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INFLUENCE OF TUBEROUS ROOT SOAKING IN SALICYLIC ACID AND FOLIAR SPRAY OF PLANTS WITH BENZYLADENINE ON GROWTH, FLOWERING AND TUBEROUS ROOT PRODUCTION OF *RANUNCULUS ASIATICUS*

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Abstract

Study of the tuberous soaking in Salicylic acid (SA) and foliar spray of plants with Benzyl adenine (BA) on growth on growth and flowering of *Ranunculus asiaticus* was carried out at one of plastic house belonging to hort. Dept. College of Agric. At aljaderia location on fall 2015. Tuberous roots were soaked at 0, 50, 100 mg L/l of Sa for 2 hrs before planting. Plant were sprayed with 0, 25, 50 mg/ l of BA when they were 4-6 leaves old. Results could be summarized as follow. Soaking tuberous roots at (100) mg/l of SA increased plant height (19.11) cm leaf area (97.7) cm^2 fresh and dry weight of vegetative growth (64.00, 38.8g. respectively. Spraying plant at 50 mg/l of BA was superior on increasing plant height (20.33 cm) leaf area (87.2cm^2) and fresh and dry weight of the vegetative growth (55.00, 32.6) g. Moreover both plant growth regulators enhanced the flowering characters. SA at 100mg/l was more effective on increasing number of flowers / plant (3.3) flowering date was earlier (101.4 days) prolonged flowering date was decreased (113.7 days) prolonged each flowering period (12.2 days) and vase life (8.4 days)in addition100 mg/l was superior on increasing number of tuberous roots production (3.3) and fresh and dry weight of root (15.4, 12.2) g While 50 mg /l of BA was effective on enhancing tuberous roots formation (2,7) and fresh and dry weight of tuberous roots as well (14.2, 10.9) g respective All interaction treatments between the plant growth regulators were significantly improved most of the characters tested.

Key words : tuberous root, Salicylic acid, foliar spray.

Introduction

Ranunculus asiaticus is known also a turban buttercup and also called an common garden ranunculus. It is a flowering bulbs it is originally found in south Europe, Syria and Iran A dwarf (30-45) cm plant with beautiful cut foliage. The flower are double, yellow in color and about 3-5 cm across (2) it thrives best during winter his propagated from seed and claw-like tubers. The flower is used as cut flowers (Al-Sahooki and Kareema, 1990; Ahmed *et al.,* 2001). The plant hormones are groups of chemical compounds which regulate plant growth. They are a molecular signal produced inside the plant and acts in minute concentration to organize the cells activities while it's produced or when its Trans located inside the plant. The plant hormones also play a role in flowering, growth systems and leaves and the development and ripening of the same time all the fruits (Wikipedia 2010) each plants hormones can be measured can be contracted by the introduction between two or more hormones. This interaction can be happen at different levels while included hormones synthesize and their receive and the secondary products and also the level of the hormone action. These interaction maybe either collaborative or contradictory or equipoise. There is about 400 gene participate in the stages of biosynthesis of the plant hormone and its translocation and function (preedakoon, 2009). It is well known that there is more than five group of hormones (auxins- Gibberellins-cytokine-abscise acid, ethylene) and salicylic acid was added also (George *et al.*, 2008). The salicylic acid was produced for the first time in Germany in 1874 and the Asprin is the trade name of the Acetyl salicylic acid (Raskin 1992).

The salicylic acid was used to study the responses of many ornamental plants to their hormone specially it is

influence on growth and flowering of plant and absorption of the mineral ions and also on the movement of the stomata and the production of the ethylene in plants (shudo 1994) and also influence the formation of chlorophyll and carotene and accelerate the Photosynthesis and the activity of some plant enzymes (Ahmed & Hayat 2007). Marthin *et al*., (2003) reported that treatment with 50 mg/L^{-1} Salicylic Acid (SA) significantly increased Leaf area, while 10 mg.L-1 (SA) increased the number of leaves. Sandoval (2004) found that folia spray *Tagetes erecta* plants with salicylic acid increased the fresh and dry weight and the length of the roots.

