Scientific Journal of Agricultural Sciences

Print (ISSN 2535-1796) / Online (ISSN 2535-180X)

Effect of Mineral and Bio Nitrogen Fertilizer and Foliar Spray with Some Growth Stimulants on Growth, Yield and Quality of Pumpkin Plants

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Citation: Hassan M. Fayza, Zaki, M.E. Mohamed, M.H.M., Halawa, S. Samar. (2024). Effect of Mineral and Bio Nitrogen Fertilizer and Foliar Spray with Some Growth Stimulants on Growth, Yield and Quality of Pumpkin Plants. Scientific Journal of Agricultural Sciences, 6 (3): 88-102.
https://doi.org/10.21608/sjas.2024.318725.1455.

Publisher :
Beni-Suef University, Faculty of Agriculture

Received: 5 / 9 / 2024
Accepted: 28 / 9 / 2024

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ABSTRACT

Bio fertilizers are becoming more and more popular as a way to increase soil fertility and productivity by supplying nutrients. So, the experimental farm of the Horticultural Department, Moshtohor Fac. of Agric., Benha Univ was the site of two field experiments through the two summer seasons of 2022 and 2023 to examine the effect of mineral or/and bio nitrogen fertilizers as soil adding with some growth stimulants, i.e, seaweed extract, potassium citrate and calcium acetate as leaves spraying on vegetative growth, chemical composition of plant foliage, yield productivity and fruit quality of pumpkin plant. In this experiment, 16 treatments were used, and they were by the multiplying between 4 mineral-N fertilizer, i.e., T1- 100% RDN (Recommended dose of Nitrogen), T2- 80% RDN + Bio fertilizer, T3- 60% RDN + Bio fertilizer, and T4- 40% RDN + Bio fertilizer and 4 foliar spray treatments, i.e., potassium citrate at 3 g/l, seaweed extract at 2 g/l and calcium acetate at 2 g/l comparing water.

Results showed that adding bio fertilizer and reducing mineral application rate by 20 % of recommended dose significantly gave the highest vegetative growth characteristics and fruit yield traits through two seasons were compared with 40% RDN + Bio fertilizer. In addition, spraying the plants with SWE at 2 g/l gave the highest significant values of these traits. As for the effect of the interaction, results revealed that fertilizing the pumpkin plants with (80%RDN. + Bio fertilizer) combined with foliar spray with SWE at2 g/l three time reflected the highest values of determined vegetative growth and fruit yield and its quality traits.

KEYWORDS: Pumpkin, Mineral/Bio Nitrogen, Growth Stimulants, Seaweed, Potassium Citrate, Calcium Acetate.

1. INTRODUCTION

Pumpkin (*Cucurbita moschata Duchesne*) is consumed in many regional dishes and in the production of cakes, purees, and preserves. In particular, mineral-nitrogen fertilizers are an essential development of plant nutrition, growth, and yield; still, they may also be a cause of pollution in the environment. (Hartman, 1988). As a result, alternative fertilizers, including bio fertilizers have received more attention. Bio fertilizers are becoming more and more popular as a way to increase soil fertility and productivity by supplying nutrients. It is thought that the best way to reduce the negative effects of chemical fertilizer use, protect soil health, and improve soil fertilizer efficiency is to combine the use of mineral and bio fertilizers. (Abdel-Nabi et al., 2014, Kamil et al.,2015 and Gomes et al ., 2020).

Nitrogen (N) was participatory in multiple critical operations, i.e., growth, the increase of the leaf and the production of biomass yield. Nitrogen is as a structural part in varied plant compositions, i.e., amino acids, chlorophyll, nucleic acids, ATP and phyto-hormones, which are necessary to perfect the biological operations, linking protein production (Frink et al., 1999, Crawford and Forde 2002 and Diaz et al., 2006). Bio-fertilizers are deemed eco-friendly trend to sustaining agriculture. They decrease adverse chemical levels, such as NO_3- and NO_2-ions in the soil and subsequently in plants, and have a favorable impact on plant health and output. Bio-fertilizers could get better growth directly through the production of photo hormones such as gibberellins, cytokines and indole acetic acid which doing as growth stimulus and indirectly by fixing nitrogen, producing bio-control agents to combat soil-borne photo pathogens, and increasing metabolite creation which enhances plant vegetative development and tissue meristematic activity to promote healthy growth. (Kumari et al., 2018 and Morais et al., 2019).

Because seaweed extracts are rich in nutrients and hormones that promote the growth of the plant, using them is one of the principles of organic cultivation (Moalla et al. 2015, Kocira et al., 2018 and Lefi et al., 2023). One of the most important nutrients for plants, potassium is necessary for diverse physiological functions, including protein synthesis, photosynthesis, and the preservation of water balance in plant tissues. (Marschner, 2012). applying a potassium-enhanced dry weight spray to plants (Shehata et al., 2018), yield (Abd-Alkarim et al., 2017; Shehata et al., 2018; Abd-Elaziz et al., 2019; Salama et al., 2019 and Qassem et al., 2022) and fruit quality (Soundharya et al., 2019 and Nada 2020). In addition, calcium (Ca) considered as one of the essential nutrients that plants require to survive, is necessary for polar growth, cell division, the prompting of many signal transductive pathways in summit plant cells, the preserving of chromosomal installation, and hormone-regulated growth (Ashraf, 2004). It stimulates phospholipase, arginine kinase and adenosine tri phosphatase (ATPase) enzymes (and El-Shoura, 2020).

