Response of dry seed yield of Faba bean "*Vicia Faba,* L." to spraying with amino acids, organic acids, (NAA) growth regulator and micro nutrients

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ABSTRACT

Field experiment were carried out at Sakha Horticultural Research Station, Agricultural Research Center, Egypt, during two successive winter seasons of 2017/2018 and 2018/2019 to study the effect of foliar spraying with some stimulate substances *i.e;* Green Miracle (G.M) at the rate of 3cm / L, Mono Potassium Phosphate (MKP) at the rate of 6 gm / L, Naphthalene Acetic Acid (NAA) at the rate of 0.6 gm / L, potassium silicate at the rate of 3cm / L, fulvic acid at the rate of 1 gm / L, Boron (B) at the rate of 1.5 gm / L, Zinc (Zn) at the rate of 1.5 gm / L and (Zinc+ Boron) at the rate of (1.5+1.5) gm / L., besides, control spraying with tap water) on growth characters, dry seed yield and its components and chemical analysis of dry seeds of broad bean (*Vicia Faba* L) cv. Weaam. The experiments were arranged in a randomized complete block design with three replications. Seeds were sown in the 1st week of November during the two seasons. The results indicated that all foliar spraying treatments increased vegetative growth characteristics, dry seed yield and its components and chemical constituents in dry seeds compared to control. Where as, foliar spraying with the Green miracle at the rate of cm3/L was among best stimulant substance, since, markedly improved most of the studied characters, i.e. vegetative growth characteristics, dry seed yield and its components and chemical constituents in dry seeds. Treatments led to highly significant increased of all studied parameters followed by foliar spraying with Naphthalene Acetic Acid (NAA) at the rate of 0.6 gm / L and potassium silicate at the rate of 3cm / L. compared to the other treatments or the control.

Keywords: Broad bean, Green miracle(G.M), Mono Potassium Phosphate (MKP), Naphthalene Acetic Acid (NAA), potassium silicate, fulvic acid , Boron (B) , Zinc (Zn).

INTRODUCTION

Broad bean (*Vicia faba*, L.) is one of the major field crops grown in Egypt. It is an important source of protein for human and animal consumption and it plays a role in the crop rotation. Legumes are considered the main sources of proteins for human, where animal protein is more expensive (Sepetoglu, 2002 and Hubbell and Gerald, 2003). Meanwhile, growing broad bean under saline conditions might adversely affect germination and growth (Abd El-Samad and Shadadd, 2013). These conditions could be more severe if the saline conditions are associated with the calcareous soil problems. It was concluded that the calcareous conditions components are the most important limiting factors against nutrients availability.

Geeth and Galal (2014) obtained variable response of pea cultivars to spraying with amino acids containing substrate.

Naphthalene Acetic Acid (NAA) as a hormone, plays an important role in physiological process that include synthesis of growth regulators. Spraying plants with NAA might improve growth, thereby increase seed yield (Cho and Prinyawiwathul, 2008). Foliar spraying of NAA is potentially an antifungal agen (Michiewiczand, 1988). Plant height, fruit set and seed yield were improved with NAA spraying (Lee, 1990). Also, NAA enhanced the mobilization of photo assimilates into filling seeds (Ibrahim *et.al* 2007).

As for Zinc, zinc is an essential micronutrient for plants (Gupta, 1989). Zn deficiency of human is the fifth major cause of diseases and deaths in the developing countries (WHO, 2002), yet, its deficiency is a wide spread problem (Trehan and Sekhon, 1977). The immobilization of Zn in soils rich in Ca2+ has an important practical impact in the Zn deficiency of plants (Pendias and Pendias, 2001) probably due to its adsorption on surfaces of clay and CaCO3 (Trehan and Sekhon,1977). Moreover, Mahady (1990) found that foliar application of ZnSO4 for broad bean plants increased the number of pods plant and seed yield. Also, Ali and Mowafy (2003) reported that application of foliar spray with Zn (2%) slightly improved groundnut yield and its attributes as well as quality. Thalooth *et al.,* (2005) found that foliar application with Zn had a positive effect on yield attributes. Added to that, foliar Zn application either at flowering or seed filling stages significantly increased number of pods/ plant, weight of pods /plant, number of seeds/ plant, weight of seeds/ plant, 100-pod weight, 100-seed weight, pod, seed and straw yield /fad (El-Habbasha *et al*., 2013).

