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The Interaction between Adding Soybean Residue and Hydrogel to the Soil on the Mineral Content of Yellow Corn (*Zea mays* L.) Plants whose Seeds are Treated with Ascorbic Acid

Y. S. Mahmood[(1)], M. S. Faysail[(2)]

[1,2] *Department of Biology/College of Education for Pure Science/University of Mosul/Iraq*

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Correspondence:
[1]yasir.22esp10@student.uomosul.edu.iq[1]

Abstract

This study was conducted in the warehouse of the Department of Biology / College of Education for Pure Sciences for the 2023-2024 season to study the effect of adding levels of hydrogel (0, 2, 4) gm/kg of soil and residues of the vegetative part of soybeans at levels (0, 4, 8) gm/kg soil in the mineral content of yellow corn plants soaked with concentrations of (0,100, 200 ppm) of ascorbic acid.

The results were analyzed using a completely randomized design and a factorial experiment with three replications. The results confirmed the existence of a discrepancy in the effect of soybean residues on mineral elements, as they ranged between inhibition and stimulation, as the residues had a stimulating effect on the calcium and nitrogen elements, While its effect was inhibitory to the element sodium and magnesium, and the addition of hydrogel showed a stimulating effect in all the nutritional elements mentioned above. On the other hand, there was a significant superiority in the content of the elements with an increase in the concentration of ascorbic acid compared to the control treatment without addition. The interactions showed a stimulating effect, especially the interaction of hydrogel levels with ascorbic acid concentrations in the studied characteristics

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1. Introduction

Yellow corn crop is considered one of the most important crops due to its high nutritional value for humans and animals. To achieve important nutritional value, the best methods must be followed in its cultivation to achieve a high production rate and unique quality in terms of serving the soil, using fertilizers, irrigation, combating diseases, and paying attention to the stage of grain maturity and harvesting[1]. Yellow corn crop belongs to the Poaceae Family, and it comes in third place in terms of importance after the wheat and rice crops [2]. Allelopathy means that one plant produces chemicals called allelochemicals that positively or negatively affect the growth and development of other plants of the same or different species [3]. The decomposition of plant waste is responsible for most of the chemicals that are added to the soil. When the plant dies, the plant remains decomposed and the allelopathic compounds are released into the environment. The important factors in this process are the nature of the plant waste, the quality of the soil, and the conditions of decomposition. These factors can determine the effectiveness of the compounds on other highly toxic organisms. Or non-toxic or stimulating to plants [4]. Hydrogels are a three-dimensional structure consisting of cross-linked polymeric resources and have a very high ability to swell in aqueous solutions. Due to the physical and chemical properties of a hydrogel such as elasticity, swelling ability, softness, and biocompatibility, there has been an increasing research interest in hydrogel synthesis [5].

Hydrogel is used to enhance the efficiency of using nutrients and water, and it is more important in areas that are almost guaranteed rain and not guaranteed rain, as it can recruit water and nutrients and release them slowly to the plant. It, also, works to aerate the soil and increase the porosity of the soil [6].Ascorbic acid (vitamin C), is a multifunctional

phytonutrient that is essential for the human diet as well as for plant development [7].Ascorbic acid plays important and pivotal roles in maintaining the redox balance within cells during all stages of plant growth and development as well as abiotic stress responses [8].Alamri *et al* [9] indicated that ascorbic acid works to improve defense systems in plants by improving the content of essential nutrients (Mg, Ca, K, P, N) as well as improving the chlorophyll content in plant leaves. Therefore, this study aims to determine the effect of adding soybean residues and hydrogel levels on the mineral composition of yellow corn plants treated with ascorbic acid.

