

**STATISTICAL ANALYSIS OF SOIL CHEMICAL PROPERTIES
In Al-Ansar district in Salah Al-Din Governorate
Republic of Iraq**

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Abstract

This study was conducted on the cultivation of the grape crop, which is characterized by Al-Ansar sub-district of Salah Al-Din Governorate. This area is characterized by the peculiarity of its cultivation and production of this crop for a long time. The area of agricultural land allocated for this crop is (23) thousand dunums, and it includes (7) sectors distributed sparsely and with different agricultural areas among them, as well as different in their production, as shown through the study. It was summarized to research on two provinces as a model for other provinces, geographical factors. Both natural and human have a distinct role in the production of this crop. Of the natural factors, light, temperature, radiation, humidity, rain, wind, frost, and dust were studied. In addition to other natural factors related to soil and water on the physical and chemical sides. The most important diseases affecting grapes and methods of their treatment were listed in one of the chapters of the treatise. Concentrations of negative anions (chloride, sulfate, bicarbonate, carbonate, nitrate, phosphate, electrical conductivity, total dissolved salts), positive cations, and other characteristics (calcium, magnesium, sodium, ionic exchange capacity, soil reaction function, organic matter). Field and recent information was distributed to (280) farmers, not counting the information and classifying it accurately about the grape crop. The laboratory aspect is very clearly visible by reviewing the results. Soil and water samples collected from the study area were analyzed in the soil and water laboratories. The statistical aspect is also clearly prominent, as the experimental design method was used for the first time, from which (complete random sectors) were chosen. In addition to that, other statistical coefficients such as correlation coefficients to clarify the nature of the relationship between the study factors. We can point out the most important and prominent results that have been reached, which are :Through what has been discussed, it was found that the cultivation of grapes in Iraq dates back to a very ancient time. In addition to its nutritional benefits, it was found that it has great medical benefits, as indicated by ancient carvings and modern laboratory analyzes, The process of propagating grapes is done in two ways, either by layering or by cuttings, which is the most successful as it preserves the strain and quality of grapes. Chemical properties also have the most prominent goal in influencing the amount of production and its distribution, especially (calcium and magnesium salts, organic matter, sulfates, dissolved salts).

key words: soil chemical properties, Salah Al-Din.

Introduction:

The relationship between soil and its characteristics and agriculture is a very close relationship due to the clear impact on agricultural production, as its characteristics (degree of salinity, texture, composition, containment of organic matter, etc.) affect the nature of agricultural activity and control the type of plant grown anywhere on the surface of the earth. This in turn leads to an attempt by the researcher to know the impact of these characteristics by studying them carefully and knowing the negatively affecting cases and the way to treat them with useful suggestions. The study of these characteristics, which depends on its own information taken from scientific laboratories, examination centers and field studies, is of great importance in making short, medium and long-term predictions. Also, field and spatial applications, especially in the areas of determining irrigation methods and special needs in the distribution of agriculture in light of the requirements and data of the available soil characteristics. The aim is to ensure security and caution in maintaining the safety of production, and given the many variables that characterize the study area, including fertile soil and large areas of arable land, as well as irrigation projects, making it an agricultural area of great economic importance in the production of grape crops of various types of high quality. The researcher pushed the study of the impact of soil characteristics on the cultivation of this crop. Also, interest in soil is the basis of development, as there is a quality that distinguishes its grains.

Research problem:

-What is the size of the impact of soil characteristics in the study area and what is its impact on the cultivation and production of grapes?

Research Hypothesis:

-There is a clear effect of soil characteristics on the fluctuation of grape production.

The importance of research:

The fruit included in the study is a major food fruit in the country, as it ranks first among the types of fruit in terms of the number of trees, as it constituted (34%) of the total fruit trees in the country¹, and for this reason it occupies a great importance, and the location occupied by the study area The proximity to the capital, Baghdad, has increased its importance due to the influence of the capital on it in economic activities, and this importance was not new, but rather dates back to long periods, as the study area is linked with the city of Baghdad by a strategic road, as well as the Tigris River was exploited in economic activities, especially transportation, as well For its association with the neighboring human settlements in paved ways². The importance of the subject also emerges from the fact that the study area is the vineyard, which occupies the first place in the number of trees in the Dujail district, as the largest number of trees is concentrated in it and by a large percentage very. ³ In addition to the great expansion in its cultivation in recent years, due to its advantages that helped in this expansion.

In addition to the aforementioned importance, knowing the impact of soil elements on the productivity of this fruit is of great importance, and therefore it was necessary to know the impact of these elements by studying them in order to know the characteristics of the soil and contribute

¹ Ministry of Planning and Development Cooperation, Central Agency for Statistics and Information Technology, Directorate of Agricultural Statistics, Comprehensive Agricultural Census Report for 2016, Baghdad, 11/15/2019.

² Taha MUSAHEB Hussein Al-Khazraji, Spatial Distribution of Urban Land Uses for Dujail District Center, Master Thesis (unpublished), College of Education / Ibn Rushd, University of Baghdad, Baghdad, 2006, pp.15.

