



Response of Potatoes to Organic Fertilizer and Biofertilizers NOVA-GR

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Abstract: A experiment was conducted to study the effect of organic fertilizer and biofertilizer NOVA-GR, 0, 25 and 50 g plant⁻¹ in growth and productivity of tow cv. of potatoes (Banba and Electra), a field experiment was conducted. The experiment has factorial RCBD of three replicates. Cultivar Banba showed better response to increased leaf area, Chlorophyll content and tuber yield (160.69 dcm², 70.80 mg/100g fresh weight and 70.01 t ha⁻¹, respectively). The 50 g plant⁻¹ of organic fertilizer NOVA-GR gave best results, for plant height, plant, leaf area, Chlorophyll content, plant dry total and tuber yield (45.8 cm, 182.2 dcm², 80.6 mg 100 g⁻¹ fresh weight, 92.0 g and 73.15 t ha⁻¹, respectively). NOVA-GR (NG) at the 50 g plant⁻¹ gave the highest mean of plant leaf area (167.0 dcm²), Chlorophyll (73.3 mg 100 g⁻¹), plant dry (86.7 g) and total tuber yield (74.1 t ha⁻¹).

Keywords: *Solanum tuberosum*, Growth parameters, Yield, Chlorophyll

Potato belongs to family Solanaceae and it is one of the important vegetable in the world and in Iraq (Potato yield was 165.6 thousand tons, with an area of 1.1 thousand hectares in Iraq (COS 2019). The world agriculture nowadays is going towards clean agriculture and less pollution by encouraging the use of as a good alternative for chemical fertilizers (Zaghloul 2002). Using humic acid on crops improves quantity and quality of crops through to role in respiration, photosynthesis, protein build up, eaten uptake and enzymatic activities (Hayes et al 2001, Chen et al 2004). Recently, many plant extracts are being used on crop plants through adding to soil. These extracts contain several cytokines, oxins, gibberellins and absesic acid (Craigie 2011, Khan et al 2011). According to NG it is thought that some humic acids have positive effect to enhance plant water uptake then better cell division and higher tuber yield. That would be via higher photosynthesis, carbon build-up and higher yield (AL-Juboori and Salem 2011, AL-Jumally 2012). It was concluded enough quantity organic fertilizers would be improve to plant growth parameter and yield when invalided with a recommended dose of chemical fertilizers. Based on these facts, this study was laid out to evaluate the response of growth and tuber yield for tow potato cultivars to the organic fertilizer and biofertilizer NOVA-GR.

MATERIAL AND METHODS

This experiment was conducted on a farm in Abu-Ghraib Tubers of cultivars Banba and Electra class elite obtained from IBM Company, Dutch company and sown on 3 June, 2019 as spring crop. Tubers were 10 cm deep on furrows of 2.5×0.75 m, and spaced 25 cm. There were 20 plants on

each furrow. A factorial experiment was applied according to the design of the randomized complete block (RCBD) with three replicates. Levels of organic fertilizer (OF) and biofertilizer NOVA-GR (NG) were 0, 25 and 50 g plant⁻¹, dressed in a groove of 25cm and the tubers were 10cm deep on same groove. Irrigation, weeding and insect control were done as needed and NPK 400-1200-240 @ was added for all experimental units. When plants reached 80 days, height was measured from 10 plants in each replication from soil surface to the highest top of plant. Plant leaf area was measured by using digitizer from, 10 plants randomly selected (Sadik et al 2011). Leaf area= number of leaves × leaf area. Chlorophyll content (mg/100g fresh weight) were estimate from fourth leaf starting from the top, washed distilled water cleaned, then cut into small slices then mixed 80% acetone, then read light absorption on light waves 663 and 645 nm by using Spectrophotometer. Chlorophyll content was estimated as total chlorophyll=20.2 D. 645+8.02 D. 663. Above ground plant day weight was taken 2 weeks before harvest from 10 plants selected at random. These were cut from soil surface sun dried, and weighed. Total tuber yield was calculated by on whole plant basis.

RESULTS AND DISCUSSION

Plant height: The difference were significant in plant height between cultivars and was maximum in Electra cv. (V2) (44.27 cm) as compared to Banba cv. (V1). According to organic fertilizer plant height was increased with increased level of organic fertilizer which gave 45.82cm in OF2 (50 g plant⁻¹). However, NG gave 45.06 cm of highest level (NG2). Cultivar V2 showed better response to increased levels of

organic fertilizer (47.16 cm) as compared to V1. Cultivars did not show significant response to the NG two levels was with organic fertilizer. The second order interactions were not significantly different in plant heights. The organic acids in manure help plant growth and give stimuli to cell division, this will act to increase number of stems per plant (Kulikova et al 2003). This is in agreement with what Fayed (2010) found when he sprayed humic acid on olive trees and EL-Bassiony et al (2010) when they sprayed humic acid on peas.

