

INFLUENCE OF CORMS SIZE AND SPRAYING WITH BENZYLADENINE AND PACLOBUTRAZOL ON GROWTH AND FLOWERING CHARACTERISTICS OF FREESIA SP. L. PLANTS

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Abstract

This experiment was conducted at the Department of biology / College of Education for Pure Sciences / University of Diyala on the *Freesia sp. L.* which have the purple flowers in order to study the effect of the corms size which are divided into small corms with weight equal to or smaller than 3 g and large corms with weight greater than 3 g intertwined with spraying with the growth regulators (the benzyladenine) at concentration of 25 , 50 mg/l and paclobutrazol at concentration of 10 , 20 mg/L as well as the handling the comparison in the recipes of the vegetative growth of the freesia plants by using global experiment using a complete randomized design with four observations of the handling. The results that have been obtained showed the following: exceeding the plants that resulting from cultivation of the large corms in recording the biggest moral values for plant height of 43.2 cm and the number of leaves 8.4 leaf / plant and leaf area of 59.4 cm²/plant and the content of the papers of chlorophyll 158.3 SPAD units and earliness in the number of days which are necessary for the emergence of flowering buds of 136.4 days and the number of florets 10.2 florets/inflorescences as well as vase life which amounting to 11.8 day. Spraying plants with benzyladenine at concentration of 50 mg/l led to register the highest values for plant height and leaf area and in the required duration for the emergence of floral buds and the length of inflorescences of flowers and the number of florets and the coordination age which amounting to 49.2 cm, 63.6 cm²/plant , 140.6 days , 31.5 cm , 10.6 florets/inflorescences and 12.5 days respectively. While spraying with paclobutrazol at concentration of 20 mg /l , the lowest values for the height of plants and the number of days required for the emergence of floral buds and the length of inflorescences which amounting to 32.4 cm , 136.5 days and 24.7 cm respectively, by the other hand recorded the highest values of the number of leafs 8.8 leaf / plant and content of leafs of chlorophyll 198.1 SPAD units. Overall, the overlap between the size of the corms and spraying with benzyladenine at concentration of 50 mg/l to led to register the biggest values for the plants height and the leaf area and the length of inflorescences while the overlap between the size large corms and spraying with paclobutrazol at concentration of 20 mg /l led to register the highest values of the recipe of number of leaves and their content of chlorophyll and decrease the number of days which are required for the emergence of floral buds. The larger values recorded for the recipe of the number of days that are required for the emergence of floral buds and the number of florets and vase life has recorded in the overlap between plants that are resulting from small corms and sprayed with benzyladenine at concentration of 50 mg /l

KEYWORDS: CORMS. BENZYL ADENINE. VASE LIFE. PACLOBUTRAZOL. *Freesia sp.*

1. INTRODUCTION

The production of ornamental plants and trade of flowers and commercialization them became one of the important business in the global arena as the industry of production of ornamental plants and trade of flowers became large and spacious in our time and occupies a prominent place in the economies of many countries of the world especially the developed countries which their economy depends on these resources (Hassan, 2005) and the bulbs of ornamental flowers considered one of the most beautiful flowers which are rare not finding them in the gardens because of the shape and the color and time of appearance of their flowers in addition to the aromatic smell of the flowers of some kinds (Kattab and Wasfi 1988). Freesia plant considers a member of the Iridaceae family which belongs to the winter annuals bulbs which belong to the monocotyledoneae plants which its agricultural importance comes from production of cut flowers or flowering potted plants as well as aromatic smell of their flowers (Ali et.al 2011).

