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Research Article

# Effect of Alar, Cycocel and Bonzi and Their Method of Applications on Growth Performance of Ivy Geranium (*Pelargonium peltatum*)

**Kebede Tedila***

*Department of Agriculture and Natural Resource Science, Debre Berhan University College of Agriculture and Natural Resource Science, Debre Berhan, Ethiopia*

## ABSTRACT

This green-house experiment was conducted to determining the growth response of *Pelargonium peltatum* to application of Alar, Cycocel and Bonzi spray and drench applications. On the test plants it was observed that the application of Alar, Cycocel and Bonzi considerably affected most of the evaluated parameters except the number of roots. Alar, Cycocel and Bonzi reduced the height of the test plant and branching habit was induced in all combinations. Accordingly, the highest number branch per plant was obtained from plants treated with Bonzi in drench application however the respective lost number of branches per plant was recorded from plants which did not receive plant growth retardant chemicals. In general the investigations entail 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 Bonzi in drench form demonstrated positive influence on cutting production can be recommended for use by commercial growers in Ethiopia.

**Keywords:** Alar; Bonzi; Cycocel; Growth retardant; *Pelargonium peltatum*

**Abbreviations:** (PLC): Programmable Logic Controllers; (PGRs): Plant Growth Regulators; (CCC): Chlormequat Chloride

## INTRODUCTION

The Ethiopian flower industry is flourishing, with the help of government incentives and low labor cost. 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 [1]. The production area and amount of earnings is expected to increase in the 2nd Growth and Transformation Plan (GTP) 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 [2].

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. 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 [3,4].

*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 [5-7]. 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 [8].

Growth retardants are highly specific in their effect on growth plants. There is no clear association between taxonomic

**Correspondence to:** Kebede Tedila, Department of Agriculture and Natural Resource Science Debre Berhan University College of Agriculture and Natural Resource Science, Debre Berhan, Ethiopia, E-mail: kebedetedila@gmail.com

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classification and plant response to a particular compound. Even different cultivars of the same species vary greatly in the responsiveness to the applied chemical [9].Thus this experiment was initiated to determine interaction effect of Alar, Cycocel and Bonzi with drench and spray applications on growth of *Pelargonium peltatum*.

# MATERIALS AND METHODS

## Description of the study area

The experiment was conducted at Jimma University College of Agriculture and Veterinary Medicine (JUCAVM), under green-house 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 26.80°C and 11.40°C respectively and the mean maximum and minimum relative humidity were 91.40% and 39.92%, respectively [10]. The mean maximum and minimum temperatures of growing greenhouse (JUCAVM) were 35°C and 20°C 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°C to 29°C and 75% to 85% respectively using a computerized Greenhouse Systems (GS).

## 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.

## Experimental design and treatments

The experiment was laid out in 3 × 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 methods of applications (drench and spray) 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 [11-13].

## Experimental procedures

The rooting processes of *Pelargonium peltatum* was done started 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.

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).

## 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 5 cm 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 ($cm^2$):** 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 [14].

**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 at flowering stage (when 50% of the plants open their flower) [15].

### Data analysis

The collected data of all parameters of the experiment was subjected to the Analysis of Variance (ANOVA) using Statistical Analysis Software (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

### 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 (36.93) was obtained from plants treated with Bonzi plant growth retardant by drench application; however, it was not statistically different from Alar applied drench application method (33.60). The minimum number of leaves (25.00) was recorded from plants which were not treated with plant growth retardant chemicals from the Table 1. The increase in number of leaves may happen because of the ability of plant growth retardant chemicals to reduce apical dominance and induce lateral growth.

### Mean leaf area

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

The leaf area of *Pelargonium peltatum* showed 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 $cm^2$) was recorded from plants which were not treated with plant growth retardants. The respective lowest leaf area (11.97 $cm^2$) was obtained from plants treated with Bonzi by drench application from the Table 1. The reason for this might be due to the fact that Bonzi 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 and Bonzi was highly significant ($p<0.01$) on the number of branches per plant.

In the interaction of chemical and method of application the highest number of branches per plant (6.73) was recorded from plants treated with Bonzi in drench form and the lowest number of branches (1.87) was obtained from plants which were not treated with plant growth retardants from the Table 1. This increase in number of branches per plant might be due to the ability of plant growth retardants to increase branching habit of plants [16].

