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Effect of Alar, Cycocel and Bonzi and Their Time of Applications on Growth Performance of Ivy Geranium (*Pelargonium Peltatum*)

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Abstract

This greenhouse experiment was conducted to determining the growth response of Pelargonium peltatum to application of Alar, Cycocel and Bonzi at different growth stage. The experiment was laid down as randomized complete block design with three replications. On the test plants it was observed that the application of Alar, Cycocel and Bonzi considerably affected most of the evaluated parameters. Alar, Cycocel and Bonzi reduced the height of the test plant and branching habit was induced. Accordingly, the highest number branch per plant was obtained from plants treated with Cycocel at their active growth stage (5.07). However this maximum result was not statistically different with Bonzi applied at active growth stage (5.20) and Alar applied at active growth stage (4.67). The respective lost number of branches per plant was recorded from plants which did not receive retardant chemicals (1.87). Overall, the investigation entails that Alar, Cycocel and Bonzi can influence growth of Pelargonium peltatum and cutting yield (branching). From commercial grower point of view, obtaining large number of quality cuttings is crucial. Hence, application of Cycocel at their active growth stage which demonstrated positive influence on cutting production can be recommended for use by commercial growers in Ethiopia.

Keywords: Pelargonium peltatum; Growth Retardant Alar Cycocel (CCC) Bonzi

Introduction

The Ethiopian flower industry is flourishing, with the help of government incentives and low labor cost (EHDA, 2012). The country is now the second-largest flower exporter in Africa, with over 100 flower growers on 1,700 hectares. The country has generated over 260 million USD from the sector in the budget year of 2011/12 and the industry becomes one of the top four sources of foreign exchange for the country (EHDA, 2012). The production area and amount of earnings is expected to increase in the 2nd Growth and Transformation Plan years and the area and revenue are projected to grow to 3,000 hectares and revenue to $550 million, respectively, due mainly to the expansion of horticulture farms in the country (Tessema and Tamene, 2015) [1].

In recent years, the numbers of cutting companies that produce small cutting planting materials has shown a rise trend and are known to be successful in their businesses (Daniel, 2013). Among these, Florensis Ethiopia PLC, Syngenta Ethiopia, Dessa plant PLC, Maranque plants PLC and Red-fox PLC are known companies and they are successful in their business. The main plants produced in these Ethiopian producers are *Pelargonium, Poinsettia, Chrysanthemum* and *Mandevilla* (Daniel, 2013; EHPEA, 2013).

Pelargonium peltatum (Ivy geranium) is one of the species grown for cuttings production in our country mainly by Florensis Ethiopia PLC. However, this plant usually grows up quickly and fall-over the growing pots (Trevor, 2005; Pobudkiewicz and Treder, 2006; Pobudkiewicz, 2008). To manage these problems, growers regularly use chemical growth retardants among which Alar (B-nine), CCC (Cycocel), Bonzi, and Florel are common. These plant growth retardants are synthetic compounds which are used to reduce the shoot length of plants in a desired height without changing developmental patterns or being phytotoxic. This is achieved primarily by reducing cell elongation and by lowering the rate of cell division (Wilhelm, 2016) [2].

Growth retardants are highly specific in their effect on growth plants. There is no clear association between taxonomic classification and plant response to a particular compound. Even different cultivars of the same species vary greatly in the responsiveness to the applied chemical (Dole and Wilkins, 2005). Thus this experiment was initiated to determine interaction effect of effect of Alar, Cycocel and Bonzi with their time of applications on growth of Pelargonium peltatum [3].

