



RESPONSE OF GROWTH AND YIELD OKRA PLANT (*ABELMOSCHUS ESCULENTUS* L.) FOR SPRAYING NANO SEA HERBS FERTILIZERS OF (SUPER FIFTY) AND (ALGATON20)

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Abstract

The experiment was carried out in one of agriculture engineering sciences college fields / Baghdad university during season of 2019, which comprised 27 treatments, those were the interference between spraying treatments of super fifty fertilizer that prepared using nanotechnology for three concentrations (0,1,2) ml/l, with further three concentrations (0,2,4) ml/l of extracted sea herbs of ALGATON20 for three replicates, plant spraying was done through two time with interval 30 day between them, using random complete block design, treatments means compared to obtain significant difference between them according least significant difference LSD test at probability of 5%. Results indicated there was significant increase of super fifty fertilizer at concentration of 2 ml/l compared control treatment for all study parameters included plant height, branches number per plant, leaves number, chlorophyll percentage in leaves %, total vegetative dry materials weight, yield early, fruits number per plant, fruit weight average, one plant yield, total yield, total dissolve solid percentage %, C vitamin, nitrogen and protein ratio in fruits. While other treatment of extracted sea herbs of ALGATON20 did not give significant rising about most study indicators, results also indicated that the dupe interference of study factors led of significant increment for most above parameters.

Key words : Okra plant, *Abelmoschus esculentus* L., nano sea herbs.

Introduction

The okra plant *Abelmoschus esculentus* L. is one of common summery vegetative crops belong Malvaceae family, it is believed to live in states of Ethiopia, Eritrea, Sudan and Egypt, which it contain some nutrients such as calcium, magnesium and phosphorus as well little amount of vitamins such as riboflavin, thiamine and A and C vitamins (Matlob *et al.*, 1989). Okra is planted for eating, it may be dried or frozen and cooked with some vegetables like tomatoes, this food are common in Iraq. Okra is used also in numeral industrial purposes such as feedstock. The extracted mucilage of horns, stems and roots could be used for sugar cane juice purification and further purposes such as adhesive material for papers and anything else (Akayashi and Sahaf, 2017). Plant Leaves have considerable ability for absorbing sprinkled substances, so absorbed material insert quickly through leaves tissue, this process has short duration between addition and absorption, this way is very important about

acceleration period of plant growth as well providing elements that they could not be absorbed through soil, this machine involve diffusion of nutrients through cutical layer inside leaves or entered through leaves stomata to insert leaf cells (Al-Sahaf, 1989).

The world has tended in recent years to use new technology for agricultural development called smart fertilizers or nano fertilizers, this modern technique still under considerations in Iraq, but several countries surrounding Iraq achieved useful experimental work and wide scope about this field such as Iran, Saudi Arabia, Egypt and Jordan.

Nanotechnology is the study that is done depending of very small particles and molecules, their dimension do not exceed 100 nm (Solomon *et al.*, 2007). This technique depend for reducing particles size to equal one per billion of meter then using it for different purposes, not only as fertilizers, but used in wide science fields such as medicine, engineering and agriculture, the positive and useful effect of nano fertilizer may be appeared on plant

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growth (Drostkar *et al.*, 2016). Nano fertilizers are natural elements used as biocatalyst against various stresses, it contain amino acids, organic acids, vitamins and heavy metals act as assistant substance for increase plant growth through stimulating metabolic of plant cells at roots zone (Ferbant, 2013). Qureshi *et al.*, (2018) confirmed that the nanotechnology has high efficiency to improve permanent agriculture, especially in developing countries, because it arise metabolic reactions widely in plant, that refer to increase creating dry materials, thus increase of crop yield, these useful conclusions are happened due to using nano particles to provide Largest surface area for increase their solubility in water, which contribute for increase penetration these substances through roots and leaves cells.

The extracted marine algae are considerable source for agricultural productivity and supplement of fertilizers, but did not substitute of them. They are non-fertilizers materials, act to stimulate plant growth at low concentrations because its content of macro and micro nutrients. They have more than one of active group to enhance plant growth such as oxins, semi oxins, vitamins and amino acids. they also contain Glycine betaine amino acid that it is regulator of osmosis pressure at high concentrations which has efficient role for increasing plant resistance under salinity and drought conditions, but the nutrients have low concentrations as well are released slowly compared chemical fertilizers (Payan Morales and Norrie, 2010), Dwivedi *et al.*, (2014) indicated the marine algae extraction have good ability for improving vegetative growth and early flowering and fruiting thus early crop yield, Akayashi and Sahaf (2017) notified that spraying extracted Sea herbs led to obtain significant effectiveness for increasing vegetative growth parameters when using three okra species. Therefore, this study aimed to evaluate the efficiency of (super fifty) and (ALGATON20) sea herbs fertilizers that were prepared using nanotechnology on vegetative growth properties of okra plant yield.