The cytokine are other group of plant hormones it's called in the fast as kinins when it extracted from the yeast the cytokine stimulate cell division and delay the senescence of the tissues. It is responsible for the movement of the oxygen in all plant and also on the length of internodes and overcome the apical dominant (Wikipedia 2010). Two hundred of natural and synthetic cytokine were known these days and most of these compounds which shows cytokine activities were amino purine compounds changed in nitrogen atom number 6 such as Benzyladenine (BA) (Sakakiabara, 2004). The cytokinin was used since many years in laboratory and it is influences in growth of different plants such as ornamental plants. Sajjad et al (2015) found that dipping gladiolus corms in BA at 0, 50, 100, 150 ppm increased the number of branches per plant, height of plant and the percentage of flowering. Al-Khassawneh *et al.,* (2007). Found that treating Iris plants *Iris nigricaans* with 0, 50, 100, 200 mg.L^{-1} increased the number of branches per plant and number of leaves and heat area and dry weight of vegetative plants. The aim of this study was to investigate the influence of dipping the rot tubers of ranunculus in Salicylic acid and foliar spray with Bnzyladenine (BA) on growth and flowering and the growth root tubers of ranunculus plants.

Material and Methods

This study was conducted in a greenhouse, department of horticulture and landscape college of Agriculture-University of Baghdad Al-Gaderia site during Autumin season 2015. The greenhouse soil was plowed and satirized and leveled. A soil sample was taken to find the physical and chemical properties of the soil. The investigation was carried out by the soil science department. College of Agriculture university of Baghdad. table 1 shows some soil characters.

The experiment of site was divided into three parts longitudinally up to middle of the house. The width of each part was 2 meter. Each part was irrigated by three plastic pipe to irrigate the plants by drip irrigation and the drip was 30 cm apparatus and the distance between the pipes was also 30 cm. The *Ranunculus asiaticus* root tubers which imported by Dekee company was used. These tubers was dipped in salicylic acid solution in the concentrations 50, 100 mg.L^{-1} for two hours before planting on mid October 2015 while the tuber in control treatment was dipped in water for the same duration. This treatment was represented by SA1, SA2, SA3 respectively in the result tables. The tubers were planted at spacing of 30 cm at a depth of 1-3 cm at the same drip opening.

Table 1: Some physical and chemical characters of the experimental soil value.

The value	Measuring unit	Adjective
1.4	$Ds.m^{-1}$	Ec
7.2		pH
8.71		CA
5.11		Mg
8.52		Cl
1.7		HCo3
0.004	%	Nitrogen Ready
73.12	Mg / kg	Phosphorus Ready
1.83	Meq / l	Potassium Ready
4.17	Meq / l	Na
0.80	%	Organic matter
2.41	Meq / kg	S
32.	%	CaCo3
		Sand
	%	Clay
		Ginger
Green Sand		Tissue

After the emergence of the plant from the soil and at the age of 4-6 pair of leaves. The plants sprayed with (BA) at 25 and 50 mg.L^{-1} while the control plants sprayed with distilled water using sprayer 3 Liter Capacity and the application done at early morning and represented by BA1, BA2, BA3 in the tables of results.

All the agricultural practices was carried out as needed, all the plants were fertilized using garden & Koala liquid fertilizer by foliar sprays every two weeks up to the end of the experiments. The fertilizer was contain 20% nitrogen, 20% phosphorus as P_2O_5 and potassium at 20% on K_2O.

The experiment was carried using RCBD with three replicates (each part is replicate), each replicate contain three plants. The experimental means was compared using LSD at 5% level of significant (AL-Shakoy & Wahaib 1990).

The experimental data was included the vegetative characters at the flower infection while flowering characters was taken at flower buds opening stage up to end of flowering stage while the root tuber characters was taken at the end of growing season senescence of the plants.

Results and Discussion

Effect of salicylic acid and Benzyladenine on vegetative characters in ranunculus plants

Table 2-A shows that foliar sprayed of ranunculus plants with (SA) significantly increased the height of plants and the highest plant 19-11 cm was found at the treatment with 100 mg.L^{-1} SA, while the shortest plant 16.7 cm was found in the control plants. Foliar spray with (SA) does not in fluencies the number of leaves per plant.