Therefore, the purpose of this study was executed to study the outcome of reform the recommended dose of mineral fertilizer by added bio-fertilizer and/or spraying with seaweed extract, potassium citrate or calcium acetate on pumpkin crop.

2. MATERIALS AND METHODS

Field experiments were conducted at the experimental farm of vegetable crops, of Agriculture Faculty, Benha University through the two summer seasons of 2022 and 2023 to test the effect of mineral or/and bio nitrogen fertilization and foliar spray with potassium citrate (PC), calcium acetate (CA) and seaweed extract (SWE) in addition to the control on vegetative growth traits, chemical constituents of plant foliage, fruit yield and fruit quality of pumpkin plants. The soil of experimentation was clay in texture with pH of 7.7. The soil properties are shown in Table 1.

Table 1 . The experimental soil as average of two seasons.

Texture	Ph	E.C dS/m	SO_4^{--}	Cl^-	HCO_3^-	Mg^{++}	Ca^{++}	K^+	Na^+	N	P	K	Fe	Mn	Zn	OM (%)
			Soluble anions (meq./L)			Soluble cations (meq./L)				Available (mg/kg)						
Clay	7.7	1.32	0.80	3.4	2.00	1.20	2.50	1.23	1.27	18.7	17.9	73.7	9.1	4.5	7.2	2.1

This experiment was 16 treatments that were the result of adding mineral-N and bio fertilizer to the soil in addition to foliar spraying some substances that were stimulants.

2.1. Nitrogen treatments

1- 100% RDN (Recommended dose of Nitrogen) (Control; 300kg Ammonium nitrate / fed.).
2- 80% RDN (240 kg Ammonium nitrate / fed.) + Bio fertilizer (20 L Nitrobein/ fed.).
3- 60% RDN (180 kg Ammonium nitrate / fed.) + Bio fertilizer (20 L Nitrobein/ fed.).
4- 40% RDN (120 kg Ammonium nitrate / fed.) + Bio fertilizer (20 L Nitrobein/ fed.).

Bio fertilizer containing active bacteria capable to N_2-fixing which were produced by the department of Microbiology, Agric. Res.

Center, Giza ,were added twice with irrigation at 20 l/fed. Where, the first time starting after 15 day from planting but the second time after 15 days from the first on. The mineral-N fertilizer treatments were divided into 3 batches starting 30 days after planting and every 15 days as interval.

2.2. Foliar spray

1. Tap water (control)
2. Seaweed extract (SWE) at 2 g/l.
3. Potassium citrate (PC) at 3 g/l.
4. Calcium acetate (CA) at 2 g/l.
   Plants were sprayed four times, beginning after 30 days from planting and every 15 days by intervals during the two seasons.

2.3. Experiment designed

A split plot designed was selected with three replications. Mineral and bio-N fertilizer treatments were placed in main plots, while foliar spray treatments were located in the subplots. Each subplot area was 18 m2 (3 ridge, 150 cm width and 4 m in length). Seeds were planted on 8th and 6th March during first and second seasons of study, respectively. Other agricultural techniques necessary for producing pumpkins were completed out as the district's standard practice.

2.4.Recorded data

2.4.1. Vegetative growth traits .

After 70 days from planting, five plants from each plot were taken and the plant height, number of branches and leaves per plant and the fresh weight per plant were assayed. Leaf area was obtained approbate to formula which means *LA (cm^2)* = Leaf dry weight (gm) x disk area (cm^2)/ disk dry weight (Wallace and Munger, 1965).

Fresh samples of branches and leaves were dried in an oven at 70 C^0 until constant weight to calculate the dry weight.

2.4.2. Chemical constituents of plant foliage.

The fifth mature leaf's was used to determine total chlorophyll reading by Minolta chlorophyll meter SPAD -502 (Yadava, 1986). Mineral nutrients, i.e., N., P. and K. were estimated in accordance with Pregl (1945), John (1970) and Brown and Lilleland (1946), respectively.

2.4.3. Fruit yield.

Total fruit number and weight kg/plant and then calculated as ton/fed.

2.4.4. Fruit quality.

At the end of season, rep sample of 3 fruits for plot was used to record the average fruit length, diameter and weight were recorded. Total carbohydrates (%) were determined in the dry matter samples according to Herbert *et al.* (1971). , Total sugars were determined by using the method described by Lane and Eynon (1923) , Total soluble solids (TSS) % were determined by using a hand refractometer according to A.O.A.C.(2012) and V.C (mg/100 g) was determined using the indictor of 2,6 dichlorophenol indophenol for titration as the method mentioned in A.O.A.C.(2012) .

2.5.Statistical analysis.

All collected data during the two growth seasons of study were submited to analysis of variance as factorial experiments in split plot design. LSD test was applied to distinguish means according to Snedecor and Cochran (1991).

3. RESULTS AND DISCUSSION

3.1.Vegetative growth characteristics.

Data recorded in Tables 1 and 2 indicate the leverage of using assorted levels of nitrogen fertilizer added with bio fertilizer (Nitrobein) as soil addition and some growth stimulating compounds as leaves spraying on vegetative growth characteristics of pumpkin plant during 2022 and 2023 seasons.