Materials and Methods

This study was carried out in department of horticulture and garden engineering fields of agricultural engineering sciences college / Baghdad university using okra plant to exam response of plant growth and productivity through spraying super fifty sea herbs fertilizer using nanotechnology which was produced by Turkish company called Agri-sciences, the prepared fertilizer contained extracted sea herbs *Ascophyllum nodosum* at percentage of 21%, NPK, growth regulators, Alginic acid, Giberellic acid. In addition, ALGATON20 sea herbs fertilizer that was produced by Atal company

contained nutrients of N, P, K, Mo at percentage of 6%, 3%, 10%, 0.3% respectively, as well oxins, cytokine, Gibberellin and amino acids. Btaira seeds were obtained from reliable source, so sown directly on field on 25/4/2019, after procedure of soil management comprised plowing twice with vertical form by together then was amended, thus divided in terraces with length 30m for each one, two seeds sowed in one whole, with distance between one to other reached 0.3m, after 10 days when germination complete reduced to one plant for each site, all planting process were done as required recommends.

The experiment involved three super fifty concentrations were (0, 1, 2) ml / l called (S0, S1, S2) and three ALGATON20 concentrations were (0, 2, 4) ml / l called (A0,,A1, A2) for three replicates to obtain experimental units number of 27 units, these fertilizers sprayed twice on vegetative part during season first one was done when the plant reached at height of 10 cm, so the second after 30 days of first one with interval two days between both fertilizers, significant difference studied according to the least significant difference LSD at probability level of 5%.

Measurements of vegetative growth were taken at terminal growth season through taking random samples of five plants for each treatment to calculate mean of followed parameters:

Vegetative growth parameters

1. Plant height (cm): The plant height was measured by metric tape on terminal growth season between at contact plant stem to soil surface and highest growth peak of plant branch.
2. Main branches number (branch/plant): main branches number was estimated on terminal growth season.
3. Leaves number (leaf/plant): plant leaves number was calculated randomly on terminal growth season.
4. Chlorophyll percentage of leaves: it was estimated using SPAD devise.
5. Vegetative part dry material weight (g/plant): estimated according mention of Sahaf (1989).

Yield properties and its components

1. crop early (ton/ha): the first three harvests represented as crop early.
2. Fruits number/plant.
3. Fruit weight average (g): measured according followed formula:

Fruit weight = experimental unit yield (g) / plants

number of experimental unit.

4. One plant yield (g): obtained through dividing experimental unit yield on plant number.
5. Total yield (ton/ha): Total yield calculated according followed formula:

Total yield (ton/ha) = experimental unit yield (ton) × hectare area (m²) / experimental unit area (m²).

6. Total dissolve solid percentage: drops of okra juice was putted on Refractometer Hand device to determinate Total dissolve solid percentage.
7. C vitamin: it was estimated depending calibration filtered juice with 2-6-Dichlorophenol Indophenols dye as mention of A.O.A.C (1980).
8. Percentage of nitrogen in fruits: it was estimated according method of Bhargava and Raghupathi (1999) by using distillation device (Khildal).
9. Protein percentage in fruits: determined according dry weight (A.O.A.C, 1980), as followed formula:

Protein percentage = N percentage in fruit × 6.25

Results and Discussion

1. Indicators of vegetative growth

Table 1 noticed for using super fifty as fertilizer, the plant gave significant difference of most vegetative growth parameters, where treatment of (S2A0) achieved highest mean of plant height (cm), branches number per plant, leaves number, chlorophyll percentage % and weight of dry vegetative part (g), reached 110.6 cm, 4.33, 145.10, 54.4% and 155.73g respectively, compared control treatment (S0 A0) that attained 88.3cm, 2.66, 94.67, 41.267% and 42.00g. Spraying ALGATON20 fertilizer improved most plant growth indicators but it was not significantly. While the interference between both fertilizers appeared significant increase about treatment of (S2A1) for most study parameters.

The significant considerable influence of super fifty fertilizer which prepared using nanotechnology is due to increase its surface area that concluded by nano particles size, lead to arise the solubility in water supported the penetration of particles through roots and leaves cells for enhancing metabolic reactions thus improvement plant growth and increase plant dry material as well vegetative growth parameters.

The increase of vegetative growth indicators when using ALGATON20 fertilizer was due to its content of micro and macro nutrients, those substances contain groups of plant growth regulars such as oxins, semi oxins, vitamins, amino and organic acids and assistant materials

act to improve plant growth and increase the quality and quantity of yield, this study agreed others study of Akayashi and Sahaf (2017). The reason of improvement these indicators at duple interference between the factors was occurred due to their influence were happen particularly for all indicators, as well their interference also sustained to arise perfection of these parameters.

