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RESEARCH ARTICLE

EFFECT OF SOME GROWTH HORMONES AND FOLIAR FERTILIZER ON GROWTH AND FLOWERING OF ALEC'S RED & SARRA ROSES

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ABSTRACT

This study was conducted at the faculty of Agriculture Omdurman Islamic University .The Rose plant rootstock Rosa canina (bankisia) cuttings were obtained on from Khartoum National Botanical Garden. These cuttings were sown in polyethylene bags on first of November 2004. On the first of February 2005, the bankesia rootstock were budded with a hybrid tea cv. Alec's Red Rose .sixty four budded rootstocks were selected and placed in the nursery, and were given all appropriate cultural practices as required. This research indicated that application of GA^3 at 200pm, BAat 500ppm and the foliar fertilizer Bayfolan at 0,03% was effective in increasing growth parameters in rose cultivars Alecs and sarah. That increase was significant in plant height, number of leaves, number of branches number of buds, number of petal, length of floral stalk, number of flowers and flower diameters.

INTRODUCTION

The interest in planting ornamental plants has started long time ago. Some historians thought that the Chinese may be the first, who invented the indoor arrangement of ornamentals, 5000 years ago. Some of the archeological excavations revealed that ancient Egyptians had planted some ornamentals in pots (Janick, 1979). The introduction of ornamentals inside the building leads to environmental improvement through cleaning of air around the closed areas, increasing oxygen percentage in addition to the influence of beauty they create (Larson, 1985). Roses are considered the oldest known flowers among ornamentals, and also the most beautiful. Rose shrubs were found growing wild in Middle Asia 4000 BC. Dried rose flowers were also found in the Egyptian tombs which reflected the interest of the old Egyptians in rose growing (Abu Dahab, 1992). The genus Rosa comprises more than two hundred varieties, and all the types found today are hybrids derived as a result of so many crosses between those different varieties. Rose plants are either erect shrubs or climbers (khattab and Wasfi, 1989) Rose plants need additional nutrients for their growth like all other cropped plants. Nutrients are needed for balanced plant growth which leads to the formation of strong floral stalks and wide wood vessels which aid in the intake of enough water and nutrients. Rose plants in the early stage of growth need nitrogenous fertilizers, also at the stage of bud formation. They need enough amounts of potassium and phosphorus. Reasonable amounts of microelements are also needed, for example, boron affects flower quality and longevity after picking (Hartman *et al*., 1981). Plant hormones have got an important role in growth and deployment of all plants including roses. It has been stated that a plant hormone is a natural substance, by the plant itself and acts to control plants activities. Plant growth regulators, on the other hand, include plant hormones, natural and synthetic.

Other non-nutrient chemicals, not naturally found in plants, but when applied to plants influence their growth and development. These are organic substances that are biologically active at very low concentrations. There are five recognized groups of natural plant hormones, which are, auxins, gibberellins, cytokines, ethylene and abscisic acid (Leopold and Kriedemann, 1975). Leopold reported that each of the mentioned organic substances is distinctive both in chemical characteristics and in being able to bring about characteristic growth responses and each group of regulators is capable of altering growth, including cell division, cell elongation, differentiation and differential growth phenomena. It is noteworthy that ornamentals, in general, and roses in particular, have recently acquired a great importance in Sudan. The demand for different ornamental plants has greatly increased for initiating gardens, lawns and decorating public and private buildings. That increasing demand lead to

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establishment of so many nurseries throughout the country, but most nurseries are found scattered in Khartoum State. Also this study which dealt with growth and development of some rose cultivars has not been done before in Sudan, therefore the study should positively add to the scientific and applied research in this field. This research has been carried out in a non-traditional style and the experimental units were subject to all possible combinations of growth hormones and a complete fertilizer. Foliar applications of hormones and fertilizer were done in simplified and applicable ways.