Data offered in Table 1 exhibit that addition of different nitrogen fertilizer, i.e., 100% RDN (Control; 300kg Ammonium nitrate/fed), 80% RDN + Bio fertilizer, 60% RDN + Bio fertilizer or 40% RDN + Bio fertilizer significantly affected all growth traits, i.e., plant height, No of branches and leaves/plant, leaf area, fresh and dry weights/ plant through two seasons. In this respect, reducing the usage rate by 20 % of RDN and adding bio-fertilizer (240 kg Ammonium nitrate + 20 L Nitrobein/ Fed) significantly gave the greatest values in all growth traits contrast with 40% RDN + Bio fertilizer. Using 80% of RDN with added bio fertilizer

Table 1. Effect of nitrogen levels and some growth stimulants on vegetative growth characteristics of pumpkin plant during 2022 and 2023 seasons.

	Treatments	Plant height (cm)	No of branches /plant	N. of leaves/plant	Leaf area ($cm^{2)}$	fresh weight/plant(g)	dry weight/ plant(g)
				2022			
Nitrogen levels	**100% N**	223.8	4.5	44.2	162.3	1592.3	159.3
	80%N+ Bio	231.8	4.8	46.7	168.1	1726.3	163.4
	60% N + Bio	190.5	4.0	39.3	152.4	1435.5	149.9
	40% N+ Bio	158.5	3.2	35.5	140.6	1192.8	138.9
	LSD	3.6	0.2	1.2	5.3	16.	2.0
Foliar spray	**Control**	180.8	3.6	38.4	145.3	1305.0	136.2
	SWE (2 g/l.)	224.5	4.7	44.5	166.9	1658.0	170.0
	PC (3 g/l.)	205.8	4.2	42.3	159.3	1542.3	158.6
	CA (2 g/l.)	193.5	4.0	40.5	152.0	1441.5	146.8
	L.S.D	4.6	0.26	1.2	5.2	7.2	1.3
				2023			
Nitrogen levels	**100% N**	233.5	4.8	48.4	169.3	1676.3	172.9
	80%N+ Bio	249.5	5.2	49.9	176.6	1808.3	180.4
	60% N + Bio	201.0	4.2	42.4	159.9	1500.0	160.3
	40% N+ Bio	169.5	3.1	38.9	151.2	1302.5	151.4
	LSD	3.4	0.2	1. 8	2.0	4.5	7.2
Foliar spray	**Control**	190.0	3.7	41.2	152.3	1395.5	153.0
	SWE (2 g/l.)	237.3	5.0	48.8	176.5	1752.8	181.6
	PC (3 g/l.)	220.0	4.5	45.8	168.6	1620.8	168.7
	CA (2 g/l.)	206.3	4.1	43.8	159.5	1518.0	161.7
	L.S.D	3.6	0.16	1.5	2.0	7. 7	4.6

PC= Potassium citrate, SWE= Seaweed extract, CA= Calcium acetate and control=without spray

(Nitrobein) excided on 100% RDN in all studied traits.

It was reported that increasing nutrient availability through the use of bio fertilizer which enhanced growth characteristics (Zdor and Anderson 1992). Bio-fertilizers cause the inactivity of organic nutrients in the soil to release certain other nutrients, such as Fe, Zn, and Mn. These elements are then made available by the production of some organic acids and photo hormones, which could promote nutrient absorption and, as a result, lead to the achievement of high dry weight. Jagnow et al.(1990). Obtained results are coincided with those mentioned by El- Sayed et al. (2016) and Dash et al. (2020) on cucumber, Shafeek et al. (2016), and Dantas et al. (2020) on squash as well as Gomes et al. (2020) on melon and on pumpkin showed that using bio fertilizers rised the traits of plant growth. Such data in Table 1 expose that spraying pumpkin plants with varied growth stimulating compounds, i.e., seaweed extract (2 g/l), Potassium citrate (3 g/l) or Calcium acetate (2 g/l.) significantly rised plant vegetative growth regarded as plant height, number of leaves and leaf area per plant as well as fresh and dry weight per plant compared with the control treatment (Without spray). Treatment of SWE at 2 g/l grant the greatest significant values of plant height, number of leaves and leaves area per plant as well as fresh and dry weight per plant during the two seasons. This result is coordinated with this reported by Yusuf et al., (2019) on eggplant and Allela et al., (2020) on cucumber.

Data offered in Table 2 exhibit clearly that soil addddition of 80% RDN (240 kg Ammonium nitrate/fed) + Bio fertilizer (20 L Nitrobein/fed.) then spray the plants with

Table 2. Effect of the interaction between of nitrogen levels and some growth stimulants on vegetative growth characteristics of pumpkin plant during 2022 and 2023 seasons.