Boron (B) is an essential micronutrient and plays a major role for plant growth and development (Pilbeam

and Kirkby, 1983; Marschner, 1995). Providing a sufficient B supply is particularly important for yield pollination (Khayyat *et al.*, 2007; Wojcik *et al.*, 1999) and fruit quality. Boron deficiency in crops is more widespread than the deficiency of any other micronutrients (Gupta, 1993). The foliar application with micro nutrients especially boron not only have major effects on flower formation, carbohydrate and protein metabolism, increase pollen germination, pollen tube growth, and yield (Gerendas and Sattelmatcher, 1990). Also is for chloroplast formation and sink limitations (Tersahima and Evans, 1988).

The beneficial effects of silicon (Si) are mainly linked with high deposition in plant tissues, which enhance its strength and stiffness, this led to a mechanical strength that reduces pest attacks and increase the light receiving position increase photosynthesis and promote growth (Epstein, 1999). Also it is supposed to reduce transpiration from the cuticle thus increasing resistance to salinity (Matoh *et al*., 1986). Some studies suggested that Si also acting a vigorous role in the biochemical processes in plant and could play a responsibility in the intracellular production of organic compounds (Fawe, 1998). Many scientists illustrated the role of silicon in plant resistance to both biotic and abiotic stress including drought (Hanafy *et al*., 2008 and Crusciol *et al*., 2009). Furthermore, Rakha (2014) showed that foliar application of potassium silicate significantly increased most of yield parameters and enhanced fruit quality of eggplant compared to control. Hussein and Muhammed (2017) reached that spraying eggplant by potassium silicate (1.5 g/L) gave the highest plant height, leaves number per plant, leaf area, chlorophyll content, and plant yield, fruits number per plant, P and K percentages in fruits.

Mono-potassium phosphate (MKP), it is an effective and readily available fertilizers used in soil applications; MKP is a formulation with the lowest salt index and thus it considered the choice of foliar fertilizer for many crops (Ankorion, 1998). K is a macro elements with a main physiological functions as enzymes activation, protein synthesis, carbohydrate metabolism, osmoregulation, stomata movement, energy transfer, phloem transport, cation-anion balance, stress resistance, improves efficiency of plant water and sugar use for maintenance and normal growth functions. Potassium with phosphorus stimulate and maintain rapid root growth of plants (Marschner, 2005; Wang *et al.*, 2013 and Salami and Saadat 2013). Sugar beet foliar application with potassium increase the biosynthesis of photosynthates. El-gamal (2009) stated that foliar spraying with potassium (1000 ppm) increased chemical compounds of sugar beet i.e., T.S.S, purity, sucrose, NPK uptake and total sugar. Fageria *et al.* (2009) stated that, foliar application of potassium, increased phytohormones and amino acids content.

Fulvic acids (FAs) are humic acids with a higher oxygen content and lower molecular weight ranging to a few hundred Daltons and can pass through micropores of biological or artificial membrane systems, whereas humic acids cannot, of larger molecule weights ranging to a few thousand Daltons (Bulgari *et a*l., 2015). Fulvic acids have greater total acidity, greater numbers of carboxyl groups, and higher adsorption and cation exchange capacities than humic acid and may play roles as natural chelators in the mobilization and transport of micronutrients (Bocanegra *et al.*, 2006). Fulvic acids can remain in soil solution even at high salt concentrations and at a wide range of pH (Zimmerli *et al*., 2008) and have long-lasting potential to interact with plant roots. Also, fulvic acid is considered a soil organic fraction that is soluble in both acid and alkali. Moreover, Fulvic acid promotes some physiological processes depending on plant species, developmental stage, and application conditions. soil applications of a "humic substance" that was shown with analysis as 90.7% fulvic acid, increased fruit weight, fruit equatorial diameter, juice pH, and vitamin C content of lemon (*Citrus limon*) trees, while, foliar applications of FA increased yield of maize under drought conditions (Anjum *et al.*,2011). In common bean, FA enhanced the numbers of root initials on hypocotyl sections, increased number and length of lateral roots of both *Arabidopsis* and tomato (Dobbss *et al*., 2007).

