



Growth and yield of potato in relation to application of Alphylax and fish oil as organic fertilizers

Wafaa Ali Hussein ^{1*}, Nafisa Elmahi Ahmed ²

¹ College of Agricultural Engineering Sciences, University of Baghdad, IRAQ

² Crop Protection Center, Agricultural Research Corporation, SUDAN

*Corresponding author: plantbreeding666@yahoo.com

Abstract

This study aimed to examine the activity of Alphylax and Fish oil fertilizers on growth and production of Potato (Everest variety) in the central regions of Iraq. The experiment was conducted in two seasons of 2017 using randomized complete block design with eleven treatment with three replicates including: control (T0), Alphylax (1, 2, 3 ml L⁻¹) symbolized T2, T3, T4, fish oil (1, 2, 3 ml L⁻¹) symbolized T5, T6, T7 and an interaction between Alphylax and fish oil (1+1, 2+2, 3+3, 1.5+1.5 ml L⁻¹) symbolized T8, T9, T10, T11, respectively. The statistical analysis revealed significant differences of T10 in producing the highest values of aerial stem number, leaf number and plant dry weight for two seasons of 2017. T7 and T9 increased nitrogen (N%) in leaf for two seasons, while T10 increased percentages of phosphorus (P), potassium (K), and calcium (Ca) for two seasons. T10 and T4 increased plant yield to 0.871g and 426g for two seasons, respectively. Plant tuber number increased at 5.90, 2.60 tuber plant⁻¹ in T10 and T5 for two seasons, respectively. T10 and T6 increased tuber weight at 198.1g and 203.7 g tuber⁻¹, respectively. It is concluded that plants fertilized by Alphylax and fish oil had higher growth rates in compared to control group. The organic materials can be considered as an applicable fertilizer in the growth and yield performance of organic potato.

Keywords: eureka, stimulator, potato production, natural compound

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INTRODUCTION

Solanum tuberosum L. considered one of the most important Solanaceae family vegetable crops. It is known as Potato or Irish Potato (In English language) attributed to Ireland where planting of Potatoes is spread in Ireland. Ireland exports Potatoes to different countries in the world. Potato has more than 2000 species and 90 genus where it considers the more of used vegetables. It is the first of tuber crops list (Hassan 1999). Potatoes lies in the fourth rank as strategic and economic crop after each of wheat, corn and rice (AL-Razaq et al. 2018, Bowen 2003, Majeed 2010, Majeed et al. 2019, Shayaa and Hussein 2019). People consume too much of Potatoes because it considers an important source of many nutritional components where it contains high proportion of starches, sugars, proteins, amino and organic acids, vitamins and metal elements (Alaee 2018, Hassan 1999).

The important role of organic materials in a soil comes from yield of its decomposition so, adding of an animal organic material and a botanical organic material will be more active than its decomposition because of attacking of precise soil biostatistics based on that it becomes one of transitional components that must renew continuously by adding organic waste to maintain

of chemical, physical properties and also properties of fertilities for the soil where it make them suitable situation thus, it helps to equivalent agricultural production by supplying plants with nutritional elements to its growth (Al-Jala 2002, Zidane and Diop 2005) .

Interest of researchers increased regarding knowledge of effect of organic fertilization on growth of plant and its relation with effect of ready components for absorption because of raising the micro-mass in the soil or because of production of humiferous substance that increase vegetarian and root growth and then increase yield (Tu et al. 2006).

Mishra et al. (2014) mentioned that using result of organic fertilization considers protection to plants and also anti-pathogen where they found that result of organic fertilization supplies the soil with dissolvable nutritional elements and it is easy to absorb by roots of plants. The microorganisms in result of organic fertilization increase ability of nutritional elements by decomposition of organic components and results nutritional elements from them in addition the secretions

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Table 1. Chemical and Physical Properties for Soil of Field Property

	Ph	EC 1:1	O. M.	N	P	K	Sand	Silty	Clay
Standard Unit			g/kg	%	%	%			
Spring Season	7.54	1.66	12.5	48	14.3	19.6	230	420	350
Autumn Season	7.39	3.21	12.7	42	11.1	23.9	190	440	370

Soil Acidity (Ph), Soil Electrical Conductivity (EC), Organic Matter (OM), Nitrogen (N), phosphorus (P), potassium (K) and Soil Particles Groups (Sand, Silt and Clay)

of microorganisms from amino and organic acids increase activity of roots and their growth thus, increase of its efficiency to absorb the nutritional elements. Result of organic fertilization increases soil aeration and obscures the effect some of heavy poisonous elements (Al-Amery and Mohammed 2017, Edwards et al. 2006, Tognetti et al. 2005).

