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Effect of Foliar Nutrient Spraying (Chlorophyll Gs) on Growth and Yield of Some Genotypes of Potato

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Abstract: *The field experiment was conducted in the autumn season / 2019-2020 and within the AL-YUSUFIYA area, south of BAGHDAD province. Three potato genotypes were used, including (ALABAD, REVERA, and ELMUNDO), The Spilt-Plot system was used in the randomized complete block design (RCBD) with three replicates per treatment, placing the foliar nutrients in the main plots and the genotypes in the secondary plots. To study the effect of genotype, foliar nutrient GS concentration and their interaction on the studied traits of two agricultural seasons. Treatments were sprayed with foliar nutrients and included three levels of 0, 30 and 60 g / 100 liters of water, The results of the results were summarized: The effect of the foliar nutrient CHLOROPHYLLGS was significant in most of the studied traits of the genotypes, where it achieved a concentration of 60 gm | 100 liters, The highest average of growth traits is obtained in the spring season and includes leaf area (186.52), leaf content of CHLOROPHYLL(42.33) spad for the spring season, and marketing yield (27.19) tons .hectares. The total plant yield is (629.25) g. As for the genotypes, the ALABAB genotype gave the highest average in the traits of the number of stems, leaf area, CHLOROPHYLL percentage, and the genotype in the number of tubers and the weight of the tuber to the total yield of the plant*.

Keywords: *genotypes; nutrient; productivity*.

1. INTRODUCTION

Potato (*Solanum tuberosum* L.) is one of the most important and widely used crops rich in nutrients and energy, it is a crop of the Solanaceae family, which includes more than 2000 species and 90 genera. Potato has gained great importance in various countries of the world and ranks fourth as a basic and economic crop after wheat, rice and corn it is a staple food in many countries of the world[1] ، [8]. Potatoes are high in carbohydrates, energy, vitamins, proteins, and some nutrients and minerals [10]. Each 100 g of potato tuber contains 7.1% carbohydrates, 79.80% water, 76% calories, 2.1% protein, 0.9% ash, 0.5% fiber and 0.1% fat, as well as in addition to low levels of potassium and magnesium [13]. The environment is a positive and important factor that helps the growth and productivity of genotypes and the yield is influenced by the cultivars and the cultivation area[11] . Modern methods of agriculture have led to an increase in production, but the excessive use of it has led to a decrease in the quality of the yield pollution of surface and groundwater, which has negatively affected the global climate[22].One of the most important agricultural problems facing potato cultivation is the lack of interest in choosing high-quality

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genotypes [20]. The area cultivated for potatoes in Iraq amounted to 31,786 dunums in 2016, with a production equivalent to 190,702 tons, and a yield of 5999.6 kg. Dunum-1 [6]. The interest in using organic nutrients has increased in recent times as one of the methods of modern agricultural trends in programs of nutrition vegetables and crops because they contain basic and necessary elements for growth [18].. Foliar nutrition is one of the most important means and good methods that provide plants with the necessary nutrients for better and faster growth and development compared to ground fertilization[3] . Potato genotypes greatly affect the quantity and quality of yield, and it is not possible to judge what is best for any genotype unless it was cultivated under close conditions[6] .Recently, the use of amino acids as foliar nutrients for plants has become widespread. As it plays a stimulating role for the plant because nitrogen is its main component and is available for absorption by the plant directly[5] . Studies have shown that 85% of the plant's need for nutrients can be given through foliar nutrition[18],[14]
the present study aims to evaluate the performance of five potato genotypes for the autumn and spring season and to study the effect of the foliar nutrient on the growth and yield traits of potatoes and their carbohydrate content.

2. MATERIALS AND METHODS

The study was conducted from September 2019 to April 2020 within Al- Yusufiya area, 20 km south of Baghdad. Five genotypes of potato were used, (Alabad , Revera and Elmundo) which are early maturing genotypes Soil physical and chemical properties were analyzed (Table 1).