Fulvic acids enhanced the uptake of phosphate in beech and N content in maize (Eyheraguibel *et al*., 2008), increased chlorophyll content in both soybean and ryegrass (Chen *et al*., 2004). Added to that, fulvic acid is expected to influence the growth and yield of faba bean cultivars.

The present investigation was carried out to study the impact of spraying different concentrations of (FA) Fulvic acid on four faba bean cultivars (Noubaria 2, Sakha 1, Sakha 3, and Sakha 4) on morphological characters, yield, and some metabolic constituents of seeds.

MATERIALS AND METHODS

The field experiments were conducted at Sakha Horticultural Research Station, Agricultural Research Center, Egypt, during the two successive winter seasons of 2017/2018 and 2018/2019. The aim of the study was to asses the level of reduction in adverse effect of soil salinity stress on growth, dry seed yield and chemical

components of broad bean (*Vicia Faba*, L) cv. Weaam. Soil samples at 50 cm depth were taken to determine physical and chemical properties (Black, 1965 and Page *et al*., 1982) (Table 1).

Table (1): Physical and chemical analysis properties of the experiment soil.

Components	1st season	2nd season
Soil Type	Salty	Salty
Organic Matter %	1.79	1.83
Clay %	44.59	43.95
Silt %	24.66	25.08
Fine Sand %	30.75	30.97
Coarse Sand %	28.51	32.22
pH	7.72	7.82
E.C. (mmhos /cm)	3.70	3.79
CaCO3 %	4.39	4.13
Total N (ppm)	63.4	62.7
Available (ppm)	14.79	15.00
Available K(ppm)	69.6	70.9

Nine treatments were included:

T_1: control (spraying with tap water).

T_2: Foliar application of Green Miracle (G.M) (3cm / L).

T_3: Foliar application of Mono Potassium Phosphate (MKP) (6 gm / L).

T_4: Foliar application of Naphthalene Acetic Acid (NAA) (0.6 gm / L).

T_5: Foliar application of potassium silicate (3cm / L).

T_6: Foliar application of fulvic acid (1 g. / L).

T_7: Foliar application of Boron (B) (1.5 g. / L).

T_8: Foliar application of Zinc (Zn) (1.5 g. / L).

T_9: Foliar application of (Zinc+ Boron) (1.5+1.5 g. / L).

Treatments were arranged in a randomized complete block design with three replications. Plot area was 11.2 m^2 four ridges of four meter length and 0.7 meter. Seeds of broad bean cv. Weaam were obtained from the Horticulture Research Institute, Agricultural Research Center, Egypt and sown on the 1st week in November during the two winter successive seasons. In hills at one side of ridges (25 cm apart).Other managements practices were followed according to the recommendations of Egyptian Ministry of Agriculture

Plants were sprayed three times at 30, 45 and 60 days after sowing. Each experimental unit received 2 liter solutions of each application using spreading agent (Super film at 1cm/L.) to improve adherence of the spray to the plant foliage for increasing absorption by the plants **(Mortvedt *et al.*, 1991)**. The untreated plants (check) were sprayed with tap water and spreading agent.

Green miracle(Trade mark) is an anti transpirant Total amino acids not less than 3 %, Fatty alcohol 80 %, other neutral alcohol 10 %, emulsifier and stabilizers 7% (obtained from local market).Mono potassium phosphate (MKP), Naphthalene Acetic Acid (NAA), potassium silicate, Fulvic acid, boron and zinc as sulphate form were also obtained from local market.

Data recorded:

Vegetative growth characteristics:

At flowering (50 days from sowing), five plants were randomly taken from each plot to evaluate vegetative growth characteristics i.e; plant height (cm) ,number of leaves/plant , number of branches/plant, stem diameter (mm) and total fresh as well as dry weight/plant (g). Plant parts (leaves and branches) were dried at 70° C till constant weight to determine dry weight.

Dry seed yield and its components:

At full seed ripening stage (120 days from sowing), a random sample of 5 plants were taken from each plot to estimate dry seed yield components

i.e.; number of seeds/pod, seed weight/pod (g), seed index (100 seeds weight g), seed yield (g/plant), while, dry seed yield /faddan was calculated from dry seed yield per plot.

