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Impact of Humic Acid Addition and Ginger Rhizome Extract Spraying on Apricot Seedlings, Cv. Hamawi

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A B S T R A C T

During the growing season of 2021, the study was carried out in the lath house of the Department of Horticulture and Landscaping at the College of Agriculture at the University of Anbar, to investigate the impact of humic acid (H) addition at values of (0, 4, 8 ml L^{-1}) and using an extract from the ginger rhizome (Z) solution at (0, 5, 10 g L^{-1}) concentrations On a few apricot seedling growth traits and chemical composition, cultivar Hamawi. The outcomes showed a considerable impact of humic acid addition on all attributes investigated, particularly the high level (H2, which exhibited the attributes with the highest values (seedlings height 30.57 cm, length of branches 18.6 cm, the stem diameter is 2.7 mm, number of leaves is 132.8 leaf $seedlings^{-1}$, the percentage of dry matter of leaves is 51.86%, the leaf area 2065.02 cm^2 $seedlings^{-1}$, chlorophyll content of leaves 11.21 mg g^{-1} fresh weight, leaves content of total carbohydrates 13.76%). Spraying ginger rhizome extract was used as treatment (Z2), and it had the most notable effects on the characteristics (The rate of increase in seedling height, rate of increase in stem diameter, rate of increase in number of leaves, percentage of leaf dry matter, leaf area, content of leaves from chlorophyll, content of leaves from total carbohydrates) which were (26.58 cm, 2.6 mm, 126.7 seedling $leaf^{-1}$, 50.79%, 1804.03 cm^2 $seedling^{-1}$, 11.13 mg g^{-1} fresh weight, and 12.95%) respectively.

Introduction

Prunus armeniaca L., the scientific name of apricot trees, is a member of the Rosaceae family. Another name for it is Armeniaca Vulgaris. [1]. According to some sources, apricot trees were first planted in northern China some 4,000 years in the past [2]. There are untamed types of it, and it is cultivated everywhere from Afghanistan to Japan. Because of this, some scholars argue that the apricot got its current name from Armenia where it originated [3]. The Greeks gave the apricot its original name, AL-Praecox, which translates to "early fruit." [4].

The fact that natural and manufactured organic fertilizers are so effective at promoting growth of plants and do not harm environmental conditions by introducing elements that plants cannot use and are toxic to water and soil is one of their most significant benefits [5]. Humic acid enhances many characteristics of soil [6]. Additionally, it increases the permeability of cell membranes and aids in nutrient absorption. Additionally, it helps to activate the production of the pigment chlorophyll [7]. initiate the division of cells, accelerate growth, foster the growth of the root and shoot systems [8], [9]. Additionally, it improves the resistance of pathogens and lessens the stressors brought on by extreme heat and salinity that lead to poisoning. This has a good impact on the continuance of essential activities [10], [11], [12]. It was reported by [13] and [14] that humic decreases the degradation of amino acids brought on by stress, boosts the effectiveness of photosynthesis, and speeds up the production of carbohydrates and proteins. Along with playing a significant part in the biological management of numerous plant pests, which helps to increase vegetative growth and consequently productivity [15], [16].

Ginger (Zingiber officinale Roscoe) is a member of the Zingiberceae family and Zingiber genus. It is a rhizome-based perennial herb that grows again every year [17]. It is a medicinal plant that thrives in hot climates and has anti-inflammatory, hypnotic, anti-emetic, and gas repellent properties that cause sweating to rise. Additionally, recent research has demonstrated that it prevents cancer, and it is added to pickles, pastries, and other meals [18], [19]. The researchers highlighted the usefulness of ginger rhizome extract in enhancing the vegetative growth of plants when applied as a spray on plant shoots [20], [21], [22]. The reasons for this are due to the content of these rhizomes of various nutrients, which are shown in Table (1), as each 100 g of ginger rhizomes containing of :

Table1: Some components of ginger rhizomes [23], [24]