Methodology

Description of the Study Area

The experiment was conducted at Jimma University College of Agriculture and Veterinary Medicine (JUCAVM), under greenhouse condition. JUCAVM is found in Jimma town, which is 355 km southwest of Addis Ababa, located at about 70 40'N latitude and 360 50' E longitudes at an altitude of 1710 meters above sea level. The mean maximum and minimum temperatures were 26.80oC and 11.40oC respectively, and the mean maximum and minimum relative humidity were 91.40% and 39.92%, respectively (Woldu et al., 2015) [4]. The mean maximum and minimum temperatures of growing greenhouse (JUCAVM) were 35o C and 20oC and the mean maximum and minimum relative humidity were 83% and 40%, respectively. In the propagation unit (Koka Florensis Ethiopia PLC) temperature and relative humidity were maintained in the range of 24 to 29°C and 75 to 85%, respectively using a computerized Greenhouse Systems.

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Experimental materials

Properly carton packed rooted cuttings of Pelargonium peltatum, (Balcon Imperial Red variety) being used as test crop was transported with inter-city bus /long distance public transport from Koka Florensis Ethiopian Private Limited Company to Jimma University College of Agriculture and Veterinary Medicine. The species was selected on the basis of the company's recommendation and taking into account its popularity in the international market. The required amount of chemical growth retardants (Alar®, CCC® and Bonzi®) for the experiment was also obtained from the farm. Round plastic pots with 2 litre volume capacity were used for repotting the received rooted cuttings. A mixture of forest soil, sand and manure at 3: 1: 1 ratio was used as a growing media. For spraying the PGRs solutions, three hand sprayers which hold a liter of a solution were utilized [5].

Experimental design and treatments

The experiment was laid out in 3 x 2 factorial arrangements with three replications in Randomized Complete Block Design (RCBD). The spacing between blocks, plots and pots were 50 cm, 25 cm and 10 cm, respectively.

Two Time of applications (Early & Late) and three chemical Growth Retardants (Alar, CCC and Bonzi), used at their recommended rates for the test crop as follows: Alar® and Cycocel® at equal concentration of 1000 ppm and Bonzi at 15 ppm (Latimer, 2009; Douglas and Brian, 1998; Brian, 2013).

The stages of application were determined as early stage when the 50% of the repotted root cuttings develop 4 new leaves per plant and as active vegetative stage when 50% of the repotted root cuttings develop 2 branches per plant. Then the treatment combinations were randomly assigned to the experimental plots and replicated three times [6].

Experimental procedures

The rooting processes of Pelargonium peltatum was done at Koka Florensis Private Limited Company. The cuttings were allowed to remain in the rooting containers for 25 days in order to ensure proper rooting at the farm. Then the rooted cuttings were packed in carton and transported to Jimma University College of Agriculture and Veterinary Medicine using public transport (inter-city bus).

The growing media was prepared from forest soil, sand and manure at the ratio of 3: 1: 1, respectively. The prepared media was allowed to moist and filled in the pot. Then after, each rooted cutting was planted in a single pot and other management practices such as watering, weeding and follow-ups were implemented uniformly to all plants as per the operational recommendations of the farm (Florensis Ethiopian Plc) [7].

Data collected

- **Plant height (cm):** The height of main stem was measured from five randomly selected plants starting from the crown (the point where the root and stem join) to the uppermost part of the plant using standard ruler at flowering stage (when 50% of the plants open their flower).

- **Main stem diameter (mm):** Stem diameter of the main stems of the sampled three plants was measured just 5cm above the surface of the media using digital Caliper and the average data was recorded.

- **Inter-node length (cm):** The length between two nodes of the main stem was measured using standard ruler from three randomly selected plants by taking the average length between two successive nodes starting from the second node of the bottom of plant.

- **Number of branches per plant:** The number of main branches was counted from five plants at flowering stage (when 50% of the plants open their flower).

- **Number of leaves per plant:** The number of leaves per plant was counted from five plants just before flowering.

- **Mean leaf area (cm2):** The area of leaf was measured using square paper from three randomly selected plants by taking randomly three leaves from top, middle and bottom parts just before flowering, and the average value was recorded (Aglave et al., 2012).