Chemical composition of dry seeds:

Total nitrogen (%) was determined by using the modified "Micro-Kjeldahl" method apparatus of Parnas and Wagner as described by Pregl (1945). Protein (%) was calculated in seeds by multiplying nitrogen (%) content by 6.25. Phosphorus (%) was estimated spectrophotometrically in dry seeds according to the method described by Murphy and Riley (1962) as modified by John (1970). Potassium was determined by flame-photometrically as described by Brown and Lilleland (1946). Zinc (Zn) and boron (B) were extracted using DTPA, (Lindsay and Norvell, 1978).

Statistical analysis:

The obtained data were subjected to the statistical analysis of variance and treatment means were compared according to the least Significant Differences (L. S. D.) test at 0.05 level) as described by Snedecor and Cochran (1980).

RESULTS AND DISCUSSIONS

1-Vegetative growth characteristics:

Data in Table (2) illustrated that all vegetative growth parameters of broad bean were significantly affected by the studied treatments. It can said that all treatments significantly enhanced all growth parameters expressed as plant height, number of leaves/plant, number of branches/plant and stem diameter as well as fresh and dry weight/plant compared to the control(tap water). Meanwhile, foliar spraying with the Green miracle (T2) at the rate of 3 cm/L was among the best stimulant substances, since, it gave the high vegetative growth characteristics. That was not different from obtained foliar spraying with Naphthalene Acetic Acid (NAA) (T3) at the rate of 0.6 gm / L or potassium silicate (T5) at the rate of 3cm / L. or spraying with fulvic acid(1 g / L). These results might be due to the beneficial effects of total amino acids in Green miracle.

Table (2): Vegetative growth characteristics of broad bean as affected by foliarspraying with growth improvers during the two winter seasons of 2017/2018 8and 2018/2019.

Treatments	1st season						2nd season					
	Plant height (cm)	No. of leaves/ plant	No. of branches/ plant	Stem diameter (mm)	Plant fresh wt. (g)	Plant dry wt. (g)	Plant height (cm)	No. of leaves/ plant)	No. of branches/ plant	Stem diameter (mm)	Plant fresh wt. (g)	Plant dry wt. (g)
T1	61.5	48.5	4.3	5.3	77.4	30.2	58.6	51.8	4.4	5.1	90.4	32.9
T2	91.7	71.3	6.6	7.6	140.1	44.6	93.5	79.5	7.1	8.5	147.5	51
T3	85.1	65.1	6.1	7.3	116.3	38.3	81.5	69.3	6.7	7.9	126.6	40.4
T4	90.1	65.4	6.5	7.9	129.2	40.9	87.5	75.2	6.5	8.1	142.3	44.9
T5	87.6	62.7	5.8	7.4	126.7	37.6	83.3	70.8	6.8	7.8	128.3	39
T6	87.6	62	6.1	7.5	124.7	35.7	81.4	72.8	6.3	7.9	118.8	36.2
T7	83.7	63.8	6	7.6	120	38.4	80.5	68.5	6.2	8.3	124	38.2
T8	83.1	61.8	5.6	7.3	107.3	39.4	83.6	66.5	6.6	7.8	126.3	39.5
T9	86.2	66.6	6.1	7.6	118	38	83.8	69.9	6.5	7.7	132.2	42.7
$L.S.D_{0.05}$	7.2	9.6	1.3	0.8	21.8	10.04	11	8.2	0.86	0.77	16.2	6.31

T_1: control (spraying with tap water).

T_2: Foliar application of Green Miracle (G.M) (3cm / L).

T_3: Foliar application of Mono Potassium Phosphate (MKP) (6 gm / L).

T_4: Foliar application of Naphthalene Acetic Acid (NAA) (0.6 gm / L).

T_5: Foliar application of potassium silicate (3cm / L).

T_6: Foliar application of fulvic acid (1 g. / L).

T_7: Foliar application of Boron (B) (1.5 g. / L).

T_8: Foliar application of Zinc (Zn) (1.5 g. / L).

T_9: Foliar application of (Zinc+ Boron) (1.5+1.5 g. / L).