³ Adnan Attia Muhammad Al-Faraji, Cultivation and Production of Fruit Trees in Salah Al-Din Governorate, Master Thesis (unpublished), College of Arts, University of Baghdad, Baghdad, 1997, pp. 74.

to its future development to ensure production, good quality and the extent of development in its cultivation due to its nutritional and economic importance

Research objective:

Knowing the types of soils and their geographical distribution in the study area and their suitability for the production of grapes, through knowing the types of soils in terms of their retention of water and moisture.

Location of the study area:

The study area is located in Dujail district, which is one of the districts of Salah Al-Din Governorate, which is one of the northern governorates in Iraq.

The district consists of (7) districts, with an area of (84) thousand dunums, and the area planted with grapes is (23) thousand dunums⁴. The study area is bounded from the north by Yathrib district and Balad district, from the west by Dujail district, from the east by Yathrib district and Al-Hatmiyyah sub-district to Balad district, and from the south by Jamil Amran and Al-Ibrahimiyya districts, see map No. (1) As for the coordinates, the study area is located between two latitude circles (33.35-33.45) to the north, and longitudes (44.27-44.33) to the east. The highway linking Baghdad and the northern provinces passes through its western end, which gave it great importance. It also passes through commercial transportation, which made its market prosperous. Large markets also provide marketing and disposal of production to All provinces of Iraq without exception.

Statistical analysis of the chemical soil properties of the study area.

Soil chemical properties have a direct impact on the soil as well as on its nature and production, so paying attention to this aspect and shedding light on it has become necessary to know what are the dimensions of this influence and what is its extension on the ground. The counties under study, and we used a statistical analysis method for their data to determine their impact. Two important factors were adopted in the analytical study, namely, the sampling site, which defines the sector. The second factor is known as treatment, which here includes salts or positive nutrients. The analysis of variance table (1) shown below shows the significant effect of these two factors on the soil of the study sector.

Table (1): Analysis of variance for the positive cations in the district (8 Abul Hassan Barrage).

⁴ Republic of Iraq, Salah al-Din District, Dujail Agriculture, Ansar District Agriculture Division, Survey Department. 10.2022.

Sources of difference	d.f degrees of freedom	s.s sum of squares	m.s mean of squares	v.r amount of variance	F pr. calculated value
sampling areas	4	979241.	244810.	3.52	
Chemical transactions under study	6	3887722.	647954.	9.33	.001<
standard error	24	1667248.	69469.		
total summation	34	6534211.			

We notice a significant difference at a significant level of 0.01. To find out the distribution of this significant difference between the treatments, the table of averages for the study treatments was used, with determining the value of the least significant difference as shown in Table (2).

Table (2) shows the average chemical coefficients used in the study

The value of the least significant difference I.S.d	Calciu m	magnesi u m	potassiu m	sodiu m	C E C cation exchange capacity	pH interaction function	O.M organic matter
344.0	749	250	45	808	13	8	1

To find out how to benefit from the table of averages and the value of the least significant difference, we perform a simple subtraction between all the averages and compare this resulting difference with the value of the least significant difference, for example, we subtract the average value of calcium salts from the values of each of the salts of magnesium, potassium, sodium (C E C) Cationic exchange capacity, pH)) the reaction function and finally the organic matter O.M. If the resulting difference is as much as the value of the least significant difference or greater, then there will be a significant difference between the two treatments whose average the subtraction process was carried out, and based on this rule there appeared a significant difference between the concentration of calcium salts and the concentration of magnesium salts, which is (499), which is greater than L.S.d)) on the one hand, and between calcium salts and each of the potassium salts, and the reaction function on the other hand. Also, the values of the concentrations of sodium salts recorded a significant difference between them and each of the values of the concentrations of magnesium and potassium salts on the other hand, and between them and each of the cation exchange capacity and the reaction function. We can infer from this conclusion that the difference in the concentration of cations in the soil has an active and definite role Variation in grape production in the study area. And that the quality in productivity as shown in the production table (36) and it is worth noting that this significant differences between the treatments have been further confirmed by the presence of significant and high correlation coefficients as shown in Table (3) This correlation shows the extent of the significant correlation between the values of ion concentrations . Where the highest was between each of sodium and calcium and the reaction function and the values were 0.9620 and 0.9052, respectively. While the values of the other correlation coefficients differed between the ions, as their values ranged between 0.5353 and 0.8222. The organic matter also gave a correlation coefficient with each of magnesium and potassium and the reaction function with values that were 0.7148, 0.6714 and 0.5707,

respectively. This indicates the strong association of these ions in affecting the yield of grapes in the study area.

Table (3) Correlation coefficient values for positive cations in the district (8 Abu Al-Hassan Barrage).

	Ca Calcium	Mg magnesium	K potassium	Na sodium	CEC Ionic exchange capacitance	pH interaction function	OM organic matter
Ca	-	-	-	-	-	-	-
Mg	0.0876	-	-	-	-	-	-
K	0.8865	0.9230	-	-	-	-	-
Na	<0.001	0.0954	0.8222	-	-	-	-
CEC	0.1150	0.6203	0.7562	0.1095	-	-	-
pH	0.9052	0.5353	0.0504	0.9620	0.6286	-	-
OM	0.1529	0.7148	0.6714	0.1426	0.0020	0.5707	-

What we notice through the analysis table is that the organic matter O.M. has reached (1), and it is considered low in this province, meaning that the high degree of alkalinity of the soil, which is estimated at (8), negatively affects the organic matter, and thus affects the plant, especially the grape plant, which needs soil with a rate of reaction Less than (6), and according to Table No. (3), the value of (0.9620) between (pH and Na) explains the increase in soil salinity. See map (1) showing the rise of magnesium.