### 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 (18.00 cm) was recorded from plants treated with Bonzi in drench application. 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.

### 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 (2.07 cm) was recorded from plants which were treated with Bonzi in drench form of application from Table 1. 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 [17].

### 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 (0.35 mm) was recorded from plants treated with Bonzi in the form of drench. However this highest value was statistically not different from the application of Alar in drench forms. The lowest main stem diameter (0.11 mm) was obtained from plants which were not treated with retardant chemicals as given in Table 1.

### Root length

Chemical was found the factor affect root length of *Pelargonium peltatum* and was highly significant ($p<0.01$).

The maximum length of root (37.43 cm) was obtained from plants which were not treated with plant growth retardants and the minimum length of root (26.17 cm) was recorded from plants which were treated with Bonzin drench form of application (Table 1).

| Trt | LN | LA | BN | PH | IL | MD | RN$^{ns}$ | RL | RV$^{ns}$ |
|---|---|---|---|---|---|---|---|---|---|
| Alar X Dr | 33.60$^{ab}$ | 28.30$^{b}$ | 4.47$^{bc}$ | 37.00$^{b}$ | 2.97$^{b}$ | 0.33$^{ab}$ | - | 30.13$^{b}$ | - |
| Alar X Sp | 29.40$^{c}$ | 28.67$^{b}$ | 3.67$^{c}$ | 39.50$^{b}$ | 3.17$^{b}$ | 0.18$^{d}$ | - | 30.07$^{b}$ | - |
| CCC X Dr | 30.47$^{bc}$ | 26.10$^{c}$ | 4.80$^{b}$ | 30.43$^{c}$ | 2.80$^{b}$ | 0.30$^{b}$ | - | 30.57$^{b}$ | - |
| CCC X Sp | 28.80$^{cd}$ | 25.30$^{c}$ | 3.67$^{c}$ | 25.27$^{d}$ | 2.83$^{b}$ | 0.25$^{c}$ | - | 31.17$^{b}$ | - |
| Bonzi X Dr | 36.9$^{3a}$ | 11.97$^{e}$ | 6.73$^{a}$ | 12.00$^{e}$ | 2.07$^{c}$ | 0.35$^{a}$ | - | 26.17$^{c}$ | - |
| Bonzi X Sp | 31.53$^{bc}$ | 22.00$^{d}$ | 4.20$^{bc}$ | 29.13$^{cd}$ | 3.03$^{b}$ | 0.24$^{c}$ | - | 29.43$^{b}$ | - |
| Control | 25.00$^{d}$ | 42.10$^{a}$ | 1.87$^{d}$ | 43.47$^{a}$ | 4.23$^{a}$ | 0.11$^{e}$ | - | 37.43$^{a}$ | - |
| $LSD_{0.05}$ | 3.89 | 2.18 | 1.10 | 3.94 | 0.41 | 0.03 | - | 3.24 | - |
| CV | 8.87 | 7.99 | 13.66 | 7.20 | 7.60 | 9.72 | - | 6.14 | - |

**Note:** CCC: Cycocel; LSD: Least Significant Difference; CV: Coefficient of Variance; X: Interaction between; Sp: Spray application; 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.

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

## DISCUSSION

Plants treated with Bonzi plant growth retardant via drench treatment produced the highest number of leaves per plant. However, this did not vary significantly from that of plants treated with Alar administered drench application technique. Plants that were not treated with compounds that impede the growth of plants had the lowest number of leaves. The capacity of plant growthretardant compounds to lessen apical dominance and promote lateral development may be the reason of the increase in leaves. The main stem diameter greatly increased when the plant growth retardant was applied. The plants that received a drench treatment from Bonzi had the largest main stem diameter. This value did not statistically vary from the use of Alar in drench forms.

## CONCLUSION

This experiment confirmed the existence of valid influence on most of the evaluated parameters. Subsequently, significant variations were observed from plant height and number of branches per plant attributed to the interaction effect of plant growth retardants and their method of applications. The shortest plant height (12.00 cm) and highest number of branches per plant (6.73) were recorded from plants treated with Bonzi® in drench form of application. In commercial cutting producer communities producing high number of branches per plant is considered positive effect. 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. Therefore, application of Bonzi® in drench form application is recommended for our greenhouse growers though further multi-locational studies may be required to come up with comprehensive suggestions.

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