Foliar spray with (SA) significantly increased the leaf area and the highest leaf area was 97.7 cm^2 in plants sprayed with 100 mg.L^{-1} (SA), while the lowest leaf area of 64.9 cm was in the control plants. Foliar spray with (SA) significantly increased the fresh and dry weight 64.0 g. and 39.8 g. was found in plants treated with 100 mg.L^{-1} (SA) respectively (Table 2-A).

Benzyl adenine at 50 mg.L^{-1} significantly increased plant height up to 20.33 cm while the concentration 25 mg.L^{-1} (BA) do not influence the characters on compared with the control plants there is no significant differences between the treatments in the number of leaves per plants.

Foliar spray with (BA) at 50 mg.L^{-1} significantly increased the leaf area up to 87.2 cm^2, while the lowest leaf area 75.4 cm^2 was in plants from the control plants. Foliar spray with BA at both concentration significantly increased both fresh and dry weight of the vegetative parts and the highest value was 55.0 g. and 32.6g. in plants treated with 50 mg.L^{-1} BA respectively (Table 2 B).

The interaction between Salicylic acid and Benzyl adenine significantly increased the height plant. The highest plant was 21.7 cm in the plants treated with 100 mg.L^{-1} SA and 50 mg.L^{-1} BA (Table 2 C). The highest number of leaves 19.3 leaf and highest leaf area per plant 103.5 cm^2 and highest fresh and dry weight of the vegetative part 66.0 g and 43.1 g. Respectively were found in plants treated with 100 mg.L^{-1} SA and 50 mg.L^{-1} BA. (Table 2C).

Effect of foliar spray with (SA) and (BA) on the flowering characters of ranunculus

The results in Table 3-A show that foliar spray with

Table 2: Effect of dipping ranunculus root tubers in SA and foliar spray with BA on vegetative characters.

Vegetative character / Conc. mg.L-1		Highestof plant(cm)	Number of leaves	Leaf area (cm2)	Fresh weight(g)	Dry weight(g)
A. Effect of Salicylic acid						
SA1 (0)		16.7	13.7	64.9	39.7	17.8
SA2 (50)		17.7	14.3	81.9	54.0	29.6
SA3 (100)		19.11	15.8	97.7	64.0	39.8
L.S.D (0.05)		2.3	3.6	1.3	1.3	0.5
B. Effect of Benzyl adenine						
BA1(0)		16.0	13.9	75.4	48.6	25.6
BA2(25)		17.0	13.8	81.8	53.0	29.1
BA3(50)		20.33	16.11	87.2	55.0	32.6
L.S.D(0.05)		2.3	3.6	1.3	1.3	0.5
C. Effect of SA X BA						
SA1	BA1(0)	13.2	12.0	56.4	34.1	14.2
	BA2(25)	17.5	14.3	66.4	39.6	16.5
	BA3(50)	19.0	14.7	71.8	45.3	22.8
SA2	BA1(0)	17.0	13.7	78.1	50.4	26.8
	BA2(25)	15.7	15.0	86.4	54.8	30.2
	BA3(50)	20.3	14.3	91.6	56.5	31.8
SA3	BA1(0)	17.8	16.0	98.6	61.4	35.8
	BA2(25)	17.8	14.3	98.0	64.3	40.5
	BA3(50)	21.7	19.3	103.5	66.0	43.1
L.S.D (0.05)		4.05	6.1	2.3	2.2	0.9

100 mg.L^{-1} (SA) only significantly increased the number of flowers per plant up to 3.3 flower per plant on compared with 2.0 flower plant in the control, also there is significant differences between the treatment with 100 mg.L^{-1} (SA) and the treatment with 50 mg.L^{-1} (SA). Treating ranunculus plant with 100 gm.L^{-1} (SA) resulted in enhancing flower initiation by 101.4 day from planting time while the plants from the control treatment flowered after 129.9 days from planting time; also the flowering duration was 12.4 days in plants treated with 100 mg.L^{-1} (SA). The flowering duration was 6.0 days in plants from control. The vase life of flowers taken from plants treated with 100 gm.L^{-1} was 9.9 day while it was 6.0 day for flowers from control plants (Table 3-A).