Treatments		Plant height (cm)	No of branches /plant	N. of leaves/plant	Leaf area ($cm^{2)}$	fresh weight/ plant(g)	dry weight/ plant(g)	Plant height (cm)	No of branches /plant	N. of leaves/plant	Leaf area ($cm^{2)}$	fresh weight/plant(g)	dry weight/ plant(g)
		First Season						Second Season					
100% N	Control	204.0	4.1	40.9	151.4	1386.0	141.6	218.0	4.2	44.9	160.3	1525.0	158.4
	SWE (2 g/l.)	247.0	5.1	47.5	172.5	1795.0	179.3	252.0	5.4	52.0	180.6	1825.0	187.6
	PC (3 g/l.)	228.0	4.6	45.1	166.4	1672.0	165.6	235.0	5.0	49.2	171.6	1736.0	176.2
	CA (2 g/l.)	216.0	4.2	43.2	158.7	1516.0	150.9	229.0	4.6	47.3	164.5	1619.0	169.3
80%N+ Nitrobein	Control	218.0	4.2	44.8	158.3	1557.0	146.3	225.0	4.6	46.5	167.4	1636.0	168.3
	SWE (2 g/l.)	252.0	5.3	49.5	179.3	1860.0	186.2	278.0	5.8	54.6	187.2	1982.0	195.4
	PC (3 g/l.)	236.0	4.9	47.3	171.2	1795.0	168.2	259.0	5.3	50.3	179.3	1864.0	181.6
	CA (2 g/l.)	221.0	4.7	45.2	163.7	1693.0	152.9	236.0	5.0	48.0	172.5	1751.0	176.2
60% N + Nitrobein	Control	169.0	3.4	36.5	142.7	1251.0	135.2	176.0	3.6	39.5	149.6	1309.0	147.2
	SWE (2 g/l.)	212.0	4.5	41.8	162.1	1617.0	162.5	224.0	4.8	45.7	171.9	1748.0	179.4
	PC (3 g/l.)	195.0	4.1	40.3	156.7	1492.0	157.3	207.0	4.3	43.2	164.3	1532.0	159.9
	CA (2 g/l.)	186.0	4.1	38.6	148.2	1382.0	144.6	197.0	4.0	41.1	153.8	1411.0	154.6
40% N+ Nitrobein	Control	132.0	2.6	31.2	128.6	1026.0	121.6	141.0	2.4	33.9	131.9	1112.0	138.2
	SWE (2 g/l.)	187.0	3.8	39.1	153.6	1360.0	151.9	195.0	3.9	42.7	166.2	1456.0	163.8
	PC (3 g/l.)	164.0	3.3	36.4	142.7	1210.0	143.5	179.0	3.2	40.3	159.4	1351.0	157.2
	CA (2 g/l.)	151.0	3.0	35.1	137.5	1175.0	138.6	163.0	2.8	38.6	147.2	1291.0	146.5
	L.S.D	9.0	0.5	2.5	10.6	17.8	3.0	7.0	0.3	2.9	4.3	14.8	22.6

PC= Potassium citrate, SWE= Seaweed extract, CA= Calcium acetate and control=Without spray

SWE at 2 g/l showed the highest values in both study seasons across all measured growth parameters. Meanwhile, application of 40% RDN (120 kg Ammonium nitrate / fed.) + Bio fertilizer (20 L Nitrobein/ fed.) and without spraying the plants restrictived the minimum values of these traits.

3.2.Chemical characteristics.

Data in Tables 3 and 4 indicate the effectiveness of fertilization using mineral nitrogen fertilizer combined with bio fertilizer (Nitrobein) and spraying with some growth stimulating compounds on Chemical components of pumpkin plant foliage during summer seasons of 2022 and 2023.

Data in Table (3) presents a significant variation in the total nitrogen, phosphorus, potassium, and total chlorophyll readings due to using the different levels of nitrogen mineral fertilizer combined with bio fertilizer during the two seasons. Regarding this, application of nitrogen fertilizers at 80% of the recommended dose with bio N-fertilizer (240 kg Ammonium nitrate/Fed + 20 L Nitrobein/ Fed then 100% of the recommended dose without added bio fertilizer (Control; 300kg Ammonium nitrate/Fed) reflected the highest values in all assayed chemical constituents compared with other treatments. Such increments in N, P and K content and total chlorophyll reading increasing the amounts of additional mineral fertilizers may cause the zoon's roots to the increase of such nutrients, which in turn increases the zoon's uptake and accumulation of these macronutrients. Also the increment in total chlorophyll reading might refered to the role of expansion the NPK which works to stimulate photosynthetic pigment and assimilation rate for precursors of carbohydrates in leaves. This results was in the same line with finding of Wang et al. (2021) and Abdelrahman et al. (2021) all investigating on cucurbitaceae crops and reported that using bio N-fertilizers significant increments all determined chemical constituents plant foliage.

Data in Table 3 signal that spraying pumpkin plants with different growth stimulating compounds, i.e., seaweed extract (2g/l), potassium citrate (3g/l) or calcium acetate (2 g/l) four times after 30 days from planting and every 15 days by intervals during the growing season significantly improved the plant foliage's readings for total nitrogen, phosphate, potassium, and chlorophyll content in comparison to the control treatment. In addition, the greatest values of total nitrogen as well as phosphorus and total chlorophyll reading were recorded in case of using SWE at 2 g/l contrast with control which recorded the minimum values. The greatest values of total potassium were listed in case of using potassium citrate (3 g/l) in first season and second one. The increments in macro nutrient and chlorophyll reading as a result of using SWE at 2 g/l may be attributed to the role of such compound in improving the passive absorption of nutrient elements and/or the availability of macronutrients for plant absorption, which in turn increased the amount of nutrients in plant foliage. In addition, such tested compounds positively impacted the assimilation of carbohydrates through the photosynthetic process, which in turn increased plant foliage. In this regard, El- Afifi et al. (2009) and Shareef et al (2022) and Alkharpotly, A. A. et al (2024) showed that spraying Summer squash with SWE significantly increased chlorophyll content in leaves. Kazemi (2013) and Qassem, et al. (2022) on cucumber, El-Shoura (2020) and Nada and Metwaly (2020) on squash indicated that the highest potassium percent in the leaves were listed with spraying of potassium.