2. Materials and Research Methods

The current study was conducted in the wirehouse and laboratories of the Department of Biology / College of Education for Pure Sciences / University of Mosul for the agricultural season 2022-2023. The effects of the mixture of soybean residues and hydrogel on the mineral composition of yellow corn plants treated with ascorbic acid concentration (0, 100, 200 ppm) were tested. The soil was brought from the fields of Al-Qasr village / Al-Hamdaniya District / Nineveh Governorate from a depth of (5-30) cm, uncultivated for two years, while the remains of soybean plants were collected from a cultivated field in Wanha District / Tal Afar District / Nineveh Governorate, and the shoots were taken and dried. In an electric oven at a temperature of 70 C° for 48 hours, then it was ground and stored in plastic boxes. A global experiment was applied in the warehouse, where (4,8gm) of the remains of the soybean plant shoots were added for every (1000gm) of soil (gm : gm). Then they were placed in plastic pots with a capacity of 10 kilograms of soil, and one liter of water was added to each pot. The mouths of the pots were closed with perforated aluminum leaves and left randomly for three weeks. Then the water hydrogel was mixed at three levels (0, 2, and 4) gm/kg of soil homogeneously with the soil. Then, some of the yellow corn seeds were soaked with three concentrations of ascorbic acid (0, 100, and 200ppm), and planting took place on Jule 2023. Five seeds of the Levantine maize variety were planted in each pot, and after 21 days had passed from the date of planting, the number of seedlings was thinned to two seedlings. In each pot, irrigation was controlled by weighing the total pots with the water added to each treatment to obtain the required field capacity. After 60 days of planting, three random replicates were used to estimate the nutrient content of the yellow corn plant.

3. Studied attributes

Estimating the content of some nutrients:

1. Sodium (Na) and potassium (K): using the Corning Flam Photometer, as described in[10].
2. Calcium (Ca) and magnesium (Mg): by plating with ferricitate as stated in [10].
3. Nitrogen (N): by distillation method using the Micro-Kjeldahl device, as indicated by [11].

All results were recorded in appropriate tables, and the results were statistically analyzed using a randomized complete design in a factorial experiment. Duncan's multiple-range test was also used to test the significance of differences between the means at the 0.5% probability level according to the SAS program. The percentage of increase or decrease in all traits was calculated according to The following equation:

Reduction of stimulation (%) = [(A × 100)/B] -100

A: Measuring the characteristics of the transaction.

B: Measuring the characteristic by comparison.

4. Results and Discussion

4.1 Sodium element (Na):

It is clear from Table (1) that soaking yellow corn seeds with different levels of ascorbic acid led to an increase in sodium concentration by increasing the levels of ascorbic concentration, reaching (10.86 and 29.96)% respectively compared to the control treatment.

The reason for the increase in sodium concentration may be due to the function of ascorbic acid in combating the harmful effects of stress, improving the physiological characteristics of the plant (increasing the water content and chlorophyll), accumulating organic matter, and better plant growth, and thus has a positive effect, as it increases the absorption of nutrients, including sodium [12].

soybean residues at a concentration of (8gm) led to a significant decrease in sodium concentration, reaching (25.90)% compared to the (4gm) treatment and the control treatment. The reason for the decrease in the percentage of sodium may be due to an increase in the concentration of potassium in the soil solution, leading to the displacement of sodium from the absorption area of the roots according to the characteristic of osmotic pressure, as the increase in the concentration of the sodium element causing an imbalance in nutrients and a decrease in their absorption by the plant [13].

As for adding hydrogel levels (2 and 4gm), there was a significant decrease compared to the control treatment. This is consistent with what was mentioned by [14], who noticed a significant decrease in the sodium concentration when adding hydrogel to the soil.

In the binary interaction (residues x hydrogel) the highest result was found when the plant was treated with a concentration of (0gm) for both residues and hydrogel, which amounted to 0.433%. Likewise, the lowest results were recorded when the concentration of residues (8gm) and hydrogel (4gm) reached 0.130%.As for the interaction between (residues x ascorbic acid), results showed that the highest concentration of sodium was recorded at the control treatment and ascorbic acid (100ppm), as it reached 0.412% compared to the other eight treatments.In the interaction (hydrogel x ascorbic) the highest result was recorded at the concentration of hydrogel (0) g and ascorbic (200ppm). However, the lowest mean value was also recorded at the concentration of hydrogel (4gm) and ascorbic (0ppm), as it amounted to 0.217% compared to the rest of the treatments.