Chemical composition (100g)		Vitamins (100g)	
P	34 mg	Vitamin C	5 mg
K	415 mg	Vitamin E	260 mcg
Mg	43 mg	Vitamin K	0.1 Mcg
Ca	16 mg	Thiamin	25 mcg
Na	13 mg	Riboflavin	34 mcg
Mn	229 mcg	Niacin	750 mcg
Fe	600 mcg	Vitamin B6	160 mcg
Zn	340 mcg	Folic acid	11 mcg
Cu	226 mcg	Pantothenic Acid	203 mcg
Si	0.7 mcg	Choline	28.8 mc
Total Carbohydrate	18 g $100g^{-1}$	Protein	1.8 g $100g^{-1}$
Sugar	1.7 g $100g^{-1}$	Total Fat	750 mg $100g^{-1}$

Amino acids, organic acids, plant hormones, and other nutritional solutions were employed for growth to accomplish these aims, and have demonstrated their effectiveness in enhancing the expansion and yield of a variety of plants [25], [26]. We choose to conduct this investigation the effects of adding humic and using ginger rhizome extract as a spray on some aspects of vegetative development and the chemical composition of saplings in light of what was previously mentioned and particularly on seedlings and fruit trees growing under the conditions of Anbar Governorate. Hamawi Apricot Variant to ensure the production of sturdy seedlings, particularly in the early years of cultivation. As seedlings use up a lot of nutrients during their first few years of existence, which are then used in their different important processes, there is also the potential to enter the production stage sooner. Additionally, both of the study's components are thought of as environmentally beneficial substances that are favored to be utilized in plant feeding.

Materials and Methods

In order to investigate the impact of adding humic and misting extract of ginger rhizome on some vegetative growth characteristics and seedling chemical content, the study was conducted in the lath house of the Horticulture Department, Agriculture College, Anbar University during the season 2021. For all of the treatments being studied, drip irrigation and pest control field operations were carried out equally. Table 2 provides the results of an investigation of the soil's chemical and physical characteristics.

Table2: Some physical and chemical characteristics of soil.

Av. P mg Kg^{-1}	Total N %	Av. K mg Kg-1	$CaCO_3$ g Kg^{-1}
3.459	0.058	64.27	156.23
Bulk density g cm^{-3}	**O.M %**	**EC ds m^{-1}**	**pH**
1.68	0.17	0.73	7.82
Ca^{++} Mq L^{-1}	**Mg^{++} Mq L^{-1}**	**Na^{+} Mq L^{-1}**	**$CO_3^{=}$ Mq L^{-1}**
5.16	7.45	0.36	Nil
$HCO_3^{=}$ Mq L^{-1}	**Cl^{-} Mq L^{-1}**	**$SO4^{=}$ Mq L^{-1}**	**Sand g Kg^{-1}**
1.85	1.48	1.79	911.3
Silt g Kg^{-1}	**Clay g Kg^{-1}**	**Texture**	
74.1	14.6	Sandy	

Treatments Employed in the Study and Data Analysis:

The initial factor in the experiment was the incorporation of humic of (8, 4, 0 ml L^{-1}) at the dates (1 of April and 1 of June. The second element, which consists of spraying extract of ginger rhizome (10, 5, 0 g l^{-1}) and spraying intervals (1 of April, 1 of May, 1 of June, 1of July, 1 of August, and 1 of October). the symbols (Z0, Z1 and Z2), which represent the aforementioned extract concentrations, respectively. A study was conducted by (RCBD). Three replications and nine treatments were used in the trial. After statistical analysis of the data, the averages were compared at a 5% probability level using the (L.S.D.) test [27].

The Measured Traits:

During the experiment, the characteristics were studied: rate of increase in seedling height (cm), average length of branches (cm), rate of increase in stem diameter (mm), rate of increase in number of leaves, dry matter of leaves (%), area of leaf, chlorophyll (mg g^{-1} fresh weight) according to the method referred to by [28], total carbohydrate content of leaves (%) according to [29] method.