Table (1) the chemical and physical traits of field soils

Units	ALYUSUFIYAH area		Traits	
	autumn season	spring season		
-	7.1	7.2	**pH**	
$dS.m^{-1}$	3.2	3.1	**Electrical conductivity (EC)**	
$mg.kg^{-1}$	17.1	17.5	**Calcium**	**Dissolved cation ions**
$mg.kg^{-1}$	3.4	3.7	**Sodium**	
$mg.kg^{-1}$	0.134	0.148	**Potassium**	
$mg.kg^{-1}$	98	104	**Total nitrogen**	
	1.2	1.3	**Organic matter**	
$gm.kg^{-1}$	540	550	**Sand**	**Soil separators**
$gm.kg^{-1}$	365	370	**Silt**	
$gm.kg^{-1}$	95	80	**Clay**	
	silty sandy loam	silty sandy loam	***Soil* Texture**	
$Kg.m^{-3}$	1.59	1.61	**Bulk density**	

Fertilization was conducted with decomposing organic fertilizer (poultry) before cultivation with tillage , in the amount of 2 tons.dunam $^{-1}$. The soil was leveling and smoothed with disc harrows and divided into

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three (replicates), each replicate includes 15 experiment units, and the area of each experiment unit is 6 m 2 (3 m × 2 m) which contains two furrows, and the distance between one furrow and another is 0.75 m. Tubers were cultivation in the upper third of the furrows with a depth of 10 cm, a distance of 1 m was left between the units Fertilization was conducted with NPK (20-20-20) fertilizer 300 kg.ha^{-1} for one time after cultivation and urea fertilizer by 300 kg.ha^{-1} in two batches, the first after emergence and the second one month after the first batch [14]. Seeds were cultivated from 9/13/2019 to 12/16/2019 in the autumn season and in the spring season from 1/15/2020 to 4/19/2020 and the tubers were cultivated on both sides of furrow , alternately at a distance of 0.30 m between one tuber and another (32 plants. experiment unit $^{-1}$). Factorial experiment conducted according to the Split - Plot system in Randomized complete block design (RCBD) by three replicates per treatment with tow factores. Firest factore is foliar nutrients with three levels (0, 30 , 60) g /100 L water in the main plots and second factore is five genotypes of potato in the secondary plots to study the effect of genotype and the concentration of the foliar nutriente (chlorophyll GS) and their interaction on the studied traits of two agricultural seasons. stems number of the plant:Relative Chlorophyll Content in Leaves (SPAD) was estimated at the time of flowering by means of a Chlorophyll Content Meter of the type CCM-200.[16].

3. RESULTS AND DISCUSSION

3.1 STEMS NUMBER PLANT^{-1}

The results in Table (2) indicate that there was a high significant response to the autumn season. The highest average for the trait in the alabad genotype was recorded at 3.70) stem. plant $^{-1}$ and the lowest average for the trait was recorded (3.02)stem .plant $^{-1}$ for Elmundo genotype ,While in the spring season a moral response occurred, the highest average of was recorded, (4.05) stem .plant $^{-1}$ for the alabad genotype and gave the lowest average reached (3.21) stem. plant $^{-1}$ for the Elmundo genotype, and this result is consistent with what was obtained by[25] the Interaction between the genotypes and the concentration of the foliar nutrient, it had a significant effect on the percentage of increase in the number of plant stems, where the alabad genotype gave the highest value for both seasons (3.95 and 4.15) stem .plant $^{-1}$ and the lowest rate was recorded in the Elmundo genotype of both seasons and reached (2.83 and 3.14) stem .plant $^{-1}$, This is in line with the findings of [24] [14],[2]

Table 2: The effect of genotype and the concentration of the leaf nutrient and their interaction on the number of stems for the autumn and spring seasons (stem.plant^{-1})

Season	genotype	Chlorophyll foliar nutrient concentration (GS)			Average
		0	30	60	
Autumn season	Alabad	3.68	3.46	3.94	3.75
	Revera	3.11	3.14	3.67	3.31
	Elmundo	2.83	3.05	3.16	3.01
	average	3.07	3.25	3.45	————
LSD 0.05	.* 0.12 :interaction ، *0.06 :foliar nutrient concentration ، *0.08 :genotype				
Season	genotype	0	30	60	المعدل
Spring season	Alabad	3.99	3.95	4.15	4.03

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	Revera	3.45	3.67	3.96	3.69
	Elmundo	3.12	3.14	3.36	3.20
	Average	3.39	3.50	3.61	---
LSD	.*0.24 :interaction ،*0.14 :foliar nutrient concentration ،*0.14 :genotype				

*P≤0.05

3-2 THE PERCENTGE OFCHLOROPHYLL IN LEAVES ((SPAD).