2. Indicators of yield and its components

Table 2 explained about significant effect of most yield indicators and its components when spraying super fifty fertilizer, as treatment of (S2 A0), it gave highest early yield, fruits number per plant, average fruit weight (g), one plant yield (g) and total yield (Ton/ha) reached 0.654 ton / ha, 49.667, 6.14g, 233.88g, 16.25 ton / ha, compared control treatment (S0A0) of 0.4517 ton / ha, 28.75, 5.63g, 159.38g, 9.62 ton / ha Respectively.

Experiment of ALGATON20 fertilizer was not influence significantly for yield indicators, while the interference between study factors caused significant increase of most indicators as shown of (S2 A1) treatment.

The rising yield and its components when spraying super fifty fertilizer referred of its effectiveness significantly on vegetative growth parameters (plant height, branches number per plant, leaves number per plant, chlorophyll percentage and dry weight), especially at treatment of (S2 A0), that catalyzed to improve metabolic interactions in plant cells to product enough energy and substances for constructing plant tissue so affect on phenotypes like dry materials, vegetative growth, plant height, branches number and leaves per plant as well others traits.

3. Specific yield indicators

Table 3 showed effect of factors comprised super fifty and ALGATON20 fertilizers as well their interference for enhance qualitative yield parameters involved total dissolve solids, C vitamin, nitrogen and protein percentage in plant horns, where the super fifty achieved increase significantly of all indicators at treatment of)S2A0(attained 5%, 29.33 mg / 100 g, 2.29% and 14.31% compared control treatment (S0A0) which obtained 3.83%, 18.16 mg / 100 g, 2.03% and 11.68%, respectively.

Treatment of ALGATON20 also gave augment of parameters but did not differ significantly. While the interference between the factors as treatment of (S2A1) indicated significant increase of parameters compared control treatment (S0A0) that reached 4.63%, 29.00 mg / 100 g, 2.18% and 13.62%, compared of 3.83%, 18.16 mg / 100g, 2.03% and 11.68% respectively.

Table 1: Effect of spraying super fifty and ALGATON20 sea herbs fertilizers on some vegetative growth indicators of okra plants.

Treatment	Plant height (cm)	Branches number/plant	Leaves number/plant	Chlorophyll %	Dry vegetative part weight(g)
S0 A0	88.3	2.66	94.67	41.267	42.00
S0A1	95.3	2.66	123.67	51.767	48.52
S0A2	83.0	2.66	122.67	44.000	66.00
S1 A0	99.0	3.00	124.00	48.467	43.30
S1A1	95.0	3.33	125.67	44.167	63.50
S1A2	92.0	2.33	124.67	53.767	96.43
S2 A0	110.6	4.33	145.10	54.400	155.73
S2A1	93.0	5.00	145.00	49.733	152.00
S2A2	87.3	4.66	140.67	47.767	155.67
L.S.D	15.5	1.26	26.062	10.04	92.03

Table2 : Effect of spraying super fifty and ALGATON20 sea herbs fertilizers on some yield indicators and its components of okra plants.

Treatment	Yield early (ton/ha)	Fruit number/plant	Fruit weight average (g)	One Plant yield (g)	Total yield (ton/ha)
S0 A0	0.4517	28.750	5.6368	159.38	
S0A1	0.4827	35.792	5.8044	211.88	14.119
S0A2	0.3683	23.292	5.7322	135.50	9.030
S1 A0	0.6830	35.333	5.8755	254.58	16.632
S1A1	0.4293	35.417	6.3694	201.58	13.434
S1A2	0.5953	33.458	6.3422	210.92	14.055
S2 A0	0.6540	49.667	6.1468	233.88	16.253
S2A1	0.5467	36.250	5.7488	207.71	13.842
S2A2	0.5890	36.458	5.9307	217.92	14.522
L.S.D	0.2635	12.287	1.2052	87.557	5.8348

Table 3: Effect of spraying super fifty and ALGATON20 sea herbs fertilizers on some specific yield indicators of okra plants.

Treatment	T.S.S %	C vitamin mg/100g	Nitrogen in horns %	Protein %
S0 A0	3.83	18.16	2.03	11.68
S0A1	4.23	23.00	2.14	13.37
S0A2	3.66	28.16	2.07	12.93
S1 A0	4.56	38.16	2.13	13.31
S1A1	4.36	25.16	2.04	12.75
S1A2	3.83	21.16	2.10	13.12
S2 A0	5.00	29.33	2.29	14.31
S2A1	4.63	29.00	2.18	13.62
S2A2	3.66	22.16	2.15	13.43
L.S.D	1.12	11.97	0.06	0.69

The yield quality improving referred of impact super fifty and ALGATON20 fertilizers to increase vegetative growth indicators as well affect on different biological processes such as cell division, hormonal balance and metabolism thus enhance rising dry material and yield components like total dissolve solid, C vitamin and fruits

content of protein.

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