut	2 nd cut	1 st Cut	2 nd cut
Control	1.35	1.51	1.37	1.53
Bio-fertilizer	3.84	3.98	3.86	4.00
Algreen 600	2.91	3.05	2.93	3.07
NPK100%	2.04	2.16	2.06	2.18
NPK50% + Bio-fertilizer + Algreen 600	2.52	2.56	2.54	2.58
NPK50% + Bio-fertilizer	2.43	2.52	2.45	2.54
NPK100% + Bio-fertilizer + Algreen 600	2.35	2.48	2.37	2.50
NPK50% + Algreen 600	2.35	2.46	2.37	2.48
LSD 5%				

However in both season using the application of bio-fertilizer showed to be the most effective one for increasing leaf potassium percentage at two cuts, in the two seasons, followed by Algreen 600-treated plants in the two seasons. In addition, the treatment of NPK 50% +biofertilizer+algreen600 recorded high significant increases in this sphere in the two seasons. In the opposite, the untreated plants had a the lowest percentage of potassium at both cuts in the two seasons.

II-5- Phosphorus percentage:

The obtained results of P% of *Ocimum* plants in response to different fertilizer treatments are tabulated in Table (11). This data revealed that in the both seasons, bio-fertilizer treatments gave the most promising effect in increasing the percentage of P% in first and second cuts .

Table (11). Effect of NPK mineral, bio-fertilizer, Algreen 600 and some their combination on *Ocimum basilicum* during two season (2012/2013- 2013/2014) on Phosphorus%.

Treatments	1 st season		2 nd season	
	1 st Cut	2 nd cut	1 st Cut	2 nd cut
Control	0.203	0.240	0.205	0.242
Bio-fertilizer	0.340	0.460	0.342	0.462
Algreen 600	0.330	0.376	0.332	0.378
NPK100%	0.203	0.323	0.205	0.325
NPK50% + Bio-fertilizer + Algreen 600	0.256	0.336	0.258	0.338
NPK50% + Bio-fertilizer	0.220	0.333	0.222	0.335
NPK100% + Bio-fertilizer + Algreen 600	0.210	0.330	0.212	0.332
NPK50% + Algreen 600	0.206	0.326	0.208	0.328
LSD 5%	0.103	0.112	0.105	0.124

On the other side, Algreen 600 produced the next value in this respect in both cuts, while NPK50%+bio-fertilizer+Algreen 600 succeeded in increasing leaf P% and ranked the third value in this concern in the two seasons. In this concern, **Gendy *et al.* (2012)** found that application biofertilizers increased N, P and K in leaves content of roselle plants. **Abou-Aly and Mady (2009)** stated that mixed

biofertilizers increased N, P and K in leaves content of wheat compared with control plants. **Mohamed et al.(2012)** revealed that application of bio and organic fertilizers increased leaf N, P and K contents of *Stevia rebusiana* plant.

II-6- Essential oil yield /plant (g)

It is clearly noticed from data in Table (12) that plant of *Ocimum basilicum* cv. Genovese which received bio-fertilizer showed the highest significant increase of essential oil yield percentage/plant, followed by Algreen 600 at the first and second cuts in both seasons. On the other side, NPK50% +bio-fertilizer+algreen 600 gave the third value at both cuts, in the first and second seasons.

Table (12). Effect of NPK mineral, bio-fertilizer, Algreen 600 and some their combination on *Ocimum basilicum* during two season (2012/2013- 2013/2014) on essential oil/ plant (g).

Treatments	1 st season		2 nd season	
	1 st Cut	2 nd cut	1 st Cut	2 nd cut
Control	0.125	0.150	0.140	0.181
Bio-fertilizer	0.435	0.550	0.454	0.700
Algreen 600	0.308	0.394	0.326	0.500
NPK100%	0.214	0.244	0.216	0.287
NPK50% + Bio-fertilizer + Algreen 600	0.243	0.330	0.258	0.437
NPK50% + Bio-fertilizer	0.230	0.315	0.243	0.424
NPK100% + Bio-fertilizer + Algreen 600	0.223	0.298	0.232	0.380
NPK50% + Algreen 600	0.218	0.275	0.228	0.358
LSD 5%	0.034	0.020	0.034	0.010

The lowest value of oil percentage per plant was produced by untreated plants at both cuts in the two seasons. These results are in close agreement with those reported by **Abd El-kader and Ghaly (2003)** on coriander, **Kandeel (2004)** on *Ocimum basilicum*, **Niakan et al. (2004)** on *Menthapiperitea*, **Gomaa and youssef (2007)** on fennel, **Badran et al., (2007)** on cumin, **Abou El-Ghait et al. (2012)** on indian fennel, **Asghar and Manijeh (2012)** on *Silybum marianum*, **Alireza (2012)** on *Foeniculum vulgare* and **Abd El- Wahab (2013)** on *Origanum syriacum* var. *Sinaicum*. In addition, **Amran (2013)** and **El-Khyat (2013)** showed that bio and organic fertilizers in combination with half dose of chemical fertilizer increased oil yield per plant and per fed. of *Pelargonium graveolens* and *Rosmarinus officinalis*, respectively.

