Al-Furat Journal of Innovations in Agricultural Sciences (FJIAS)

EVALUATION OF THE PERFORMANCE OF THREE POTATO GENOTYPES UNDER THE BIOLOGICAL AND ORGANIC FERTILIZATION

Marwa Hasan Jaralla[1*] , Jassim Jawad Jader [1]

[1] Department of Plant Production Techniques / Al-Musayyib Technical College / Al-Furat Al-Awsat Technical University

* Corresponding author E-mail: alnuaimid92@atu.edu.iq

Received (20/09/2025), Received in revised form (30/10/2025)
Accepted (10/11/2025), Available online (31/12/2025)

FJIAS 2025, 1(4): 35-45

Abstract. *This study was carried out during the winter season of 2020 to evaluate the performance of three genotypesof potato (Solanum tuberosum L.) with the effect of biological ferttilizer(Mycorrhizae(MY) and Azotobacter(AZ))and organic ferttilizer(chickens Residual (I)) the included of eight levels of ferttilizer(0,MY,AZ,I,(MY+AZ),MY*I,AZ*I,(MY+AZ)*I) and the genotypeswere (HERMOSA, SIFRA and ALVERSTONE). the Potato tubers were planted in Babylon Governorate / Al-Musayyab project area using a factorial experiment according to the Randomized Complete Block Design (RCBD) with three replications to study the characteristics of genotypes growth and yield. the study showed significant differences for all the studied traits among genotypes , fertilizer treatments and the interaction among genotypes and fertilizer treatments.the treatment (organic (I) with HERMOSA variety) gave the highest average in plant height (69.85) cm , as compared to (control with ALVERSTONE variety) treatment which gave the lowest average (41.87) cm . while the treatment (organic (I) with HERMOSA variety) and (organic (I) with (MY+AZ) with HERMOSA variety) gave the highest average in leaf area of the plant (8160 and 7918) $cm^2.plant^{-1}$respectively , as compared to (control with ALVERSTONE variety) treatment which gave the lowest average (3514) $cm^2.plant^{-1}$. while the treatment (control with SIFRA variety) gave the highest average in The relative content of chlorophyll in leaves (26.74) , as compared to (azotobacter with ALVERSTONE variety) treatment which gave the lowest average (11.66). while The treatment ((MY+AZ) with ALVERSTONE variety) gave the highest average in Marketable tuber weight (161.39) gm , as compared to ((MY+AZ)*I with HERMOSA variety) treatment which gave the lowest average (75.20) gm . while The treatment (organic (I) with HERMOSA variety) gave the highest average in Percentage of dry matter in tubers (67.70) (%), as compared to ((MY+AZ)*I with ALVERSTONE variety) treatment which gave the lowest average (22.92) (%).while The treatment (organic (I) and Azotobacter with ALVERSTONE variety) gave the highest average in Total yield per plant (802.20) g. $plant^{-1}$, as compared to (control with SIFRA variety) treatment which gave the lowest average (221.90) g. $plant^{-1}$. the aim of study is to find the best varety was ALVERSTONE and the AZ*I best treatment.*