Results and Discussion

Seedling Height (cm):

In particular, H2 produced the highest level of 30.57 cm, was strongly affected by the addition of humic acid on the rate of seedling height development (Figure 1A). 17.05 cm was the smallest measurement for Treatment (H0). The two treatments (Z1 and Z2) were gave highest value, reaching 26.58 and 25.98 cm, respectively, had a significant impact on the trait under study. The outcomes, however, demonstrated that spraying of extract of ginger rhizome had impact on seedling height under study, especially the two treatments (Z1 and Z2) that gave the highest rates of increase in seedling height (26.58 and 25.98 cm, respectively). The lowest growth rate (17.95 cm) was seen with the therapy Z0. The treatment (H2Z1) reached the highest value of 36.14 cm, while the treatment (H0Z0) that gave the lowest value of 14.09 cm (Table 3).

Branch Lengths (cm)

The findings demonstrate that two treatments H2 and H1 of humic gave maximum values of 18.6 and 17.7 cm, respectively (Figure 1B), while the treatment (H0) gave lowest value of 15.8 cm. The outcomes additionally demonstrated the strong impact of spraying ginger rhizome extract, with treatment (Z1) gaving the highest value of 8.18 cm, while the treatment (Z0) gave the lowest value of 16.3 cm. The treatments H2Z1 gave the greatest value of 7.21 cm and the smallest branch length (1.14 cm) compared to control treatment H0Z0 (Table 3).

Stem Diameter (cm):

The findings demonstrate that humic acid considerably enhanced stem diameter in apricot seedlings (Fig. 1C), the two treatments (H2 and H1) gaving 2.7 and 2.2 cm, respectively, while the treatment (H0) gave the lowest diameter of 1.8 cm. The extract of ginger rhizome had a considerable impact, resulting in (Z1 and Z2) which gave the highest values of 2.6 and 2.3 cm, respectively, while the treatment (Z0) produced the lowest diameter of 1.8 cm. The treatment (H2Z1) had the greatest rate of increase in stem diameter, 3.0 cm, whereas the control (H0Z0) had the lowest value, 1.3 cm (Table 3).

Number of Leaves (Leaf $plant^{-1}$):

The findings demonstrate that humic acid significantly increased the number of leaves on apricot seedlings (Figure 1D), the treatment (H2) gave the highest number of 132.8 leaf $plant^{-1}$ while (H0) gave lowest number of 103.7 leaf $plant^{-1}$. A significant difference between the two treatments Z1 and Z0, which produced the lowest value of 106.8 leaf $plant^{-1}$, and the treatment (Z2), which created the maximum value of 126.7 leaf $plant^{-1}$, can be seen after spraying ginger rhizome extract. In example, treatment (H2Z1), which had a maximum value of 148.6 leaf $plant^{-1}$ and a minimum value of 97.3 leaf $plant^{-1}$ (Table 3).

Leaves Dry Matter (%):

The findings demonstrate that feeding humic to apricot seedlings considerably enhanced the amount of dry matter in the leaves (Figure 2A). With 51.86% and 44.04% dry matter in the leaves, treatment H2 outperformed treatment H0. The treatment (Z2) of extract of ginger rhizome gave highest percentage of 50.79%, which was very different from treatments (Z1 and Z0), which had the lowest value of 44.38%. The treatment (H2Z1), which had the highest value of 58.13%, and the treatment (H0Z0), gave the lowest percentage 42.76% (Table 3).

Leaves Area (cm^2 $plant^{-1}$):

The findings showed that treatment (H2) of humic acid having the highest level of 2065.02 cm^2 $plant^{-1}$ over the other two treatments (H0 and H1). Contrarily, Treatment H0 954.49 cm^2 $plant^{-1}$ had the lowest level of the tested feature (Fig. 2B). The extract of Ginger rhizome (Z2) was sprayed, with the highest value being 1804.03 cm^2 $plant^{-1}$ and the lowest being 1067.14 cm^2 $plant^{-1}$. This was significantly better than treatments (Z0 and Z1). The interaction of the research variables significantly impacted results, especially for treatment (H2Z2), which had the highest leaf area (2453.54 cm^2 $plant^{-1}$), while the control treatment (H0Z0) declined to its lowest value (762.24 cm^2 $plant^{-1}$) (Table 3).