Returning to the other part of the coefficients, which represent negative anions, it is possible to note the analysis of variance table shown below Table (4).

Table (4) Analysis of variance for negative cations, district (8 Abu Al-Hassan barrage)

Sources of difference	d.f. degrees of freedom	s.s sum of squares	m. s mean of squares	v.r The amount of contrast	F pr. calculated value
sampling areas	4	2232395.	5580899	2.90	
chemical transactions	7	130415263.	18630752	9.67	001<.
standard error	28	53953088.	1926896		
total summation	39	206691947.			

We note from Table No. (4) that there is a significant difference at a significant level of (0.01). In order to find out the distribution of the significant difference between the treatments, the table of averages was used with the determination of the value of the least significant difference as shown in the following table (5):

Table (5) Average values of negative ion concentrations in the district of (8 Barrages of Abu Al-Hassan)

I.s.d The value of the least significan t differenc e	chlorin e	sulfat e	bicarbonat e	carbonat e	nitrat e	phosphat e	electrical conductivit y	dissolve d salts of the kidney
1798.4	1568	1483	707	49	53	1	25	5691

There is a significant difference between each of the concentrations of chlorine salts and the rest of the values of the other treatments, which are sulfates, bicarbonates, nitrates, phosphates, and finally the electrical conductivity.. It can be inferred from this conclusion that the difference in the concentration of negative anions in the soil has an effective role in the variation in the production of the grape crop in the region The study is a province (8 Abu Al-Hassan barrages) and that the quality of production is due to the balance of the yield between the salts, but their increase and imbalance causes the decline of the cultivated areas and the abundance of soil composting and salinization and then the lack of production as shown in the production table (1) look at map (3) and it is worth Mentioning that the significant difference between the treatments was further confirmed by the presence of significant and high correlation coefficients, Table (6). Where each of chlorine was associated with sulfates, carbonates and total dissolved salts with values of (0.9994), 0.9994 and 0.9998), respectively. As for the sulfates, their correlation was with each of the bicarbonates, the electrical conductivity, and finally with the total dissolved salts, with values of (0.9976), -0.5223, and (0.9995), respectively. While carbonates and bicarbonates were associated with both electrical conductivity and total dissolved salts. Finally, nitrates were associated with electrical conductivity with a correlation coefficient of (0.9875).

Table (6) shows the values of the correlation coefficient for the negative cations of the district (8 Barrages of Abu Al-Hassan)

	Cl chlorine	SO ₄ sulfites	HCO ₃ bicarbo nate	CO ₃ carbona te	NO ₃ nitrate	PO ₄ phosph ate	EC electrical conductivity	TDS total dissolved salts
Cl	-	-	-	-	-	-	-	-
SO ₄	0.9994	-	-	-	-	-	-	-
HCO ₃	0.9994	0.9976	-	-	-	-	-	-
CO ₃	-0.1588	0.1275-	0.1084-	-	-	-	-	-
NO ₃	-0.4118	0.3849-	-0.3748	0.9476	-	-	-	-
PO ₄	0.2364	0.2195	0.2169	0.2412-	0.1607-	-	-	-
EC	-0.5465	0.5223-	-0.5125	0.8918	0.9875	0.1522-	-	-
TDS	0.9998	0.9995	0.9975	0.1567-	0.4128-	0.2284	0.5477-	-

1- Al Hayer 12 District:

Analysis of variance table (7) shows the significant effect of the subject factors in the study hypothesis of 12 Al-Hayr district .

Table (7) Analysis of variance for positive cations (District 12 Al-Hayr)

Sources of difference	d.f degrees of freedom	s.s sum of squares	m.s mean of squares	v.r amount of variance	Fpr calculated value
sampling areas	4	110712	27678	3.95	
The chemical treatments under study	6	1273074	2121779	30.28	.001<
standard error	24	168194	7008		
total summation	34	1551980			

We note that the significant difference was at a significant level of (0.01). In order to find out the distribution of this significant difference between the transactions, the table of averages was used with the determination of the value of the least significant difference as shown in Table (8).

Table No. (8) shows the average chemical treatments used in 12 Al-Hayr provinces

I.S.d The value of the least significant difference	Calcium	magnesium	potassium	sodium	C E C cation exchange capacity	pH interaction function	O.M organic matter
109.3	413	177	20	477	13	7	1

As usual, we subtract the average value of calcium salts from the values of each of the magnesium and potassium salts, as it amounted to (236) and recorded a value of (109.3). .. It can be inferred from this conclusion that the difference in the concentration of cations in the soil has an effective and definite role in the variation in the production of the grape crop in the study area. And that the quality in productivity as shown in the production table (22) see map (4) showing a decrease in the magnesium element, It is worth noting that these significant differences were confirmed by the presence of significant correlation coefficients between the organic matter and the sodium element, which amounted to 0.5431) and this indicates the great role played by the sodium ion in determining productivity and its clear effect more than the rest of the ions.

