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The Effect of Vitamin B3 and Humic Acid on Flowering Traits and Roots Growth of Geranium *Pelargonium hortorum* L.

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Abstract : The current study was conducted during the agricultural season (2019-2020) in the lath house that (covered with Saran and cloth) belonging to the Agricultural Research and Experiment Station at the College of Agriculture, University of Basrah, We sprayed Geranium *Pelargonium hortorum* L. with three a concentrations (0, 50, 100) mg. L^{-1} of the organic fertilizer humic acid as well as three concentrations (0, 40, 80) mg. L^{-1} of vitamin B_3 nicotine amide. Then, we investigated the response of Geranium plant for two treatments in n the vegetative ,flowering and root growth after three sprays of each treatment fertilizer humic acid and nicotine amide at (100 and 80) mg. L^{-1} respectively caused led to the improvement of flowering and root growth indicators, which included (flowering date, the length stalk of inflorescence, percentage of dry matter in inflorescences, length of main roots, number of main roots, percentage of dry matter in the root system). The present study indicated the important role of humic acid and nicotine amide in the amelioration of flowering and root growth of geranium plant.

Keywords: Geranium, humic acid, Nicotine amide.

Introduction

Geranium *Pelargonium hortorum* L. belongs to the Geraniaceae family, The original home of geranium is. South Africa, where it is found naturally growing in hot and dry environments i (Vanderwalt *et al*., 1977). It has important economic value due to for the beauty shape of leaves and flowers of plant as well as the length of the flowering period and the multiplicity of colours, give the plant wide use (Larson & Fonterno, 1992). The leaves of plants are semi-circular with a light green colour containing a brown ring in the middle. The end of its flowers differ according to the cultivars they are characterized by multiple colours including red, white or pink and the overlapped colours from these colours with single and check spelling petals in the branches are a soft and that are getting solidified later. The plant is sexually produced by seeds and asexual production is carried out by the mind and blooms throughout the year (Abu Dahab, 1992). In addition to use geranium plant in balconies and windows decorationas pot plants, it is used as a medicine plant by utilization the leaves are protect from

the insect bites, treatment of shemorrhids and rheumatism, and to strengthen of immune system (Al-Ghitani, 1958; Bertin, 2001; Elena & Lucian, 2010). Foliar fertilization is considered one of the correct and balanced fertilization programs that provide deficient elements by spraying on the leaves which help to be absorbed directly and avoid the loosing of fertilizers by washing when added to the soil (AlSahaf, 1994). Vitamins have a role in improving the productivity vegetative and flowering growth (Bearder, 1980; Arteca, 1996) because the vitamin as bio-regulators can at check spelling concentrations exert a profound effect upon plant through regulation primary and secondary metabolism (Abd El-Aziz *et al*., 2007; Amin & Ismail 2015). Vitamin B_3 is Nicotinamide, Which is a component of Co-enzymatic component of NADP + and NAD + (San & Ota, 1977; Bearder, 1980). Humic acid is a compound that is resulting from the decomposition of organic matter (Fathy *et al*., 2010), which contains differentiated ratios of carbon, hydrogen, nitrogen and oxygen (Senesi, 1992). Humic acid works as growth regulation of plant hormones and increased flowering in pelargonium plants (Piccolo *et al*., 1992; Nardi *et al*., 2002; Morard *et al*., 2011).

This study was conducted due to the aesthetic and coordination value of geranium plant and the need to expand its cultivation whether in pots or in garden lands.

Materials &Methods

This experiment was conducted in the lath house (covered with saran) at the Department of Horticulture and landscape in the College of Agriculture, University of Basra for the period 12/2/2019 to 10/6/2019. Geranium plants *(Pelargonium hortorum* L. have brought from one of the nurseries in Baghdad on 10/2/2019 at the age 55 days. Geranium seeds were planted on 15/12/2018, after 57 days seedlings were transferred to pots have 22 cm diameter. Then seedling were washed and sterilized with a 4% formalin solution, before agricultural operations, a Random sample of soil that used for the cultivation was taken for chemical and physical analysis (table 1). The experiment was conducted as a factorial experiment (3×5) according to Randomized Complete Blocks Design, with three replicates and the averages were compared using the least difference test (L.S.D) below the 5% probability level (Al-Rawi & Khalaf Allah, 1980).

Table (1): Some of chemical and physical traits of the study pots soil that used in the experiment.

Traits	value
Soil texture	Sandy loam
Sand (1g.$^{-kg}$)	861.8
Silt (1g.$^{-kg}$)	80.84
Clay (1g^{-kg})	57.36
PH	7.31
E.C. (dsm^{-1})	1.54
Organic matter (%)	1.84
Zn++ (ppm)	1.37
N (ppm)	171.00
P (ppm)	2.47
K+(ppm)	57.17

Table (2): Chemical composition of humic acid organic fertilizer according to (Humin Tech).