Data listed in Table 4 exhibit clearly that using of 80% RDN (240 kg Ammonium nitrate / fed.) + Bio fertilizer (20 L Nitrobein/ fed.) then spray the plants with SWE at 2 g/l resulted the highest precentage of the total nitrogen, phosphorus and total chlorophyll reading in the two seasons of study. Furthermore, application of 80% RDN (240 kg Ammonium nitrate / fed.) + Bio fertilizer (20 L Nitrobein/ fed.) then spray the plants four times starting after 30 days of planting and every 15 days intervals with potassium citrate (3 g/l.) exhibited the greatest values in the total potassium during both seasons.

Table 3. Effect of nitrogen levels and some growth stimulants on chemical constituents of pumpkin plant during 2022 and 2023 seasons.

Treatments		Chlorophyll reading (SSpd)	N%	P%	K%	Chlorophyll reading (SSpd)	N%	P%	K%
		2022				2023			
Nitrogen levels	100% N	65.78	2.13	0.37	1.56	71.80	2.33	0.42	1.92
	80%N+ Bio	67.85	2.27	0.39	1.72	76.56	2.52	0.44	2.14
	60% N + Bio	62.53	1.96	0.35	1.48	67.35	2.14	0.38	1.70
	40% N+ Bio	57.33	1.73	0.33	1.31	61.93	1.82	0.35	1.46
	LSD	LSD	0.08	0.008	0.1	1.5	0.12	0.008	0.05
Foliar spray	Control	58.45	1.86	0.32	1.34	65.58	2.03	0.37	1.58
	SWE (2 g/l.)	69.10	2.20	0.39	1.57	74.11	2.39	0.42	1.90
	PC (3 g/l.)	64.71	2.06	0.37	1.74	70.23	2.27	0.40	1.99
	CA (2 g/l.)	61.23	1.96	0.36	1.42	67.73	2.12	0.39	1.74
	L.S. D	7.3	0.60	0.006	0.06	2.0	0.06	0.006	0.08

PC= Potassium citrate, SWE= Seaweed extract, CA= Calcium acetate and control=Without spray

Table 4. Effect of the interaction between of nitrogen levels and some growth stimulants on chemical constituents of pumpkin plant during 2022 and 2023 seasons.

Treatments		Chlorophyll reading	N%	P%	K%	Chlorophyll reading	N%	P%	K%
		2022				2023			
100% N	Control	61.20	1.93	0.33	1.37	68.70	2.16	0.40	1.69
	SWE (2g/l.)	71.50	2.32	0.41	1.64	75.60	2.51	0.43	2.01
	PC (3 g/l.)	66.33	2.17	0.39	1.82	72.50	2.38	0.42	2.13
	CA (2 g/l.)	64.10	2.09	0.36	1.42	70.40	2.27	0.42	1.86
80%N+ Nitrobein	Control	62.50	2.10	0.36	1.52	72.40	2.35	0.41	1.98
	SWE (2g/l.)	74.90	2.45	0.42	1.75	82.83	2.67	0.47	2.25
	PC (3 g/l.)	68.70	2.29	0.41	1.98	76.20	2.66	0.44	2.25
	CA (2 g/l.)	65.30	2.22	0.40	1.63	74.80	2.41	0.43	2.07
60% N + Nitrobein	Control	58.30	1.82	0.31	1.28	63.50	1.99	0.35	1.41
	SWE (2g/l.)	67.50	2.11	0.39	1.52	71.20	2.31	0.41	1.82
	PC (3 g/l.)	64.10	1.98	0.36	1.69	69.10	2.17	0.39	1.91
	CA (2 g/l.)	60.20	1.92	0.35	1.41	65.60	2.08	0.38	1.65
40% N+ Nitrobein	Control	51.80	1.58	0.30	1.18	57.70	1.63	0.32	1.24
	SWE (2g/l.)	62.50	1.93	0.36	1.36	66.80	2.07	0.38	1.52
	PC (3 g/l.)	59.70	1.79	0.34	1.45	63.10	1.86	0.36	1.68
	CA (2 g/l.)	55.30	1.62	0.33	1.23	60.10	1.72	0.35	1.39
	L.S.D	14.4	0.13	0.05	0.13	3.7	0.15	0.014	0.15

PC= Potassium citrate, SWE= Seaweed extract, CA= Calcium acetate and control=Without spray

Meanwhile, application of 40% RDN (120 kg Ammonium nitrate / Fed.) + Bio fertilizer (20 L Nitrobein/ Fed.) without spraying the plants listed the minimum values of these traits.

3.3.Fruit yield and physical characters

Date in Tables 5 and 6 show the effect of mineral and bio nitrogen levels and foliar spray with some growth stimulating compounds as well as their interaction on fruit length, diameter, weight, total fruit yield/plant and total fruit yield/fed of pumpkin during the two successive summer seasons of 2022 and 2023.