See table (9). Significant correlation coefficients for County 12 El Hayr

transactions	CEC exchange capacity	Ca Calcium	K potassium	Mg magnesium	Na sodium	OM organic matter	pH interaction function
CEC	-	-	-	-	-	-	-
Ca	0.1038	-	-	-	-	-	-
K	0.0525	0.0018	-	-	-	-	-
Mg	0.0653	<0.001	<0.001	-	-	-	-
Na	0.0968	0.0010	0.0014	0.0015	-	-	-
O-M	0.1898	0.4515	0.4089	0.3983	0.5431	-	-
pH	0.0711	0.0118	0.0090	0.0060	0.0245	0.2523	-

•Negative ions in the study county 12 Al Hayr

•We can notice the statistical analysis of it as shown in Table (10) as follows:

Table (10) Analysis of variance for negative cations, study district 12, Al-Hayr

Sources of difference	d.f degrees of freedom	s.s sum of squares	m.s mean of squares	v.r amount of variance	F pr calculated value
sampling areas	4	2671613	667903	3.02	
The chemical treatments under study	7	41301150	5900164	26.71	001<
standard error	28	6183978	220856		
total summation	39	50156740			

We notice a significant difference at a significant level of (0.01) when conducting the statistical analysis as shown in the analysis of variance table. In order to find out the distribution of this significant difference between the transactions, the table of averages was used with the determination of the value of the least significant difference as shown in Table (11)

Table (11) shows the average values f the chemical coefficients of the study district 12 Al-Hayr

The value of the least significant difference I.S.d	chlorine	sulfate	bicarbonat e	carbonat e	nitrate	phosphat e	electrical conductivity	total dissolved salts
608.8	913	794	384	20	22	0	7	3195

There is a significant difference between the total dissolved salts and the rest of the treatments at all. Through this discrepancy, we can infer that the different concentrations of negative cations in the soil have an effective role in the variation in the production of grapes in the study area (12 al-Hayr). And that the quality in production is due to the balance of the yield between the salts. As for its increase and imbalance, it causes a decline in the cultivated areas, the abundance of soil composting and salinization, and then the lack of production, as shown in the production table (36). See map (5). It is worth mentioning that the significant difference between the treatments It was reinforced by the presence of significant and high correlation coefficients Table (12).

Table (12) Correlation coefficients for negative anions (District 12 Al-Hayr)

	Cl chlorine	SO ₄ sulfate	HCO ₃ bicarbonat e	CO ₃ carbonat e	NO ₃ nitrate	PO ₄ phosphat e	EC electrical conductivity	TDS dissolved navigat or
Cl	-	-	-	-	-	-	-	-
SO ₄	0.9988	-	-	-	-	-	-	-

HCO3	0.9972	0.9955	-	-	-	-	-	-
CO3	0.9902	0.9845	0.9810	-	-	-	-	-
NO3	0.9907	0.9845	0.9835	0.9994	-	-	-	-
PO4	0.9970	0.9931	0.9944	0.9919	0.9917	-	-	-
EC	0.9948	0.9979	0.9882	0.9798	0.9778	0.9887	-	-
TDS	0.9999	0.9992	0.9975	0.9887	0.9894	0.9961	0.9952	-

From the table above, it is clear to us that there is a strong correlation between the negative elements, which have a major role in determining productivity, as we mentioned above, as it is considered one of the important nutrients for plants in a state of balance and one of the determinants that work to reduce production in the event of its rise, because this works to raise the osmotic pressure in the soil.

2- Tal al-Sakhr District 13:

And the analysis of variance table (13) shown below shows the significant effect of the two study factors, which are the sampling areas and the study coefficients that exist in the study hypothesis.

Table (13) Analysis of variance for the positive cations of the province (13 Tal al-Sakhr)

Sources of difference	d.f degrees of freedom	s.s sum of squares	m.s mean of squares	v.r amount of variance	F pr calculated value
sampling areas	6	563644	93941	2.40	
chemical transactions	6	2376046	396008	10.12	001<.
standard error	36	1408930	39137		
total summation	48	438620			

We notice that there is a significant difference at a significant level of (0.01). In order to find out the distribution of this significant difference between the transactions, the table of averages was used with the determination of the value of the least significant difference as shown in Table (14).

Table No. (14) shows the average chemical coefficients for the province (13 Tal al-Sakhr).

Less significant difference value I.S.d	calciu m Ca	magnesi m Mg	potassiu m K	Sodiu m Na	C E C cation exchange capacity	pH interaction function	O.M organic matter
214.5	493	244	87	557	13	8	1

There appeared a significant difference between the concentrations of calcium salts and between each of the rest of the treatments, except for the concentrations of sodium. The same was the case between the values of magnesium salts and the rest of the treatments.. Also, the sodium salts recorded a significant difference between them and each of the values of the other treatments,

except for the concentrations of magnesium ion. Also, the value of cation exchange capacity recorded a significant effect with each of the values of positive cations, which are calcium, magnesium, potassium and sodium. This, of course, indicates the strong correlation between these positive ions and the exchange cationic capacity, which plays a major role in storing nutrients in the soil as ready materials that the plant can refer to when it needs food. These results were accompanied by supporting values, which are the strong and significant correlation coefficients between them, as shown in Table (15).