Foliar sprays with 50 mg.L^{-1} (BA) significantly increased the number of flowers per plants up to 3.0 flower per plant while plants from the control treatment gave 1.9 flowers per plant, plants treated with 50 gm.L^{-1} gave flower earlier than the control plants and it take 113.7 days to flowering from planting time (Table 3 B). The flowering period was 12.2 days in plants treated with 50 gm.L^{-1} (BA) and the vase life of flowers from the same treatment was longer and it reached 8.4 days while it was 6.0 days.

Table 3C show that the interaction treatment 100 mg.L-1 (SA) and 50 gm.L^{-1} (BA) significantly increased the number of flowers per plant up to 3.7 flowers per plant on compared with 1.0 flowers per plant in control treatment. The same treatment initiated flowers earlier 95.9 days from planting on compared with 131.7 days in control treatment. The longevity of flower in plants of 13.3 days was in the interaction treatment 100 mg.L^{-1} (SA) + 50 mg.L^{-1} (BA) while it is was 5.7 days in control treatment. The longest vase life for flower was 11.7 days in same treatment while the shortest vase life 5.7 days in control treatment (Table 3C)

Effect of dipping ranunculus root tubers in (SA) and foliar spray with (BA) on root tubers

There a significant increase in number of root tuber initiated per plant as a result of dipping in 100 mg.L^{-1} (SA) and the highest number 3.3 tuber per plant was in treatment 100 mg.L^{-1} (SA) (Fig. 1).

The same treatment gave the highest fresh and dry weight of root tubers 15.4 and 12.2 g respectively.

Foliar spray with (BA) significantly in flounced the root tuber characters. Foliar spray with 50 mg.L^{-1} significantly increased the number of root tuber up to 2.7

Table 3: Effect of dipping ranunculus root tuber in (SA) and foliar spray with (BA) on flowering characters.

Vegetative character / Conc. mg.L-1		Highestof plant(cm)	Number of leaves	Leaf area (cm2)	Fresh weight(g)
A.Effect of Salicylic acid					
SA1 (0)		2.0	129.9	10.3	6.0
SA2 (50)		2.2	123.9	10.2	6.3
SA3 (100)		3.3	101.4	12.4	9.9
L.S.D (0.05)		0.7	2.1	0.9	0.8
B.Effect of Benzyladenine					
BA1(0)		1.9	122.3	9.9	6.4
BA2(25)		2.7	119.2	10.9	7.3
BA3(50)		3.0	113.7	12.2	8.4
L.S.D(0.05)		0.7	2.1	0.9	0.8
C. Effect of SA X BA					
SA1	BA1(0)	1.0	131.7	8.7	5.7
	BA2(25)	2.3	130.7	10.3	6.0
	BA3(50)	2.7	127.3	12.0	6.3
SA2	BA1(0)	1.7	129.0	9.3	5.3
	BA2(25)	2.3	124.3	10.0	6.3
	BA3(50)	2.7	118.3	11.3	7.3
SA3	BA1(0)	3.0	106.3	11.7	8.3
	BA2(25)	3.3	102.7	12.3	9.7
	BA3(50)	3.7	95.3	13.3	11.7
L.S.D (0.05)		1.3	3.7	1.5	1.4

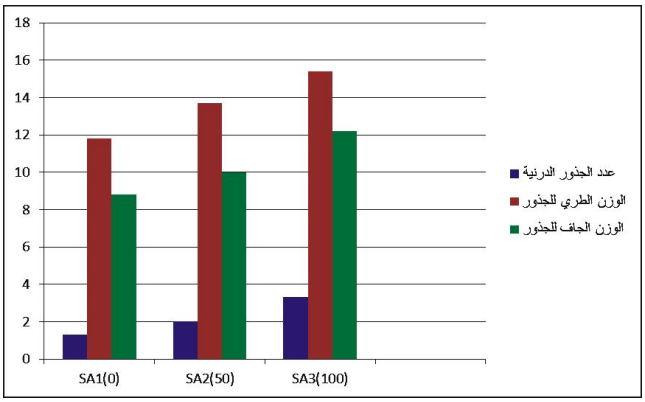

Fig. 1: Effect of dipping Ranunculus root tuber in (SA) in the formed root tuber characters.