- **Number of roots per plant:** The number of main roots (roots raised from the main stem crown) per plant was counted from three randomly selected plants after cleaning the soil from the roots at flowering stage (when 50% of the plants open their flower).

- **Root length (cm):** The root length of three randomly selected plants was measured using standard ruler from the crown of the plant to the lower end point of the roots after cleaning the soil from the roots at flowering stage (when 50% of the plants open their flower).

- **Root volume (ml):** The volume of cleaned roots of three randomly selected plants was measured first by immersing the roots in a beaker containing 1000 ml of water and then by calculating the volume of water displaced (Allen, 1996) at flowering stage (when 50% of the plants open their flower) [8].

Data analysis

The collected data of all parameters of the experiment was subjected to the Analysis of Variance (ANOVA) using SAS computer software (version 9.3). Least significant difference (LSD) procedures at 0.05 probability level of significance was used for comparing treatment means.

Results and Discussion

Number of leaves per plant

The application of chemical plant growth retardants on leaf number of Pelargonium peltatum was significant ($p< 0.05$).

The maximum number of leaves per plant (32.73) was obtained from plants treated with Bonzi plant growth retardant at their early growth stage; however, it was not statistically different from other treatment combinations except the control group. The minimum number of leaves (25.00) was recorded from plants which were not treated with PGRs. The increase in number of leaves probably happened because of the ability of PGRs to check apical dominance and induce lateral growth [9, 10].

Mean leaf area

The effects growth retardant chemicals were highly significant ($p< 0.01$) on leaf area of the test plant.

The leaf area of Pelargonium peltatum showed that a significant reduction in response to plant growth retardants since all the applied treatments resulted in smaller leaf area than the control. The maximum leaf area (42.10 cm2) was recorded from plants which were not treated with plant growth retardants. The respective lowest leaf area (22.00 cm2) was obtained from plants treated with Bonzi at their early growth stage. The reason for this might be due to the fact that Bonzi PGR

moves slowly in the plant tissue and so, it inhibits leaf expansion in prolonged period of time.

Number of branches per plant

The effect of chemicals Alar, Cycocel, Bonzi and their respective time of applications was, significant ($p<0.05$) on the number of branches per plant.

In the test plant the highest number branch per plant was obtained from plants treated with CCC at their active growth stage (5.07). However this maximum result was not statistically different with Bonzi applied at active growth stage (5.20) and Alar applied at active growth stage (4.67). The respective lost number of branches per plant was recorded from plants which did not receive retardant chemicals (1.87). This increase in number of branches per plant might be due to the ability of PGRs to increase branching habit of plants (Li, 2013) [11].

Plant height

The application of chemical plant growth retardants on height of Pelargonium peltatum was highly significant ($p< 0.01$).

With regard to plant height there was a highly significant variation attributable to the effect of plant growth retardants. The result depicted in Table 1 indicates that all the treatment suppressed the height as compared to the control. The maximum height of the test plant (43.47 cm) was recorded from plants which were not treated with plant growth retardants, while the minimum height (29.13 cm) was recorded from plants treated with Bonzi at their early growth stage. The possible reason for this might be because Bonzi was taken up by the plant tissue slowly from the media, with longer exposure resulting in greater inhibition of inter-nodal and hence stem elongation as compared to CCC and Alar plant growth retardants (Boldt, 2008) [12].

Inter-node length

The application of plant growth retardant chemicals was highly significantly ($p<0.01$) influenced inter-node length of the test plant.

The maximum length of inter-node (4.23 cm) was obtained from plants which were not treated with PGRs and the minimum length of inter-node (2.56 cm) was recorded from plants which were treated with Bonzi applied at early growth stage of the test plant. The possible reason for this might be Bonzi was taken up to the plant tissue slowly from the media, with longer exposure resulting in greater inhibition of inter-nodal elongation as compared to CCC and Alar plant growth retardants (Boldt, 2008) [12, 13].