As for the triple interaction (residue x hydrogel x ascorbic acid), the highest mean value was recorded in sodium concentration when the plant was treated with a concentration of (8gm) of residue, a concentration of (0gm) of hydrogel, and a concentration of (200ppm) of ascorbic acid, as it reached 0.585%. compared to the other twenty-six transactions.

Table 1. Effect of the interaction of soybean residues and hydrogel on the (%) sodium concentration in the tissues of vegetative plants of yellow corn plants whose seeds were soaked with concentrations of ascorbic acid.

Plant residues (gm)	Hydrogel levels (gm)	Ascorbic acid (ppm) Zero	100	200	Residue x Hydrogel	Effect of residuals	Effect of hydrogel
zero	zero	0.390 bc	0.520ab	0.390 bc	0.433 a		
	2	0.130 de	0.390bc	0.390 bc	0.303bcd		
	4	0.130 de	0.325c	0.325 c	0.260 cd		
4	zero	0.260 cd	0.130de	0.390 bc	0.260 cd		
	2	0.390 bc	0.520ab	0.130 de	0.347abc		
	4	0.390 bc	0.390bc	0.390 bc	0.390 ab		
8	zero	0.260 cd	0.260cd	0.585 a	0.368 ab		
	2	0.325 c	0.130de	0.260 cd	0.238 d		
	4	0.130 de	0.000 e	0.260 cd	0.130 e		
residues x ascorbic	zero	0.217 cd	0.412 a	0.368 ab		0.332 a	
	4	0.347 ab	0.347ab	0.303 bc		0.332 a	
	8	0.238 c	0.130 d	0.368 ab		0.246 b	
hydrogel x ascorbic	zero	0.303bcd	0.303bcd	0.455 a			0.354 a
	2	0.282bcd	0.347 b	0.260bcd			0.296 b
	4	0.217 d	0.238 cd	0.325 bc			0.260 b
effect of ascorbic		0.267 b	0.296ab	0.347 a			

*Means with similar letters indicate no significant differences between them at the probability level (0.5%) according to Duncan's multinomial test.

4.2 Potassium (K):

The results of Table (2) indicated significant differences due to soaking corn seeds with different levels of ascorbic acid, especially the concentration of (100ppm), and the percentage of increase reached 21.87% meanwhile no significant differences appeared as a result of adding soybean residues to the soil compared to the control treatment. Our results are consistent with the results of [15] who showed a significant increase in many nutritional elements in wheat plants sprayed with ascorbic acid concentrations, including potassium.

However, adding hydrogel led to a significant increase in potassium concentration, especially at the level of (2gm), as the percentage reached 28.27% compared to the untreated control. The reason may be attributed to the composition of the hydrogel itself, as it is composed of potassium polyacrylate, thus providing an appropriate percentage of potassium close to the root hairs, which is absorbed and then enters the plant and reaches the rest of its parts, including the tissues of the shoots [14].

As for the result of the interaction between (residues × Hydrogel), the highest average rate of potassium concentration was recorded at the concentration of (8gm) of sediments and (2gm) of hydrogel, as it reached 10.668% compared to the other eight treatments.

Was noted that the highest mean value was recorded in the interaction (residues x ascorbic acid) at a concentration of (4gm) of residues and (100ppm)of ascorbic acid, as the value reached 10.178%, while the lowest mean value was recorded in the control treatment for both residues and ascorbic acid compared to the other treatments.

Regarding the interaction (hydrogel x ascorbic), results showed that the highest mean value in potassium concentration was recorded at the concentration of (2gm) of hydrogel and (100ppm) of ascorbic, reaching 10.216% compared to the other eight treatments.