Keywords: *Mycorrhizae, Azotobacter , Organic fertilizer, potato .*

1. INTRODUCTION

The potato (*Solanum tuberosum* L.) is one of the most important and most widely used crops rich in nutrients and energy. It is one of the crops of the Solanaceae family, which includes more than 2000 species and 90 genera. It is of great importance in various countries of the world and ranks fourth as a basic and economic crop after. Of wheat, rice, and corn [1]. Potatoes contain a percentage of vitamins, proteins, energy, carbohydrates, salts and some nutrients [2]. the area allocated for the cultivation of this crop in Iraq in 2019 amounted to about (74) thousand dunums, and its total production amounted to (426) thousand tons [3]. the composting process is one of the important means to increase the yield of fruits and improve their physical properties. Its purpose is to reduce the use of chemical fertilizers and move towards clean (sustainable) agriculture. Those concerned are now turning to the use of bio-fertilizers for their role in increasing the growth and development of plants and inhibiting the growth of pathogenic microorganisms, and at the same time contribute to resisting various stress conditions [4] and [5]. the organic fertilizer had a significant effect on the growth characteristics and yield of potatoes in comparison with the use of the same nitrogen level of chemical fertilizers [6]. the use of natural materials such as organic fertilizers and bio fertilizers is a suitable alternative to chemical fertilizers [7]. the random use of chemical fertilizers results in several problems, but the use of organic and biological fertilizers reduces these problems [8]. There are many ways that lead to increasing production and improving its quality, including the selection of genotypeswith good specifications and high production, which is one of the most important determinants of productivity [9]. and affects the genotypesin general, environmental and genetic overlap, as the genetic nature of the cultivated variety effectively affects the Yield quantity and quality [10]. the use of natural materials such as organic fertilizers and bio fertilizers is a suitable alternative to chemical fertilizers [7].

2. MATERIALS AND METHODS:

three genotypesof potato (Solanum tuberosum L.) (HERMOSA, SIFRA and ALVERSTONE) with the effect of biological ferttilizer(Mycorrhizae(MY) and Azotobacter(AZ))and organic ferttilizer(chickens Residual (I)) the included of eight levels of fertilizer (0,MY,AZ,I,(MY+AZ),MY*I,AZ*I,(MY+AZ)*I). The genotypeswere planted in one of the agricultural fields in the Al-Musayyab project area, which is 42 km north from the center of Babylon Governorate, where they were obtained from Al-Saad stores in Yusufiyah / Baghdad. Tuber planting began on 4/2/2020 and harvested on 9/5/2020 .

the land was prepared for cultivation by plowing, then smoothing it with disc harrows, leveling it and dividing it into three sectors for each experiment, where the planting was done on a meadow with a length of 2 m, a width of 1 m in the meadow, and the distance among a mead and another 1 m, with 2 meadows for each experimental unit which area is 4 m^2 (the length of the unit is 2 m and width unit 2 m), leaving a space of 1 m among the experimental units. The tubers were planted for each plant 8 tuber on one side of the meadow with a distance of 20 cm among tuber and another where the number of tubers for one experimental unit amounted to 16 tuber.

A factorial experiment was carried out according to the RCBD (Randomized complete block design) (genotypesand fertilization, which includes organic ferttilizer(ITALPOLLINA poultry) and biological fertilizer (Mycorrhizal fungi (MY) and Azotobacter (AZ))), and with three replications, all soil and crop service operations were conducted. Ferttilizeraccording to the recommendations for the potato crop. DAP mineral fertilizer was added before planting. Also, urea fertilizer was added by 300 kg. ha-1 in two batches, the first after emergence and the second one month after the first batch [11]. The transactions were randomly distributed within each replicate. The results were analyzed according to the statistical program GENSTATE 12 and using the EXCEL program, and the means were compared according to the least significant difference test (LSD) at a probability level of 0.05 [12]. The potato tubers were planted in soil of known characteristics as in Table (1).

Table (1) Some physical and chemical properties of the soil of the experiment site

Measured characteristic	Unit of measure	Value
Electrical conductivity (EC)	**dSm^{-1}**	2.4
pH	---	7.23
Ready Nitrogen (N)	mg kg^{-1} soil	25
Ready phosphorous (P)	mg kg^{-1} soil	4.21
Ready potassium (K)	mg kg^{-1} soil	111.01
Organic matter (OM)	g kg^{-1}	7.5
Calcium carbonate (CaCO3)	$g.kg^{-1}$	292.1
Dissolved calcium (Ca+2)	mEq L^{-1}	14.22
Dissolved magnesium (Mg+2)	mEq L^{-1}	6.22
Dissolved sodium (Na+)	mEq L^{-1}	4.21
Dissolved bicarbonate (HCO3)	mEq L^{-1}	1.01
Dissolved chlorine (Cl)	mEq L^{-1}	21.03
Dissolved potassium (K)	mEq L^{-1}	3.22
Volumetric moisture content at field capacity	cm^3 cm^{-3}	0.303
Volumetric moisture content at permanent wilting point	cm^3 cm^{-3}	0.140
Soil separated sand	2 g kg^{-1} soil	464
The silt	2 g kg^{-1} soil	336
Clay	2 g kg^{-1} soil	200
Tissue class		loam

studied traits

Plant height (cm):

It was measured from the area of contact of the stem with the soil to the the highest peak of five plants selected from each experimental unit of the middle rice and taken the average.

