



EFFECT OF ADDING WHEAT ORGANIC RESIDUES AND SALICYLIC ACID ON GROWTH AND CORMS PRODUCTION OF *FREESIA HYBRIDA* PLANTS

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Abstract

An experiment was conducted to study the effect of adding Wheat Organic Residues (WOR) to the soil of the pot and spraying Salicylic acid (SA) on growth parameters of freesia plants and production of its corms. The experiment was adopted as two factors. The first include three levels of organic i.e., 0, 5 and 10% while second include three concentration of Salicylic acid i.e., 0, 50 and 150 mg L⁻¹. The results showed that adding 10% of WOR or spraying SA significantly increased the No. of total leaves, shoot dry weight, total chlorophyll content in the leaf, total soluble carbohydrate in the leaf, No. of corms per plant, diameter of corms, No. of the inflorescence per plant length of inflorescence stem and No. of florets per inflorescence, compared to the control treatment which gave the lowest values. Also, the results of the interaction between two factors showed that adding WOR at level 10% and spraying SA significantly increased all the growth parameters of freesia plants.

Key words : *Freesia hybrida* plant, Wheat organic residues, Salicylic acid.

Introduction

Freesia plant belongs to the Iridaceae family, it is an annual winter plant grown in private and general garden and in the pots. It is one of the most important cut flower bulbs in the world (Khan *et al.*, 2006; Mahmoud and Amine, 1989). It is cultivated in places that are free of frost and in the rich soil in organic materials to improve the growth and flowering parameters and high production of new corms (Al-Batal, 2010).

Organic matter is a group of substances that are biologically derived from nature or the changed by soil temperature whether the source is alive or dead (Arnout, 2001; Al-Zurfi, 2018). Muslat and Muslh (2012) mentioned that organic matter rich in nutrients and hormones, also it adjust the pH value of the soil as a result of the release of CO₂ gas when dissolved and improvement soil properties. Wheat organic residues is one of the organic substances added to the soil, which improves the physical, chemical and biological properties of the soil, as it reduces the bulk density and improve the

soil porosity, which results in the regulation of the water movement and gases exchange, also works to increase the ability of the soil to the water and stability of soil aggregates. Increasing the amount of the wheat organic residues added to the soil leads to increasing the soil content of the organic matter, which increases the content of the Humic and Fulvic acids, and that are a natural chelate compounds helps to release the nutrients necessary for plant growth from soil minerals (Salman, 2000). This leads to the provision of an appropriate amount of them around the propagation area of the roots, which increases the availability of the soil elements necessary for plant growth like N, P and Mg (Najem, 2015). Rajvanshi and Dwived (2014) noted that the addition of compost to soil planted with *Zinnia elegans* L. Resulted in a significant increase in plant height, number of leaves, number of flowers and flower diameter. Al-Sahaf *et al.*, (2006) concluded that the addition of 10% wheat manure fertilizer to the *Dianthus caryophyllus* L. plant resulted in a significant increase in the number of leaves, flower diameter, and flowering life.

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Salicylic acid was a phenol compound, the chemical structure was $C_6H_4(OH)COOH$ (24) that organizes the growth and flowering of the plant, effecting in many biological processes in a plant, such as flowering stimulated, the formation of chlorophyll and efficiency photosynthesis, via its roles in cells division and elongation (Al-Zurfy *et al.*, 2018; Shakirova *et al.*, 2003). Al-Abbasi *et al.*, (2015) stated that spraying *Zinnia elegans* L. with Salicylic acid at a concentration of 50 mg. L⁻¹ increased the number of leaves, leaves area, a number of flowers per plant and flowers dry weigh. Al-Sahaf *et al.*, (2016) mentioned that spray salicylic acid at a concentration of 60 mg.L⁻¹ on the *Matthiola incana* L. led to a significant increase in the number of leaves the content of leaves of total chlorophyll, number of the flowers and the diameter of the flower.

For the important of freesia plant as an international cut flower (Imanishi, 1993), and reducing the pollution of the soil, this study was done aimed to improvement growth, flowering parameters and increased the production of the news corms by adding Wheat Organic Residues to the soil and spraying Salicylic acid with different concentrations to the Fressia plants.

Materials and Methods

An experiment was carried out in the lath houses of the Faculty of Agriculture, University of Kufa, Iraq during the growing season 2016–2017, to study the effect of added Wheat Organic Residues (WOR) and spraying Salicylic acid (SA) on the growth and flowering parameters of *Freesia* plant that were planted on 2016 \ 11 \ 10 from the producer Inc. De Ree Holland, in pots with a diameter of 25cm which contain sandy soil in valium 2L, and table 1 physical and chemical proprieties of pots soil. Analysis was carried out in the postgraduate laboratory-Faculty of Agriculture - University of Kufa, Iraq.