As for the second order interaction (residues x hydrogel x ascorbic acid), it was found that the highest mean value was recorded at the concentration of (0,4gm) of soybean residues, (2,0gm) of hydrogel, and (100ppm) of ascorbic acid, as the percentage reached 11.385%.

Table 2. **Effect of the interaction of soybean residues and hydrogel on the concentration of potassium (%) in the tissues of vegetative plants of yellow corn plants whose seeds were soaked with concentrations of ascorbic acid.**

Plant residues (gm)	Hydrogel levels (gm)	Ascorbic acid (ppm) zero	100	200	Residue x Hydrogel	Effect of residuals	Effect of hydrogel
Zero	Zero	4.865 lm	6.095 i-l	6.900 f-l	5.953e		
	2	8.200 d-e	11.385 a	8.050 e-i	9.211 b		
	4	6.245 i-l	10.235 a-d	10.350 a-d	8.943 b		
4	Zero	6.015 jkl	11.385 a	9.200 b-e	8.866 bc		
	2	6.820 g-l	7.878 e-k	10.465 abc	8.387 bc		
	4	6.705 h-l	11.270 ab	7.935 e-k	8.636 bc		
8	Zero	9.005 c-f	3.680 m	8.970 c-g	7.218 d		
	2	10.385 abc	11.385 a	10.235 a-d	10.668 a		
	4	8.890 c-g	8.510 c-h	5.865 kl	7.755 cd		
residues x ascorbic	Zero	6.436 d	9.238 ab	8.433 bc		8.036 a	
	4	6.513 d	10.178 ab	9.200 ab		8.630 a	
	8	9.427 ab	7.858 c	8.357 bc		8.547a	
Hydrogel x ascorbic	Zero	6.628 e	7.053 de	8.356 bc			7.346 b
	2	8.468 b	10.216 a	9.583 a			9.423 a
	4	7.280 cde	10.005 a	8.050 bcd			8.445 a
effect of ascorbic		7.459 b	9.091 a	8.663 a			

*Means with similar letters indicate no significant differences between them at the probability level (0.5%) according to Duncan's multinomial test.

4.3 Calcium (Ca):

Results of Table (3) showed that there was a significant increase in calcium concentration when soaking corn seeds with concentrations (100 and 200ppm) of ascorbic acid, as the percentages reached (20.29 , 25.87)% respectively, compared to the control treatment. The reason for the increase in the ratio of calcium may be due to the properties of ascorbic acid, it improves plant growth and thus increases the absorption of nutrients. The results of the current study are consistent with [16] who reported that the use of ascorbic acid led to an increase in the content of nutrients including calcium in both stressed and non-stressed plants.

There was also a significant increase in calcium concentration when adding (8gm)of soybean residue to the soil, reaching 55.93% compared to the control treatment, as plant residues decompose in the soil and thus contribute to soil fertility and improve its biological, and physical and chemical properties. The plants responded in a way with positive effects of the decomposition of soybean plant residues in the soil by improving its growth condition. This is due to the presence of beneficial substances for growth as effective alternatives to positive interference. This is consistent with [17] who showed that adding the residues of the vegetative system of the *Medicago sativa* L. plant led to an increase in the concentrations of phosphorus, potassium, and calcium compared to the control treatment

Hydrogel had a positive effect, as it caused a significant increase in the calcium percentage when used at levels of (2, 4gm), as the percentages reached (30.33 , 42.27)% respectively, compared to the control treatment. The reason for the increase in the calcium percentage may be due to the hydrogel retaining water and nutrients provided to the plant for longer periods close to the root absorption area, thus increasing the absorption of nutrients, including calcium. This is consistent with a study [18] and [19], who stated that the hydrogel had an important and significant role in enhancing and improving the efficiency of nutrient and water use.