The leaf area of the plant (cm^2 . $plant^{-1}$):

It was calculated by multiplying the average surface area of the leaf (cm^2) by the number of leaves per plant For five plants. Where the surface area of the leaf was measured by (PLANNIMETER) device .

The relative content of chlorophyll in leaves (SPAD):

The percentage of chlorophyll in potato leaves at the time of flowering was estimated by a Chlorophyll Content Meter type CCM - 200 plus by taking the reading for five plants from each experimental unit and then taking the average and it was measured in SPAD units [13] and [14].

Number of marketable tubers per plant:

It was calculated for five plants randomly taken from each experimental unit and the average was extracted after excluding damaged and distorted tubers with a diameter of less than 2.5 cm [15].

Marketable tuber weight (gm):

The weight of tubers of the previous five plants was measured and divided by the number of tubers per experimental unit.

Percentage of dry matter in tubers (%):

Pieces of tubers were taken and weighed, then dried in an electric oven at a temperature of 70°C, until the weight was stable, as [16]. After the weight was stable, it was taken out of the oven and weighed and the percentage of dry matter in the tubers was calculated according to the following equation:

$$\text{The percentage of dry matter in the tubers } = \frac{\text{Dry weight of tubers}}{\text{Fresh weight of tubers}} * 100\%$$

the total yield per plant (gm. plant^{-1}):

It was calculated by multiplying the average number of tubers for the previous five plants * the average tuber weight for each experimental unit.

3. RESULTS AND DISCUSSION

The results showed that there were significant differences among the genotypes, and this indicates the difference in the genetic structure of each varety, which led to different responses among the genotypes. and showed significant differences among the fertilizer treatments, because the mixing of these treatments has enhanced the content of the soil with most of the elements needed by the plant, which reflected positively on the height of the plant. and showed significant differences in the interaction among fertilizer treatments and varieties. This difference among the response of genotypesto fertilizers is due to the variation of the genetic structure of the variety and its response to fertilizers and the type of these fertilizers.

Plant height (cm):

From table(2) below The HERMOSA cultivar was superior as it gave the the highest average for plant height of 60.79 cm, followed by ALVERSTONE (57.32) cm, while SIFRA was the shortest, reaching 52.18 cm. It is noted that the biological and organic ferttilizer(MY+AZ)*I gave the the highest rate of plant height of (64.49) cm. Significant differences were also found among the interactions of genotypes with fertilization, as the interaction among organic fertilizer and varety HERMOSA (H*I) achieved the the highest plant height of (69.85) cm, while the interaction among ALVERSTONE and HERMOSA genotypes with bio and organic ferttilizer(MY+AZ)*I gave the the highest average plant height was (68.91) cm and (68.63) cm respectively. While the interaction treatment among the control (0) and ALVERSTONE varety gave the the lowest average plant height reached (41.87) cm. We note that there are significant differences among the genotypes, and this indicates the difference in the genetic structure of each varety, which led to different responses among the genotypes. We note that there are significant differences among the fertilizer treatments, because the mixing of these treatments has enhanced the content of the soil with most of the elements needed by the plant, which reflected positively on the height of the plant. The results agree with [17] when studying the effect of three types of Mycorrhizae on the growth and yield of potatoes. The results of the study showed that Glomus Mosseae caused an increase in plant height, fresh and dry weight of the shoot and an increase in the number of tubers with an increase in absorption rates of both elements of phosphorous. and nitrogen.