Data in Table 5 show that fruit length, diameter, weight and total fruit yield per plant and total fruit yield per fed of pumpkin were

Table 5. Effect of nitrogen levels and some growth stimulants on fruit yield characteristics of pumpkin plant during 2022 and 2023 seasons.

Treatments		Fruit length (cm)	Fruit diameter (cm)	Fruit weight (kg)	Total fruit yield (kg/ plant)	Total fruit yield (Ton/fed.)	Fruit length (cm)	Fruit diameter (cm)	Fruit weight (kg)	Total fruit yield (kg/ plant)	Total fruit yield (Ton/fed.)
		2022					2023				
Nitrogen levels	100% N	26.0	18.2	4.3	7.3	35.0	28.9	20.0	4.4	7.7	37.0
	80%N+ Bio	29.0	20.3	4.4	7.5	36.1	31.0	21.4	4.5	8.0	38.5
	60% N + Bio	23.8	16.0	4.0	6.5	31.3	25.7	16.8	4.1	7.0	33.5
	40% N+ Bio	20.7	14.3	3.4	6.0	28.6	22.6	15.0	3.5	6.3	30.5
	LSD	LSD	0.7	0.04	0.10	0.45	0.7	0. 8	0.11	0.16	0. 78
Foliar spray	Control	22.6	15.6	3.7	6.1	29.2	24.6	16.5	3.8	6.4	30.7
	SWE (2 g/l.)	25.8	17.7	4.1	7.5	35.9	27.7	18.7	4.2	8.1	38.8
	PC (3 g/l.)	27.2	18.8	4.4	7.1	34.2	29.3	19.9	4.5	7.5	36.0
	CA (2 g/l.)	24.0	16.7	3.9	6.6	31.7	26.6	18.1	3.9	7.1	34.0
	L.S.D	0. 73	0.6	0.06	0.10	0.51	1.0	0.6	0.6	0.16	0. 93

PC= Potassium citrate, SWE= Seaweed extract, CA= Calcium acetate and control=Without spray

significantly influenced by the using of assorted levels of nitrogen fertilizer through two seasons of study. Addition of mineral nitrogen fertilizer at 80% of RDN with bio N-fertilizer followed by treatment of 100 % of RDN without bio fertilizer exhibited the greatest values for fruit yield traits. However, significant differences were noticed between these treatments. These resuts are connected with the increase in vegetative growth rate (Tables 1 and 2). These results are accordance Dash et al. (2020), Silva et al. (2021) and Alipour Kafi et al, (2021) decided that total fruit yield was enhanced as a result of application bio fertilizers .The positive effect of nitrogen levels on physical fruit quality maybe due to the enhancing effect of such treatments on vegetative growth parameters (Tables 1) and the chemical content of plants (Table 3) which affect consequently quality of produced fruits. This results is agreement those obtained by Dash et al. (2020) on different cucurbitaceous crops reported that application of nitrogen fertilizers increased physical fruit quality expressed as fruit length, diameter and size

Such data in Table 5 reveal that spraying pumpkin plants with different growth stimulat compounds, i.e., seaweed extract (2g/l), potassium citrate (3g/l) or calcium acetate (2 g/l.) significantly increased fruit length, diameter, weight, total fruit yield/plant and total fruit yield/fed of pumpkin contrast with the control treatment (Without spray). Spraying the plants with SWE at 2 g/l gave the rised significant values of these traits in both seasons. These increases are related to increase in vegetative growth (Tables 1 and 2) which in turn affects the proutivity of plants. In these concerned, comparable results was obtained by Yusuf et al., (2019), Shareef et al (2022) and Alkharpotly et al., (2024) on different crops.

Data in Table 6 expose that using the rate 80% of the RDN + 20 L Nitrobein/ Fed and spaying the plants with SWE at 2 g/l reflected the greatest values for total fruits yield and its components traits.

3.4.Chemical Fruit quality

Data recorded in Tables 7and 8 indicate the effectiveness of fertilization using different levels of nitrogen fertilizer added with bio

Table (6): Effect of the interaction between of nitrogen levels and some growth stimulants on fruit yield characteristics of pumpkin plant during 2022 and 2023 seasons.