In the binary intervention (residue x hydrogel) the highest average rate of calcium percentage was recorded at a concentration of (8gm) of residue and (4gm) of hydrogel, as it reached 4.293% compared to the rest of the treatments.

As for interference (residue x ascorbic acid), the highest mean value was found in the percentage of calcium when adding (8gm) of soybean residue and soaking corn seeds at a concentration of (100ppm) of ascorbic acid, reaching 3.987%. However, the lowest mean value was recorded at a concentration of (4gm) of residue and concentration (0ppm) of ascorbic acid.

It was, also noticed that the highest recorded mean value resulted from the interaction (hydrogel x ascorbic acid), which amounted to 3.680% when adding the hydrogel at a concentration of (4) gm/kg of soil and soaking the corn seeds at a concentration of (200ppm) of ascorbic acid.

In terms of the interaction among (residues x hydrogel x ascorbic acid), the highest average percentage of calcium in the shoots of corn plants was recorded when adding soybean residues and hydrogel to the soil at concentrations of (4 and 8gm), respectively, and soaking corn seeds at a concentration of (100ppm) ascorbic acid, which amounted to 5.520% compared to the other twenty-six treatments.

Table 3. Effect of the interaction of soybean residues and hydrogel on the calcium concentration (%) in the tissues of vegetative plants of yellow corn plants whose seeds were soaked with concentrations of ascorbic acid.

Plant residues (gm)	Hydrogel levels (gm)	Ascorbic acid (ppm) zero	100	200	Residue x Hydrogel	Effect of residuals	Effect of hydrogel
Zero	Zero	1.533de	1.725 de	1.533 de	1.597 e		
	2	2.530cde	2.530cde	4.025abc	3.023 bc		
	4	2.070de	3.220bcd	2.070 de	2.453cde		
4	Zero	1.380 e	2.070 de	2.760cde	2.070 de		
	2	1.840 de	2.760cde	1.610 de	2.070 de		
	4	1.840 de	1.840 de	4.830 a	2.837bcd		
8	Zero	2.760cde	4.140abc	2.300 de	3.067 bc		
	2	4.600 ab	2.300 de	4.140abc	3.680 ab		
	4	3.220bcd	5.520 a	4.140abc	4.293 a		
residues x ascorbic	Zero	2.044 d	2.492 cd	2.543 cd		2.360 b	
	4	1.687 d	2.223 cd	3.067 bc		2.326 b	
	8	3.527 ab	3.987 a	3.527 ab		3.680 a	
Hydrogel x ascorbic	Zero	1.891 d	2.645bcd	2.198 cd			2.245 b
	2	2.990abc	2.530bcd	3.258 ab			2.926 a
	4	2.377bcd	3.527 a	3.680 a			3.194 a
effect of ascorbic		2.419 b	2.901 a	3.045 a			

*Means with similar letters indicate no significant differences between them at the probability level (0.5%) according to Duncan's multinomial test.

4.4 Magnesium (Mg):

The results of Table (4) showed that soaking corn seeds with different levels of ascorbic acid led to a significant increase in the percentage of magnesium, especially the concentration (100ppm), as the percentage of increase reached 32.31% compared to the control treatment. Perhaps the reason for the increase is due to the functions of ascorbic acid that are beneficial to plants, as it enhances plant growth and the rate of photosynthesis and transpiration. It also works to reduce the percentage of ions leaking from cell membranes due to oxidative stress, which leads to an increase in the percentage of magnesium in various plant tissues, which is included in the chlorophyll molecule is combined with the element nitrogen, as it is an essential element for completing the process of photosynthesis [20].