Table (2) average of plant height (cm) for potato genotypes and the biological and organic ferttilizer

Ferttilizertreatments	Genotypes			Ferttilizertreatments
	A	S	H	
0	41.87	45.47	52.33	46.56
MY	47.47	43.67	53.67	48.27
AZ	57.93	51.07	52.16	53.72
(MY+AZ)	54.83	48.93	65.70	56.49
I	53.00	59.00	69.85	60.62
MY*I	66.53	54.47	67.40	62.80
AZ*I	68.00	58.87	56.60	61.16
(MY+AZ)*I	68.91	55.93	68.63	64.49
LSD0.05	1.42*			0.82*
genotypes average	57.32	52.18	60.79	
lsd0.05 (Genotypes)	0.50*			

the leaf area of the plant (cm^2 . plant^{-1}):

From table (3) below it was found that there were significant differences among the average leaf area of the plant (cm^2 $plant^{-1}$) by the effect of biological and organic fertilizers. Where the varety (HERMOSA) outperformed by giving the the highest leaf area of (6759.25) cm^2. $Plant^{-1}$, followed by the varety SIFRA, which gave (5773.75) cm^2 $Plant^{-1}$, while ALVERSTONE varety was the least in number, reaching (32.83) cm^2. $Plant^{-1}$. As for the biological and organic fertilization, plants of treatment AZ*I (Azotobacter with organic fertilization) excelled, followed by treatment I (organic) in giving the the highest average of (6891.67 and 6837.67) cm^2 $Plant^{-1}$, which does not differ significantly with it, while the control treatment plants gave the the lowest mean of (4936.67) cm^2 $Plant^{-1}$, while plants treated with interaction (I) with varety (HERMOSA) and ((MY+AZ)* I with varety (HERMOSA) gave the the highest mean leaf area of (8160.00 and 7918.00) cm^2. $Plant^{-1}$, while gave the comparison treatment with ALVERSTONE varety the lowest average reached (3514.00) cm^2 $Plant^{-1}$. We note that there are significant differences among the genotypes, and this indicates the difference in the genetic structure of each varety, which led to different responses among the genotypes. We note that there are significant differences among the fertilizer treatments, because the mixing of these treatments has enhanced the content of the soil with most of the elements needed by the plant, which reflected positively on the height of the plant. The height of the plant is related to the increase in the leaf area, as the increase in the nodes on the stem leads to an increase in the number of leaves and thus the leaf area of the plant increases.

Table (3) average leaf area per plants (cm^2 $plant^{-1}$) for potato genotypes and the biological and organic ferttilizer

Ferttilizertreatments	Genotypes			Ferttilizertreatments
	A	S	H	
0	3514.00	4219.00	7077.00	4936.67
MY	4604.00	5707.00	7541.00	5950.67
AZ	5762.00	4837.00	4413.00	5004.00
(MY+AZ)	5367.00	5310.00	4595.00	5090.67
I	5147.00	7206.00	8160.00	6837.67
MY*I	5498.00	6292.00	7540.00	6443.33
AZ*I	7766.00	6079.00	6830.00	6891.67
(MY+AZ)*I	5499.00	6540.00	7918.00	6652.33
LSD0.05	269.00*			155.30*
genotypes average	5394.63	5773.75	6759.25	
lsd0.05 (Genotypes)	95.10*			

the relative content of chlorophyll in leaves (SPAD):

From Table (4), the results of the relative content of chlorophyll in leaves showed that there were significant differences among the averages of the relative content of chlorophyll in leaves due to the effect of biological and organic fertilizers. Where the varety SIFRA outperformed by giving the the highest reading of the relative content of chlorophyll in the leaves reached (21.12), followed by the varety HERMOSA, which gave (18.49), while the varety ALVERSTONE was the least in number, reaching (14.43). As for the biological and organic fertilization, the plants treated ((MY+AZ)*I) which gave the the highest average of (20.99), while the plants treated with (I) the the lowest average was (15.50). Significant differences were also found among the interactions of the genotypes with the fertilization. The interaction among the comparison treatment (0) with the varety (SIFRA) achieved the the highest mean for the relative content of chlorophyll in leaves that amounted to (26.74), while the interaction treatment among Azotobacter with ALVERSTONE gave the the lowest average reached (11.66). We note that there are significant differences among the genotypes, and this indicates the difference in the genetic structure of each varety, which led to different responses among the genotypes.