Table (15) Correlation coefficient in the province (13 Tal al-Sakhr)

	Ca Calcium	Mg magnesium	K potassium	Na Sodium	CEC exchange capacity	pH interaction function	O-M organic matter
Ca	-	-	-	-	-	-	-
Mg	0.0098	-	-	-	-	-	-
K	0.3235	0.9274	-	-	-	-	-
Na	<0.001	0.0261	0.2073	-	-	-	-
CEC	0.5324	0.6973	0.5679	0.5573	-	-	-
pH	0.0682	0.1277	0.4200	0.0402	0.5647	-	-
O-M	0.4493	0.7870	0.3197	0.4738	0.0141	0.5131	-

As for negative ions, they are shown in the analysis of variance table, table (16), as follows:

Table (16) Analysis of variance for negative cations in (13 Tal al-Sakhr) district:

Sources of difference	d.f degrees of freedom	s.s sum of squares	m.s mean of squares	v.r amount of variance	F pr calculated value
sampling areas	6	15134220	2522370	2.04	
chemical transactionsnegative	7	57648311	8235473	6.66	.001<
standard error	42	519455973	1236809		
total summation	55	124728504			

We notice a significant difference at a significant level of (0.01). In order to find out the distribution of this significant difference between the transactions, the table of averages was used with the determination of the value of the least significant difference as shown in Table (17) that follows.

Table No. (17) shows the average chemical treatments used in the district (13 Tal al-Sakher):

The value of the least significant difference I.S.d	chlorine CI	sulfate SO ₄	bicarbonate HCO ₃	carbonate CO ₃	nitrate NO ₃	phosphate PO ₄	electrical conductivity EC	total dissolved salts TDS
1199.7	1112	998	462	25	26	0	228	3215

According to the subtraction method, the significant difference is between the dissolved salts and the rest of the treatments. Through this discrepancy, we can deduce that the difference in the concentration of negative cations in the soil has an effective role in the variation in the production of grape crops in the study area (13 Tal al-Sakhr) district, and that the quality of production is due to the balance of the yield between salts. Cultivated and frequent soil composting and salinization, then lack of production. In this province, a difference in production and an increase is noted, and this is due to the appropriateness of these elements and their balance. It appears in the production table (36). It is worth noting that the significant difference between these coefficients was confirmed by the presence of significant and high correlation coefficients. in table (18)

Table (18) averages of the correlation coefficient in the province (13 Tal al-Sakhr)

	CI chlorine	SO ₄ sulfate	HCO ₃ bicarbonate	CO ₃ carbonate	NO ₃ nitrate	PO ₄ phosphate	EC Electrode connection	TDS soluble salts
CI	-	-	-	-	-	-	-	-
SO ₄	0.9984	-	-	-	-	-	-	-
HCO ₃	0.9918	0.9960	-	-	-	-	-	-
CO ₃	0.9420	0.9460	0.9367	-	-	-	-	-
NO ₃	0.9401	0.9496	0.9568	0.9758	-	-	-	-
PO ₄	0.9095	0.9165	0.9236	0.9777	0.9936	-	-	-
EC	-0.4665	0.4940-	0.5619-	0.4082-	-0.5963	-0.5652	-	-
TDS	0.8476	0.8534	0.8591	0.7424	0.7556	0.7180	-0.4209	-

It can be seen from the table of significant correlation, as the highest value was recorded between chlorine, sulfate, sulfate, and bicarbonate, reaching (0.9984) and (0.9960), respectively. As well as between bicarbonate and chlorine and nitrates and phosphates amounted to 0.9918 and 0.9936, respectively. And that these syndromes may be one of the reasons for the increase in the production of grapes in this province from the rest of the provinces by a distinct difference.

3- Districts 14 of Tal Sheikhan and 15 of Khait Al-Ajda:'

The analysis of variance table (19) shown below shows the significant effect of the study workers in 14 Tal Sheikhan and 15 Khait Al-Ajdaa.

Table (19) Analysis of variance for the positive cations of two districts (14 Tal Sheikhan and 15 Khayat al-Jada')

Sources of difference	d.f degrees of freedom	s.s sum of squares	m.s mean of squares	v.r amount of variance	F pr calculated value
sampling areas	5	72927	14585	3.72	
chemical transactionsnegative	6	1629614	271602	69.31	001<.
standard error	30	117567	3919		
total summation	41	1820109			

We notice a significant difference at a significant level of (0.01). In order to find out the distribution of this significant difference between the transactions, the table of averages was used with the determination of the value of the least significant difference as shown in Table (20. (

Table No. (20) shows the average chemical coefficients for the two cantons (14 Tal Sheikhan and 15 Khait al-Jadaa)

The value of the moral differenceI.S. d	calciu m Ca	magnesiui m Mg	potassiu m K	Sodiu m Na	C E C cation exchange capacity	pH interaction function	O.M organic matter
73.81	422.7	187.2	18.8	494.7	13.2	7.6	1.1

There is a significant difference between the concentrations of calcium salts and the rest of the treatments, except for sodium salts. As for the magnesium salts, there was a significant difference between them and the rest of the treatments. The significant differences between the cationic exchange capacity treatment and each of the cations, which are calcium, magnesium, and potassium, are evidence of the strong bonding between them, in addition to their significant role in influencing many interactions inside the soil, which are reflected in one way or another on production control. Correlation coefficients also came to confirm this strong correlation between these coefficients Table (21).