The results in Table (3) showed a highly significant response for both seasons where it gave the highest average for the trait in the alabad genotype of (41.42) Spad for the autumn season., The Elmundo genotype was recorded at the lowest average for the trait, which was (37.45) Spad. While in the spring season, the highest average of the trait in the alabad genotype was recorded, (42.33) Spad, and the lowest average was recorded for the trait, (38.47) spad for the Elmundo genotype. This result is consistent with those obtained by [25].The interaction between genotypes and the foliar nutrient concentration, it had a significant effect on the chlorophyll percentage in the leaves. As the alabad genotype gave the highest value of interaction for both seasons, it was (43.47 and 44.40) Spad, and it gave the lowest average of interaction in Elmundo genotype of the two seasons, which amounted to (28.29 and 37.65) spad for the chlorophyll percentage in the plant. This is due to the fact that the leaf nutrient chlorophyll Gs works to increase the availability of chlorophyll due to contains the molybdenum element and is considered one of the macro elements that act as a catalyst in the nitrates formation inside the plant and that the molybdenum element is responsible for the activity of enzymes dependent on it directly or indirectly through low levels on growth the plant and the presence of this element in the foliar nutrient, it works to save the enzymatic activity inside the plant, especially associated with nitrogen, phosphorus and potassium, and the most important elements in the formation of the chlorophyll molecule inside the leaf [19].

Table 3: The effect of genotype and concentration of foliar nutrient and their interaction on the chlorophyll percentage of in leaves (SPID) for the autumn and spring seasons

Season	**Genotype**	**Chlorophyll foliar nutrient concentration (GS)**			**Average**
		0	**30**	**60**	
Autumn season	Alabad	39.97	40.94	43.47	41.46
	Revera	36.82	40.43	34.37	40.17
	Elmundo	28.29	36.50	37.62	37.47
	Average	37.31	39.00	41.23	---
LSD 0.05	.0.69 :interaction ، 0.40 : foliar nutrient concentration ،0.41 :genotype				
Season	genotype	0	30	60	average
Spring season	Alabad	40.81	42.41	44.40	42.33
	Revera	39.32	40.84	43.26	41.14
	Elmundo	37.65	38.72	39.74	38.47
	Average	39.08	40.44	42.25	---
LSD 0.05	0.49 :interaction ، 0.31 : foliar nutrient concentration ، 0.11 :genotype				

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3-3 QUANITATIVE TRAITS OF THE YEILD

3-3-1 THE TUBERS NUMBER (tuber .plant $^{-1}$)

The results in Table (4) showed a high significant response for both seasons, where the highest average of the trait was recorded in the alabad genotype, reaching (6.80) tuber.plant $^{-1}$for the autumn season, and the Elmundo genotype recorded the lowest average (4.31) tuber.plant $^{-1}$,While in the spring season the alabad genotype gave the highest average reaching (7.14 tuber.plant $^{-1}$) and the lowest average reaching (4.22) tuber.plant $^{-1}$for the Elmundo genotype. The interaction between genotypes and of leaf nutrient concentration, it significantly affected the increase in the tubers number per plant, As the alabad genotype gave the highest value for both seasons, it was (7.24 and 7.42) tuber .plant $^{-1}$, and the Elmundo genotype recorded the lowest average for both seasons, reaching (4.05 and 3.96) tuber plant $^{-1}$, This may be due to the fact that the foliar nutrient has an important role where it contains important nutrients needed by the plant in bioprocesses as the sugars move from the places of their formation to the places of growth in the tuber and in an activate cycle many enzymatic reactions and then increase the growth expressed by increasing the dry matter and starch Increasing the absorption of nutrients that increase the photosynthesis efficiency in plant leaves due to its expansion, and this is why it increases the carbohydrates whose surplus reaches the tuber and is stored in the starch form [7] .