Many studies such as Al- Saad (2000) and Al-Sawaf and Alwan (2010) on *Freesia* plants and Mane et.al (2007) and Ahmed et.al (2009) on *Polianthus tuberosa* L. plant and Al-Shaykhli (2013) on the bulbs of *Iris holandric* showed that there are many factors which include the size of bulbs affect morally on the recipes of vegetative growth for the ornamental plant and even Hatamzadeh et.al (2012) pointed that the commercial farms and the amount of flowers yield depends mainly on the size of the planted bulbs . On the other hand, a lot of researches pointed to the importance of hormonal plants and their impact on many ornamental plants including ornamental bulbs through earliness and prolongation the coordination age and delaying aging and elongation of the leg and increasing the leaf area and increase the number of floral buds and the number of flowers in the inflorescences and increasing the length of petals and delaying their fall (Emongor, 2004 and Khan and Chaudhry, 2006 and Janowska, 2013), the cytokinin considered one of the plant hormones that play a key role in regulating the life cycle of the plant cell and many of the events in the evolutionary plant (Schmulling, 2004). Moreover many ornamental plants became treated with growth obstacles especially these who grown as flowering potted plants to improve the quality of the product without a detrimental effect on the morphology of the plant but works at the same time to delay the plant growth by blocking cell division in the under apical region including paclobutrazol and cycocel (Henny, 1990 and Dole and Wilkins, 2005). Due to the importance of Freesia plant from the economic aesthetic side and the validity of flowers for coordination as well as being one of the important flowering potted plants due to the need of commercial varieties to the support to preserve the integrity of growth, this study conducted in order to study the effect of the size of corms and spraying with benzyladenine and paclobutrazol in recipes of vegetative growth and flowering .

2. RESEARCH MATERIALS AND ITS METHODS

The experiment was conducted in a plastic house in the College of Educational for Pure Science / Diyala University for the period from October 2013 until April 2014 where the corms of *Freesia sp.* plants with purple flowers planted on 10.10.2013 in plastic pots at diameter 25 cm containing 12 kg of dried aerobically component such as soil of gardens and animal manure (sheep) with full decomposition and has volumetric ration of 3: 1: 1 and 5 cm in depth.

The study included the following factors: the size of corms which are divided into two sizes depending on the weight of the corms into small corms which have the average weights of smaller or equal to 3 g and the large corms which have the average weight of greater than 3g overlapping with spraying by growth organizers; the benzyladenine (BA) at concentration of 25, 50 mg / l and the paclobutrazol (PBZ) at concentration of 10 , 20 mg /l without overlap between them as well as treatment the comparison which sprayed with distilled water. The growth regulators was sprayed in the early morning and in two phases, the first one when there was on the plants two complete papers and the second after the arrival of plants to the fifth paper and thus the experiment included two important factors ; the size of corms and spraying with growth regulators as an experiment with the complete randomized design and with four experimental units for each the rates then compared according to polynomial Duncan test at 5% probability (Daoud and Abd- Elias, 1990). The data recorded on traits during the opening of basal rosette of floral inflorescences which included:

Recipes of vegetative growth

1. Plant height (cm): The measurement done starting from the base of the plant until the top of the longest paper with metric ruler.
2. Number of leaves Leaf/Plant.
3. The leaf area (cm²/plant) was calculated according to the method that described by Watson and Watson (1953) as a random sample of the plant has been taken one of each treatment then a known area was cut then dried in an

electric furnace at a temperature of 75°C until stability of the dry weight and then the area of the leaf calculated according to the following equation :

Leaf area (cm ²) =	the dry weight of leaves X the leaved area	X number of the known leaves
	The dried weight of the known leaf area	

- Measuring the chlorophyll content of leaves using a SPAD-502 chlorophyll meter and by SPAD units

Recipes floral growth

- The number of days required for the emergence of floral buds (day): calculated by the number of days from the date of agriculture until the emergence of floral buds.
- The length of inflorescences : which measured from the area of the inflorescences emergence of between leaves to the top.
- Number of florets / inflorescences.
- Vase life (Day): calculated from the date of picking floral inflorescences when the first basic flower opens until loss of the value of vase life value(Williom, 1987) and using only tap water and at room temperature.

Various service operations done for all plants symmetrically which included hoeing the soil and get rid of the developing bushes and irrigation was conducted manually when the soil dry . A program for the prevention of diseases used with the fungicide control sodec which contain 278g / L and 222 g / L of dimethoate and chlorpyrifos respectively and by 1 g / liter for each spray, the plants sprayed with pesticide Mancozeb 80% to combat biting insects during the emergence of symptoms of injury.

