BIBLIOGRAPHY

BURAS, JESIE P. MARCH 2006. Effect of Pinching on the Growth, Yield and Quality of Garland Chrysanthemum. Benguet State University, La Trinidad, Benguet.

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ABSTRACT

The study was conducted at the Ornamental Horticulture Research Area, Benguet State University, La Trinidad, Benguet from November 2004 to February 2005 to determine the appropriate method of pinching Garland chrysanthemum that would increase shoot yield; and to determine its effect on the vegetative growth and shoot quality of Garland chrysanthemum.

Result showed that roll on pinch increased the number of lateral stems and had the highest total yield of Garland chrysanthemum. Plant pinched with roll on, soft and hard were comparable with each other on the number of harvesting and number of suckers produced per plant but were significantly different over the control (unpinched plants). Unpinched plants (control) had the lowest number of lateral stems, suckers and harvesting. It had also the lowest total yield per plot.

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INTRODUCTION

Garland chrysanthemum (*Chrysanthemum coronarium* L.) belongs to the family *Asteraceae*. The crop is annual that grows to a height of 30-90 cm. It has a single tender, round stalk with finely cut green leaves. The leaves are alternate auricled and clasping at the base, oblong to lanceolate which is 10 cm long or less, bipinnately parted, the lobes are entirely narrowed or toothed and thick. The color of the flowers is bright yellow. This crop looks like the leafy portion of the ornamental version (Quisumbing, 1978).

Garland chrysanthemum is used in oriental cooking in Japan, China and Southeast Asia. It is used in fish dishes, soups, stir fries, and leafy salads because of its strong flavor. Sprouted seeds and petals of flower are edible either fresh or dried. In harvesting, the younger the plant, the milder the leaves. The crop is a good source of phosphorus, vitamin C, calcium, and high in iron.

Apical dominance is the presence of the apical shoot which prevents lateral branches to develop. Pinching of shoots as they are produced affect the concentration of auxin in the apical meristem resulting to the growth of dormant lateral buds. Diversified method of pinching produced multiple branching that have more number of shoots.

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REVIEW OF LITERATURE

Pinching

Pinching is a cultural practice which is highly related to pruning, however, the main objectivesof pruning are different from those of pinching. Pruning is done to reduce the height of the plant, to remove old and disease branches, and also to encourage the growth of larger canes or stem for the production of longer stemmed blooms. Pinching on the other hand, is employed to build up the plants before they are allowed to flower for cutflower production, to produce the desired number of lateral stems or branches and encourage larger diameter of canes. Pinching also improved the physical appearance of the plant and coincide harvest periods with pick demand and higher prizes (Rimando, 2001).

Two months from transplanting, the plants are pinched. Pinching is done just above the six nodes from the base of the plants. When the first lateral shoots are allowed to flower, flushing as almost at the same time. If the market demands lesser volume with continuous supply, pinch the half of the flowers and allow the other half to flower. This practice is called “pinch and a half and double pinch”. Things that are done when the resulting shoots are pinched. Lateral shoots produced unnecessary shoots. The outcome of the reproductive part of the stem generally above the 28th nodes from the previous cut or pinch. Failure to remove them would result in short stem and small flower (Hermano, 2000).

Effect and Importance of Pinching

Pinching is a diversified method which affects the concentration of auxin in the apical meristem resulting to the growth of dormant lateral bud. In 1990, Laurie and Ries found that better flowers on longer stems of high quality are obtained from pinched plant.

Under New York conditions, Fuller (1961) reported that pinching induces flowering and increases the number of branches on the stem. Pinching prevents the limited carbohydrates supply from being expended in the early stages of growth, thereby promoting the development of bottom breaks (Laurie *et al*., 1958).