MATERIALS AND METHODS

Branches from bankasiae plants (Rosa canina) were collected from the nursery in November month. Secateurs were used to sharply cut the branches in segments of 20cm length. Polyethylene bags of size 10x20cm were packed with a mixture of sand and silt in the ratio of 1:2. Each polyethylene bag was supplied with 1.5kg of the soil mixture. The cuttings were then placed in the bags (as single cutting in each bag) in vertical position and the portion dipped in the soil was 5cm in length. Buds were obtained from Khartoum Botanical Garden. Strong owing plant of the cultivar Sarah was chosen. The seedlings were again placed in framed bed and irrigated as usual. The same treatment was done for the the cultivar Alec's Red. Two concentration of the hormones indolebutyric acid (IBA) were proposed for the experiment (250ppm and 500ppm). For the hormone (BA) two concentrations proposed for the experiment (500ppm and 1000ppm). According to experiment conducted by (Clark *et al*., 1991) two concentrations of GA, were proposed for the experiment which were 100ppm (donated by GA3 1) and 200ppm (donated by GA3,2). The liquid fertilizer Bayfolan was diluted according to the instructions. The dosage was 40-60mls of liquid fertilizer 20 liters of water for one Fadden of the crop. The hormones at their different concentrations and the foliar fertilizer were applied in combination to the plant sunder study.

RESULTS AND DISCUSSION

Statistical analysis of mean plant height showed that the cultivars (control), treatments (hormones +foliar fertilizer) and their interactions significantly (P<0.0l) influenced plant height throughout the period of readings, (Appendix 1). At all readings C_2 (Alec's Red) recorded a significantly' higher plant height as compared to C_1 (Sarah). On the other hand, the treatment GA_32+F_2 gave a significantly higher plant height at all readings as compared to all other treatments. The treatment BA_2+F_2 gave a significantly lower plant height as compared to all other treatments. The interaction $C_2XGA_32+F_2$ gave a significantly higher plant height at all readings as compared to all other interactions. Whereas the interaction $C_1XBA_1±GA_31XF_1$ gave a significantly lower plant height at all readings s compared to all other interactions (Tables 1, l6^{in} reading).In this study, plant height (cm) at all readings was significantly in C2 (hybrid tea cultivar, Alec's Red) than in C1 (Floribunda cultivar, Sarah) as shown in Table (1). This is attributed to the genetic characteristics of this hybrid, because one of the main targets of any breeding programmed is to increase plant height in ornamentals especially in case of cut flowers in an attempt to increase the floral stalk. Also attaining plant height in a shorter period of vegetative growth will achieve earliness. Treatment GA32+F2 increased significantly plant height when compared to all other treatments at all readings. This was due to the effects of the combination of hormone and fertilizer on either cell division or cell elongation which initially affect the internodes length, because studies indicated that number of nodes is genetically controlled and therefore increase in plant height came from increase in internodes length. Similar results were also obtained by (McDaniel, 1989 and Riviv *et al*., 1993). The findings in this study were also in with (Mahrana and pani, 1982) who stated that GA3 (50-2010ppm), cocel (chiomequat) at (2500-1 0000ppm) or MH (250-1000 ppnn) when Jed to cv. 'Celebration' one month after pruning, GA_3 amd MH sed plant height whereas cycocel at 2500 and l0000ppm decreased $i1A_3$, especially at 200ppm advanced flowering whereas MH delayed it (Goergiev, 1971). Also reported that vegetative growth and so other quality characteristics of rose cultivars, 'Baccara' and 'Super Star' have both significantly affected by addition of different levels of trace elements (Ali and Alsafar, 2006). Mentioned that in a field experiment evaluated the effect of nitrogen and gibberellin pretreatment on growth and development of two cultivars (Topaz and Sancerre) of Gladiolus corms in Saudia-Arabia.

The experiment soil was loamy saind and received four levels of nitrogen (0, 25, 50, 75 kg N/ha) applied as urea. Gladiolus corms were presoaked for 24 hours in GA_3 solution of a concentration of 0 and 1 O0ppm. Stem height, number of leaves per plant, leaf area, shoot dry weight, number of corms per plant, corms dry weight and flower diameter increased significantly with nitrogen and GA_3 treatments, and significant difference was observed between the performance of the two cultivars, and cv. Topaz proved to be superior to cv. Sancerre in all growth parameters (Lee *et al*., 2001). Also stated that plant height and length of flower stalk increased as the application level of GA_3 increased and the number of days to flowering was sbortned by GA_3 treatment of Baegkwang, Chrysanthemums and Dendranthema cut flowers. (Ballantyne, 1991) also reported that one-year-old plant of Rhododendron hybrids Coral Bells, Fashion, Hexe, Hinocrimson, Hinodegiri and Red Wing were potted in 1.41 litre pots, pruned to 4-6 leaves and then, two weeks later, placed in a growth chamber and exposed to irradiances of 100, 200 or 350 umol s' m2 for 15 howrs/day. Some of the plants were sprayed to run off with 1mM (GA_3 + 0.1 %Tween-20, weekly for 5 weeks. Control plants were sprayed with 0.1% Tween-20 only.