	Treatments	Fruit length (cm)	Fruit diameter (cm)	Fruit weight (kg)	Total fruit yield (kg/ plant)	Total fruit yield (Ton/fed.)	Fruit length (cm)	Fruit diameter (cm)	Fruit weight (kg)	Total fruit yield (kg/ plant)	Total fruit yield (Ton/fed.)
		2022					2023				
100% N	Control	23.6	16.3	4.0	6.4	30.8	26.2	17.8	4.1	7.0	33.5
	SWE (2g/l.)	27.5	18.8	4.5	8.0	38.4	29.8	20.6	4.5	8.4	40.4
	PC (3 g/l.)	28.1	20.2	4.6	7.7	36.7	31.1	21.8	4.7	7.9	38.0
	CA (2g/l.)	24.8	17.6	4.1	7.1	34.2	28.6	19.7	4.3	7.6	36.3
80%N+ Nitrobein	Control	25.6	18.7	4.1	6.7	32.2	28.7	19.5	4.2	7.2	34.4
	SWE (2g/l.)	30.4	20.5	4.5	8.3	39.5	31.7	21.7	4.7	8.9	42.8
	PC (3g/l.)	32.6	21.8	4.9	7.9	37.8	33.5	23.2	5.0	8.2	39.2
	CA (2g/l.)	27.5	20.1	4.2	7.3	34.8	30.2	21.2	4.3	7.8	37.5
60% N + Nitrobein	Control	22.4	14.7	3.7	5.9	28.5	23.6	15.2	3.9	6.1	29.3
	SWE (2g/l.)	24.1	16.8	4.1	7.1	34.0	26.3	17.3	4.1	7.8	37.4
	PC (3g/l.)	25.2	17.2	4.2	6.8	32.8	27.8	18.1	4.3	7.1	34.2
	CA (2g/l.)	23.6	15.4	3.9	6.3	30.0	25.1	16.7	4.0	6.9	32.9
40% N+ Nitrobein	Control	18.6	12.6	3.1	5.3	25.3	19.8	13.4	3.2	5.3	25.5
	SWE (2g/l.)	21.3	14.7	3.5	6.6	31.7	23.1	15.3	3.6	7.2	34.6
	PC (3g/l.)	22.8	15.9	3.7	6.1	29.3	24.9	16.4	3.9	6.8	32.5
	CA (2g/l.)	20.2	13.8	3.2	5.8	27.9	22.4	14.7	3.2	6.1	29.3
	L.S.D	**1.4**	**1.2**	**0.15**	**0.2**	**0.9**	**1.9**	**1.2**	**0.14**	**0.3**	**1.7**

PC= Potassium citrate, SWE= Seaweed extract, CA= Calcium acetate and control=Without spray

Table 7. Effect of nitrogen levels and some growth stimulants on some fruit quality characteristics of pumpkin plant during 2022 and 2023 seasons.

Treatments		TSS	Total carbohydrates	V C	Total sugars	TSS	Total carbohydrates	V C	Total sugars
		First Season				Second Season			
Nitrogen levels	100% N	4.48	15.08	14.66	1.97	4.80	17.84	16.21	2.10
	80%N+ Bio	4.73	16.10	15.95	2.17	5.08	19.48	17.38	2.34
	60% N + Bio	3.48	12.63	13.22	1.72	4.05	13.98	14.25	1.95
	40% N+ Bio	3.18	10.23	11.96	1.38	3.38	12.13	13.02	1.52
	LSD	LSD	0.65	1.5	NS	0.16	0.46	0.46	0.06
Foliar spray	Control	3.58	11.58	12.35	1.56	3.85	13.18	13.26	1.73
	SWE (2 g/l.)	4.08	14.02	14.40	1.90	4.45	16.65	15.80	2.04
	PC (3 g/l.)	4.38	15.80	15.40	2.07	4.88	18.57	17.36	2.24
	CA (2 g/l.)	3.83	12.64	13.65	1.72	4.13	15.03	14.44	1.91
	L.S. D	0.16	0.64	1.4	NS	0.16	0.56	1.1	0.06

PC= Potassium citrate, SWE= Seaweed extract, CA= Calcium acetate and control=Without spray

Table 8. Effect of the interaction between of nitrogen levels and some growth stimulants on some fruit quality characteristics of pumpkin plant during 2022 and 2023 seasons.

Treatments		TSS %	Total carbohydrates %	V C	Total sugars%	TSS %	Total carbohydrates %	V C	Total sugar%s
		First Season				Second Season			
100% N	Control	4.10	12.90	12.86	1.74	4.30	14.70	14.10	1.86
	SWE	4.60	15.60	15.24	2.05	4.90	18.60	16.78	2.12
	PC (3g/l.)	5.00	17.50	16.12	2.19	5.40	21.27	18.61	2.38
	CA (2g/l.)	4.20	14.30	14.42	1.91	4.60	16.80	15.36	2.05
80%N+ Nitrobein	Control	4.30	14.30	14.36	1.95	4.50	17.10	15.56	2.13
	SWE	4.90	16.30	16.28	2.21	5.30	20.20	17.92	2.39
	PC (3 g/l.)	5.20	18.70	17.65	2.47	5.73	21.90	19.71	2.62
	CA (2g/l.)	4.50	15.10	15.52	2.03	4.80	18.70	16.32	2.23
60% N + Nitrobein	Control	3.10	10.70	11.76	1.41	3.70	10.80	12.21	1.73
	SWE	3.50	13.57	13.64	1.85	4.10	15.10	14.92	2.03
	PC (3g/l.)	3.80	14.90	14.57	1.98	4.50	16.60	16.24	2.13
	CA (2g/l.)	3.50	11.37	12.91	1.63	3.90	13.40	13.61	1.91
40% N+ Nitrobein	Control	2.80	8.40	10.41	1.12	2.90	10.10	11.18	1.19
	SWE	3.30	10.60	12.42	1.47	3.50	12.70	13.57	1.62
	PC (3g/l.)	3.50	12.10	13.26	1.63	3.90	14.50	14.86	1.83
	CA (2g/l.)	3.10	9.80	11.73	1.31	3.20	11.20	12.46	1.45
	L.S.D	0.37	1.24	2.8	3.1	0.38	1.07	2.03	0.16

PC= Potassium citrate, SWE= Seaweed extract, CA= Calcium acetate and control=Without spray

fertilizer, 60% RDN + Bio fertilizer or 40% RDN + Bio fertilizer significantly affected the studied fruit quality traits, i.e., TSS, total carbohydrates, V C, total sugars contents during both seasons except total sugars in first season. Application 80 % of RDN and adding bio fertilizer (240 kg Ammonium nitrate / Fed. + 20 L Nitrobein/ fed) significantly replicated the greatest values in these traits contrast with 40 % of RDN.