Potassium humate	85%
Water-soluble potassium (K_2O)	11.0%
Nitrogen	0.8%
Iron	1.0%
Humidity	12-10%
Dry matter	88-90%
Degradation	99.8%
Other materials	15%

The studies traits

Flowering growth indicators -

1. Flowering date (day)

Measured by calculation the average of days that accounted between plant cultivation to open the first flower in the inflorescence of each plant of the experimental unit.

2-The length of inflorescence stalk

The length of inflorescence stalk is indicated from the contact place of flowers stalks in the inflorescence to contact place of the leaf stalk by using the metric tape. The average of recorded numbers is calculated later.

3-Percentage of dry matter in inflorescences

After taking the fresh weight of srandom samples of in florescences, percentage of dry matter of selected plants were dried by electric oven at 70º C for 48 hours and until weight stability. The percentage of dry matter of the inflorescence was calculated according to the following equation:

$$\text{Inflorescences} = \frac{Dry\ weight\ of\ inflorescences}{fresh\ weight\ of\ inflorescences} \times 100$$

The root system traits .

1. Number of main roots

After the indication of flowering, the pot was placed in the water basin for 24 hours and shaken until removing of all the suspended roots. Then the average of main roots number calculated) Al-Ali, 2011).

2. Length of the main roots

The length of main root of each plant in the experimental unit was measured by tape measure and the averages were calculated.

3.Percentage of dry matter in the root system

After taking the fresh weight of the root system, the root system was dried by an electric oven at 70 ° C for 24 hours until weight stability. Then the percentage of dry matter was calculated by the following equation:

$$\text{Percentage of dry matter in the root system} = \frac{The\ dry\ weight\ of\ the\ root\ system}{fresh\ weight\ of\ the\ root\ system} \times 100$$

Results & Discussion:

Flowering growth traits

Table (3) showed that spraying plants with humic acid at 100 mg.L^{-1} a concentration has a significant effect in the flowering indictors including flowering date, length inflorescence stalk, Percentage of dry matter in inflorescences, which gave (69.641, 12.376 and 9.557), respectively compared to the control plants which gave and sprayed with distilled water (91.708, 9.428 and 6.753), respectively. This result may be due to the positive effect natural stimulants such as Auxins, Cytokinins and amino acids, which led to the growth and thus the early flowering (Al-Ani, 1987). Humic acid also, has micronutrients that stimulate vegetative growth which, reflected in the improving of photosynthesis efficiency and energy-rich compounds, which improved the plant growth and early flowering (Adams & Winsor, 1979). The Increasing of inflorescence stalk length is attributed to contain humic acid on IAA-like substances in cell elongation and increased the elongation of the in florescrnce stalk (Menhnett, 1979). This result is in identical with (AlSultan *et al*., 1994) on the geranium plant.

Table (3): Effect of Spraying with Vitamin Nicotine amid and Humic Acid and their Interactions on flowering traits and roots growth of *P. hortorum*.

Treatments		flowering date (day)	The length flower's stalk (cm)	Percentage of dry matter in inflorescences(%)
mg. L^{-1})) Humic acid levels				
0		91.708	9.428	6.753
50		75.856	10.748	8.244
100		69.641	12.376	9.557
LSD		0.304	0.195	0.252
(mg. L^{-1}) Nicotineamide Levels				
0		84.510	9.823	8.504
40		76.426	11.272	10.402
80		76.269	11.456	9.799
LSD		0.304	1.195	0.252
Interaction levels between humic acid and nicotine amide				
0	0	97.667	8.900	6.309
	40	90.510	9.057	6.570
	80	86.947	10.327	7.381
50	0	85.380	9.830	7.278
	40	70.367	10.987	8.481
	80	71.820	11.427	8.974
100	0	70.483	10.740	8.504
	40	68.400	13.773	10.402
	80	70.040	12.613	9.799
LSD 0.05		0.527	0.338	0.436

The increase in the percentage of dry matter in inflorescence may be due to the content of humic acid on compounds (Potassium humate, Nitrogen, Iron and Dry matter) that are necessary to promote the carbohydrates manufacture and accumulation the carbohydrate in inflorescence, which led to increase the percentage of dry matter. This result agrees with Amin (2018) result on Cardinea. However, the spraying with nicotineamide at a 80 mg.L^{-1} led to the highest average amounted to (76.269, 11.456 and 9.799), respectively for the previous indictors compared to control plants which gave (84.510, 9.823 and 8.504), respectively the reason increase of flowering growth after nicotine amide treatment due to its role in the production of amino acid and nuclear which is reflected positively on the manufacture and transfer of carbohydrates from leaves to flower buds, which leads to create balance between carbohydrates and protein, which has a positive role in the early of flowering date, Percentage of dry matter in flowers (Florent, 1986).