Table 4: The effect of genotype and concentration of foliar nutrient and their interaction on the tubers number .plant^{-1} for the autumn and spring seasons

Season	genotype	Chlorophyll foliar nutrient concentration (GS)			Average
		0	30	60	
Autumn season	Alabad	6.16	7.06	7.24	6.82
	Revera	5.95	6.15	6.22	6.11
	Elmundo	4.05	4.31	4.58	4.31
	Average	5.41	5.76	5.98	————
LSD 0.05	. 0.19 :interaction ، 0.11 :foliar nutrient concentration ، 0.12 :genotype				
Season	genotype	0	30	60	Average
Spring season	Alabad	6.74	7.26	7.42	7.14
	Revera	5.82	6.25	6.39	6.15

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	Elmundo	3.96	4.22	4.48	4.22
	Average	5.42	5.78	6.04	---
LSD 0.05	0.09 :interaction ، 0.05 :foliar nutrient concentration ، 0.04 :genotype				

*P≤0.05

3-3-2-TUBER WEIGHT (g)

The results in Table (5) showed the presence of a high significant response for both seasons, which recorded the highest average in the alabad genotype, reaching 96.56 g for the autumn season ,The Elmundo genotype was recorded the lowest average as it reached (62.06) while in the spring season it gave the highest average as it reached 102.28 g for the Revera genotype and the lowest average was (63.05) g for the Elmundo genotype. The interaction between the genotypes and the concentration of the foliar nutrient, the response was highly significant in increasing the tuber weight in the plant, where the alabad genotype gave the highest value for the autumn season, reaching (103.69) g .The Revera genotype was thin for the spring season and it reached (113.63 gm).The reason for this is due to the determinants of nutritional value that depend on several factors, including genetics, environmental conditions and nutrition, This greatly affects the genotypes, the strength of the vegetative parts of the plant, and their positive role in representing the carbohydrates that are synthesized inside the plant and stored in the tuber[12] ,This is in agreement with results obtained by [15] , [9].

Table 5: The effect of genotype and concentration of the foliar nutrient and their interaction on tuber weight (g.plant $^{-1}$) for the autumn and spring seasons

Season	**genotype**	**Chlorophyll foliar nutrient concentration (GS)**			**Average**
		0	**30**	**60**	
Autumn season	Alabad	89.98	96.03	103.69	96.56
	Revera	87.90	97.03	101.71	95.55
	Elmundo	59.05	61.40	65.73	62.06
	Average	76.06	81.34	86.49	
LSD 0.05	*0.17 :التداخل، *0.10 :foliar nutrient concentration ،*0.08 :genotype				
Season	genotype	0	30	60	Average
Spring season	Alabad	84.73	93.80	100.54	93.02
	Revera	92.51	100.69	113.63	102.28
	Elmundo	60.06	62.48	66.62	63.05
	Average	77.13	83.07	89.13	---
LSD 0.05	.*0.17 :*0.09 :foliar nutrient concentration ،*0.12 :genotype				

*P≤0.05

From the above, it is evident the importance of using the foliar nutrient (GS Chlorophyll) in appropriate concentrations that stimulate the bioactivities inside the plant and increase the effectiveness and activity of the meristemic, As it gave an increase in the vegetative total, increased of photosynthesis, and the transfer of processed materials in the leaves to the tubers, which helped increase the tuber weight in one plant, this

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is in agreement with [21]. . and through this study, we recommend planting the two genotypes alabad and Revera is also evident, because they are distinguished by the traits of the tubers nun ber, the tuber weight in two seasons of the study also, we suggest using the foliar nutrition nutrient (GS) at a concentration of 60 g per 100 liters by spraying 40 days after emergence .This is to give it the highest yield of the plant marketable, improve the yield characteristics and maintain the highest level of crop productivity and produce a healthy yield with the best possible quality.

4. CONCLUSIONS

deduce from the above study, the importance of genotypes and their displayed effect on the studied traits in a significant way. The effect of the leaf nutrient chlorophyll GS was significant in improving the vegetative, quantitative and qualitative characteristics of potato tubers, and positively in those traits, as the concentration of 60 g / 100 L gave the best results in affecting some characteristics of the vegetative growth, quantitative and qualitative of the tubers

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