Table (4) average relative content of chlorophyll in leaves for potato genotypes and the biological and organic ferttilizer

Ferttilizertreatments	Genotypes			Ferttilizertreatments
	A	S	H	
0	13.54	26.74	18.37	19.55
MY	13.61	19.41	21.40	18.14
AZ	11.66	17.15	18.87	15.89
(MY+AZ)	13.00	22.94	17.80	17.91
I	13.28	17.27	15.96	15.50
MY*I	14.05	19.84	17.34	17.08
AZ*I	17.36	21.51	18.29	19.05
(MY+AZ)*I	18.92	24.12	19.91	20.99
LSD0.05	0.64*			0.37*
genotypes average	14.43	21.12	18.49	
lsd0.05 (Genotypes)	0.23*			

Number of marketable tubers per plant:

From Table (5) the results of Number of marketable tubers per plant showed that there were significant differences among the average number of marketable tubers per plant by the effect of biological and organic fertilizers. Where the HERMOSA varety outperformed by giving the the highest reading of the number of marketable tubers per plant which reached (4.91), followed by ALVERSTONE varety which gave (4.14), while the SIFRA variety was the least numbered reaching (3.53). As for the biological and organic fertilization, plants treated with (I) outperformed with the mycorrhizal (MY), which gave the the highest average of (4.89), while the comparison treatment (0) gave the the lowest average of (3.45). Significant differences were also found among the interactions of the genotypes with the fertilization. The interaction among the treatment of organic (I) and the bio-fertilizer (Azotobacter + Mycorrhizal) (MY+AZ)*I with the varety (HERMOSA) achieved the the highest average for the number of marketable tubers. per plant, it was (5.94). While the interaction among the comparison treatment (0) and the varety SIFRA gave the the lowest mean of (2.20). We note that there are significant differences among the genotypes, and this indicates the difference in the genetic structure of each varety, which led to different responses among the genotypes. We note that there are significant differences among the fertilizer treatments, because the mixing of these treatments has enhanced the content of the soil with most of the elements needed by the plant, which reflected positively on the height of the plant. The results are the included with what [18] indicated to the role of Azotobacter and Phosphobacter bacteria in reducing the level of NPK mineral fertilizer added to 70.05 of the recommended ratio with an increase in yield, size of tubers and number of tubers, especially when using the 70.05 level compared to the 100% level.

Table (5) average number of marketable tubers per plant for potato genotypes and the biological and organic ferttilizer

Ferttilizertreatments	Genotypes			Ferttilizertreatments
	A	S	H	
0	3.22	2.20	4.94	3.45
MY	4.59	3.25	3.73	3.86
AZ	3.53	3.15	4.51	3.73
(MY+AZ)	3.23	4.34	4.86	4.15
I	3.60	3.93	5.37	4.30
MY*I	4.83	4.36	5.47	4.89
AZ*I	5.19	3.77	4.47	4.48
(MY+AZ)*I	4.93	3.22	5.94	4.69
LSD0.05		0.11*		0.07*
genotypes average	4.14	3.53	4.91	
lsd0.05 (Genotypes)		0.04*		

Marketable tuber weight (gm):