In 1959, Rockwell said that pinching at the proper height result in stronger stalks which result continuity of flower production. Pinching keeps the plant in a vigorous condition. It improves the quality and promotes as well as balanced appearance. Lack of pinching result in a straggly bush and poorly formed flowers. In order to produce multiple branching in chrysanthemum, one should keep the plant young by frequent division and pinch them back three times during the growing season. He proposed that tall growing types should be pinched when it reaches the height of 9 to 12 inches high.

Pinching of shoots as they are produced prevents the maturity of flowers and increase carbohydrate concentration which stimulates bottom breaks and result to a well balanced appearance and elegant blooms (Bailey, 1930).

Perennials should be cared off properly in order to produce many flowers per plant, but sizes and blooms can be doubled or even tripled by pinching the bark of the growing stems of certain plants, forcing them to send out three or four blooms which will be smaller, but will be numerous than without pinching (Crocket, 1972). The same author said that in lowering the height of plants, pinching makes the plant less vulnerable to wind so they may not have to be staked out for support.

Irrigation and Fertilization

Upon planting the seedlings, the soil is near saturation. This is done by irrigating the plant with an interval of three to four days. Bi-weekly watering is needed while the plants are recovering. The frequency of watering can be made longer, when the plants

have fully recovered and developed. The rate of water ranges from five to nine liters per square meter per irrigation.

Long dry and/or wet soil that are below or above the field capacity level greatly affects the growth and flower quality. The former causes smaller flowers with fewer petals, hardened foliage and stems. The latter makes poor root growth, long internodes and flowers which lessens the shipping quality. Thus, the soil must be kept within the field capacity level of water (Hermano, 2000).

Work and Carew (1955) reported that fertilization practices are best planned in accordance with local advice and experience.

The nutrients for plants are obtained from readily available soluble fertilizers combined in a concentrated solution. A fertilizer proportioned or injector dilutes the concentrate with the irrigation water to provide the proper amount of nutrient to the plants (Larson, 1980).

MATERIALS AND METHODS

Materials

The materials used in this study were Garland chrysanthemum seeds, farm tools such as: grabhoe, inorganic and organic fertilizers, measuring materials, and planting guide.

Methods

Experimental design and treatments. The study was laid out in a randomized complete block design (RCBD) with three replications. There were ten sample plants per treatment replicated three times. The treatments were as follows:

Code	Description
T_1	Control (No pinching)
T_2	Soft pinch (1-3 cm was removed from the tip/shoot)
T_3	Hard pinch (>3 cm was removed from the tip/shoot)
T_4	Roll on pinch (<1 cm was removed from the tip/shoot)

Seed sowing. The seeds were sown in a seedbed and transplanted after one month. Regular irrigation, pest management and other cultural practices were applied for optimum growth of the seedlings.

Land preparation and fertilizer application. An experimental area of 48 m^2 was prepared and divided into three blocks. Each block was further subdivided into 1 m x 3 m experimental plots, leveled and applied with fertilizers (inorganic and organic) then mixed with the soil.

Planting. The plots were irrigated first before the one-month old seedlings were

transplanted. The planting distance used was 20 cm x 20 cm between hills and rows.

Pinching. When the plants were 15 cm tall, the first pinching was done to all treatments to induce production of laterals.

Other cultural management practices. Other cultural management practices such as pest control, weeding and watering were employed to enhance optimum growth of the plant.

Harvesting. Harvesting was done by cutting at least 15 cm from the tip leaving at least three to four nodes from the lateral shoots to grow for succeeding harvesting. The duration of harvesting was two months from the first harvest. Shoot tip cuttings harvested were classified as follows: thick (3-4 mm); medium (2-3 mm) and thin (<2 mm).