Chlorophyll Content of Leaves (mg g^{-1} fresh wt):

The findings in (Fig. 2C) demonstrate that humic considerably boosted the chlorophyll, with H2 treatment surpassing H0 and H1 with 11.21 mg g^{-1}, while treatment H0 gave (9.37 mg g^{-1}). The extract of ginger rhizome showed that treatment (Z2) gave highest value of 11.13 mg g^{-1} that it produced. Consequently, the non-spray treatment (Z0), which produced the lowest value of 9.15 mg g^{-1}, was enhanced by 21.63%. The treatment (H2Z1) caused leaves to have a chlorophyll content of 12.38 mg g^{-1} as opposed to 8.26 mg g^{-1} for control treatment (H0Z0) (Table 3).

Carbohydrate Content of the Branches (%)

The findings demonstrated that humic acid addition to apricot seedlings resulted in significant changes in leaf area characteristics, with treatment (H2) having the highest value of 13.76% compared to H0 and H1's respective values of 11.26% and 11.95% (Figure 2D). Ginger rhizome extract sprayed on Z2 and Z1 treatments produced higher values than Z0 treatments (12.95 and 12.38%, respectively), whereas treatment (Z0) produced the lowest value (11.64%). The treatment (H2Z1) resulted in a branch's carbohydrate content of 14.86% compared to control treatment H0Z0's value of 10.24% (Table 3).

