

## Effect Of Gibbrllen Spraying And Soil Fertilizing With Humic Acid At Vegetative and Root System Growth At Mandarin Saplings *Citrus reticula* L.

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**Abstract:** This study was conducted in one of the lathe houses that follows station (B) in Horticultural and Landscape Design – Agricultural Engineering Sciences- University of Baghdad (Al Jadria ) to investigate the effect of foliar spraying of Gibbrllen and soil application of Humic Acid on Tangerine Saplings (*Citrus reticulata* L.). The experiment describes the significant effects of GA and Humic acid upon most vegetative characteristics like the height of the plant, number of shoots, number of leaves and percentage of dry matter in the vegetative system ). There was a special effect for two factors on most Root tarts, such as (root volume, number of roots, root diameter and percentage of dry matter in the root system). They significantly affect rest and leave chemical content traits under consideration. On the other hand, the interaction between two factors significantly affects most tarts under investigation.

**Keywords:** mandarin, Gibbrllen, Humic Acid, vegetative and root system.

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### Introduction

Mandarin *Citrus reticulata* L. Its evergreen tree belongs to the Rutaceae family. A distinctive aromatic smell distinguishes its trees; in addition to its aromatic flowers, the rind of its fruits is distinct from one variety to another by its aromatic nature. Mandarin is a medium-sized evergreen tree with many branches; its leaves are glossy green, and the flowers bloom singly or in groups in the axils of the leaves. Blooms are self-fertile or Parthenocarpic, such as Satsuma variety <sup>1</sup>. Plant growth regulators play a significant role in the important physiological process that controls plant growth, especially Gibberellic acid or GA3, managed as a stimulant of stem elongation, enhanced leave area distance by cell elasticity and elongations, increasing plant nutrients absorbing efficiency due to plant growth <sup>2</sup>. <sup>3</sup> mentioned that GA3 effect significantly on vegetative growth parameters of Canino apricot trees. Fertilization is a necessary application demand for growth and high yield; Humic acid is an organic matter with bio-controlled stimulants. They were found under natural conditions. Humic acid applied to soil affects plant growth and development <sup>4</sup>. <sup>5</sup> reported that Humic acid is due to increasing nutrient uptake, activated soil micro-organisms and hunching availability of soil nutrients, especially in alkaline soils.

## Materials and Methods

The nursery experiment was carried out in a metal frame of the plastic house covered with a green 50% sun shade net, followed by horticultural and garden designs- College of Agricultural and Engineering Sciences- University of Baghdad. For three years, mandarin saplings were planted in 35\*30 plastic pots. The saplings were sprayed with three concentrations of GA3 (0, 250,500)mg.l<sup>-1</sup>, and the spraying was repeated three times. Soil of saplings will irrigated with three concentrations of Humic acid (0, 0.1, 0.2) vol.vol<sup>-1</sup> per pot three times. The traits such as plant height, stem diameter, shoot number, leaves number, leave area distance, percentage of dry matter for vegetative and root system, roots number, roots volume, roots diameter, leave contents of chlorophyll, nitrogen, phosphorous, potassium, magnesium, iron and carbohydrates in both of vegetative and root systems. The experimental design was RCBD with two sapling experimental units and three replications. Genstat program will analyze the variance between treatments; the means were compared with a 5% LSD test.

## Results

Results in Table 1 showed that spraying mandarin saplings with 500 mg.l<sup>-1</sup> of GA3 increased most of the vegetative characteristics such as plant height, shoots number, leaves number, leave area distance and percentage of dry matter in the vegetative system, compared with control treatment, the results were (99.32cm, 28.7shoot.plant<sup>-1</sup>, 136.4leaf. plant<sup>-1</sup>,43.66decim<sup>2</sup>,85.01%) alternatively. This will belong to gibberellins affected on the cell wall to make it more elastic, which leads to elongating and increasing its ability to divide. In the same table, we found that Humic acid has a significant effect when added to pot soil, especially at the highest level of 0.2 vol.vol<sup>-1</sup> on most vegetative traits such as plant height, leaves number, leave area distance and percentage of dry matter in the vegetative system, the results reach (102.83cm, 141.1 leaf. plant<sup>-1</sup>, 45.16decim<sup>2</sup>, 88.26%) respectively, compared with control treatment that gave lowest value in the same traits. Between the effect of two factors on most vegetative characteristics, there was another effect of the interaction between them on all traits.