3. RESULTS AND DISCUSSION

Recipes of vegetative growth

Plant height (cm)

Data in table (1) pointed to outweigh the freesia plants that resulting from cultivation of large-size corms in the recipe of plant height which equal to 43.2 cm in comparison with the height of the plants that result from small size corms which are 34.7 cm. plants that sprayed with benzyladenine at concentration of 50 mg / l in their height which was 49.2 cm exceeds morally while the plants that sprayed with paclobutrazol at concentration of 20 mg / l showed lower values of plant height which amounting to 32.4 cm. The overlapping data between the size of corms and spraying by growth regulators showed that the highest moral values 53.0 cm recorded in plants heights that result from cultivation of large corms which sprayed with benzyladenine at concentration of 50 mg / l and this value descended to the lowest in the plants that result from cultivation of small corms that sprayed with paclobutrazol at concentration of 20 mg / l as it amounted to 24.5 cm.

Number of leaves / plant:

The results in the table (1) shows the moral superiority of plants that result from cultivation of large corms from those resulting from cultivation of small corms in the number of leaves per plant. The plants sprayed with paclobutrazol at concentration of 20 mg / l exceeded in the number of leaves as reached 8.8 leaf / plant which did not differ significantly from the treatment with paclobutrazol at concentration of 10 mg / l and benzyladenine at concentration of 50 mg / l. The data indicate that the plants resulting from cultivation of large corms which sprayed with paclobutrazol at concentration of 20 mg / l has recorded the highest moral values of the number of leaves amounting to 9.0 leaf / plant and has recorded lower values of 7.0 and leaf / plant in plants resulting from small corms that have not sprayed with growth regulators.

Table (1): Effect the size corm and spraying with benzyladenine and with paclobutrazol in the recipe of plant height (cm) and number of leaves of *Freesia sp.* plants.

Size of corms (g)	Concentration of growth regulator (mg/l)					Effect of corms size
	0	25 BA	50 BA	10 PBZ	20 PBZ	
The plant height (cm)						
The small	39.0 b-e	34.5 d-e	45.5 a-c	30.0 e-f	24.5 f	34.7 b
The large	40.3 b-d	46.6 ab	53.0 a	36.0 c-e	40.3 b-d	43.2 a
Effect of growth regulators	39.6 b	40.5 b	49.2 a	33.0 c	32.4c	
Number of leaves						
The small	7.0 d	7.5 cd	8.3 a-c	7.6 b-d	8.6 ab	7.8 b
The large	8.0 a-d	7.6 b-d	8.6 ab	8.6 ab	9.0 a	8.4 a
Effect of growth regulators	7.5 b	7.5 b	8.5 a	8.1 ab	8.8 a	

Values of the similar letters to each factor or their interventions do not differ significantly according to polynomial Duncan test under probability level of 5%.

THE LEAF AREA (CM² / PLANT):

The plants resulting from cultivation of large corms exceeded morally which amounting to 59.4 cm² (Table 2) compared to a value of 54.5 cm² which recorded for plants resulting from cultivation of small corms. The plants that sprayed with benzyladenine at concentration of 50 mg / l in the area of their leaves which amounting to 63.6 cm² exceeded over plants of comparison treatment. The overlap data indicate that plants resulting from the cultivation of large size which sprayed with benzyladenine at concentration of 50 mg / L has recorded the highest values of 72.3 cm² of leaf area and that this value be brought down to a minimum of 38.3 cm² in comparison plants resulting from cultivation of large corms that have not sprayed with growth regulators.

THE CONCENTRATION OF CHLOROPHYLL (SPAD UNITS)

Noted from the data in table (2) that the freesia plants resulting from large corms has recorded the highest moral values of the concentration of chlorophyll amounting to 158.3 SPAD units compared to plants resulting from the cultivation of small size corms which amounting to 135.5 SPAD units and the plants that sprayed with paclobutrazol at concentration of 20 mg / l exceed morally form all other treatments at concentration of chlorophyll amounting to 198.1 SPAD units. The overlapping data shows that plants resulting from the cultivation of large corms and sprayed with paclobutrazol at concentration of 20 mg / L recorded the highest moral values which amounting to 204.1 SPAD units while in comparison with plants that resulting from cultivation of small size corms.