Result of organic fertilization contains big micro-mass, organic material, humiferous acids and components work as growth and Enzymes regulators (Abed Al-Hussain and Muhammed 2016, Nikolic and Hermary 2008). Organic materials can be manufactured or natural such as Alphylax and Fish oil. The objective of this study is to examine the activity of Alphylax and Fish oil on growth and production Potato (Everest variety) in the central regions in Iraq.

MATERIALS AND METHODS

This research was conducted at vegetable field of the Horticulture Department –College of Agricultural Engineering Sciences, Baghdad University. The experiment was conducted using randomized complete block design (Al-Sahuki and Wahib 1990) with 3 replicates.

The tuber of Imported Potato Elite Grade, Everest were planted in (8/2/2017) used in Spring season and use part of its yield to Autumn cultivation, it has planted in 20/9/2017 after storage.

The soil settlement and ploughing of field carried out and the soil of field divided in to furrows and then samples of the soil have taken in depth (30cm) to analyze it in the laboratories of the Soil and Water Sciences Department, Agricultural College, Baghdad University. The chemical and physical characteristics of the soil was shown (Table 1).

Potatoes have planted in rated weight (35-55) g, the distance between tuber within the furrow 25 cm using interchanging method on the side of the furrow. The experimental unit includes (10) plants, using drip irrigation in this investigation by a system that prepared for this purpose. (Abushama et al 2014).

Eleven treatments where they included in each:

1-control spraying with water (T1), 2- Alphylax by spraying (1, 2, 3) ml L⁻¹ (it is commercial product that produced by Dutch Selko company) it contains a group of acids as following; Propionic acid, Formic acid, Lactic acid, Arthroposphoric acid, Citric acid, Sorbic acid and anti-vaporization, water, Ammonia symbolized (T2,T3, T4). 2- Fish oil by spraying (1, 2, 3) ml L⁻¹ where it consists of (48%) fish oil and plant growth stimulator

(Soil Technologiescrf (USA)) symbolized (T5, T6, T7), and interaction between Alphylax and Fish oil (1+1, 2+2, 3+3, 1.5+1.5) ml L⁻¹respectively symbolized (T8, T9, T10, T11), The plants are sprayed with Alphylax and Fish oil three times beginning of four true leaves where the period between spray and other was two weeks.

The parameters that measured is the plant height (cm), aerial stem number, leaves number, plant¹ wet and dry plant weight (g), leaf area, plant¹(dcm²) (Majeed,2010), dried vegetative growth weight (gm.), N%, P%, K%, Ca%, plant yield, plant tuber number, plant tuber weight, tuber dry matter %, hardness, total soluble solids (%). The collected data analyzed using analyses of variance and the means were compared according to LSD test under 5% probability.

RESULTS

The results which obtained from research showed the significant differences of spraying (3 ml L⁻¹) of Fish oil gives significant results with regarded to height and wet weight of potato plant in Spring and Autumn seasons of 2017 where it records (106.88, 112.67 cm plant⁻¹) and (537,504g plant⁻¹) respectively while the lowest values found in T1 (81.33, 89.78 cm plant⁻¹) and (252, 289.5g plant⁻¹) for two season respectively, The highest values was attained in spraying (3 ml L⁻¹) of Alphylax and (3 ml L⁻¹) Fish oil led to increase number of aerial stems of plant, number of leaves and dry weight of plant in Spring and Autumn seasons of 2017 where it records (2.607, 2.165 stem plant⁻¹), (141.4, 144.96 leaf plant⁻¹) and (76.7, 76.5 g plant⁻¹) In comparing with (1.110, 1.385 stem plant⁻¹) (77.33, 127.5 leaves) (48.8, 42.00 g plant⁻¹) in T1 for Spring and Autumn seasons respectively (Table 2).