Plants were assessed after 8 weeks in the growth chamber. GA3 had a greater effect on shoot elongation in Coral! Bells, Fashion, Hinodegiri and Red Wing than in Hexe or Hinocrimsoin. GA_3 was also more effective on plants exposed to an irradiance of 35W mMol $s^{-1}m^{-2}$ than those growing lower irradiates (Anderson, 1992). Mentioned that 'Roge- White' which i's a unique genetic line of Aquilegia x hybrid Sims that will flower with a cold period, does not have an extended juvenile growth phase, and is responsive to gibberellins treatment. Plants treated at the 7-leaf stage with GA4,7 boitced and flowered 20 days earlier than untreated plants. Gibberellins treatment did not increase the growth rate (leaves/day), but induced flowering after the production of fewer leaves. Plant

Table 1. Effects of cultivars, treatments and their interaction on height of rose plants, at 16th reading obtained during 2005/2006 seasons

Cultivars / Treatments	16th reading: 54 weeks from budding cm.		
	C_1	C_2	Treatment mean
Control	73.00 t	100.50 fg	86.75 ij
$IBA_1 + F_1$	79.75 n	109.25 b	94.50 c
$IBA_1 + F_2$	83.75 l	107.50 c	95.63 b
$IBA_2 + F_1$	83.75 l	107.50 c	95.63 b
$IBA_2 + F_2$	77.50 op	103.50 d	90.50 e
$GA_31 + F_1$	79.25 m	101.50 f	90.38 ef
$GA_31 + F_2$	76.50 pq	97.25 i	86.88 j
$GA_32 + F_1$	81.25 m	104.00 d	92.63 d
$GA_32 + F_2$	84.00 l	115.50 a	99.75 a
$BA_1 + F_1$	76.00 q	98.75 h	87.38 hi
$BA_1 + F_2$	77.50 op	102.75 e	90.13 f
$BA_2 + F_1$	77.75 o	104.50 d	91.13 e
$BA_2 + F_2$	74.25 rs	96.00 j	85.13 k
$IBA_1 + GA_31 + F_1$	74.75 r	101.00 fg	87.88 gh
$IBA_1 + BA_1 + F_1$	73.00 t	97.75 hi	85.38 k
$BA_1 + GA_31 + F_1$	73.50 st	92.75 k	83.13 l
Cultivar mean	77.42 b	102.05 a	

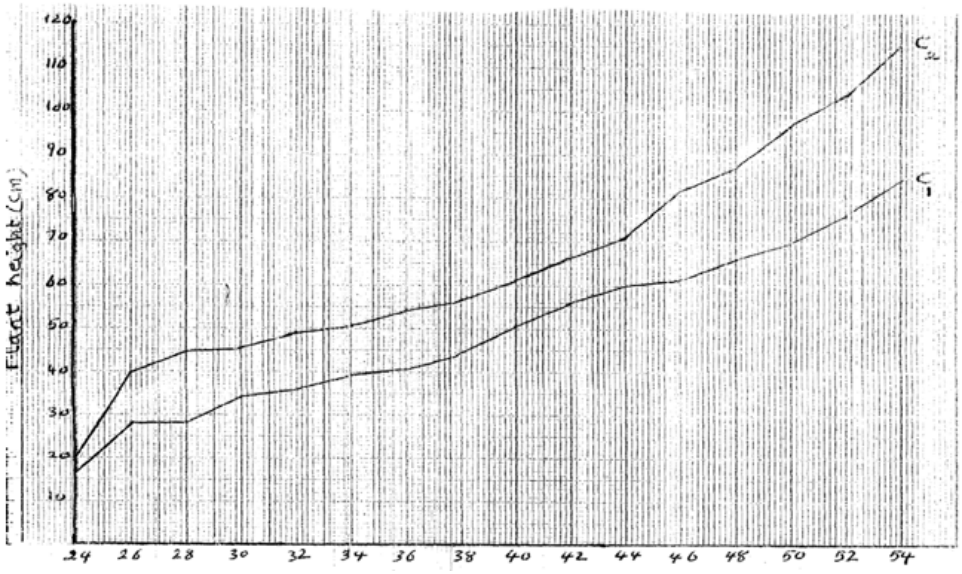
SE ± for Treatments (T) 0.10
S.E ± for Cultivars (C) 0.29
.E ± for C x T (Interaction) (T) 0.42
Means followed by similar letters are not significantly different at level of probability according to Duncan New Multiple Range Test (DNMRT).