Main stem diameter

The application of plant growth retardants was found highly significant ($p< 0.01$) on main stem diameter of Pelargonium peltatum.

Main stem diameter significantly increased in response to applying plant growth retardant. The highest main stems diameter (0.34 mm) was recorded from plants treated with CCC at their active growth stage. The respective lowest main stem diameter (0.11 mm) was obtained from plants which were not treated with plant growth retardant chemicals.

Root length

The effect of plant growth retardant Chemicals was found highly significant ($p<0.01$) on the root length of Pelargonium peltatum.

The maximum length of root (37.43 cm) was obtained from plants which were not treated with plant growth retardant Chemicals and the minimum length of root (28.14 cm) was recorded from plants which were treated with Alar at their active growth stage [14].

Root volume

The effect plant growth retardant Chemicals were found significant ($p< 0.05$) on root volume of the test plant.

With regard to chemical application the maximum root volume (15.10 ml) was obtained from plants treated with Bonzi at their active growth stage but it was not statistically different from CCC applied at early growth stage (15.00 ml), CCC applied at active growth stage (12.93 ml), the Control (12.50 ml) and Bonzi applied at early growth stage (11.03 ml). The respective minimum root volume (7.53 ml) was recorded from plants treated with Alar at their active growth stage (Table 1) [15,16].

Summary and Conclusion

This study verified the existence of valid influence on most of the evaluated parameters. Subsequently, significant variations were observed from plant height and main stem diameter attributed to the interaction effect of plant growth retardants and their method and time of applications. The shortest plant height (25.27 cm) was recorded from plants treated with CCC at their early growth stage and the highest number of branches per plant (5.07) was recorded from

Table 1: Interaction effect plant growth retardant chemicals and their time of application on tested parameters.

Treatments	LN	LA	BN	PH	IL	MD	RN ^{ns}	RL	RV
Alar X Act	27.33^{ab}	25.73^{bc}	4.67^{ab}	35.27^{c}	2.63^{c}	0.19^{c}		28.00^{c}	7.53^{c}
Alar X Ear	29.40^{ab}	28.67^{b}	3.67^{c}	39.50^{b}	3.17^{b}	0.18^{c}		30.10^{bc}	10.00^{bc}
Bonzi X Act	31.40^{a}	27.43^{b}	5.20^{a}	26.23^{de}	2.87^{bc}	0.20^{c}		30.77^{b}	15.10^{a}
Bonzi X Ear	31.53^{a}	22.00^{c}	4.20^{bc}	29.13^{d}	2.03^{d}	0.24^{b}		29.43^{bc}	11.03^{abc}
CCC X Act	31.33^{a}	27.57^{b}	5.07^{a}	27.67^{de}	2.70^{c}	0.34^{a}		31.00^{b}	12.93^{ab}
CCC x Ear	28.80^{ab}	25.300^{bc}	3.53^{c}	25.27^{e}	2.83^{bc}	0.25^{b}		31.17^{b}	15.00^{a}
Control	25.00^{b}	42.10^{a}	1.87^{d}	43.47^{a}	4.23^{a}	0.11^{d}		37.43^{a}	12.50^{ab}
$LSD_{0.05}$	5.33	5.30	0.80	3.73	0.45	0.03		2.43	4.55
CV	8.87	7.99	13.66	7.20	8.02	9.72		6.14	20.57

CCC (Cycocel) **Act** (Active growth stage) **CV** (Coefficient of variance)
X (Interaction between) **Ear** (Early growth stage) **LSD** (Least significant difference)
ns (None Significant at 5%)
LN Leaf of Number/plant **PH** Plant Height **RN** Root Number/Plant
LA Mean Leaf Area **IL** Inter-node Length **RL** Root Length
BN Number of branch/plant **MD** Main Stem Diameter **RV** Root Volume

plants treated with CCC® at their active growth stage. Beside this all the applied treatments brought reduction in plant height and increment in number of branches per plant. Commercial nurseries that specialized in producing small cuttings and plugs are always striving to make their stock plants compact and branchy with thick stem in order to supply maximum salable products with the desire quality standards. To this effect, application of CCC® at early growth stage of the plant can be recommended for our greenhouse growers though further multi-locational studies may be required to come up with comprehensive suggestions.