The positive effect of nitrogen levels on physical fruit quality maybe due to the enhancing effect of such treatments on vegetative growth parameters (Tables 1 and 2)

which affect consequently quality of produced fruits. This results is agreement those obtained by Dash *et al.* (2020) on different cucurbitaceae crops reported that application of nitrogen fertilizers increased physical fruit quality expressed as fruit length, diameter and size.

Regarding the effect of different spraying pumpkin plants with different growth stimulating compounds, .e., Seaweed extract (2 g/l), Potassium citrate (3 g/l) or Calcium acetate (2 g/l.) after 30 days from planting and every 15 days intervals through the growing season, the data in Table 7 reveal that TSS, total carbohydrates, V C, total sugars contents were significantly affected due to spraying the studied growth stimulating compounds. Meanwhile the differences didn't reach to significance level (5%) in case of total sugars contents in first season. In this respect, spraying the plants with potassium citrate (3 g/l.) was ranked first followed by SWE at 2 g/l. Obtained results are true in both seasons of study. Similar results were recorded by Kazemi (2013), Shehata et al., (2018), Abd-Elaziz *et al.*, (2019), Nada and Metwaly (2020), El-Shoura (2020) and Qassem, et al. (2022)

About the effect of the interaction, data in Table 8 reveal that supplying the plants with mineral fertilizer (N) at rate of 80 % with added bio fertilizer (240 kg Ammonium nitrate / Fed.) + 20 L Nitrobein/ Fed) combined with spraying the plants every 15 Days with the potassium citrate (3 g/l.) reflected the greatest values of fruit traits expressed as TSS, total carbohydrates, V C, total sugars contents during both seasons of study.

4. CONCLUSION

It could be recommended that under such situation of this experiment using 80% RDN (240 kg Ammonium nitrate / fed.) + Bio fertilizer (20 L Nitrobein/ fed.) then spray the plants with SWE at 2 g/l for producing the best vegetative growth with the highest fruit yield of pumpkin.

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الملخص العربي

تأثير التسميد النتروجيينى المعدنى والحيوى والرش الوقى ببعض منشطات النموعلي نمو وانتاجية وجودة نباتات قرع العسل

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أصبحت الأسمدة الحيوية أكثر شيوعآ كوسيلة لزيادة خصوبة التربة وانتاجيتها من خلال توفير العناصر الغذائية . لذلك اجريت تجربة حقلية خلال موسمي زراعة .بقسم البساتين كلية الزراعة بمشتهر جامعة بنها خلال موسمي الصيف لعام ٢٠٢٢و٢٠٢٣ لدراسة التسميد النتروجيينى المعدنى والحيوى والرش الوقى ببعض منشطات النمومثل مستخلص الطحالب البحرية وسترات البوتاسيوم واسيتات الكالسيوم وتأثيرهم علي النمو الخضري والتركيب الكيمائي للاوراق وانتاجية وجودة محصول القرع العسلي.تم في هذة التجربة استخدام ١٦ معاملة ومشاركتهم مع الاسمدة المعدنية النيتروجية .، المعاملة الاولي ١٠٠% من المعدل الموصي به للنيتروجين المعاملة الثانية ٨٠% من المعدل الموصي به للنيتروجين + التسميد الحيوي والمعاملة الثالثة ٦٠% من المعدل الموصي به للنيتروجين +التسميد الحيوي والمعاملة الرابعة ٤٠% من المعدل الموصي به للنيروجين +التسميد الحيوي والرش ببعض منشطات النمو مثل سترات البوتاسيوم بمعدل ٣ جرام/ لتر ومستخلص الطحالب البحرية بمعدل ٢ جرام /لتر واسيتات الكالسيوم بمعدل ٢ جرام /لتر وبالاضافة للماء .

أظهرت النتائج بان أضافة التسميد الحيوي وتقليل معدل اضافة النيتروجين عن المعدل الموصي به بنسبة ٢٠% من المعدل الموصي به مع اضافة التسميد الحيوي أدي الي حدوث معنوية لاعلي القيم في جميع صفات النمو الخضري المدروسة ، وصفات المحصول الثمري وكمية المحصول خلال موسمي الدراسة بتقليل كميات النيتروجين الي ٦٠% من المعدل الموصي به مع اضافه التسميد الحيوي ورش النباتات بمستخلص الطحالب البحرية بتركيز ٢ جرام /لتر أعلي القيم المعنوية لهذه الصفات .اما عن تأثير التفاعل فقد اظهرت النتائج ان امداد النباتات بتسميد معدني ٨٠% مع اضافة السماد الحيوي ورش النباتات كل ١٥ يوم ب٢جرام /لتر مستخلص الطحالب البحرية اعلي القيم في صفات النمو المدروسة وصفات المحصول.

الكلمات المفتاحية: قرع العسل، التسميد النتيروجيني المعدني والحيوي،منشطات النمو،الطحالب، سترات الكالسيوم، اسيتات الكالسيوم