Table 2. Mean values for rose plants heights, cvs. C1 and C2, as affected by treatments, cultivars and their interaction during 2005/2006 seasons

Treatments	Cultivar	Mean values for plant height in cm															
Control	C_1	20.25	21.50	21.05	25.75	27.50	30.25	32.50	35.00	38.25	43.25	47.50	52.25	57.25	61.00	69.50	73.00
	C_2	18.00	30.00	34.75	37.00	39.00	41.50	46.75	49.25	52.25	56.50	62.25	70.00	75.00	85.50	90.50	100.50
IBA_1+F_1	C_1	18.00	25.25	27.00	29.00	31.00	34.50	37.25	40.75	44.00	48.75	55.25	59.25	63.25	68.25	76.00	79.75
	C_2	15.75	24.25	31.25	41.50	44.25	46.50	51.25	54.00	58.50	63.50	71.25	80.00	84.25	93.25	100.50	109.25
IBA_1+F_2	C_1	17.50	19.50	29.25	33.00	35.25	37.25	40.00	43.50	59.00	54.75	59.00	65.00	69.75	73.50	80.25	83.75
	C_2	21.75	22.75	32.50	37.80	40.50	42.75	45.25	48.25	52.25	57.25	66.00	73.50	78.75	89.75	95.50	107.50
IBA_2+F_1	C_1	17.00	22.00	29.75	30.75	32.50	34.25	36.00	40.50	44.25	49.00	53.25	58.50	62.50	66.25	73.50	83.75
	C_2	21.75	25.75	27.50	30.80	33.00	36.50	39.25	42.25	46.50	49.75	56.75	68.75	71.75	82.00	86.75	107.50
IBA_2+F_2	C_1	15.75	21.50	25.25	27.50	30.75	32.50	35.25	39.50	44.75	50.50	55.50	61.50	64.75	66.75	74.00	77.50
	C_2	17.00	28.75	34.00	38.00	41.25	44.75	47.50	50.00	55.00	59.50	68.50	79.00	84.75	92.50	95.75	103.50
GA_31+F_1	C_1	15.75	18.00	27.25	29.50	30.00	35.00	35.75	39.50	45.00	49.75	54.00	60.75	63.50	67.00	74.00	79.25
	C_2	16.50	21.50	35.75	36.50	41.25	44.00	45.00	48.25	53.25	58.25	65.00	71.50	76.25	85.00	89.50	101.50
GA_31+F_2	C_1	16.50	21.50	25.25	29.50	30.00	35.00	37.50	41.25	44.50	49.75	53.50	59.00	62.75	65.75	72.00	76.50
	C_2	18.75	25.50	29.25	39.30	41.25	44.00	46.75	49.75	53.50	55.25	62.50	73.75	77.25	84.25	88.50	97.25
GA_32+F_1	C_1	20.50	23.50	23.75	31.25	33.25	31.25	35.00	35.25	43.50	49.25	59.50	64.75	67.75	71.00	76.75	87.25
	C_2	19.75	39.75	42.25	46.00	47.75	50.50	53.00	55.75	58.25	63.50	68.75	78.00	81.50	90.75	95.75	104.00