These results are agreed with results of Halhout *et al*. (1993) on tomato plant and Al-Zarfi (2017) on the Gladiolus we found the bi-interaction between humic acid at 100 mg. L^{-1} and nicotine amide at 40 mg.L^{-1}, had a significant effect in the improving of flowering growth indicators. The interaction average of flowering date, length of inflorescence stalk, and percentage of dry matter in inflorescence which 68.400, 13.773 and 10.402 respectively.

The Root system traits

Table (4) showed that plants spraying with humic acid at 100 mg. L^{-1} a concentration has a significant effect in root length, number of main roots, and percentage of dry matter in the root system which gave (8.489, 48.120 and 12.577) respectively, compared to the control plants that gave (5.381, 31.380 and 8.633), respectively. The increase in the number of root and root length with humic acid treatment may be due to humic acid contains high nutrients (Potassium humate and dry matter) as well as auxine and cytokinins which increase the tolerance of plants to different environmental stresses and promote the root growth. (Nordi *et al*., 2002). The significant excelled in the percentage of dry matter after humic acid treatment may be that humic acid has macro and microelements (Water-soluble potassium (K2O), Nitrogen and Iron) and some substances that have the same auxine function. In addition, humic acid help to increase of leaf area and its content of chlorophyll, which induced the bioactivity of plants and thus increased the roots growth (Al-Katib (2000)). This is same result that obtained by Al-Jubouri (2014).

The same table also shows plants which sprayed with 80 mg. L-1 of nicotine amide led to the highest average amounted (7.443, 42.360, and 11.591), respectively compared to the with control plants which gave 5.854, 33.490 and 9.380, respectively. The reason increase of roots number and length after nicotine amide spray is due to its great effect on the formation of proteins, amino acids, carbohydrates and enzymatic compounds that activate the vegetative growth and thus reflected on the increase of photosynthesis process and stimulate the root growth (Delphine & Wendham, 1985). These results agree with result of Abbass *et al.* (2018) on *Mathiola incana* L. The significant increase in the percentage of dry matter may be due to the role of vitamin B3 in the increasing of numbers and areas of leaves which play an important role in the increasing of photosynthesis. Also, nicotine

Table (4). Effect of Spraying with Vitamin Nicotineamid and Humic Acid and their Interactions on Flowering traits and roots growth of *Pelargonium hortorum* L.

Treatments		Number of main roots	Length of the main roots	Percentage of dry matter in the root system
(mg. L^{-1})Humic acid levels				
0		5.381	31.380	8.633
50		6.723	37.970	10.799
100		8.489	48.120	12.577
LSD		0.195	0.657	0.205
(mg. L^{-1})Nicotineamide Levels				
0		5.854	33.490	9.380
40		7.296	41.630	11.039
80		7443	42.360	11.591
LSD		0.195	0.657	0.205
Interaction levels between humic acid and nicotineamide				
0	0	5.110	30.500	8.315
	40	5.073	31.130	8.303
	80	5.960	32.510	9.282
50	0	5.933	31.760	9.456
	40	6.700	37.750	10.716
	80	7.537	44.400	12.225
100	0	6.520	38.200	10.368
	40	10.133	56.000	14.097
	80	8.833	50.170	13.265
LSD 0.05		0.338	1.138	0.3466

amide increased the leaves content of potassium that is important in photosynthesis and cell division which lead to increase the roots weight (Volt *et al*., 1987). These result is compatible with Ali (2011) result on the dahlia plant. For the bi-interaction between humic acid and nicotineamide, we obtained there was significant effect in the improving of the vegetative growth indicators. The treatment of humic acid and nicotine amide at 100 and+ 40 mg.L^{-1} respectively which gave the highest average of the root length, number of main roots, and percentage of dry matter in the root system which 10.133, 56.000 and 14.097, respectively compared to the lowest average that gave amounted to 5.110, 30.500 and 8.315 respectively .

Conclusions

The results of current study showed that the treatment with 100 mg.L-1 of Humic acid and 80 mg.L-1 of Nicotineamid led to the improvement of floral and root growth indicators. However, The interaction of 100 mg.L^{-1} of Humic acid and 40 mg.L^{-1} of Nicotineamide 40 mg. L^{-1} was the best in the improvement of floral and root growth indicators. The present study investigated the important role of humic acid as an organic fertilizer and nicotine amid as a vitamin and theinteraction between them on the floral and root growth of geranium plant.

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