Table (21) Averages of the correlation coefficient in the two districts (14 Tal Sheikhan and 15 Khait Al Jada')

	Ca Calcium	Mg magnesium	K potassium	Na sodium	CEC exchange capacity ketonic	pH interaction function	O-M organic matter
Ca	-	-	-	-	-	-	-
Mg	0.9920	-	-	-	-	-	-
K	0.8963	0.9287	-	-	-	-	-

Na	0.9704	0.9923	0.9575	-	-	-	-
CEC	0.7315	0.6944	0.7308	0.6614	-	-	-
pH	0.4514	0.5072	0.6328	0.5504	0.3299	-	-
O-M	0.7108	0.6399	0.6241	0.5877	0.9021	0.2237	-

The correlation is a good level and high rates reached the highest at (0.9920) between ions (Ca, Mg), while the lowest values of significant correlation were recorded with both magnesium and the interaction function was 0.5072). Where the values of the other correlation coefficients were distributed between these two values.

Table (22) Analysis of variance for negative ions in the two districts (14 Tal Sheikhan and 15 Khait Al-Jeda)

Sources of difference	d.f degrees of freedom	s.s sum of squares	m.s mean of squares	v.r The amount of contrast	F pr calculated value
sampling areas	5	1594678	318936	2.98	
chemical transactions	7	55323562	7903366	73.95	.001<
standard error	35	3740358	106867		
total summation	47	60658598			

We note from Table No. (22) that there is a significant difference at a significant level of (0.01). In order to find out the distribution of this significant difference between the transactions, the table of averages was used with the determination of the value of the least significant difference as shown in Table (23).

Table No. (23) shows the average chemical treatments used in the two districts (14 Tal Sheikhan and 15 Khait al-Jada')

The value of the least significant difference I.S.d	chlorine Cl	sulfate SO ₄	bicarbonate HCO ₃	carbonate CO ₃	nitrate NO ₃	phosphate PO ₄	electrical conductivity	total dissolved salts
383.2	943	856	408	20	21	0	6	3375

We see a significant difference between chlorine salts and all other treatments except for the total dissolved salts treatment. . We can deduce from this conclusion that the difference in the concentration of negative cations in the soil has an active role in the variation in the production of the grape crop in the study area, two districts (14 Tal Sheikhan and 15 Khayet al-Jada'), and that the quality of production is due to the balance of the yield between salts. In the decline of cultivated areas and the abundance of soil composting and salinity, and then the lack of production. In these two provinces, a difference in production and an increase is noted, and this is due to the appropriateness and balance of these elements, which appears in the production table (36).

Table (23) Correlation coefficient in two districts (14 Tal Sheikhan and 15 Khayat al-Jada')

	Cl chlorine	SO ₄ sulfate	HCO ₃ bicarbonate	CO ₃ carbonate	NO ₃ nitrate	PO ₄ phosphate	EC electrical conductivity	TDS dissolved salts the college
Cl	-	-	-	-	-	-	-	-
SO ₄	0.9990	-	-	-	-	-	-	-
HCO ₃	0.9956	0.9912	-	-	-	-	-	-
CO ₃	0.9700	0.9633	0.9707	-	-	-	-	-
NO ₃	0.9725	0.9760	0.9600	0.9324	-	-	-	-
PO ₄	0.9262	0.9190	0.9350	0.9682	0.9229	-	-	-
EC	0.9900	0.9852	0.9935	0.9884	0.9538	0.2628	-	-
TDS	1.0000	0.9992	0.9956	0.9684	0.9731	0.9257	0.9896	-

Table (23) shows that there are strong and significant correlation coefficients between all the coefficients except for one correlation coefficient between phosphate and electrical conductivity. These correlations emphasize the significant role played by these coefficients (nutrient salts) in controlling the amount of crop productivity, as is evident from the production table.

4- District 16 Hillis:

Table (24) shown below shows the significant effect of these two factors (districts and salt concentrations) on the hypothesis of the study.

Table (24) Analysis of variance for positive cations in the district (16 Hillis)

Sources of difference	d.f degrees of freedom	s.s sum of squares	m.s mean of squares	v.r The amount of contrast	F pr. calculated value
sampling areas	4	45350.	11338	3.73	
chemical transactions	6	630394.	105066.	34.58	.001<
standard error	24	72910	3038		
total summation	34	7486553.			

There is a significant difference at a significant level of 0.01. In order to find out the distribution of this significant difference between the transactions, the table of averages was used with the least significant difference value, as shown in Table (25).