Table (2): continued

GA_32+F_2	C_1	18.00	28.00	28.00	34.00	35.25	38.75	40.25	44.50	50.50	55.50	60.00	61.50	65.75	69.50	76.50	84.00
	C_2	20.00	39.50	43.75	44.50	48.25	50.50	54.00	56.50	60.75	65.75	71.00	82.25	87.00	96.75	104.00	115.50
BA_1+F_1	C_1	17.50	19.00	23.75	26.00	29.00	31.50	34.00	37.75	42.25	45.75	50.75	55.50	59.50	64.50	71.50	76.00
	C_2	17.25	27.25	35.50	37.80	40.25	45.75	48.75	52.25	57.25	61.50	69.50	78.75	82.00	89.50	94.50	98.75
BA_1+F_2	C_1	16.50	21.00	25.00	27.75	28.75	32.25	34.50	38.75	45.00	50.25	54.00	59.25	63.00	66.00	73.00	77.50
	C_2	23.25	36.75	40.50	42.30	45.25	49.00	51.50	54.75	56.25	61.75	68.50	77.00	82.25	91.50	96.00	102.75
BA_2+F_1	C_1	16.50	23.50	29.50	33.50	38.00	40.50	42.25	45.50	50.00	55.00	56.00	63.25	66.00	68.25	73.25	77.75
	C_2	21.00	30.75	37.25	42.30	45.00	49.00	52.75	56.00	59.75	64.25	70.50	77.00	82.75	93.00	97.50	104.50
BA_2+F_2	C_1	16.75	20.75	24.00	27.75	29.25	31.50	33.50	38.00	42.75	48.00	35.50	58.50	61.75	64.50	71.50	74.25
	C_2	20.00	31.00	34.75	38.75	41.50	47.25	49.25	51.75	54.75	60.25	66.25	76.25	79.50	86.00	90.00	96.00
$IBA_1+GA_31+F_1$	C_1	16.00	21.75	29.00	33.25	34.50	36.50	38.25	41.50	45.75	51.00	57.00	62.00	64.75	67.25	70.75	74.75
	C_2	16.75	33.25	38.25	41.50	44.25	48.75	52.50	55.75	59.25	63.75	69.00	74.75	78.00	89.25	94.50	101.00
$IBA_1+BA_1+F_1$	C_1	19.75	26.75	27.00	30.25	31.25	33.50	36.00	39.00	42.00	47.25	53.00	58.50	61.50	64.00	69.00	73.00
	C_2	19.00	28.25	34.75	35.00	37.25	42.00	45.25	48.50	55.00	60.50	65.25	74.25	77.75	85.00	88.75	97.75
$BA_1+GA_31+F_1$	C_1	19.00	25.00	26.00	29.00	30.25	33.75	35.50	38.75	42.75	48.75	53.50	57.25	60.25	63.00	67.50	73.50
	C_2	16.25	24.25	27.75	29.80	32.75	35.50	38.00	41.00	46.25	52.00	57.75	66.75	70.75	82.00	86.50	92.75



Graph 3. Representing effects of treatment, cultivars and their interaction on rose plant height (cm)

height and the number of flowers/plant increased significantly. GA417 treatment delayed flower senescence and on (Table 2).

Conclusion

Two cultivars of a hybrid rose, namely "Alec's Red" and a floribunda rose "Sarah", which is a local name for "Matangi rose", were both subjected to investigation under different treatments combinations that included application of IBA, GA3 and BA growth hormones plus a liquid foliar fertilizer "Bayfolan". Control plants received only water and surfactant Tween-20. Plants under study were in replicates of four in a completely randomized design. Results obtained showed that both cultivars; were significantly ($P<0.01$) affected by the nature of cultivars and thy the treatments and also by the interaction between treatments and cultivars. In this study cv. "Alec's Red" gave a significantly ($P<0.0l$) higher plant heights as compared to cv. "Sarah", with GA_3+Bayfolan. Number of leaves, number of branches and number of petals were also significantly ($P<0.0$ 1) higher in cv. "Alec's Red" when compared to "Sarah", with BJA and Bayfolan. Number of

buds, length of floral stalk and flower diameter were significantly (P<0.0l) higher in cv. "Alec's Red" when compared to cv. "Sarah" under GA_3+Bayfolan, whereas the same treatment gave a significantly, (P<0.0 1) higher number of flowers in cv. "Sarah" as compared to cv. "Alec's Red". This study indicated that application of GA3 and BA+ the foliar fertilizer "Bayfolan", had positive effects on vegetative growth, which was expressed by plant height, number of leaves and number of branches, and also, positive effects on reproductive growth, as express seed by number of buds, number of floral petals, length of floral stalk, number of flowers and flower diameter. The effects GA_3, BA+ the foliar fertilizer "Bayfolan", where more pronounced in cv. "Alec's Reed" as compared to cv. "Sarah" in all parameters , except number of flowers where cv. "Sarah" surpassed cv. "Alec's Red", under the same treatments.

Recommendations

It is observed that roses in Sudan do not have the attention they deserve from producers who still adopt traditional methods in production. Roses are recognized as the most beautiful plants among ornamentals and now there are more than 60000 cultivars throughout the world, and hence roses are highly ranked among charming shrubs, so more attention must be for better growth and development, especially that a great need for roses has become a necessity, either to be used as cut flowers or for landscape. It has been proved in many research findings that growth hormones have remarkable effects on plant growth and development, whereas application of nutrients is also inevitable.

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