Geeth and Galal (2014) obtained similar results with pea. Abdel-Aziz and Geeth (2017) working on pea pointed out that foliar spraying with the Green miracle at a concentration of 3 cm/ L markedly improved most of the growth characters. Sharief and El-hamady (2017) on broad bean found that, foliar spraying of Naphthalene Acetic Acid (NAA) significantly affected, plant height and number of branches/plant. Abdel-Baky *et al*., (2019) on faba bean mentioned that applications of fulvic acid (FA) increased all vegetative characters (i.e., plant height, number of branches and leaves, and total dry weight/plant (Nesreen *et al.,* 2012) showed that potassium silicate rates led to significantly increased plant height, number of leaves and branches/plant and dry weight of bean. The superiority of potassium silicate might be due to the role of K in mitigating the toxic effect of Na under salt stress (Tahir *et al*., 2006). Hashemi *et al*., (2010) reported that salinity decreased plant growth parameters (tissue fresh and dry weights). Application of potassium silicate to wheat improved plant height to 44 and 50cm and increased shoot dry weight to 20.27 and 24.39g/plant.

2-Dry seed yield and its components:

Concerning to the effect of some foliar application substances on broad bean dry seed yield, data in Tables (3) showed that these treatments led to a significant increase in dry seed yield .i.e.; number of seeds/pod, seed weight/pod (g), seed index 100 seeds weight (g), seed yield (g/plant), as well as, seed yield /fad compared to the control. Data also cleared that, spraying with the Green miracle (T2) at the rate of 3 cm/L or by foliar spraying with Naphthalene Acetic Acid (T3) (NAA) at the rate of 0.6 g. / L or potassium silicate (T5) at the rate of 3cm / L. gave high dry seed yield and its components compared with the other treatments or the control. The obtained resulted might be attributed to that the important effects of green miracle substance which contains total amino acids and the favorable effects of amino acids which plays an important role in plant resistance to biotic and abiotic stresses. Also, amino acid increase the content and activity of endogenous plant growth regulators, which promote growth of plant organs due to conversion into Indol Acetic Acid (IAA). Auxins promote growth, increase building metabolites, retard senescence, enhance cell division, chlorophyll accumulation and stimulate dry matter production as a result of higher photosynthetic activity, consequently increase translocation and accumulation of micro elements in plant organs as well as building blocks of proteins. These results are in agreement with those reported by Sharief and El-hamady(2017) working on broad bean. They mentioned that, adding NAA levels up to 60 ppm significantly increased pods number, seeds /pod, 100-seed weight (g), seed yield/plant and seed yield (ton/ha). Abdel-Baky *et al*., (2019) reported that foliar application with FA, significantly improved yield and its components (i.e.; number of pods/plant, weight of pods/plant, seed index, seed yield/plant and seed yield/faddan) of all studied faba bean cultivars. Nesreen *et al.,* (2012) illustrated that, foliar spraying with potassium silicate gave the highest pods number and seed yield of bean. Moreover, Ismail and Shatta(2017) studied the effect of spraying potassium silicate on

Table (3): Dry seed yield and its components of broad bean as affected by foliarspraying with different substances during the two winter seasons of 2017/2018 8and 2018/2019.

Treatments	1st season						2nd season					
	No. of seeds/pod	Dry seed weight (g/pod)	Seed index 100 seeds wt. (g)	Shell out %	Dry seed yield (g/plant	Dry seed yield (kg/fed)	No. of seeds/pod	Dry seed weight (g/pod)	Seed index 100 seeds wt. (g)	Shell out %	Dry seed yield (g/plant	Dry seed yield (kg/fed)
T1	3.8	3.9	90.9	71	28.6	654.5	3.7	3.8	94.6	71	29	662.1
T2	5.8	6.5	138.5	81.7	41.2	927.8	5.9	6.5	132.6	83.9	41.6	951.6
T3	5.2	5.3	132	81	39.8	885.3	5.2	5.3	120.9	81.8	38.8	887.6
T4	5.5	5.7	128.5	77.2	35	800.8	5.3	5.8	121.1	77.8	41.4	938.3
T5	5	5.3	124	78.1	31.6	754.8	5.3	5.4	115.5	79	38	872.4
T6	4.7	5.3	128.7	78.6	34.7	793.9	5.6	5.5	120.4	80	38.5	880
T7	5.3	5.4	127.4	79.1	35.1	801.6	5.2	5.3	121.1	79.1	40	913.5
T8	5	5.5	116.1	79.1	35.2	780.9	5.6	5.3	121.1	78.4	38	867.8
T9	5.1	5.9	128.4	79.8	36.6	835.8	5.4	5.5)	117.4	80.7	38	897.1
$L.S.D_{0.05}$	0.74	1.33	20.3	6.94	7.41	152.4	0.98	0.95	16.04	5.5	4.5	102.9