Treatment	Plant height cm	Shoot no.	Stem diameter mm	Leave no.	Leave area dis. Desi <sup>2</sup>	Veg. Dry weight percentage	
Ga0Hu0	80.25	18.30	7.53	110.0	35.20	<b>68.84</b>	
Ga0Hu1	91.47	18.30	8.17	125.6	40.21	<b>78.52</b>	
Ga0Hu2	88.23	24.00	8.40	121.0	38.72	<b>75.72</b>	
Ga1Hu0	89.02	17.00	7.30	122.3	39.15	<b>76.41</b>	
Ga1Hu1	81.00	17.00	7.37	111.0	35.52	<b>69.48</b>	
Ga1Hu2	100.57	20.00	7.87	138.0	44.16	<b>86.33</b>	
Ga2Hu0	103.27	31.70	8.40	142.0	45.44	<b>88.64</b>	
Ga2Hu1	75.00	22.30	8.03	103.0	32.96	<b>63.67</b>	
Ga2Hu2	119.70	32.00	5.63	164.3	52.59	<b>102.73</b>	
Ga0	86.65	20.20	8.03	118.8	38.04	<b>74.36</b>	
Ga1	90.20	18.00	7.51	123.7	39.61	<b>77.41</b>	
Ga2	99.32	28.70	7.36	136.4	43.66	<b>85.01</b>	
Hu0	90.84	22.30	7.74	124.7	39.93	<b>77.96</b>	
Hu1	82.49	19.20	7.86	113.2	36.23	<b>70.56</b>	
Hu2	102.83	25.30	7.30	141.1	45.16	<b>88.26</b>	
LSD	Ga	1.396	7.36	N.F	1.987	0.636	<b>1.096</b>

	Hu	1.396	N.F	N.F	1.987	0.636	<b>1.096</b>
	Ga×Hu	2.417	12.75	N.F	3.442	1.101	<b>1.898</b>

**Table 1. Effect Of Gibbrllen Spraying And Soil Fertilizing With Humic Acid on Vegetative Traits.**

Table 2 showed there were more effects of GA3 on root trait underestimation. We found that the highest concentration of GA3 (500 mg.l<sup>-1</sup>) has superiority over other concentrations in all root traits like root volume, root number, root diameter, percentage of dry matter in the root, carbohydrates on both root and shoot, results were reaches (272.6ml<sup>3</sup>, 4.19 root.plant<sup>-1</sup>, 11.18 mm, 60.12%, 10.20%, 12.2%) respectively, while control treatment gave lowest value. Results in Table 2 showed that Humic acid in 0.2 vol.vol<sup>-1</sup> was superior in root traits such as root volume, root number, root diameter, percentage of dry matter in the root, and carbohydrates on both root and vegetative systems. Their results were reached (267.5 ml<sup>3</sup>, 4.1 roots.plant<sup>-1</sup>, 10.97mm, 58.98%, 10%,12.2%) respectively. In contrast, the control treatment gave the lowest results. The same table found that the interaction of two factors significantly affects all root characters.

Treatment	Root vol. ml <sup>3</sup>	Root no.	Root diameter mm	Root. Dry weight percentage	Veg. carbo-hydrate %	Root carbo-hydrate %	
Ga0Hu0	195.0	3.00	8.00	43.00	7.30	<b>8.90</b>	
Ga0Hu1	208.6	3.20	8.55	46.01	7.80	<b>9.52</b>	
Ga0Hu2	229.5	3.51	9.41	50.61	8.59	<b>10.47</b>	
Ga1Hu0	210.6	3.23	8.63	46.44	7.88	<b>9.61</b>	
Ga1Hu1	231.6	3.55	9.50	51.07	8.66	<b>10.56</b>	
Ga1Hu2	261.6	4.02	10.73	57.69	9.77	<b>11.93</b>	
Ga2Hu0	237.9	3.65	9.75	52.47	8.90	<b>10.85</b>	
Ga2Hu1	268.6	4.14	11.01	59.24	10.05	<b>12.25</b>	
Ga2Hu2	311.3	4.78	12.77	68.65	11.65	<b>14.20</b>	
Ga0	211.0	3.24	8.65	46.54	7.89	<b>9.63</b>	
Ga1	234.6	3.60	9.62	51.73	8.77	<b>10.70</b>	
Ga2	272.6	4.19	11.18	60.12	10.20	<b>12.44</b>	
Hu0	214.5	3.29	8.79	47.30	8.02	<b>9.78</b>	
Hu1	236.3	3.63	9.69	52.10	8.84	<b>10.78</b>	
Hu2	267.5	4.10	10.97	58.98	10.00	<b>12.20</b>	
LSD	Ga	3.609	0.0576	0.1488	0.795	0.1346	<b>0.1660</b>
	Hu	3.609	0.0576	0.2578	0.795	0.1346	<b>0.1660</b>
	Ga×Hu	7.251	0.0998	3.052	1.377	0.2332	<b>0.2875</b>