Table (25) shows the average chemical coefficients used in the district of 16 Hillis

The value of the	Calcium	magnesium	potassium	sodium	C E C	pH	O.M
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least significant difference I.S.d					cation exchange capacity	interaction function	organic matter
71.95	280.0	127.6	12.9	346.4	14.0	7.3	1.1

The salts of calcium, magnesium and sodium had significant effects with potassium, cation exchange capacity, reaction function and organic matter. We can deduce from this conclusion that the difference in the concentration of cations in the soil has an effective and definite role in the variation in the production of the grape crop in the study area. And that the quality in productivity is as shown in the production table (36). Map (10) also shows this difference. It is worth noting that these significant differences between the treatments were further confirmed by the presence of significant and high correlation treatments. Table No. (26)

Table (26) shows the correlation coefficient of positive cations in the district (16 hills)

	Ca Calcium	Mg magnesium	K potassium	Na sodium	CEC exchange capacity	pH interaction function	O-M organic matter
Ca	-	-	-	-	-	-	-
Mg	0.9921	-	-	-	-	-	-
K	0.9952	0.9926	-	-	-	-	-
Na	0.9754	0.9952	0.9799	-	-	-	-
CEC	0.3204	0.4213	0.3201	0.4853	-	-	-
pH	0.8325	0.7754	0.8113	0.7194	0.1021	-	-
O-M	0.4542	0.5267	0.4317	0.5620	0.9367	0.3385	-

The values of the correlation coefficients ranged between the highest (0.9799) between sodium and potassium ions, and the lowest (0.5620) between organic matter and sodium.

-*Statistical analyzes of negative ions in (16 Hallees) district.

There is a significant difference between the coefficients of negative anions at the probability level (0.01), as shown in the following table (27):

Table (27) Analysis of variance for negative cations in (16 Hallees) district

Sources of difference	d.f degrees of freedom	s.s sum of squares	m.s mean of squares	v.r The amount of contrast	F pr. calculated value
sampling areas	4	45350.	11338	3.73	
chemical transactions	6	630394.	105066.	34.58	.001<
standard error	24	72910	3038		
total summation	34	7486553.			

In order to find out the distribution of this significant difference between the transactions, the table of averages was used with the determination of the value of the least significant difference as shown in Table (28)

Table (28) Average positive ions in the district (16 halls)

The value of the least significant difference I.s.d	chlorine	sulfate	bicarbonate	carbonate	nitrate	phosphate	electrical conductivity	dissolved salts for college
340.8	645	566	291	11	14	1	4	2348

Total dissolved salts recorded a significant difference with all treatments under study. As for the treatments of each of chlorine, sulfate, and bicarbonate, there were significant differences between them and each of carbonate, nitrate, and electrical conductivity. While the rest of the relationships remained without a significant impact.

Through this discrepancy, we can deduce from this conclusion that the difference in the concentration of negative cations in the soil has an active role in the variation in the production of the grape crop in the study area (16 Hales) district, and that the quality of production is due to the balance of the yield between salts. In the decline of the cultivated areas and the abundance of soil composting and salinization, and then the lack of production, but in this, the balance of these elements played a role in improving production, as shown in the production table (36). (29.)

Table (29) shows the correlation coefficient of negative ions in the district (16 Hillis)

	Cl chlorine	SO ₄ sulfate	HCO ₃ bicarbonate	CO ₃ carbonate	NO ₃ nitrate	PO ₄ phosphate	EC Electrode connection	TDS soluble salts
Cl	-	-	-	-	-	-	-	-
SO ₄	0.2882	-	-	-	-	-	-	-
HCO ₃	0.3390	0.9972	-	-	-	-	-	-
CO ₃	0.1893	0.9805	0.9736	-	-	-	-	-
NO ₃	0.2024	0.9889	0.9862	0.9936	-	-	-	-
PO ₄	-0.0967	0.9041	0.8764	0.9519	0.9323	-	-	-
EC	0.3337	0.9956	0.9977	0.9609	0.9788	0.8653	-	-
TDS	0.3072	0.9968	0.9976	0.9661	0.9834	0.8775	0.9996	-

5- Bazna District 17:

It is clear from the analysis of variance table (30) shown below that there is a significant effect

of these two factors on the hypothesis of the study.

Table (30) Analysis of variance for interrupted positive cations (17 weights)

Sources of difference	d.f degrees of freedom	s.s sum of squares	m.s mean of squares	v.r The amount of contrast	F pr. calculated value
sampling areas	4	560390.	140097	3.90	
chemical transactions	6	1663089.	277182.	7.72	.001<
standard error	24	861627	35901		
total summation	34	3085106			

And this significant difference was at a significant level of (0.01). In order to find out the distribution of this significant difference between the transactions, the table of averages was used with the determination of the value of the least significant difference as shown in Table (31).

Table (31) shows the average chemical parameters used in the study

The value of the least significant difference I.S.d	Calcium Ca	magnesium Mg	potassium k	sodium Na	C E C cation exchange capacity	pH interaction function	O.M organic matter
247.3	478	208	21	538	14	8	1.

We note the significant difference recorded between calcium salts, magnesium salts, and sodium on the one hand, and the rest of the other treatments, which are potassium, cationic exchange capacity, reaction function, and organic matter. The study area. The quality of productivity is as shown in the production table (36). It is worth mentioning that these significant differences between the treatments have been further confirmed by the presence of significant and high correlation coefficients. Table No. (32)

Table (32) shows the correlation coefficient of positive cations in (17 Bzna) district

	Ca chlorine	Mg magnesium	K potassium	Na sodium	CEC exchange capacity	pH interaction function	O-M organic matter
Ca	-	-	-	-	-	-	-
Mg	0.9921	-	-	-	-	-	-
K	0.9974	0.9926	-	-	-	-	-
Na	0.9754	0.9952	0.9799	-	-	-	-
CEC	0.3204	0.4213	0.3201	0.4853	-	-	-
pH	0.8325	0.7754	0.8113	0.7194	0.1021	-	-
O-M	0.4542	0.5267	0.4317	0.5620	0.9367	0.3385	-

By looking at the above correlation coefficient joule, we can see the strength of the correlation between the elements, and it recorded a strong correlation strength at the top (0.9974) between

potassium and sodium (0.9799) and between calcium and potassium (0.9974), while the least of them was between the organic matter on the one hand and each of magnesium and sodium (0.9974). 0.5267 and 0.5620), respectively.