Consequently, it is preferable from the previous results that treating basil plants with bio-fertilizer treatment, Algreen600 and with the combined treatment between half dose of chemical fertilizer+ + bio fertilizer and Algreen600 for enhancing growth and oil productivity of this plant. Therefore, the present study strongly admit the use of such

treatment to provide good and high exportation characteristics due to its safety role on human health.

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تأثير بعض الأسمدة علي تحسين النمو و إنتاجية الزيت في نبات الريحان (صنف Genovese)

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أجريت تجربتين حقليتين لتقييم تأثير الأسمدة الحيوية (نترو بين و فوسفورين) عند استخدامها مع نصف جرعه السماد الكيماوي مقارنة بجرعه السماد الكيماوي الكاملة في وجود الرش الورقي بمادة **Algreen 600** بتركيز (واحد جرام في اللتر) علي بعض صفات النمو و صبغات البناء الضوئي و المحتوي الكيماوي و محصول الزيت لنبات الريحان خلال موسمي ٢٠١٢/٢٠١٣ و ٢٠١٣/٢٠١٤. وكذلك تم دراسة تأثير التفاعل بين الرش الورقي بمادة **Algreen 600** بتركيز (واحد جرام في اللتر) و معاملات التسميد علي النمو و المحتوي

الكيميائي ومحصول الزيت لنبات الريحان. اوضحت النتائج ان استخدام معاملة التسميد الحيوي قد سجلت أعلى القيم بالنسبة لطول النبات، عدد الأفرع للنبات والوزن الطازج والجاف للنبات بالنسبة للحشتين في كلا الموسمين. أيضا وجد أن استخدام معاملة الرش بمادة **Algreen 600** بتركيز (واحد جرام في اللتر) قد اعطت زيادة معنوية كبيرة في القراءات الخضريه السابق ذكرها بالنسبة للحشتين في كلا الموسمين يليها في ذلك استخدام معاملة نصف المعدل من التسميد الكيماوي + التسميد الحيوي في وجود الرش بمادة **Algreen 600** بتركيز (واحد جرام في اللتر). وبالنسبة لمحصول الزيت الكلي /نبات. أيضا أظهرت النتائج أن استخدام معاملة التسميد الحيوي قد سجلت أعلى القيم بالنسبة للحشتين في كلا الموسمين يليها في ذلك استخدام معاملة الرش بمادة **Algreen 600** بتركيز (واحد جرام في اللتر). أيضا أظهرت النتائج أن استخدام معاملة نصف المعدل من التسميد الكيماوي + التسميد الحيوي في وجود الرش بمادة **Algreen 600** بتركيز (واحد جرام في اللتر) قد أدى إلي زيادة معنوية كبيرة في محصول النبات من الزيت بالنسبة للحشتين في كلا الموسمين. أوضحت النتائج أن محتوى الأوراق من صبغات البناء الضوئي وهي كلوروفيل أ، ب، ومحتوي الأوراق من النيتروجين و الفوسفور والبوتاسيوم لنبات الريحان خلال موسمي النمو قد ازدادت بقوة نتيجة استخدام معاملة التسميد الحيوي والتي قد سجلت أعلى القيم في ذلك يليها استخدام معاملة الرش بمادة **Algreen 600** بتركيز (واحد جرام في اللتر). وكذلك أظهرت النتائج أن نصف المعدل من التسميد الكيماوي + التسميد الحيوي في وجود معاملة الرش بمادة **Algreen 600** بتركيز (واحد جرام في اللتر) أدى إلي زيادة معنوية كبيرة في محتوى الأوراق من صبغات البناء الضوئي وهي كلوروفيل أ، ب، ومحتوي الأوراق من النيتروجين و الفوسفور والبوتاسيوم لنبات الريحان خلال موسمي النمو. ولقد أكدت هذه النتائج أن استخدام معاملة التسميد الحيوي ومعاملة الرش بمادة **Algreen 600** بتركيز (واحد جرام في اللتر) ومعاملة نصف المعدل من التسميد الكيماوي + التسميد الحيوي في وجود معاملة الرش بمادة **Algreen 600** بتركيز (واحد جرام في اللتر) أدى إلي تحسين النمو وزيادة إنتاجية الزيت لنبات الريحان وتقليل الاسمدة الكيماوية.