Table (2): Effect the size of corm and spraying with benzyladenine and paclobutrazol in the leaf area (cm²/ plant) and the concentration of chlorophyll (SPAD units) in the leaves of *Freesia sp.* plants.

Size of corms(g)	Concentration of growth regulator(mg/l)					Effect of corms size
	0	25	50	10	20	

		BA	BA	PBZ	PBZ	
The leaf area (cm ² /plant)						
The small	46.8 d	54.4 cd	54.9 cd	55.4 cd	61.0 b-c	54.5 b
The large	38.3 e	67.1 ab	72.3 a	53.6 cd	65.6 ab	59.4 a
Effect of growth regulator	42.5 c	60.7 a	63.6 a	54.5 b	63.3 a	
Concentration of chlorophyll (SPAD units)						
The small	72.1 i	89.7 h	162.3 d	161.4 d	192.2 b	135.5 b
The large	109.6 g	142.1f	181.0 c	155.1 e	204.1 a	158.3 a
Effect of growth regulators	90.8 e	115.9 d	171.6 b	158.2 c	198.1 a	

Values of the similar letters for each factor or their interventions do not differ significantly according to polynomial Duncan test under probability level of 5%

RECIPES OF FLOWERING GROWTH

THE NUMBER OF DAYS REQUIRED FOR THE EMERGENCE OF FLORAL BUDS (DAY):

The results in the table (3) indicate that the cultivation of plants resulting from the large size of freesia corms had an early flowering as it took for the emergence of floral buds period amounted to 136.4 days compared to plants resulting from small-size cultivation corms which recorded a period amounted to 140.6 days. And the time required for the emergence of floral buds reduced to 136.5 days in plants that are sprayed with paclobutrazol at concentration of 20 mg / l while the delayed appearance of floral buds to 140.6 days when spraying plants benzyladenine at concentration of 50 mg / l. The overlapping data indicate that the plants resulting from cultivation of large corms and sprayed with paclobutrazol has reduction in the time required for the emergence of floral buds which amounting to 135.0 days while the highest values for the number of days required for the emergence of floral buds amounting to 142.0 days and recorded in plants resulting from cultivation of small corms and sprayed with benzyladenine and both concentrations under study.

LENGTH OF FLOWERING INFLORESCENCES (CM):

Noted from the data in the table (3) that the size of corms did not have a significant impact on the length of the flowering inflorescences although the plants resulting from the cultivation of large corms had given floral inflorescences taller than the plants resulting from cultivation of small corms. The highest values of the floral corms floral which amounting to 31.5 cm has been recorded in plants that sprayed with benzyladenine at concentration of 50 mg / l while spray plants with paclobutrazol at concentration of 20 mg / l led to the reduction of the length of floral corms to 24.7 cm. And the plants resulting from the cultivation of the small size of corms which splashed with benzyladenine at concentration of 25 mg / l recorded higher values amounting to 33.3 cm and this value descended to a minimum of 22.7 cm in inflorescences of plants resulting from the cultivation of the small size corms which sprayed with paclobutrazol at concentration of 20 mg/l.

Table (3): The effect of the size of corm and spraying with benzyladenine and paclobutrazol in the number of days required for the emergence of floral buds (day) and the length of floral corms (cm) for *Freesia sp.* plants

Size of corms(g)	Concentration of growth regulators(mg/l)					Effect of the size of corms
	0	25 BA	50 BA	10 PBZ	20 PBZ	
Number of days required for appearance of floral buds (day)						

The small	140.6 ab	142.0 a	142.0 a	140.3 ab	138.0 a-c	140.6 a
The large	136.3 bc	136.6 bc	139.3 ab	134.6 c	135 c	136.4 b
Effect of growth regulators	138.5 ab	139.3 ab	140.6 a	137.5 b	136.5 b	
Length of floral inflorescences						
The small	24.0 cd	33.3 a	30.0 a-c	25.1 cd	22.7 d	27.0 a
The large	32.3 ab	25.5 b-d	33.1 a	27.3 a-d	26.6 a-d	29.0 a
Effect of growth regulators	28.1 ab	29.4 ab	31.5 a	26.2 b	24.7 b	