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Conflict of Interest

There is no conflict of interest.

References

1. Aglave VA, Sambre NB, Patil SB (2012) Estimating leaf area by using imaging technique. IJAIR ISSN: 2278-7844.
2. Allen P (2012) Finding volume of irregular objects by a water displacement method.
3. Boldt JL (2008) Whole plant response of Chrysanthemum to Bonzi, Chlormequat chloride and (S)-Abscisic acid as a function of exposure time using a split-root system. Thesis Presented to the Graduate School of the University of Florida in Partial Fulfillment of the Requirements for the Degree of Master of Science.
4. Brian E (2013) Plant growth regulator guide. North Carolina State University.
5. Daniel H (2013) Evaluation and Development of Floriculture Supply Chain in Ethiopia, to Attenuate Environmental Impact and Logistics Cost (Doctoral dissertation, AAU).
6. Douglas B, Brian W (1998) Best Management Practices for Plant Growth Regulators used in Floriculture. Horticulture Information Leaflet 529: 1-16.
7. EHDA (2012) Ethiopian Horticulture Development Agency. Annual Report. Addis Ababa, Ethiopia
8. EHPEA (2013) Ethiopian Horticulture Producer Exporters Association. Annual Report. Addis Ababa, Ethiopia
9. Latimer JG (2009) Selecting and using plant growth regulators on floricultural crops produced by communications and marketing. College of Agriculture and Life Sciences, Virginia Polytechnic Institute and State University
10. Li M (2013) Pinching, Bulking Duration, and Plant Growth Retardant Effects on Growth and Flowering of Greenhouse-grown Achillea ×'Coronation Gold' and Coreopsis verticillata 'Moonbeam. M.Sc. thesis, Auburn, Alabama
11. Pobudkiewicz A (2008) The influence of growth retardants and cytokinins on flowering of ornamental plants. ACTA Agrobotanica 61: 137-141.
12. Pobudkiewicz A, Treder J (2006) Effects of flurprimidol and Alar on growth and flowering of oriental lily 'Mona Lisa'. Scientia horticulturae 110: 328-333.
13. Tessema S, Tamene A (2015) Ethiopian flower industry flourishes. Government incentives and low labor costs are bringing in foreign investment.
14. Wilhelm R (2016) Growth retardants: Effects on Gibberellin Biosynthesis and Other Metabolic Pathways. Annual Review of Plant Physiology and Plant Molecular Biology 51: 501-531
15. Woldu Z, Mohammed A, Belew D, Bekelle Y, Aragaw T, et al. (2015) Combined Effects of 1-MCP and Export Packaging on Quality and Shelf-life of Cavendish Banana (Musa sp.) Food Science and Quality Management 45:2-3

Table 2: Analysis of variance for different agronomic characters in M2 of sesame.

Source of variation	df	Y (kg/ha)	DF	PH	NBPP	NCPP	DM	NSPC	TSW (gm)	CC
Replication	1	30867.1	7.692	1095.42	4.2885	6336.1	94.231	29.25	0	0
Accession	24	3179.9	35.338	483.55	5.0036	683.3	126.784	136.16	0.43460ns	10128
Residual	46	2279.2	14.912	361.04	2.7004	454.3	189.746	89.818	0.19275	4215.3

ns: nonsignificant, ∗=significant ($p < 0.05$), df.: degree of freedom, Y= yield, NCPP= number of capsules per plant, NSPC=number of seed per capsule, TSW=thousand seed weight, DF=days to 50% flowering, PH=plant height, NBPP= number of branches per plant, DM=days to 50% maturity, CC=chlorophyll contents