From Table (6) the results of Marketable tuber weight (gm) showed There are significant differences among the average marketable tuber weight (gm) by the effect of biological and organic fertilizers. Where the ALVERSTONE varety outperformed by giving the the highest reading of the marketable tuber weight amounted to (134.93) g, followed by the SIFRA varety, which gave (103.93) g, while the HERMOSA varety was the least in number, reaching (85.10) g. As for the biological and organic fertilization, the plants of the treatment (MY+AZ)*I outperformed, as it gave the the highest average of (116.20) g, while the mycorrhizal treatment gave the the lowest average of (98.30) g. Significant differences were also found among the interactions of genotypes with fertilization. The interaction among the treatment (MY+AZ) and the varety (ALVERSTONE) achieved the the highest mean of the marketable tuber weight that reached (161.39) g. Whereas, the interaction among treatment (MY+AZ)*I with the variety HERMOSA gave the the lowest mean of (75.20) g. The results are in line with [19], where the researchers conducted a study to find out the response of potato seedlings to inoculation with the mycorrhizal fungus Glomus etunicatum and Glomus fistubsum with Bacillus subtilis.

Table (6) average marketable tuber weight (gm) for potato genotypes and the biological and organic ferttilizer

Ferttilizertreatments	Genotypes			Ferttilizertreatments
	A	S	H	
0	129.98	100.84	84.75	105.19
MY	100.81	106.42	87.68	98.30
AZ	113.70	104.11	91.00	102.94
(MY+AZ)	161.39	95.88	85.32	114.20
I	125.13	100.52	90.65	105.43
MY*I	150.43	87.18	83.16	106.92
AZ*I	154.67	106.39	83.04	114.70
(MY+AZ)*I	143.33	130.07	75.20	116.20
LSD0.05		2.17*		1.25*
genotypes average	134.93	103.93	85.10	

lsd0.05 (Genotypes)	0.77*	

Percentage of dry matter in tubers (%):

From Table (7) the results of Percentage of dry matter in tubers (%) showed There are significant differences among the average Percentage of dry matter in tubers (%) by the effect of biological and organic fertilizers. Where the HERMOSA varety outperformed by giving the the highest reading of the percentage of dry matter in the tubers amounted to (43.15) (%), followed by ALVERSTONE varety, which gave (36.88) (%), while the SIFRA variety was the least in number as it reached (36.50) (%). which is not significantly different from ALVERSTONE varety. As for the biological and organic fertilization, the plants of the treatment (MY *I) outperformed, as it gave the the highest average of (50.51) (%), while the mycorrhizal treatment gave the the lowest average of (32.05) (%). Significant differences were also found among the interactions of the genotypes with the fertilization, the interaction among the treatment of organic fertilizer (I) with the varety (HERMOSA) achieved the the highest average of the percentage of dry matter percentage in the tubers reached (67.70) (%). While the interaction among treatment (MY+AZ)*I with ALVERSTONE variety gave the the lowest average amounted to (22.92) (%). The results agree with what was mentioned by [20], where it was found that inoculation of potatoes with Azotobacter and phosphate-degrading bacteria together improves growth characteristics, dry matter, carbohydrate content, and then potato productivity.

Table (7) average percentage of dry matter in tubers (%) for potato genotypes and the biological and organic ferttilizer

Ferttilizertreatments	Genotypes			Ferttilizertreatments
	A	S	H	
0	32.37	35.20	55.07	40.88
MY	35.70	27.87	32.59	32.05
AZ	38.20	33.20	28.87	33.42
(MY+AZ)	52.73	24.26	35.63	37.54
I	30.82	26.34	67.70	41.62
MY*I	47.46	65.71	38.35	50.51
AZ*I	34.83	44.60	25.22	34.88
(MY+AZ)*I	22.92	34.85	61.74	39.84
LSD0.05		1.77*		1.02*
genotypes average	36.88	36.50	43.15	
lsd0.05 (Genotypes)		0.63*		

The total yield per plant (gm plant^{-1}):