Meanwhile, there was a significant decrease in the concentration of magnesium when the residue was added at a concentration of (4, 8gm), as the percentages reached (20.14, 21.64 %) respectively, compared to the control treatment. The reason may be due to the presence of sodium ions in the growth medium in high concentrations that reduce the absorption of magnesium. As for the mechanism proposed by [21], the stimulatory or synergistic effect is due to the presence of multiple allelopathic compounds. Most of the allelopathic chemical compounds released from allelopathic crops such as sorghum Bile, sunflower, rice, and others are of a phenolic nature. [22] identified some types of phenolic compounds in sunflower waste, including (P-Protocate churic, Caffeic acid, Syringic acid). However [23] clarified that these types of phenolic compounds inhibit the absorption of mineral elements such as nitrogen, phosphorus, potassium, iron, and molybdenum from the soil solution by the mung bean plant.

A significant increase was observed in the concentration of magnesium when using the hydrogel with concentrations of (2, 4gm), and the percentages reached (75.77, 49.00%) respectively compared with the control treatment. Nutrients are among

the most important factors that determine the success and growth of the plant. These elements are found naturally in the soil or are added to the plant so that it grows well and sound. These elements are not absorbed naturally due to the lack of sufficient moisture, because according to the osmotic pressure, they are not transferred into the plant due to the lack of moisture. Adding hydrogel to the soil works to provide appropriate moisture near the roots, enabling the plant to absorb nutrients, including magnesium. This explains the reason for the increase in the percentage of magnesium in the shoot. This is consistent with [24] that using hydrogels with a high ability to absorb water and dissolved nutrients, retain them for the longest possible period, and release them slowly during the crop growth stages.

Regarding the binary interaction (residue x hydrogel), the best result in magnesium concentration was recorded when the plant was treated without residue and (2gm) of hydrogel, as the result reached 5.760% compared to the other eight treatments.

As for the result of the interaction (residues x ascorbic acid), the treatment of (0) residues and (100ppm) PPM of ascorbic acid outperformed the rest of the other treatments, reaching 5.320%. The lowest mean value of magnesium concentration was also recorded when the plant was treated with a concentration of (8gm) of the remaining corn seeds were soaked with a concentration of (0) ascorbic acid, and the percentage reached 3.067%.

As for the interaction between (hydrogel x ascorbic acid), the highest average rate of magnesium concentration was found at the concentration of (2gm) of hydrogel and (100ppm) of ascorbic acid, and the percentage reached 5.473% compared to the other eight treatments.

In terms of the triple interaction (residue x hydrogel x ascorbic acid), the highest values were recorded at a concentration of (0 and 2gm) of residue and hydrogel, respectively, and (100ppm) of ascorbic acid, and the percentage reached 7.920%.

Table 4. Effect of the interaction of soybean residues and hydrogel on the magnesium concentration(%) in the tissues of the vegetative tissues of yellow corn plants whose seeds were soaked with concentrations of ascorbic acid.

Plant residues (gm)	Hydrogel levels (gm)	Ascorbic acid (ppm) zero	100	200	Residue x Hydrogel	Effect of residuals	Effect of hydrogel
Zero	Zero	2.000 h	3.002 g	3.005 g	2.669 d		
	2	4.080 de	7.920 a	5.280 b	5.760 a		
	4	3.840 def	5.040 bc	3.720 e-g	4.200 b		
4	zero	2.001 h	3.004 g	3.007 g	2.670 d		
	2	3.300 bc	4.780 bc	3.240 fg	3.773 c		
	4	3.960edf	3.480efg	3.480efg	3.640 c		
8	zero	2.000 h	3.003 g	2.006 h	2.336 d		
	2	3.720 d-g	3.720d-g	4.440cd	3.960 bc		
	4	3.480efg	3.600efg	3.720d-g	3.600 c		
residues x ascorbic	zero	3.306 d	5.320 a	4.001		4.209 a	
	4	3.087d	3.755 bc	3.242 d		3.361b	
	8	3.067 d	3.441 cd	3.388 cd		3.298 b	
Hydrogel x ascorbic	zero	2.000 f	3.003 e	2.672 e			2.559 c
	2	3.700 cd	5.473 a	4.320 b			4.498 a
	4	3.760 cd	4.040 bc	3.640 d			3.813 b
effect of ascorbic		3.153 c	4.172 a	3.544 b			

*Means with similar letters indicate no significant differences between them at the probability level (0.5%) according to Duncan's multinomial test.