Values of the similar letters to each factor or its interventions do not differ significantly according to polynomial Duncan test under level of probability equal to 5 %

NUMBER OF FLORETS / INFLORESCENCES

The results in the table (4) show superiority of the plants that resulting from cultivation of large corms in comparison with the plants resulting from cultivation of small corms in the recipe of number of florets. Spraying plants with growth regulators led to increase in the number of florets per inflorescences in comparison with plants of comparison. It seems clear from the overlapping data that the highest values of 11.0 floret/ inflorescences recorded in plants resulting from cultivation of small corms and sprayed with benzyladenine at concentration of 50 mg / L in comparison with plants of comparison that resulting from cultivation of small corms and recorded a value amounted to 7.3 floret/ inflorescences.

THE VASE LIFE (DAY)

Data in Table (4) referred to the significant superiority of the cut inflorescences of plants that resulting from cultivation of large corms in the recipe of vase life as recorded 11.8 days before the appearance of signs of wilt in comparison to vase life of the cut inflorescences of plants that resulting from cultivation of small corms which amounting to 10.7 days. Spraying plants with growth regulators which are under study shows the increase the life of the vase life of the cut inflorescences and recorded the highest values of 12.5 days when sprayed with benzyladenine at concentration of 50 mg / l. The overlapping data indicate that the highest values has recorded 13.0 days of vase life from the plants that resulting from the cultivation of the small size of freesia corms and this value has declined to 9.0 days in the life of the vase life of comparison plants that resulting from cultivation of small corms

Table (4): The effect of size of corm and spraying with benzyladenine and paclobutrazol in the number of florets / inflorescences and vase life (day) for *Freesia sp.* plants.

Size of corms (g)	Concentration of growth regulators(mg/l)					Effect of corms size
	0	25 BA	50 BA	10 PBZ	20 PBZ	
Number of inflorescences						
small	7.3 b	9.5 a	11.0 a	9.5 a	10.0 a	9.4 b
large	10.3 a	10.6 a	10.3 a	10.1 a	9.6 a	10.2 a
Effect of growth regulators	8.8 b	10.0 ab	10.6 a	9.8 ab	9.8 ab	
The vase life						
small	9.0 d	10.5 b-d	13.0 a	9.5 cd	11.5 a-c	10.7 b

large	11.5a-c	11.5 a-c	12.0 ab	12.0 ab	12.0 ab	11.8 a
Effect of growth regulators	10.2 b	11.- a-b	12.5 a	10.7 b	11.7 a-b	

The values of similar letters to each factor or their interventions do not differ significantly according to polynomial Duncan test under level of probability of 5%

Overall, the results of the current study indicate that the use of freesia corms of large size led to a significant increase in all the qualities of the vegetative growth of the plants produced from them which contain the recipe of plant height and the number of leaves and the leaf area and the concentration of chlorophyll in the leaves, these results are consistent with the findings of the Saad (2000) on freesia plants and Addai and Scott (2011) on the Hyacinth and lily plants, the cause may be attributed to the amount of stored food such as carbohydrates which increases with the size of corms as well as the degree of physiological maturity and which is reflected on the strength plant growth and then reflected on the floral growth recipes, as the plants that resulting from cultivation of large-sized corms outperformed morally than plants that resulting from small sized corms in the recipe of the number of days required for flowering and these results are consistent with the findings of the Moradian (1983) on the *Gladiolus* plant and Shaykhli (2013) on the iris plant and superiority was morally in every recipe of the number of florets per each inflorescences and the coordinating age of inflorescences as well as the increase in the length of floral inflorescences and this is in accordance to what Al-Saad found (2000) on the freesia plant and Mane et.al (2007).