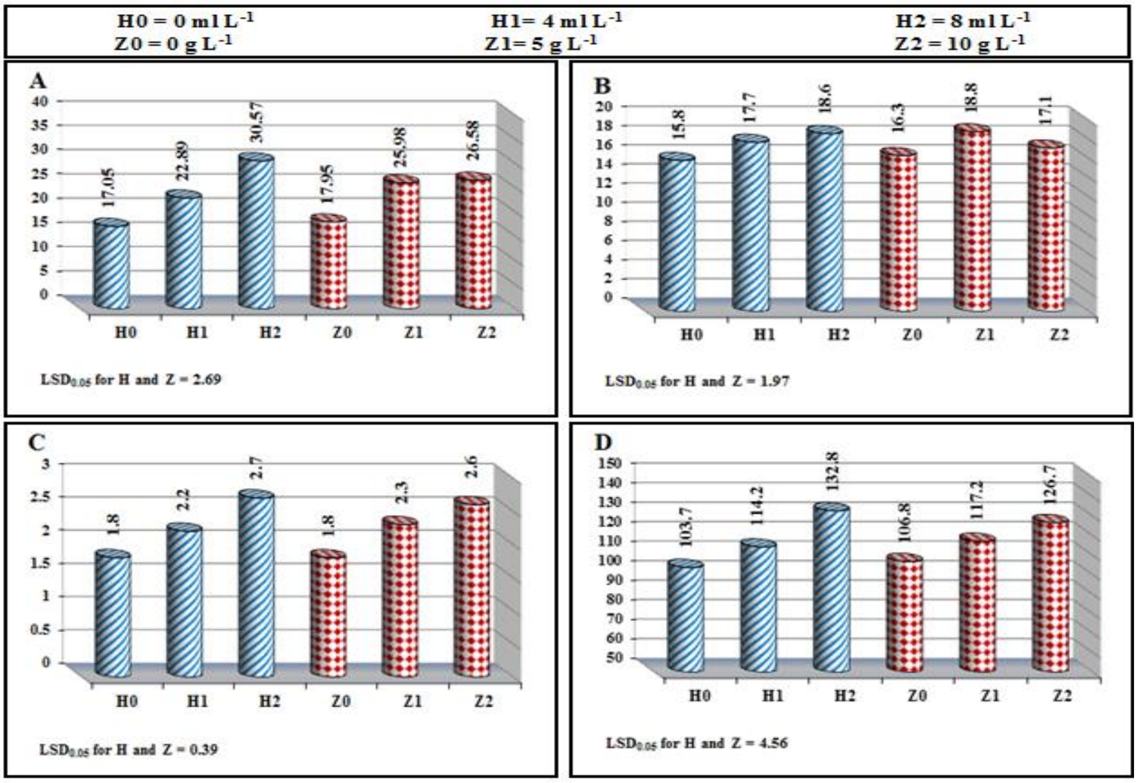

Figure 1: Effect of adding humic acid and spraying with extract of ginger rhizomes on some vegetative growth traits of Apricot seedlings Cv. Hamawi

Table 3: Effect of adding humic acid and spraying with extract of ginger rhizomes interaction on some vegetative growth traits of Apricot seedlings Cv. Hamawi

Humic acid ($ml\ L^{-1}$)	Extract of ginger rhizomes ($g\ L^{-1}$)	Seedling height (cm)	Branch lengths (cm)	Stem diameter (cm)	number of leaf (leaf $plant^{-1}$)
0	**0**	14.09	14.1	1.3	97.3
	5	19.42	16.0	1.6	103.7
	10	17.65	17.4	2.4	110.0
4	**0**	18.46	18.5	1.5	105.2
	5	22.38	18.6	2.3	115.8
	10	27.82	15.9	2.8	121.6
8	**0**	21.30	16.3	2.7	117.8
	5	36.14	21.7	3.0	132.1
	10	34.27	17.8	2.6	148.6
LSD $_{5\%}$		**4.65**	**3.42**	**0.68**	**7.90**

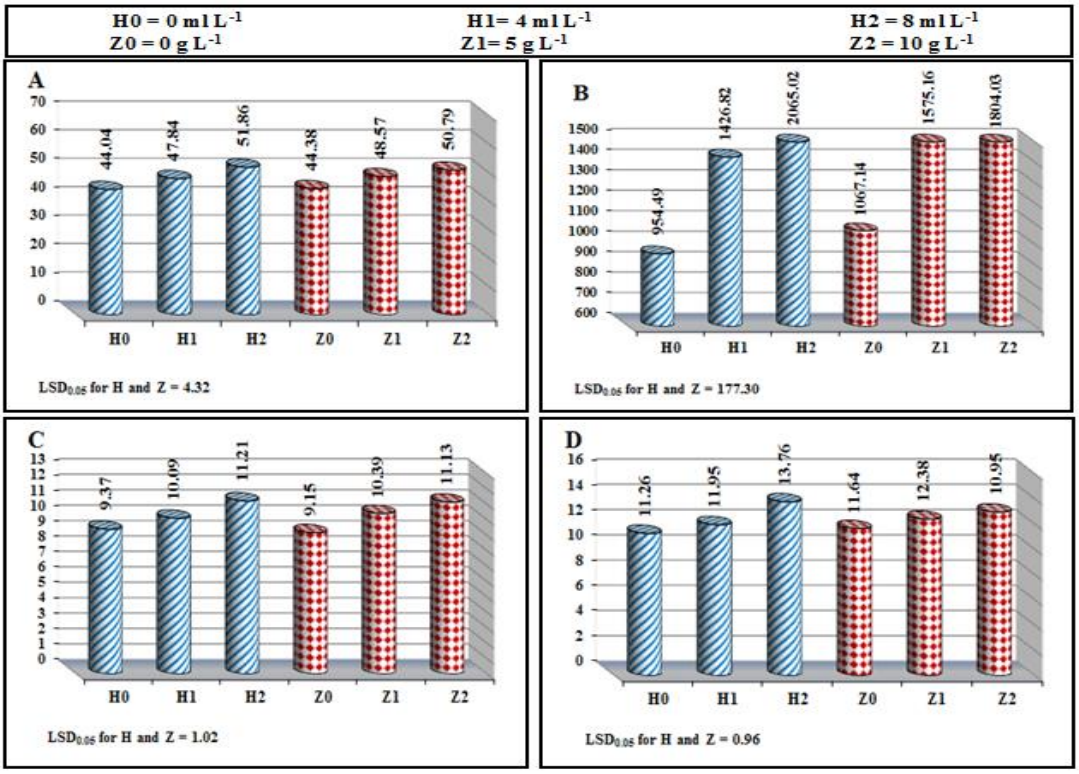

Figure 2: Effect of adding humic acid and spraying with extract of ginger rhizomes on some vegetative growth traits of Apricot seedlings Cv. Hamawi