4.5 Nitrogen

The statistical analysis of Table (5) indicated that there was a significant increase in the percentage of nitrogen in the shoots of yellow corn plants at two concentrations (100 and 200ppm) of ascorbic acid, as the percentages reached (26.10 and 19.47 %), respectively, compared with the control treatment. This is consistent with [25] who showed that the use of ascorbic acid in different concentrations led to an increase in the concentration of macronutrients such as nitrogen, phosphorus, and potassium, as these elements work to mitigate the harmful effects of various environmental stresses by improving the physiological and molecular mechanisms of plants.

A non-significant increase in nitrogen concentration was observed when the plant was treated with a concentration of (8gm) of residues compared to the treatment of (4gm) and the control treatment. The reason may be that some plants vary negatively or positively with plant residues, inhibiting or reducing some of their characteristics, or interacting positively, thereby stimulating their growth. This depends on the concentration of the residues and the type of plant part [26

There was also a significant increase in nitrogen concentration when using a level of (2.4gm) of hydrogel added to the soil, and the percentages reached (21.17, 20.62 %) respectively, compared to the control treatment. The reason for the increase in the percentage of nitrogen in the shoot may be due to the role of the hydrogel, as it works to provide good moisture inside the soil, and this in turn provides a suitable atmosphere for the growth and activity of bacteria and fungi. It is no secret that the nitrogen element does not exist in a ready form that can be absorbed by the plant inside the soil, and therefore it cannot Therefore, nitrifying bacteria and other microorganisms perform this function by converting the nitrogen element from the form that is not ready for absorption to the ready form, and then it is absorbed by the root hairs and enters the plant and reaches and distributes it to all parts of the plant, including the vegetative groups. Our results agree with [27], and this was also confirmed by [28] who reported that urea coated with hydrogel had a significant effect on the level of nitrogen in the flag leaf of the wheat plant.

The best result of the interaction between (residue x hydrogel), was recorded when using a concentration of (8gm) of residue and (4gm) of hydrogel, as the result reached 0.950%. Also, the lowest value was recorded when a concentration of (8gm) of residue and without adding hydrogel.

As for the result of the interaction between (residues x ascorbic acid), the best average rate of nitrogen percentage was found when adding the residues at a concentration of (8gm) to the soil and soaking the seeds at a concentration of (200ppm) of ascorbic acid, as it reached 1.024% compared to the other eight treatments.

Regarding the result of the binary interaction (hydrogel x ascorbic acid), the highest mean of the nitrogen percentage was found when treating the plant with a concentration of (8gm) of residue and soaking the seeds with a concentration of (200ppm) of ascorbic acid, as it reached 1.045% compared to the rest of the other treatments.

As for the triple interaction (residue x hydrogel x ascorbic acid), results showed that the highest mean value was at a concentration of (8gm) of residue, (2gm) of hydrogel, and (200ppm) of. Ascorbic acid amounted to 1.274% compared to the other twenty-six transactions.

Table 5. Effect of the interaction of soybean residues and hydrogel on the % nitrogen concentration in the tissues of the vegetative tissues of yellow corn plants whose seeds were soaked with concentrations of ascorbic acid.