The moral superiority which of the plants that sprayed with benzyladenine in the recipe of plant height with increase in concentration may be due to the role of cytokinin of increasing the cell division and the addition of new cells to the plant (Mazher et.al, 2011), the plants that treated with paclobutrazol recorded the lower values in plant height and in this direction several studies suggest that the growth obstacles effect on the biosynthesis of jprlin by inhibiting it through turning in its built way (Chaney, 2005) so the growth obstacles have an effect opposite to the jbrlin their effects not appear in developing tops but appear in the sub apical parts by inhibition cell elongation (Saleh, 1991). The results showed that the largest leaf area recorded when the plants sprayed with benzyladenine at concentration of 50 mg / l although the biggest values of the number of leaves recorded in the plants that are sprayed with paclobutrazol at concentration of 20 mg / l and this result could be explained on the basis that the estimation of the leaf area depended on the value of dry weight of known area which indicate that the leaves of plants treated at concentration of 50 mg / liter of benzyladenine was thicker and richer in content of dry matter which was reflected in recording the larger values. The data of leaves content of chlorophyll show that spraying plants at concentration 20 mg / l of paclobutrazol has recorded the highest moral values and has been attributed that according to Grossmann (1992) in his study about soybean and Sebastian et.al (2002) on the cloves plant that treatment plants with growth inhibitors increases the content of plant of the cytokinin which plays an important role in the differentiation and development of chloroplast and works on the construction of chlorophyll and inhibit its destruction (Horgan, 1984) and this is what confirmed by the recorded value confirms the of the content of leaves of chlorophyll during treatment of plants with benzyladenine at concentration of 50 mg / l and this determines in the same direction the effect of spraying plants at concentration of 20 mg / l with paclobutrazol in the number of leaves which recorded the highest values which did not differ significantly during the treatment at concentration of 50 mg / l with benzyladenine because of regulatory role of cytokinin in in the formation of leaves through the promotion of cell division at the developing top and their differentiation into leaves.

The increase in the number of days required for the emergence of floral buds directly proportional with the increased in the concentration of the used benzyladenine (Table 1) may be as the result of the lengthening the bully phase of plants as said Abd-Elhamid et.al (1993) that the overlapping between the cytokinin and some internal hormones may lead to inhibit the emergence of buds. And that the increase in the length of the inflorescences bearer during treatment with benzyladenine may be due to the effective role of cytokinin in increasing the concentration of internal gibberellin which led to increase cell division and their elongation (Abdoul 1991). Also the accumulation of nutrients in the plant which sprayed with growth regulators may has a role in increasing the number of florets / inflorescences in comparison with the treatment comparison and the results observed in the data of vase life reinforce this interpretation as noted that spraying plants with benzyladenine and paclobutrazol and in different concentrations adopted in the experiment increased the vase life although they are no different morally form comparison treatment which may be attributed to the increase in the content of plants from carbohydrates which would be reflected on the content of the flowers of carbohydrates which as a result on the content of

flowers because they are the main source of energy in the plant cell and this increase reflected on the coordination age, as reported by Capdeville et.al(2003) that there are many reasons for the role of carbohydrates (such as sucrose) in prolong the age of the coordinating flowers such as maintaining the structure and function of mitochondria and other organelles in the cell and its role in regulating the withdrawal of water and minerals to the vessels of wood through the control of transpiration as well as the highest values of the vase life which registered for the inflorescences which cut from plants that sprayed with benzyladenine at concentration of 50 mg / l may be due to the role of cytokinins in maintaining the permeability of cell membranes and water balance (Bufler et.al, 1980) or its role in inhibition protein analyzing and RNA in plant cells as it works at its accumulation sites on the withdrawal of nutrients and free amino acids and sugars (Wasfi,1995) and that the existence of ideal concentration works to reduce the sensitivity of flowers to ethylene and thus delay florets wilting and falling them which terminates the vase life of them (Sankhla et.al 2005). It is noted that the results taken an inverse relationship with the concentrations of paclobutrazol in the recipe of the period required for the emergence of floral buds and the length of floral inflorescences which may explain according to the role of paclobutrazol in obstruction the effect of gibberellin (GA₃) (Scott et.al 1999) through its role in the inhibition of biosynthesis of gibberellin or interference with its effects or even speed up the destruction process and therefore this is also reflected on reducing its role in the decomposition of starch into sugars in the leaves and flowers which is reflected in the improvement of the coordination age by improving water balance where through increasing the dissolved parts in the cell and thus withdraw larger amounts of water (Emongor, 2004 and Hopkins and Huner, 2004).

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