From Table (8) the results of The total yield per plant (gm plant^{-1}) showed There are significant differences among the average The total yield per plant (gm plant^{-1}) by the effect of biological and organic fertilizers. Where the ALVERSTONE varety outperformed by giving it the the highest reading of the trait of the total yield of one plant which reached (561.36) g. Plant^{-1}, followed by the varety HERMOSA, which gave (416.18) g Plant^{-1}, while the varety SIFRA was the least in number as it reached (363.33) g plant^{-1}. As for the biological and organic fertilization, plants treated with organic fertilizer (I) outperformed with Azotobacter, which gave the the highest average of (524.87) g Plant^{-1}, followed by plants treated ((MY+AZ)*I) which gave (523.73) g plant^{-1}, which is not significantly different from the first treatment. Followed by plants treated with organic fertilizer (I) with (Mycorrhizae), which gave (520.57) g Plant^{-1}, which is not significantly different from the first treatment, while plants from the control treatment gave the the lowest average amounted to (352.83) g plant^{-1}. Significant differences were also found among the interactions of genotypes with fertilization, the interaction among treatment (AZ*I) with ALVERSTONE varety achieved the the highest mean for the characteristic of the total yield of one plant reached (802.20) g

plant^{-1}. Whereas, the interaction among the comparison treatment with SIFRA varety gave the the lowest average amounted to (221.90) g plant^{-1}. the results of the study agree with ([21], [22], [23]), who indicated that the type and level of the added fertilizer affects the physical and chemical properties of the soil and thus encourages vegetative growth, which is reflected in the increase in yield and its components. We note that there are significant differences between the nutritional treatments, because the mixing of these treatments has enhanced the content of the soil with most of the elements needed by the plant, which reflected positively on the total yield of one plant (gm plant^{-1}).

Table (8) average of the total yield per plant (g plant-1) for potato genotypes and the biological and organic ferttilizer

Ferttilizertreatments	Genotypes			Ferttilizertreatments
	A	S	H	
0	418.30	221.90	418.30	352.83
MY	463.00	345.50	327.40	378.63
AZ	401.00	327.70	410.70	379.80
(MY+AZ)	522.30	416.40	414.60	451.10
I	450.50	395.30	486.50	444.10
MY*I	727.00	380.10	454.60	520.57
AZ*I	802.20	401.50	370.90	524.87
(MY+AZ)*I	706.60	418.20	446.40	523.73
LSD0.05	16.38*			9.46*
genotypes average	561.36	363.33	416.18	
lsd0.05 (Genotypes)	5.79*			

4. CONCLUSIONS

the superiority of ALVERSTONE varety over the two genotypes HERMOSA and SIFRA in the trait (total yield per plant (g plant^{-1}). the fertilizer treatment (AZ*I) was superior in the total yield of one plant (gm plant^{-1}), which is not significantly different from the treatment (MY+AZ)*I in the same previous trait, as well as the treatment (AZ*I) in leaf area. per plant (cm^2 plant^{-1}) . the interaction treatment among fertilizer (AZ*I) and ALVERSTONE varety was superior in the total yield per plant (g plant^{-1}).

We suggested the cultivation of the ALVERSTONE varety due to its characteristics of yield and characteristics . and Using the fertilizer combination (AZ*I) with other genotypesdue to its superiority in the characteristics of the yield and its components.

5. REFERENCES

[1] Bowen, W.T . 2003. Water productivity and potato cultivation in J.W. Kijhe, R.Barke, and D. molden. Water productivity in Agriculture: limits and opportunities For improvement CAB, International P: 229 -238.

[2] FAO Stat .2010. Food and Agriculture Organization Of The United Nations, New Light on a Hidden Treasure, edited by Fao. Rome (Italy) .

[3] Annual Statistical Collection . 2019. Crop and vegetable production report for the year 2019 , central Statistical Organization , Agricultural Statistics Directorate, The Ministry of Planning , Baghdad, Iraq .

[4] Mahanty, T., S. Bhattacharjee, M. Goswani, P. Bhattacharyya, B. Das, A. Ghosh and P . Tribedi. 2016. Bio fertilizers: a potential approach for sustainable agriculture development, Review Article, Environ Sci. Pollut Res., 1–22.

[5] Tomer, S., D. C. Suyal and R . Goel. 2018. Biofertilizers: A timely approach for sustainable agriculture, Plant Microbe Interaction., 17 : 375 – 195.