eggplant. They found that, spraying potassium silicate produced the highest values of yield and its components. The beneficial effects of silicon (Si) are mainly linked with high deposition in plant tissues, enhance strength and stiffness, this led to mechanical strength reduces housing, pest attacks and increase the light receiving position of the plant, increase photosynthesis and promote growth (Epstein, 1999), also supposed to reduce transpiration from the cuticle thus increasing resistance to salinity (Matoh *et al*., 1986)

3- Chemical composition of dry seeds:

According to chemical constituents in dry seeds, the data in Table (4) revealed that, Chemical composition of dry seeds i.e; N, P, K, crude protein, Zn and B in broad bean seeds were increased with all tested treatments. It is noticed that, foliar spraying with the Green miracle (T2) at the rate of 3 cm/L gave high values of N, P, K and crude protein in dry seeds followed by foliar spraying with Naphthalene Acetic Acid (NAA) (T4) at the rate of 0.6 gm / L and potassium silicate (T5) at the rate of 3cm / L. compared to other treatments or the control. Whereas, B content was high and increased by adding boron (B) (T4) at the rate of 1.5gm/L. Meanwhile, Zn content was markedly high and increased by spraying zinc (Zn) (T8) at the rate of 1.5gm/L. It might be concluded that, the highest values of N, P, K, crude protein, Zn and B in dry seeds were attributed to the favorable effects of Green miracle which contains total amino acids which plays an important role in plant synthesis: Janska *et al.* (2009) demonstrated that plants received Green miracle have cryoprotective molecules such as soluble sugars (saccharose, raffinose, stachyose and trehalose), sugar alcohols (sorbitol, ribitol and inositol) and low-molecular weight nitrogenous compounds (proline and glycine betaine). These results are came to the same conclusion with Sharief and El-hamady(2017) who concluded that spraying Naphthalene Acetic Acid up to 60 ppm raised of total protein % of broad bean seeds. Abdel-Aziz and Geeth (2017) noticed that, foliar spraying with Green miracle as a stimulant substance at rate of 3 cm^3/ L significantly increased all chemical composition of pea cultivars. Geeth and Galal (2014) pointed out that, there were significantly increase in nitrogen and protein (%) content in dry pea seeds by spraying amino acids at a rate of 100 ppm/ L. Khatab *et al.*, (2016) illustrated that there were progressive increases in both Zn and B in broad bean seeds by increasing rates of the foliar applied of Zn and B.

Table (4): chemical constituents of broad bean as affected by foliar spraying with growth improvers substances during the two winter seasons of 2017/2018 8and 2018/2019.

Treatments	1st season						2nd season					
	N	P	K	Protein	Zn	B	N	P	K	Protein	Zn	B
T1	2.99	0.36	1.42	18.67	36.3	21.21	3.05	0.37	1.43	19.06	37.3	21.62
T2	3.87	0.85	1.93	24.18	51	33.93	3.88	0.86	1.94	24.25	51.3	33.85
T3	3.60	0.75	1.83	22.52	48	29.01	3.66	0.76	1.84	22.87	48	27.80
T4	3.64	0.81	1.84	22.77	49.3	28.54	3.67	0.83	1.84	22.93	49	28.56
T5	3.51	0.65	1.66	21.93	42.7	28.58	3.53	0.66	1.66	22.04	42	28.60
T6	3.59	0.72	1.75	22.42	47	26.18	3.54	0.71	1.76	23.90	47.6	27.59
T7	3.42	0.59	1.56	21.37	40.3	29.61	3.42	0.60	1.59	21.38	40.7	29.40
T8	3.37	0.48	1.49	21.06	59.7	28.76	3.39	0.49	1.48	21.17	60.3	28.76
T9	3.44	0.52	1.62	21.52	54.7	28.47	3.42	0.54	1.63	21.37	56	28.52
$L.S.D_{0.05}$	0.09	0.02	0.02	0.57	1.79	1.43	0.10	0.02	0.03	0.65	1.93	0.48

T_1: control (spraying with tap water).