Table 3 shows the significant impact of treatment on plant nutrient concentration. The highest values was attained in T7 (3 ml L⁻¹) Fish oil, treatment of spraying by (2 ml L⁻¹) Alphylax and treatment of spraying by (2 ml L⁻¹) Fish oil give significant results in Nitrogen percentage of potato's leaves (2.915%) and (2.87%) for two seasons respectively as compared with (1.499, 1.12)%. Using together treatment of spraying by (3 ml L⁻¹) Alphylax and (3 ml L⁻¹) Fish oil have influence of increasing potato's leaves content of Phosphor, Potassium and calcium in Spring and Autumn seasons of 2017 with (0.52%,0.36%), (2.863%, 3.94%) and (1.057%, 1.093%) for two seasons respectively as compared with lowest average (0.186, 0.211) (1.711, 1.19) (0.893, 0.988) in T1 for two season respectively (Table 3).

Table 2. Impact of Alphylax and Fish oil on vegetative growth traits of Potato Plant

Traits treatments	spring 2017	Autumn 2017	spring 2017	Autumn 2017	spring 2017	Autumn 2017	spring 2017	Autumn 2017	spring 2017	Autumn 2017
	plant height (cm)		Aerial stem number		leaves number		wet vegetative growth (gm.)		dried vegetative growth (g.)	
T1	81.33	89.78	1.110	1.385	77.33	127.5	252	289.5	48.8	42.00
T2	90.55	95.83	1.773	1.900	86.66	128.3	303	319.5	53.6	51.00
T3	81.66	104.03	1.773	1.850	81.66	126.1	384	341.0	66.3	59.50
T4	92.22	106.50	2.110	1.770	105.77	126.9	426	449.0	69.9	64.50
T5	95.78	109.39	2.000	1.830	104.55	129.9	429	436.5	72.4	63.50
T6	95.77	110.10	1.887	1.850	112.78	130.3	438	378.5	72.8	67.50
T7	106.88	112.67	2.000	1.900	126.55	131.6	537	504.5	76.2	75.50
T8	98.85	105.94	2.440	1.995	126.11	136.2	453	483.5	72.6	72.00
T9	100.22	103.70	2.330	2.000	136.99	136.8	490	471.0	74.3	72.00
T10	93.89	103.00	2.607	2.165	144.96	141.4	473	468.5	76.7	76.50
T11	103.33	106.94	2.000	1.665	131.11	135.6	413	426.5	65.9	68.50
I.s.d.	2.11	5.733	0.292	0.130	3.77	4.12	49.5	38.35	3.39	4.93

Table 3. Impact of Alphylax and Fish oil on nutrient content of potato leaves plant

Traits treatments	spring 2017	Autumn 2017	spring 2017	Autumn 2017	spring 2017	Autumn 2017	spring 2017	Autumn 2017
	N%		P%		K%		Ca%	
T1	1.499	1.12	0.186	0.211	1.711	1.19	0.893	0.988
T2	2.498	1.62	0.310	0.227	2.001	1.70	0.897	1.038
T3	2.582	1.87	0.366	0.244	2.001	1.79	0.907	0.991
T4	2.749	1.50	0.396	0.267	2.276	2.02	0.947	1.068
T5	2.832	1.77	0.353	0.226	2.276	2.83	0.960	1.043
T6	2.665	1.50	0.423	0.287	2.532	2.31	0.997	1.063
T7	2.915	1.62	0.426	0.279	2.699	2.46	0.963	1.043
T8	2.749	1.75	0.406	0.284	2.679	2.27	1.023	1.073
T9	2.749	2.87	0.453	0.298	2.800	3.07	1.013	1.071
T10	2.749	2.00	0.520	0.360	2.863	3.94	1.057	1.093
T11	2.582	2.00	0.330	0.291	2.640	2.90	1.037	1.063
I.s.d.	0.338	0.602	0.068	0.591	0.124	0.79	0.029	0.022

Table 4. Impact of Alphylax and Fish oil on yield traits of potato plant

Traits treatments	spring 2017	Autumn 2017	spring 2017	Autumn 2017	spring 2017	Autumn 2017
	Plant yield g plant ⁻¹		Plant tuber number tuber plant ⁻¹		Tuber weight g tuber ⁻¹	
T1	634.7	425	5.400	2.45	124.9	173.8
T2	748.2	364	5.600	2.20	146.3	167.8
T3	758.0	272	5.100	1.75	172.6	155.1
T4	787.7	426	4.800	2.35	148.2	180.1
T5	833.7	344	5.267	2.60	137.9	141.5
T6	838.8	310	5.600	1.50	145.4	203.7
T7	858.5	285	5.433	1.45	158.3	194.5
T8	856.2	180	5.433	1.50	150.0	121.2
T9	931.5	280	5.433	1.50	158.9	192.5
T10	942.8	262	5.900	1.95	198.1	137.0
T11	871.0	323	5.200	2.00	154.3	160.0
I.s.d.	56.00	25.11	0.706	0.54	22.50	63.87