**Table 2. Effect Of Gibbrllen Spraying And Soil Fertilizing With Humic Acid on Root Traits.**

Table 3 noted that the content of plants' chemical elements and compounds were increased after plants sprayed with GA3, especially the highest concentration of 500 mg.l<sup>-1</sup> in most characteristics such as (chlorophyll, nitrogen, phosphorous, potassium, magnesium, and iron) in plants leave they reach (51.73 mg. 100g fresh wet, 1.913%, 0.310%, 1.8%, 269.7mg, 185,4mg) respectively, compared with other treatments. The same table showed that Humic acid has a significant effect on leaf content of nutrients and compounds in the highest level 0.2 vol.vol<sup>-1</sup> on all root traits such as chlorophyll, nitrogen, phosphorous, potassium, magnesium, and iron in the leaf, results reach (50.75 mg. 100 g fresh wet, 1.981%, 0.321%, 1.863%, 279.1 mg, 191.9 mg) respectively, the reason for Humic acid action that increases

availability of elements in soil and admonition by plant itself, thus will enhanced the accumulation of elements in plant. Table 3 showed a significant effect of interaction between two experiment factors.

Treatment	Chlorophyll	Nitrogen %	Phosphorous %	Potassium %	Magnesium mg	Iron mg	
Ga0Hu0	37.00	1.700	0.275	1.595	239.0	<b>164.3</b>	
Ga0Hu1	39.59	1.780	0.289	1.675	250.9	<b>172.5</b>	
Ga0Hu2	43.54	1.923	0.312	1.809	271.0	<b>186.3</b>	
Ga1Hu0	39.96	1.730	0.281	1.627	243.7	<b>167.5</b>	
Ga1Hu1	43.94	1.800	0.292	1.692	253.4	<b>174.2</b>	
Ga1Hu2	49.64	2.000	0.325	1.882	281.8	<b>193.7</b>	
Ga2Hu0	45.15	1.850	0.301	1.741	260.8	<b>179.3</b>	
Ga2Hu1	50.97	1.870	0.303	1.760	263.5	<b>181.2</b>	
Ga2Hu2	59.07	2.020	0.328	1.900	284.6	<b>195.7</b>	
Ga0	40.04	1.801	0.292	1.693	253.6	<b>174.3</b>	
Ga1	44.51	1.843	0.299	1.733	259.69	<b>178.5</b>	
Ga2	51.73	1.913	0.310	1.800	269.7	<b>185.4</b>	
Hu0	40.70	1.760	0.285	1.654	247.8	<b>170.4</b>	
Hu1	44.83	1.816	0.294	1.709	256.0	<b>175.9</b>	
Hu2	50.75	1.981	0.321	1.863	279.1	<b>191.9</b>	
LSD	Ga	0.323	0.01170	0.002022	0.01078	1.597	<b>1.097</b>
	Hu	0.323	0.01170	0.002022	0.01078	1.597	<b>1.097</b>
	Ga×Hu	0.560	0.02026	0.003502	0.01867	2.766	<b>1.900</b>

**Table 3. Effect Of Gibbrllen Spraying And Soil Fertilizing With Humic Acid on leave contents of chemicals elements and compounds.**

### Discussion

The results showed that Humic acid has a significant effect when added to pot soil because of the direct and indirect effects of Humic acid on plant growth and development; this will agree with <sup>6</sup>. Moreover, the results indicate that Gibberellins have an indirect effect on the roots because they encourage the growth of the shoot and thus increase Auxins syntheses in apical buds, which increases growth and development in roots; this will conform with <sup>7</sup> that note GA3 encourages cell division and elongation increase shoot length that will increase Auxins syntheses indirectly effect on root growth. Furthermore, Gibberellins play the role of the sink to nutrients when it is applied, so it Increases the contents of leaves from elements and indirectly chlorophyll synthesis in chloroplasts; this conforms with <sup>8</sup>. <sup>6</sup> reported that Humic acid plays the role of soil conditioner and increases the availability of elements in soil <sup>10,11</sup>.

### Conclusions

Gibberellic acid and Humic acid both indirectly and directly affect plant physiological processes and nutritional status, enhancing plant growth in vegetative and root systems by chemical elements that uptake carbon assimilation and metabolism and energizing hormones.

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