Plant leaf area: The difference were significant in plant height between cultivars and was maximum in V1 gave 160.69 cm² while V2 gave 153.16 dcm² both levels of showed significant difference in plant leaf area (160.96 and 182.21cm²) for 25 and 50 g plant⁻¹, respectively. Same trend was with NG but the values and the difference were lower than with organic fertilizer cultivars did not respond significantly with levels of NG, while they were significant with organic fertilizer. At the Same time higher level of organic fertilizer and NG gave better results. The application of organic fertilizers supply some micro nutrient to plants which help better growth and yield. The increase plant leaf area increased could be a result of N released from organic fertilizers to increases number of plant stems and leaf area (Kulikova et al 2003).

Chlorophyll content in leaves: Leaves of cultivar V1 gave 70.80 mg chlorophyll/100g fresh weight of leaves while V2 gave 59.41 the best value of chlorophyll Content clue to of was 80.64 while NG gave 73.32 at same higher level (50 g plant⁻¹) of both fertilizers. Increased level of organic fertilizer gave positive increase in chlorophyll content cultivars with NG level were not significantly different the same trend was in organic fertilizer (Table 2). Chlorophyll content has been affected by nutrient elements that organic fertilizers contain, especially N and Mg that help building units of porphyrin and chlorophyll. Nitrogen content in leave can tell us how much chlorophyll is there Peter and Carl (2005), Guler (2009). However, we cannot forget the complementary effect of chemical fertilizer added to the soil, and the active role of organic fertilizers to enhance many activities in plant metabolism processes.

Plant day weight of green biomass: Cultivars did not differ in this trait, they gave an average of 80.6 g. Meanwhile, increased levels of both NG and organic fertilizer increased Plant day weight significantly addition of 50g plant⁻¹ of organic fertilizer gave 92.0 g plant⁻¹, while same level in NG gave 86.7 g plant⁻¹. Interaction between cultivars and fertilizers was not significant (Table 2). Al-Muhamadi and Hardan 2013, Osman 2007) found that plant dry weight was increased by applying

Table 1. Effect of organic fertilizer (OF) and NOVA-GR (NG) on the Plan height and leaf area

Cultivars (V)	Plant height (cm)				V × B	Plant leaf area (cm ²)			V × NG
	NOVA-GR (NG)	Organic fertilizer (OF)				Organic fertilizer (OF)			
		0	25	50		0	25	50	
Banba	0	36.1	40.97	42.2	39.76	117.42	160.93	175.29	151.21
V1	25	41.3	41.17	44.7	42.39	133.39	161.38	180.78	158.52
	50	42.4	43.9	46.57	44.29	148.58	181.89	186.56	172.35
Electra	0	35.53	44.23	45.94	41.9	105.43	147.7	181.01	144.71
	25	41.7	46.13	47.38	45.07	125.41	149.86	183.87	153.05
V2	50	42.3	47.03	48.15	45.83	135.44	163.99	185.77	161.73
	LSD 5%	NS			NS	NS			NS
					V means				V means
V × OF	V1	39.93	42.01	44.49	42.14	133.13	168.07	180.88	160.69
	V2	39.84	45.8	47.16	44.27	122.09	153.85	183.55	153.16
LSD 5%		1.37			0.79	5.79			3.34
					NG means				NG means
NG × OF	0	35.82	42.6	44.07	40.83	111.42	154.32	178.15	147.96
	25	41.5	43.65	46.04	43.73	129.4	155.62	182.32	155.78
	50	42.35	45.47	47.36	45.06	142.01	172.94	186.16	167.04
LSD 5%		1.68			0.97	7.09			4.09
OF means		39.89	43.9	45.82		127.61	160.96	182.21	
LSD 5%		0.97				4.09			

organic fertilizers to potato plants. Amino acids and could enhance meristematic cells and tissues to propagate, along with cell division, then light and carbon dioxide capturing will be higher, then chlorophyll content will be increased and then total dry matter will be increased (Al-Barzanji 2007). In gunnel, humic acid plays several activities in plants then it will be reflected on plant dry weight (Yildirim 2007).