The experiment was adopted into randomized complete block design (RCBD) with two factors, First added Wheat organic residues with three levels *i.e.* (0, 5 and 10). That produced in the Organic Agriculture Center, Ministry of Agriculture, Al-Najaf, Iraq. Second three concentrations of salicylic acid *i.e.* (0, 75 and 150 mg.L⁻¹). Salicylic sprayed two times first that plant stage3-5 true leave, second after 21 days from the first spray. Means were compared by least significant difference at the probability level of 5% (Al-Rawi and Khalaf-Alla, 2000). All service operations like irrigation and weeding for each experimental units were done when required.

At the end of the experiment in 12\02\2017 we measured the following parameter: Time required for

emergence: were calculated from the beginning of planting until the emergence of vegetative growth of the leaves above the soil surface. Number of leaves (leaf.plant⁻¹), shoot dry weight (g): The shoot was dried in the oven of 65C° for 72 hours until the weight stabilized. Content of total chlorophyll in leaves (mg.100g⁻¹ fresh weight): estimated according to Goodwin (1976), Total soluble carbohydrates in leaves (mg.g⁻¹ dry weight): measured according to Duboies *et al.*, (1965), number of inflorescence per plant (inflorescence.plant⁻¹), inflorescence stalk length (cm), number of floret per inflorescence (floret.Inflorescence⁻¹), number of corms per plant and the diameter of corms (cm): measured by Venire caliper from the biggest two points.

Results

Resulted in table 3 show that added Wheat Organic Residues(WOR) at a level 10% significantly decreased the time required for emergence, and increased the number of leaves per plant, shoot dry weight, content of total chlorophyll in leaves, content of total soluble carbohydrates, number of corms per plant and diameter of corms compared with the control treatment which gave the highest time for emergence and the lowest values for author parameters.

Spraying salicylic acid at a concentration 150mg.L⁻¹ also significantly decreased the time required for emergence and increased the number of leaves, shoot dry weight, content of total chlorophyll in leaves, content of total soluble carbohydrates and diameter of corms, compared to the treatment that spraying plant with distilled water only (control) which gave the highest time required for emergence, and the lowest values for author parameters (Table 3).

From the interaction between the two factors result showed that added WOR at a level 10% and spraying SA at a concentration of 150 mg.L⁻¹ significantly decreased the time required for emergence and increased the number of leaves, shoot dry weight, the content of total chlorophyll and content of total soluble carbohydrates compared with to the non-sprayer plants (control) which gave the highest time required for emergence, and lowest values for author parameters (Table 3).

Resulted in table 3 showed that added ROR at a level 10% significantly increased the number of inflorescence per plant, inflorescence stalk length, and number of florets per inflorescence, compared to the control treatment which gave the lowest values. In addition that spraying SA at a concentration 150 mg.L⁻¹ significantly increased the number of inflorescence per plant, inflorescence stalk length, number of floret per

inflorescence, compared to spraying distilled water only (control) which gave the lowest values (Table 4).

Adding ROR at a level of 10% and spraying SA at a concentration of 75 mg.L⁻¹ significantly increased the number of inflorescences per plant. Meanwhile added ROR at a level 10% and spraying salicylic acid at a concentration of 150 mg.L⁻¹ significantly increased the inflorescence stalk length and the number of florets per inflorescence, compared to distilled water spray treatment (control) which gave the lowest values (Table 3).

Discussion

From the table 3 the rustled show that there is a significant increase in growth parameters. This increases can be attributed to the addition of Wheat Organic Residues improvement the chemical and biological properties of the soil by increasing the activity of microorganisms within organic residues (Perucci, 1990), which increased the availability of essential nutrients necessary for growth in most of the plant’s biological processes, which are already present within the organic residues components (Hayat and Ahmad, 2007; Ullah *et al.*, 2008), also the results in table 3 indicate that was a significant increase in the number of dry leaves and shoot dry weight when wheat organic residues added. This may be due to the role of the nutrients present in the combination of wheat organic residues table 2 as products for their degradation, which have an important role in the process of photosynthesis, food manufacturing and stimulate the cell division (Adu-Dhahi, 1988; Al-Shafa, 1989; Al-Zurfy *et al.*, 2018) Finally improvement the parameters of plant growth.

In addition, the added of wheat organic residues caused significant increases in the flowering parameters, and that may be wheat organic residues table 4 contain many nutrients necessary for growth when analyzed, such as nitrogen, potassium and phosphorus table 2, which stimulates the process of photosynthesis and the increase of processed substances such as carbohydrates table 3 and thus their transfer from the source (leaves) to places stored in flowers (sink) (Perucci, 1990) To improve flowering and corms parameters. In addition to that Balakumbahan and Rajamani (2010) confirmed that the organic waste added to the soil when decomposed releases heat, which that activated the biological processes and stimulate the plant metabolism. Thus, increases in soil temperature stimulate the plant absorption of nutrients such as nitrogen and potassium which activated the growth and development of the plant, finally improvement flowering and corms parameters (Rajvanshi and Dwived,

2014).