Statistical analysis of negative ions.

Table (33) Analysis of variance for negative cations in (17 Bzna) district.

It turns out that there is a significant difference at a significant level of (0.01). As shown in the following table (33):

Sources of difference	d.f. degrees of freedom	s.s sum of squares	m. s. mean of squares	v.r The amount of contrast	F pr. calculated value
sampling areas	4	12345030	3086257	3.22	
chemical transactions	7	56414761	8059252	45.95	001<.
standard error	28	28647747	1023134		
total summation	39	97407539			

In order to find out the distribution of the significant difference between the transactions, the averages table was used with the determination of the value of the least significant difference as shown in Table (34).

Table (34) Average negative ions in the province (17 Bzna)

The value of the least significant difference I.s.d	chlorine	sulfate	bicarbonate	carbonate	nitrate	phosphate	electrical conductivity	dissolved salts for college
340.8	1034	948	460	24	14	0	8	3736

The total dissolved salts gave a significant difference with all the treatments under study. While each of the chlorine ions, sulfate and bicarbonate gave a significant difference with each of the nitrates and phosphates and electrical conductivity. Through these contrast we can infer that the difference in the concentration of negative cations in the soil have an effective role in the variation of the production of grape crop in the study area (17 bazna) and that the quality In production, this is due to the balance of the yield between the elements and the lack of salinity and then the lack of production. We notice here the high percentage of dissolved salts, the rate of chlorine, and the decrease in bicarbonate negatively affected the production of the studied fruits, in addition to the decrease in organic matter as shown in the production table (36). It is worth mentioning that the difference The significant correlation between the coefficients has been further confirmed by the presence of significant and very high correlation coefficients Table (35)

Table (35) shows the correlation coefficient of negative ions in (17 Bzna) district

	CI chlorine	SO ₄ sulfate	HCO ₃ carbonate	CO ₃ carbonate	PO ₄ nitrate	EC Electrical connection	TDS soluble salts	PO ₄ phosphate
CI	-	-	-	-	-	-	-	-
SO ₄	0.9994	-	-	-	-	-	-	-
HCO ₃	0.9989	0.9984	-	-	-	-	-	-
CO ₃	0.9989	0.9993	0.9963	-	-	-	-	-
PO ₄	0.9562	0.9625	0.9477	0.9690	-	-	-	-
EC	0.9986	0.9975	0.9997	0.9975	0.9455	-	-	-
TDS	0.9998	0.9998	0.9992	0.9989	0.9576	0.9987	-	-
PO ₄	0.9994	1.0000	0.9984	0.9993	0.9625	0.9975	0.9998	-

Here, the strength of the correlation coefficient between the elements is evident, as the highest value between the ion (SO₄-CI) was 0.9994, and the lowest was between each of the electrical conductivity and phosphates, which amounted to 0.9455.

Table (36) shows the areas and varieties of grapes and the quantity of production by percentage, according to the questionnaire

The percentage of infection in each province	Diseases of all kinds	Productivity kg / dunum	grape varieties	cultivated area	District name and number	T
innate%45 insectivorous%35	Dubas powdery whiteinnate insectivorous	4250	Confectioner Kamali Des Anz is French	1340	8 Kantar Abu Al- Hassan	1
innate%27 insectivorous %42	Dubas powdery whiteinnate insectivorous	6250	Pastry chef Kamali Des French goats with egg white currants	4300	12 perplexity	2
innate%32 insectivorous %43	Dubas powdery whiteinnate insectivorous	6750	Pastry chef Kamali Des French goats with egg white currants	5400	13 rock hill	3
innate%37 insectivorous %44	Dubas powdery whiteinnate insectivorous	4500	Confectioner Kamali Des Anz is French	3450	14 Tell Sheikhan	4

innate%26 insectivorous %32	Dubas powdery whiteinnate insectivorous	4750	Confectioner Kamali Des Anz is French	280	15 stump thread	5
innate%35 insectivorous %48	Dubas powdery whiteinnate insectivorous	5250	Pastry chef Kamali Des French goats with egg white currants	3740	16 Halees	6
innate%33 insectivorous %50	Dubas powdery whiteinnate insectivorous	5000	Pastry chef Kamali Des French goats with egg white currants	3630	17 by weight	7
				22140	the total	8

The work of the researcher based on the questionnaire

Conclusions:

- 1- We notice, through statistical analyzes, the strong correlation between the ionic elements and the extent of their impact on productivity, as this was shown in the high production in the provinces that have a neutral or almost equal percentage of these elements.
- 2- The rise of some elements in the provinces of 8 Barrages and 14 Tal Sheikhan negatively affected production.
- 3- The rise of dissolved salts led to the spread of salinity in the soil over large areas of the study area.