T_2: Foliar application of Green Miracle (G.M) (3cm / L).

T_3: Foliar application of Mono Potassium Phosphate (MKP) (6 gm / L).

T_4: Foliar application of Naphthalene Acetic Acid (NAA) (0.6 gm / L).

T_5: Foliar application of potassium silicate (3cm / L).

T_6: Foliar application of fulvic acid (1 g. / L).

T_7: Foliar application of Boron (B) (1.5 g. / L).

T_8: Foliar application of Zinc (Zn) (1.5 g. / L).

T_9: Foliar application of (Zinc+ Boron) (1.5+1.5 g. / L).

Abdel-Baky *et al*., (2019) showed that, applications of Fulvic acid (FA) significantly improved the nutritional value and quality of faba bean seeds i.e.; crude protein, minerals (phosphorus, and potassium) content. Furthermore, Ismail and Shatta (2017) recorded that, foliar spraying of eggplant plants with potassium silicate significantly improved chemical constituents either in the leaves or in the fruits compared with control treatment during both seasons. On the other hand, Nesreen *et al.*, (2012) found that, nitrogen, phosphorus and potassium concentrations and uptake not affected significantly by spraying bean plants with potassium silicate

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استجابة محصول البذور للفول الرومي للرش بالاحماض الامينية والاحماض العضوية ومنظم النمو نفالين استيك أسيد والعناصر الصغري

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اجريت تجارب حقليه بمحطه بحوث البساتين بسخا – مركز البحوث الزراعيه –جمهوريه مصر العربيه, خلال الموسم الشتوي لعامي ٢٠١٨/٢٠١٧ ,٢٠١٩/٢٠١٨ بهدف دراسه تأثير الرش الورقي بمجموعه من المواد المحفزه للنمو (جرين ميركيل بمعدل ٣سم/لتر ,الرش بسماد فوسفات احادي البوتاسيوم بمعدل ٦ ج/لتر, الرش بنفثالين اسيتيك اسيد بمعدل ٠,٦جم/لتر, الرش بسيلكات البوتاسيوم بمعدل ٣سم/لتر, الرش بفالفيك اسيد بمعدل ١جم/لتر ,الرش بالبورون بمعدل ١,٥حم/لتر, الرش بالزنك بمعدل ١,٥جم/لتر والرش بخليط من البورون والزنك بمعدل ١,٥جم+١,٥جم/لتر بلاضافه الي معامله الكنترول (ماء الصنبور)) واثر ذلك علي صفات النمو الخضري والمحصول البذري الجاف ومكوناته والمحتوي الكيميائي للبذور الجافه علي صنف الفول الرومي وئام. وقد صممت التجربه كقطاعات كامله عشوائيه في ثلاث مكررات وتمت الزراعه في الاسبوع الاول من شهر نوفمبر لكلا الموسمين. وقد اظهرت النتائج ان الرش الورقي بجميع المواد المستخدمه في الدراسه ادي الي زياده في جميع الصفات المدروسه مثل صفات النمو الخضري والمحصول البذري الجاف ومكوناته والمحتوي الكيميائي للبذور الجافه وقد ادي الرش الورقي جرين ميركيل بمعدل ٣سم / لتر الي افضل تحسين ملحوظ في جميع الصفات المدروسه متبوعه بالرش الورقي بنفثالين اسيتيك اسيد بمعدل ٠,٦جم/لتراً, الرش بسيلكات البوتاسيوم بمعدل ٣سم/لتر مقارنه بباقي المواد

الكلمات الداله: الفول الرومي- جرين ميركيل - فوسفات احادي البوتاسيوم - نفثالين اسيتيك اسيد- سيلكات البوتاسيوم - حمض فالفيك – البورون- الزنك.