Tuber yield: Cultivar V1 gave 70.01 t ha⁻¹ while V2 gave 58.99 t ha⁻¹ with a significant difference increased levels of both organic fertilizer and NG increased tuber yield. The 50 g plant⁻¹ of gave 73.15 t ha⁻¹ while Same level of NG gave 74.06 t ha⁻¹ without a significant difference. Interaction between cultivars and fertilizers was significant the higher value of tuber yield was obtained from V1 with 50 g plant⁻¹ NG Which gave 74.99 t ha⁻¹. Cultivars showed different response to both fertilizer levels cultivar V2 gave 80.73 t ha⁻¹ of the levels 25 g plant⁻¹ of organic fertilizer, compared to V1 with 50 g plant⁻¹ NG which gave 70.35 as compared to the control (53.39 t ha⁻¹). Cultivar V1 gave the highest tuber yield when plants treated with 50g plant⁻¹ of both organic fertilizer and NG fertilizers to give 90.55 t ha⁻¹ (Table 3).

Tuber yield increases could be attributed to the powerful effect of organic matter in improving soil physical chemical, and biological activities that lead to better cell division, growth, and higher yield. Some of effects of organic matter is

Table 3. Effect of organic fertilizer (OF) and NOVA-GR (NG) on tuber yield

Cultivars (V)	NOVA-GR (NG)	Organic fertilizer (OF)			V × NG
		0	25	50	
BANBA V1	0	42.37	67.00	74.20	61.19
	25	59.38	67.04	62.95	63.12
	50	58.42	76.01	90.55	74.99
ELECTRA V2	0	41.90	56.60	73.42	57.31
	25	49.08	56.13	66.57	57.26
	50	55.85	60.34	71.06	62.42
LSD 5%			7.47		4.31
V × OF	V1	53.39	80.73	75.89	70.01
	V2	48.95	57.69	70.35	58.99
LSD 5%			4.31		2.49
NG × OF	0	42.14	61.8	73.81	59.25
	25	54.23	61.58	64.75	60.19
	50	57.14	84.24	80.8	74.06
LSD 5%			5.28		3.05
OF means		51.17	69.21	73.15	
LSD 5%			3.05		

Table 2. Effect of organic fertilizer (OF) and NOVA-GR (NG) on Chlorophyll content and Plant day weight

Cultivars (V)	NOVA-GR (NG)	Chlorophyll content (mg/100g fresh weight)				Plant day weight (g plant ⁻¹)			
		Organic fertilizer (OF)			V × NG	Organic fertilizer (OF)			V × NG
		0	25	50		0	25	50	
BANBA V1	0	41.5	64.23	84.12	63.28	61.8	73.6	92.9	76.1
	25	47.98	73.41	90.75	70.72	71	80.1	92	81
	50	60.42	80.44	94.3	78.39	79.8	85.5	96.3	87.2
ELECTRA V2	0	40.72	52.65	63.3	52.22	45.3	82.7	79.4	69.1
	25	43.55	62.18	67.58	57.77	84.8	81.6	94.9	87.1
	50	52.19	68.73	83.82	68.24	77.6	84.6	96.4	86.2
LSD 5%		5.01			NS	NS			NS
V × OF	V1	49.97	72.69	89.72	70.8	70.9	79.8	93.7	81.5
	V2	45.49	61.19	71.56	59.41	69.2	83	90.2	80.8
LSD 5%		2.89			1.67	N.S			N.S
NG × OF	0	41.11	58.44	73.71	57.75	53.5	78.1	86.2	72.6
	25	45.77	67.8	79.16	64.24	77.9	80.9	93.4	84.1
	50	56.3	74.58	89.06	73.32	78.7	85.1	96.4	86.7
LSD 5%		N.S			2.04	9.1			5.2
OF means		47.73	66.94	80.64		70	81.4	92	
LSD 5%		2.04				5.2			

its content and release of some trace elements that help to increase tuber yield (Abdelrazzag 2002). This idea comes with agreement with what was found by Al-Hassan (2008) that organic fertilizers have positive effect in potato tuber yield. The significant increases in tuber yield of potato cultivars were attributed to some available N which stimulate oxin production that helps cell division and elongation. That will increase plant height and plant leaf area to capture more carbohydrate, then higher tuber yield (Abu Dahi and Al-Younes 1988).

CONCLUSIONS

The present study concluded that the potato cultivars response to organic fertilizer and biofertilizer NOVA-GR. Organic fertilizer and biofertilizer NOVA-GR help plant growth and give increase plant height, chlorophyll content and plant leaf area to capture more carbohydrate, then higher tuber yield.

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