Data gathering. The data gathered, tabulated and subjected to variance analysis and mean separation test using the Duncan's multiple range test (DMRT) were as follows:

1. Number of lateral shoots produced per plant. The total number of lateral shoots produced in two months were recorded.

2. Number of harvest. The total number of harvesting for two months duration was counted and recorded.

3. Number of suckers produced per plant. This was taken two months from transplanting.

4. Total yield per plot. All the plants harvested per plot were weighed.

5. Documentation of the study in pictures.

RESULTS AND DISCUSSION

Average Number of Lateral
Stems per Plant

Significant differences were observed as to the number of lateral stems produced per plant as affected by the different type of pinching (Table 1). Garland chrysanthemum pinched roll on produced the highest number of lateral stems with a mean of 8.70 stems/plant while the unpinched plants produced the least number of lateral stems with only 6.07. Roll on pinch had the highest but not significant with soft pinch. Roll on pinch and soft pinch is significantly different with the control and hard pinch. This result complements the claims of Larson (1980) that pinching is known to alter development of carnation. It increases the diameter of the canes which promoted the development of more lateral buds and thus, helps a lot in development of the plant.

Number of Harvest for Two Months

Table 2 shows the number of harvesting for two months as affected by pinching. No significant differences were observed on the Garland chrysanthemum plants pinched with soft

Table 1. Average number of lateral stems per plant

TREATMENT	MEAN
Control (No pinching)	6.07b
Soft pinch	7.17ab
Hard pinch	6.87b

Roll on pinch	8.70a

Means with a common letter are not significantly different at 5% level by DMRT

Table 2. Number of harvest per plant for two months cropping season

TREATMENT	MEAN
Control (No pinching)	2.67b
Soft pinch	4.00a
Hard pinch	4.00a
Roll on pinch	4.00a

Means with a common letter are not significantly different at 5% level by DMRT

pinch, hard pinch, and roll on pinch in terms of the number of harvesting of shoot tip cuttings for the two months cropping period. However, pinched chrysanthemums had significantly more number of harvesting shoots compared to the control which had the lowest number of harvests per cropping. There were significantly more number of harvesting on pinched plants because they produced more shoots compared to the control. According to Larson (1980), mums are pinched to produce multi-stemmed plants. Pinching is the removal of the central growing point (bud) so that lateral shoots will develop producing more laterals where shoots are formed. The same author added that pinching the vegetative terminal shoots breaks apical dominance and allows development of axillary shoots.

Number of Suckers Produced per Plant

Results show that there were no significant differences observed on the number of suckers produced as affected by pinching as shown in Table 3. However, pinched plants

had significantly more number of suckers compared to the unpinched plants. This result complements the claims of Rimando (2001) that pinching the terminal tip of the shoots to force the axillary buds to break out, consequently several lateral stems as well as the suckers Table 3. Number of suckers produced per plant

TREATMENT	MEAN
Control (No pinching)	1.90b
Soft pinch	3.70a
Hard pinch	3.67a
Roll on pinch	3.83a

Means with a common letter are not significantly different at 5% level by DMRT

will be produced per plant. The same author also said that pinching will prevent the formation of the flowers and forces new growth of bud or suckers from the base of the plant.

Total Yield

Significant differences were observed on the total yield per plot of Garland chrysanthemum as affected by pinching (Table 4). Garland chrysanthemum pinched with roll on pinch had significantly higher yield as compared to the other treatments. This was followed by plants pinched with soft pinch and hard pinch, while the control (unpinched) had the lowest yield. This confirms the statement of Schilleter (1940) that in chrysanthemum, pinching is applied and known to increased flower stems per plant, thus increasing also flower production, pinching allows the growth of many branches which usually result in giving the desired height and sizes of flower per plant.

Other Observations

Incidence of insect pest infesting the plants were: white flies and leaf miners. They attack the leaves of the plants, thus, decreasing the saleability of the harvested shoots.

Table 4. Total yield (kg/plot)

TREATMENT	MEAN
Control (No pinching)	1.99a
Soft pinch	2.66a
Hard pinch	2.51a
Roll on pinch	3.50a

Means with a common letter are not significantly different at 5% level by DMRT

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

The study was conducted at the Ornamental Horticulture Research Area, Benguet State University, La Trinidad, Benguet from November 2004 to February 2005 to determine the appropriate method of pinching Garland chrysanthemum that would increase shoot yield; and to determine the effect of pinching on the vegetative growth and shoot quality of Garland chrysanthemum.