[6] Merghany, M. M . 1998. Effect of irrigation systems and regimes in relation to farmyard manure levels on potato yield and quality in new reclaimed sandy soils, Annals of Agric. Sci. Moshtohor, 36 (2),997-1014.

[7] El-Akabawy, M. A . 2000. Effect of some bio fertilizers and farmyard manure on yield and nutrient uptake of Egyptian clover grown on lomy sand soil, Egypt, J. Agric, Res. 78 (5) .

[8] Zaghloul, R. A . 2002 . Bio ferttilizerand organic manuring efficiency on growth and yield of potato plants, Recent Technologies in Agriculture. Proceedings of the 2nd congress, Faculty of Agriculture, Cairo University.

[9] Taha, F . 2007 . Effect of potassium fertilizer and soil coverage in three cultivars of Solanum tuberosum L planted in Basrah Governorate, Master's Thesis in Agricultural Sciences, Horticulture Department, College of Agriculture, University of Basra, Iraq.

[10] Kumar, A., M. S. Dahiya and R. D . Bhutani. 2000 . Performance of brinjal (Solanum melongena L.) genotypes in different environments of spring summer season, Haryana J. Hort, 11: 63-67.

[11] Isho, K., H. Hassan, S. Touma and S . Hussein. 2009 . Effect of different levels of nitrogen fertilizer on potato growth and productivity, Damascus University, Journal of Agricultural Sciences, 25 (1): 15-28 .

[12] Al-Rawi, M. and A . K. Allah 2000 . Design and analysis of agricultural experiments. Faculty of Agriculture, University of Al Mosul, Iraq.

[13] Minnotti, P. L., D. Halseth and J . Sieczka. 1994. chlorophyll measurement to assess the nitrogen status of potato varieties. Hortscience, 29(12): 1497-1500.

[14] Jemison, J. and M . Williams. 2006. potato-grain study project report water quality office, university of maine, cooperation extension.

[15] Al-Jubouri, K . 1995 . Effect of adding foamed sulfur and phosphorous on growth, yield and nutrient content of potato plants, Master Thesis, faculty of Agriculture, Baghdad University.

[16] Al-Sahhaf, F . 1989. Applied Plant Nutrition. House of Wisdom Press, Ministry of Higher Education and Scientific Research, Baghdad University.

[17] Gong, Z ., W . Qing, Z. Rong and W.R . Jun. 2001. Effect of different VA mycorrhiza fungi on the growth of potato, Acto Agriculture, Boreull Sinica.

[18] Khurana,S.C and R.D. Bhutani. 2005. Effect of FYM, biofertilizer and inorganic fertilizer on potato, Potato Journa, 32 (3) :242-242.

[19] Vosatka, M and M . Gryndler. 2000. Response of micropropagated potatoes transplanted to peat media to post-vitro inoculation with arbuscular mycorrhizal fungi and soil bacteria, Applied Soil Ecology. 15 (2): 145-152.

[20] Mahendran, P. and N . Kumar. 1998. Effect of bio fertilizers on tuber yield and certain quality parameters of potato cv. Kufri jyoti, South Indian Horticulture, 46(1-2), 47-48.

[21] Al-Hassan, H . 2008. The effect of organic ferttilizeron soil fertility properties and potato productivity in the conditions of Al-Qusayr area in Homs governorate, Master Thesis, College of Agricultural Engineering, Al-Baath University, Syria.

[22] Al-Mohammadi, O . 2009. The use of animal fertilizers and hay as a method for organic farming and its effect on the growth and production of tomatoes, PhD thesis, Horticulture department, College of Agriculture - University of Baghdad.

[23] Al-Zahawi, S . 2007. The Effect of Different Organic Fertilizers and Soil Covering on Growth, Production and Quality of Potato (Solanum tuberosum L.), Master Thesis, Horticulture department, faculty of Agriculture, Baghdad University, Iraq.