The results of table 3 showed a significant increase in the growth parameters when spraying with Salicylic acid. The reason may be due to its important role in stimulating the plant to manufacture the Auxins and cytokines. Auxins is one of the main factors in the activity of top meristem and procambium cell and thus stimulate cell division and enlargement. As well as its role in the emergence of shoots and activity the efficiency of photosynthesis, which leads to the provision of materials and energy to build new tissues (Issa *et al.*, 2018; Popova *et al.*, 1997), ultimately increase the vegetative growth of the plant. In addition to that its role in increasing the activity of enzymes, especially the enzymes responsible for the photosynthesis process (Alhasnawi *et al.*, 2017; Hayat and Ahmad, 2007) and in the formation of chlorophyll pigment, which eventually increases the metabolism compounds (Popova *et al.*, 1997), also its role in preventing polysaccharide hydrolyzing Leading to the integration of soluble sugars into a polysaccharide (Alhasnawi *et al.*, 2016, Khodary, 2004), which eventually increases the leaf content of total chlorophyll and carbohydrates (Alhasnawi *et al.*, 2017).

Table 1: Chemical and physical properties of the experimental soil.

Soil texture Soil (Sandy soil)	Particles (%)	Quantity
	Clay	02.00
	Silt	05.20
	Sand	92.80
Chemical properties	Values	Unit
Ph	07.45
Electric Conductivity (Ec)	Ds.M ⁻¹	02.71
N	Mg.L ⁻¹	00.55
P	Mg.L ⁻¹	02.55
K ⁺	Mg.L ⁻¹	33.60
Orange matter	%	00.95

Table 2: Chemical properties of the wheat organic residues.

Unit	Values	Chemical properties
7.56	Ph
2.81	Ds.M ⁻¹	Electric Conductivity (Ec)
3.54	%	N
0.11	%	P
1.95	%	K ⁺
0.057	%	Mg++
26.34	%	Organic matter
4.76	%	Humic acid
3.95	%	Fulvic acid
1.70	%	Humine

Table 3: Effect of wheat organic residues and salicylic acid on growth parameters of *Freesia* plants.

Corms diameter (cm)	Corms plant ⁻¹	Florets Inflorescence ⁻¹	Inflorescence stalk length (cm)	Inflorescence plant ⁻¹	Total Soluble Carbohydrates (mg. g ⁻¹ dry weight)	Total Chlorophyll (mg.100 gm ⁻¹ fresh weight)	Shoot dry weight (g)	Leaves plant ⁻¹	Days to emergence (days)	Treatments		
0.36	1.33	6.00	24.43	3.66	6.36	63.54	1.60	4.33	1.60	0	Wheat organic residues (ROR)× Salicylic acid(SA)	0
0.46	2.33	6.33	25.46	4.33	6.53	64.16	1.80	4.66	1.80	75		
0.63	2.66	6.66	26.06	4.66	6.93	64.98	1.90	5.33	1.90	150		
0.73	3.00	7.33	26.93	5.33	7.36	65.66	2.13	5.33	2.13	0		5
0.80	3.66	7.66	29.10	5.66	7.86	66.24	2.60	6.33	2.60	75		
1.00	4.00	8.66	30.56	6.33	8.30	66.86	2.93	6.33	2.93	150		
1.13	3.66	9.33	31.40	6.33	8.43	67.28	3.10	6.66	3.10	0		10
1.36	4.66	12.00	33.33	8.00	9.26	69.50	3.36	7.33	3.36	75		
1.30	3.33	13.66	34.73	7.33	9.90	69.78	3.46	8.00	3.46	150		
0.139	0.600	0.726	0.670	0.754	0.459	0.826	0.149	0.564	0.149	LSD _{0.05}		
0.080	0.346	0.419	0.387	0.435	0.265	0.476	0.086	0.326	0.086	LSD _{0.05} (WOR)		
0.080	0.346	0.419	0.387	0.435	0.265	0.476	0.086	0.326	0.086	LSD _{0.05} (SA)		

Salicylic acid spray on *Freesia* was also observed to have a significant increase in flowering growth parameters (Table 4). This may be attributed to its role in increasing photosynthesis, including carbohydrates table 3, thus increases sugar important in the Strengthening of flowering growth such as flowers, which is a weak consumer competing poorly with other consumption centers. In addition to the role of salicylic acid in its effect on the multiple physiological roles of the plant, it is a plant hormone with a clear effect in the growth and development of the plant meristem and thus increase and improve the parameters of flowering growth (Hayat and Ahmad, 2007). The significant increase in the number of flowers is due to the fact that salicylic acid has a role in maintaining the levels of Auxin and cytokines in plant tissues, which have an important role in cell division and enlargement (Shakirova *et al.*, 2003).

Spray Salicylic acid led to a significant increase in the number and diameter of corms table 3, this is due to its role in improving the growth of the root system (increasing the number of the roots and their branches), in addition to stimulating the synthesis of Auxin and cytokines (Hayat and Ahmad, 2007), and its roles in increase the cell division and enlargement, and activation photosynthesis, this lead to increase Metabolism products, including carbohydrates table 3 and the transfer from source to sink (book growth of plants) and the corms is one of the stored parts in the plant. Which eventually led to an increase in the number and diameter of corms.

Conclusion

Form the results adding Wheat Organic Residues and spraying Salicylic acid improvement growth parameters and increased corms production of *Freesia* plants

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