Table 4 shows that Spraying by together Alphylax and Fish oil has an influence for increasing yield of plant where (T10) gives the highest average of yield of plant with (871 g plant⁻¹) for Spring season of 2017 and (426 g plant⁻¹) in treatment (T4) for Autumn season of 2017 while T1 and T8 gives the lowest average of yield (634.7, 180 g plant⁻¹) for two season respectively, and the highest number of tubers seasons in T4 and T7 (5.900, 2.35 tuber plant⁻¹) for Spring and Autumn season respectively as compared (4.800, 1.45 tuber plant⁻¹) in T4 and T7 for Spring and Autumn season respectively, while the treatment (T10, T6) gives the highest weight of tuber that records (198.1, 203.7 g tuber⁻¹) for two season respectively as compared with lowest average (124.9, 121.2 g tuber⁻¹) in T1, T8 for two season respectively.

Table 5 shows that Spraying by together Alphylax and Fish oil has a good influence where the dry weight for tubers of potato's were (20.45, 24.27) gr in (T10) for

Autumn and Spring season respectively while T1 gives the lowest average (15.35, 15.07 g tuber⁻¹) for two season respectively. Also (T10) gives a significant result with respect to hardness of tubers where was (11.85 kg/cm²) with no significant difference with (T6) for Spring seasons compared with (9.41, 12.50 kg cm² -¹) in T1 for two season respectively. The percentage of Total Soluble Solids increased with respect to (T6) 7.00 for autumn season as compared with 5.00 in T1.

Treatment of spraying by (3ml/l) Alphylax and (3ml/l) Fish oil together has an significant result with respect to increasing in characters of vegetative growth (Height of plant, Number of aerial stem, Number of leaves and dried vegetative growth), The reason of these increasing maybe belong to they contain Catalyzed materials that make it give an significant result if it compared with others treatments and contain anti- vaporization materials that help for using an enough water in plant by

Table 5. Impact of Alphylax and Fish oil on yield quality of potato plant

Traits treatments	spring 2017		Autumn 2017		spring 2017		Autumn 2017	
	Tuber dry weight		Tuber firmness		TSS			
T1	15.35	15.07	9.41	12.50	5.00	5.00	5.00	5.00
T2	16.43	20.66	10.83	13.75	4.00	6.00	6.00	6.00
T3	15.69	20.16	10.33	14.62	5.00	6.50	6.50	6.50
T4	17.58	20.59	10.50	13.38	5.00	6.50	6.50	6.50
T5	19.80	23.00	10.16	14.25	4.00	6.00	6.00	6.00
T6	18.34	22.17	11.41	13.25	5.00	7.00	7.00	7.00
T7	19.36	23.02	10.75	13.75	4.00	5.50	5.50	5.50
T8	16.64	22.38	10.75	15.38	4.00	6.25	6.25	6.25
T9	18.75	19.87	10.58	14.50	5.00	6.50	6.50	6.50
T10	20.45	24.27	11.95	15.50	5.00	6.00	6.00	6.00
T11	16.49	19.70	10.75	14.50	5.00	6.50	6.50	6.50
l.s.d.	0.541	0.228	0.795	1.632	NS	0.491	0.491	0.491

reducing of transpiration rate that is the main resource to lose the water at late stage of growth of plant especially Spring season as shown in **Table 3**. (Campbell and Zenter 1993, Davenport and Hagan 1982) and also, the used components in this study contain amino acids that increase ability of phosphorous due to a low pH (Leytem and Sims 2005, Ohno et al. 2005, Tisdale et al. 1985, Wolf and Snyder 2003). Thus, conditions are in place to dissolve nutrients and transfer them from soil to plants (Abu Dahi and Al-younis 1988), and then these elements accumulated in the tissues of the plant, which led to an increase in the yield (**Tables 4 and 5**).

CONCLUSION

It is concluded that interaction between Alphylax and fish oil in treatment T10 (3+3 ml L⁻¹) was the highest

value in plant yield for two seasons and that due to positively and significantly effects on growth and yield parameters. We recommend to use that concentration (T10) and according its positive effects we also recommended to reconduct the treatment with higher concentrations on the growth and yield indicators in potato plants to know how it will respond.

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