Results of the study revealed that roll on pinch increased the numbers of lateral stems and had the highest total yield. Plant pinched with roll on pinch, soft pinch and hard pinch were comparable with each other on the number of harvesting and the number of suckers produced per plant but were significantly different over the control (unpinched plants).

Unpinched plants (control) had the lowest number of lateral stems, suckers, and the number of harvest. It had also the lowest yield per plot.

Conclusion

From the preceeding results presented and discussed, Garland chrysanthemum performs better when pinched with roll on pinch compared to the other methods of pinching.

Recommendation

It is recommended that Garland chrysanthemum should be pinched using the roll-on- technique when they reached 15 cm in height to increase lateral stem production; thus, increasing the yield.

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APPENDICES

Appendix Table 1. Number of laterals per plant

TREATMENT	REPLICATION I	II	III	TOTAL	MEAN
T_1	5.80	6.30	6.10	18.20	6.07
T_2	6.40	8.40	6.70	21.50	7.17
T_3	8.00	6.80	5.80	20.60	6.87
T_4	8.40	8.90	8.80	26.10	8.70

Analysis of Variance

Source of variation	Degrees of freedom	Sum of squares	Mean square	Computed F	TABULAR F 0.05	0.01
Replication	2	1.140	0.570			
Treatment	3	10.940	3.647	5.64*	4.76	9.78
Error	6	3.880	0.647			
Total	11	15.960				

* = Significant Coefficient of variation = 11.17%

Appendix Table 2. Number of harvest for two months

TREATMENT	REPLICATION I	II	III	TOTAL	MEAN
T_1	3.0	3.0	2.0	8.0	2.67
T_2	4.0	4.0	4.0	12.0	4.00
T_3	4.0	4.0	4.0	12.0	4.00
T_4	4.0	4.0	4.0	12.0	4.00

Analysis of Variance

Source of variation	Degrees of freedom	Sum of squares	Mean square	Computed F	TABULAR F 0.05	0.01
Replication	2	0.167	0.083			
Treatment	3	4.000	1.333	16.00**	4.76	9.78
Error	6	0.500	0.083			
Total	11	4.667				

** = Highly significant

Coefficient of variation = 7.87%

Appendix Table 3. Number of suckers per plant

TREATMENT	REPLICATION I	II	III	TOTAL	MEAN
T_1	1.60	2.20	1.90	5.70	1.90
T_2	3.50	3.70	3.90	11.10	3.70
T_3	3.70	3.50	3.80	11.00	3.67
T_4	3.70	3.90	3.90	11.50	3.83

Analysis of Variance

Source of variation	Degrees of freedom	Sum of squares	Mean square	Computed F	TABULAR F 0.05	0.01
Replication	2	0.140	0.070			
Treatment	3	7.609	2.536	78.72**	4.76	9.78
Error	6	0.193	0.032			
Total	11	7.943				

** = Highly significant

Coefficient of variation = 5.48%

Appendix Table 4. Total yield (kg/ha)

TREATMENT	REPLICATION I	II	III	TOTAL	MEAN
T_1	2.110	2.120	1.750	5.980	1.99
T_2	2.200	2.550	3.235	7.985	2.66
T_3	3.035	2.652	1.860	7.537	2.51
T_4	3.790	3.015	3.750	10.505	3.50

Analysis of Variance

Source of variation	Degrees of freedom	Sum of squares	Mean square	Computed F	TABULAR F 0.05	0.01
Replication	2	0.074	0.037			
Treatment	3	3.523	1.174	4.30ns	4.76	9.78
Error	6	1.640	0.273			
Total	11	5.237				

Ns = Not significant Coefficient of variation = 19.60