Plant residues (gm)	Hydrogel levels (gm)	Ascorbic acid (ppm) zero	100	200	Residue x Hydrogel	Effect of residuals	Effect of hydrogel
Zero	zero	0.490 e	0.685cde	0.979 b	0.718 b		
	2	0.685cde	0.979 b	0.979 b	0.881 a		
	4	0.882 bc	0.979 b	0.784 bcd	0.882 a		
4	zero	0.784bcd	0.784bcd	0.833 bcd	0.800 ab		
	2	0.734 b-e	0.979 b	0.882 bc	0.865 a		
	4	0.784bcd	0.979 b	0.685 cde	0.816 ab		
8	zero	0.587 de	0.637cde	0.808 bcd	0.677 b		
	2	0.685cde	0.784bcd	1.274 a	0.914 a		
	4	0.882 bc	0.979 b	0.990 b	0.950 a		
residues x ascorbic	zero	0.685 c	0.881 ab	0.914 ab		0.827 a	
	4	0.767 bc	0.914 ab	0.800 bc		0.827 a	
	8	0.718 c	0.800 bc	1.024 a		0.847 a	
Hydrogel x ascorbic	zero	0.620 e	0.702 de	0.873 bc			0.732 b
	2	0.701 de	0.914abc	1.045 a			0.887 a
	4	0.849 bc	0.979 ab	0.820 cd			0.883 a
effect of ascorbic		0.724 b	0.865 a	0.913 a			

*Means with similar letters indicate no significant differences between them at the probability level (0.5%) according to Duncan's multinomial test.

5. Conclusion

It is clear from the results of the current study that adding hydrogel to the soil stimulated most of the traits (Mg, Ca, K, P, N percentages). Likewise, soaking yellow corn seeds with increasing concentrations of ascorbic acid also achieved a stimulating effect in all of the above traits. Meanwhile adding residues in soybeans, their effect varied between inhibition and stimulation, and this depends on the concentration of the residues and the degree of their decomposition in the soil, as the greater the concentration of decomposed residues in the soil, the more it has a negative effect, and vice versa in low concentrations. The effect depends on the plant part and the environmental conditions surrounding the plant interactions,

especially the interference of hydrogel levels. As for ascorbic acid, it showed a stimulating impact, and therefore the interaction of factors increases the stimulating effect of those factors.

The results of the current study show the necessity of selecting crops based on taking into account allelopathic effects.

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7. Conflict Of Interest

The authors declare no conflict of interest.

8. References

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التداخل بين إضافة متبقيات فول الصويا والهلام المائي الى التربة في المحتوى المعدني لنبات الذرة الصفراء (*Zea mays* L.) المعاملة بذورها بحامض الاسكوربيك

ياسر صالح محمود[1] محمد سعيد فيصل[2]

قسم علوم الحياة, كلية التربية للعلوم الصرفة, جامعة الموصل, الموصل, العراق

المستخلص:

اجريت هذه الدراسة في البيت السلكي التابع لقسم علوم الحياة / كلية التربية للعلوم الصرفة لموسم 2023-2024 بهدف دراسة تأثير اضافة مستويات من الهلام المائي (0 , 2 , 4) غم/ كغم تربة ومتبقيات الجزء الخضري لفول الصويا وبمستويات (0 , 4 , 8) غم/ كغم تربة في المحتوى المعدني لنبات الذرة الصفراء المنقعة بتراكيز (200,100,0) جزء في المليون من حامض الاسكوربيك.

تم تحليل النتائج باستعمال التصميم العشوائي الكامل Completely Randomized Design وبتجربة عاملية وبواقع ثلاث مكررات, وأكدت النتائج الى وجود تباين في تأثير متبقيات فول الصويا في العناصر المعدنية إذ تراوحت بين التثبيط والتحفيز حيث اثرت المتبقيات تأثيراً تحفيزياً في عنصري الكالسيوم والنتروجين, بينما كان تأثيرها تثبيطياً في عنصر الصوديوم والمغنيسيوم, وأظهر إضافة الهلام المائي تأثيراً تحفيزياً في جميع العناصر الغذائية المذكورة اعلاه , ومن ناحية اخرى فقد حصل تفوق معنويا في محتوى العناصر مع زيادة تركيز حامض الاسكوربيك مقارنة مع معاملة السيطرة بدون إضافة. في حين التداخلات أظهرت تاثيراً تحفيزياً خصوصاً تداخل مستويات الهلام مع تراكيز حامض الاسكوربيك في الصفات المدروسة.