Table 4: Effect of adding humic acid and spraying with extract of ginger rhizomes interaction on some vegetative growth traits of Apricot seedlings Cv. Hamawi

Humic acid (ml L^{-1})	**Extract of ginger rhizomes (g L^{-1})**	Leaves Dry Matter (%)	Leaf Area (cm^2 $plant^{-1}$)	Chlorophyll Content of Leaves (mg g^{-1} fresh wt.)	Carbohydrate Content of the Branches (%)
0	0	42.76	762.24	8.26	10.24
	5	43.92	879.42	8.64	10.72
	10	45.43	1221.80	11.21	12.83
4	0	45.57	961.61	8.67	11.21
	5	43.65	1582.11	10.15	11.57
	10	54.30	1736.75	11.46	13.08
8	0	44.81	1477.58	10.53	13.48
	5	58.13	2263.95	12.38	14.86
	10	52.64	2453.54	10.72	12.94
LSD $_{5\%}$		**7.49**	**307.09**	**1.77**	**1.65**

Discussion

All of the vegetative properties and chemical composition of the apricot seedlings (Cv. Hamawi) were strongly impacted by the addition of humic, the causes of this might be traced to its function in expanding leaf area (Figure 2B), which is positively reflected in the rise in chlorophyll content in leaves (Figure 2C) and hence, the synthesis of more carbohydrates (Figure 2D). Additionally, humic helps to promote the production of chlorophyll and to assemble carbohydrates, amino acids, and enzymes [30]. Additionally, it functions similarly to auxins in promoting cell division, enhancing the growth of root systems, and raising the amount of dry matter, all of which promote plant growth and enhance vegetative growth [31]. Additionally, humic contributes to an increase in the production of proteins and energy-rich molecules (ATP) within plant tissues [32]. Due to the organic acids and nutrients that it contains, humic also has a beneficial effect on plant growth [33]. Additionally, humic is crucial for promoting soil water retention, root development, microbial community activity, and soil characteristics ([34], [35], Additionally, it plays a part in enhancing the growth medium's chemical and physical qualities, boosting the availability of nutrients, and promoting plant growth [36], [37]. Humic also helps plants become more resistant to pest infestation [38]. Additionally, it is a source of polyphenol, a chemical that serves as a respiratory medium. This boosts the biological activity of the plant by stimulating the enzymatic system and increasing dry matter synthesis [39],[40].

The benefits of spraying ginger rhizome extract on seedlings, such as improved vegetative growth manifestations and increased chemical content, may be attributed to its role in increasing leaf area and chlorophyll content, which has a significant impact on increasing the production of carbohydrates during photosynthesis, which is used to provide the energy required for the vital processes that seedlings must carry out, as well as the extract's amount of macro and micronutrients, vitamins, proteins, and carbohydrates, all of which are highly powerful at triggering a variety of physiological processes in plants [41], [42], including the creation of chlorophyll and the subsequent large-scale production of carbohydrates, both of which help to accelerate the vegetative development rates of seedlings.

Conclusion

After analyzing the study's findings, it can be said that apricot seedlings of the Cv. Hamawi variety responded favorably to both the high quantities of both ginger rhizome extract and ground fertilizer with Humic. Therefore, given that increasing plant vegetative growth depends mostly on balanced nutrition and that malnutrition has a detrimental effect on the growth of fruit seedlings, we advise fertilizing apricot seedlings with both study components.

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