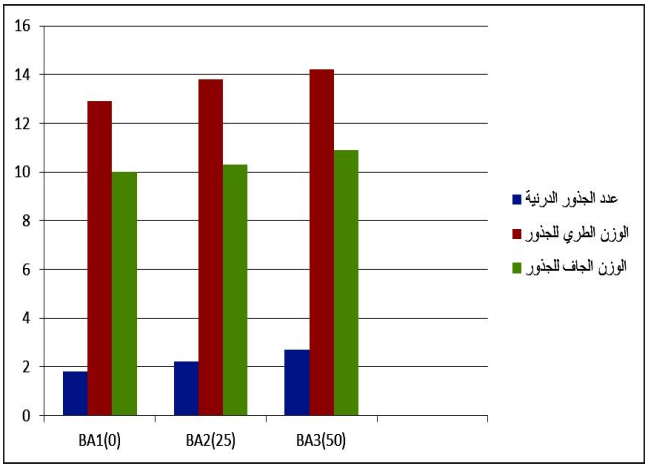

Fig. 2: Effect of foliar spray with (BA) on the characters of formed ranunculus root tubers.

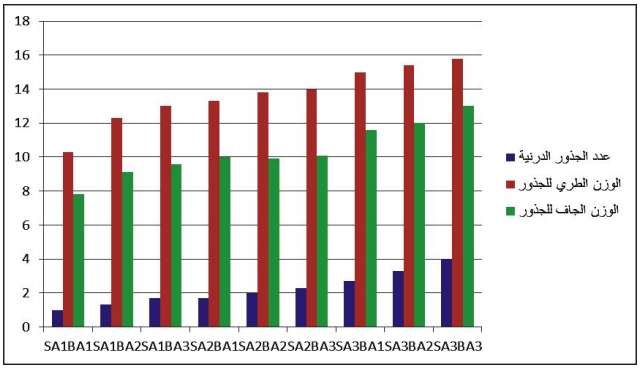

Fig. 3: Effect of the interaction of SA X BA on the characters of ranunculus root tuber formed.

root tubers per plant and also increased the fresh and dry weight of the root tuber up to 14.2 and 10.9 gm. Fig. 2.

The interaction between the two factors significantly increased the number of root tuber and the highest number 4.0 root tuber per plant was in the treatment 100 mg.L^{-1} (SA) plus 50 mg.L^{-1} (BA) and also their treatment gave the highest fresh and dry weight of root tubers (15.8 g. and 13.0 g. respectively Fig. 3).

The influences of salicylic acid concentration used in this study maybe due to its role in the formation of chlorophyll ad carotene pigments and acceleration of photosynthesis and increased the enzyme activities which influences the steps of carbohydrate production (Hayat and Ahmed, 2007). The response of the plants to the treatment with (SA) deepened on the type of plant and its plants and its growth stages when the application of SA was carried out and the concentration used (Kaskin, 1992).

Uzunova and Popva (2000) stated that the influences of (SA) in plant growth may be due to its role in leaves stricter and green plastid and then in the photosynthesis. The influence of (SA) may be due to its effect on preventing the oxidation of auxines and increasing plant content of these axuins as results of increasing nitrate reductase enzyme (Ahmed et al, 2001).

Melotto *et al*., (2006) found that salicylic acid organized the stomata action and then positively improve the photosynthesis activities through the regulation CO2 movement to the plant tissues. Salicylic acid increased the activities of 1, 5 bio phosphate carboxylase – oxygenize (Slaymaker *et al*., 2002).

The response of ranunculus plants to the application of Benzyladanine.

The most important influences of cytokinin was stimulate cell dilution and apical dominance and enhanced the growth of lateral buds and improve the movement of stomata cells in same plants. (Sengbusch. 2010). The cytokine stimulate specially the formation of protein and participate in organizing the life cycle of the cells and also stimulate growth of the plastids, delayed the senescence of leaves, Adding cytokine to one spot in plant *i.e.* (leaf) make this part active in received and storing the amino acids which trans located from of part of the plant (George *et al*., 2008).

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