

Knowledge Management on the Use of Different Flower Inducers on the Growth Of Flowering Plants: *Hydrangea (Hydrangea Macrophylla)*

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ABSTRACT

The study entitled “Knowledge Management on the Use of Different Flower Inducers on the Growth of Flowering Plants Hydrangea (Hydrangea macrophylla)” was conducted to find out which among the flower inducers used will promote higher number of shoots of Hydrangea macrophylla; to determine its effects on the height and quality of blooms of Hydrangea. The four flower inducers used in the study which correspond also to the four treatments were: A-Byfolan, B-Crop giant C- Turton, and D-Siam. Treatment E was the control treatment. Based on the results of the study, different flower inducers significantly increase the final height wherein plants sprayed with Crop giant significantly were the tallest while the untreated plants were significantly the shortest. Furthermore, the different flower inducers used in the study have no significant influence on the average number of shoots per plant, average number of flowers and the biggest full bloom flowers.

Keywords: Flower inducers, hydrangea, knowledge management

1.0 INTRODUCTION

The traditional mophead hydrangea (*Hydrangea macrophylla*) is a popular ornamental plant grown for its large globular flower clusters. It is a medium sized semi deciduous perennial shrub commonly known as million flowers. Its leaves are toothed along the edges. Each bloom is made up of small flowers, often in clusters of colored sepals (leaves and scales which enclose the flower buds), which makes the hydrangea so attractive. The blooms can

have colors ranging from white, blue, lavender, and rose, purple-pink and red. The color of the flower is said to be dependent on the acidity of the growing medium as discussed in Grolier Academic Encyclopedia (1983). Contrary to the popular opinions, it is not the acidity that affects the color; it is the aluminum in the soil that can only be absorbed by the plants under acid conditions. Hydrangeas are well known in Europe, USA and Asia. They are grown commercially as potted plants in many countries for a well-established market. Although hydrangea is adapted to the climatic condition of the Philippines, no large-scale commercial production exists in the country. It is only grown in backyard gardens or as ornamentals plants however, with big and well developed flowers it becomes attractive and commands higher price to the buyers. Many gardeners have experienced disappointments with their hydrangeas, which become too tall and leggy and do not bear flowers in that condition. At present, not much is known about the growth and flowering behavior of hydrangea particularly with the use of phytohormones thus this study.

1.1 Objectives of the study

- * To find out which among the flower inducers used will promote better number of shoots on *Hydrangea macrophylla*.
- * To determine the effects of different flower inducers to the height of hydrangea.
- * To determine its effects the on quality of blooms of Hydrangea.

2.0 REVIEW OF LITERATURE

The study conducted by Arconada (2005) showed that interrupting of long period with light cause plants to responds as through they are experiencing long days instead of short days. they further stressed that the intensity of light producing this effect varies from species to species.

The first step in forcing flowers is to determine which plants are good candidates for the procedure. Next is to learn when to force flowers. Usually, February and March are the months to force flowers depending if when flower in demand or with good prices Beaulieu (2008).

Chaiklakyán (2002) revealed that the leaf was part of the plant that best responded to the length of the day or night. The day length sends a signal to the bud where's flowers actually form through a chemical substance called hormones. The plant hormones or phytohormones are substances that regulate most of the life cycle events in plants, including germination, growth through cell division and elongation, flowering, fruit ripening, and seed dormancy, and death. They often mediate between external stimuli (such as light or temperature) and the plants psychological response. Plant biologists believe that hormones exert their effects via specific receptor sites in target cells, similar to the mechanism found in animals.

Taking cuttings is one of the simple ways of propagating shrubs including hydrangea. Reproduction of this kind is called vegetative propagation. Many plants including roses and fruit trees are produced by vegetative propagation. Young plants grown in this way sometimes grow more quickly than those produced by seeds. In that way, the growers can make sure that his new plant will exactly be the same as the original Propagation of hydrangea is with cuttings obtained from the stems of non-flowering shoots or ground shoots with two or three pairs of leaves. Cuttings of hydrangea are usually taken from April-August. They grow best in a well-drained soil, which contain plenty of organic matter or humus Gapoy (2009).

They are best to root in sand in a shaded area. Hydrangea can grow in a full sun if they are watered well, but will grow more freely in a partial shade. Hydrangea need plenty of water, so watering thoroughly once per week or more frequently is advised. A general-purpose fertilizer, such as 10-10-10 applied at the rate of 2 cups per 100 square feet in March, May and July is suggested. Water soon after application to help dissolve the fertilizer and send it into the soil. Early researchers have discovered that some plants have more natural root promoting chemicals than others. Indoleacetic Acid

(IAA) is a natural plant hormone that causes roots to form on plant stems (Rooting Hormone). An agent for inducing flower bud formation in plants comprising unsaturated fatty acids having an oxo group and a hydroxy group, and a hydroperoxy group. For example, it was found out that gibberellins, a growth hormone of plants when applied, causes flower bud formation of long-day plants even under short day condition and that pineapples start flower formation after the application of a-naphthalene, a synthetic auxin, which is currently used industrially Cooper (2002).

Diseases can have significant impacts on the appearance, health, and market value of hydrangea. The common diseases found in hydrangeas are powdery mildew, cercospora leaf spot, botrytis blight, verescence, and virus. These can be controlled by the use of the following fungicides like for botrytis blight increasing air circulation and removing affected leaves can also be helpful in controlling them De Datta (2008).

Hydrangea macrophylla cultivar is a deciduous shrub grown mainly for their flowers. Hydrangeas flower heads last for months and often with pleasing color that change as they age Fuentes. Unlike seed, which may produce variable offspring, cuttings may be used for cultivars, hybrid and exports. Sowing seed is simple and inexpensive but it is relatively slow to produce plants of flowering size. This technique is suitable for raising several mainly deciduous shrubs. The cuttings, which have soft base, have higher capacity to root than cutting with more mature wood. Cuttings were trimmed just below the node and lower leaves are removed. Soft tips are generally pinched out, as it is vulnerable to rotting. Tip removal also encourage rooting Geanago (2009).

Although a vast body of descriptive data is available on plant development, many problems remains unsolved. A plant stem grows by division of a group of cells near the tip of the stem. Regions of active cell division in growth in plants are called meristems. At sometime during the life of the plant, the meristem at the stem tips or in lateral buds stop producing stems and leaves, and produce flowers instead. Frequently, this occurs in response to the environmental changes especially in temperature and light conditions as cited by Mendoza (2009) .

In fact, the Del Monte Philippines, Dole Philippines Inc. and the Philippine Packing Corporation induce off-season flowering and fruiting of pineapple by applying calcium carbide (carburo) and ethylene. They use calcium carbide in solution or granular form by dissolving 2 kg Carbide in kerosene can of water (Mendoza, 2004).

The genus hydrangea is composed of several native and introduced deciduous shrubs well known for their spectacular floral display and lustrous green foliage. The big leaf hydrangea (*Hydrangea macrophylla*,) native to Japan is the most recognized and widely planted. Blossoms of the many cultivars of this hydrangea range from white or pink to deep blue. If your hydrangea doesn't flower, it is usually because of frost or winter damage, pruning too late, or too much nitrogen. Commercial use of hormone in plants where auxins are used as herbicides to induce fruit development without pollination, and to induce root formation in cuttings. Cytokinins are used to maintain the greenness of plant parts, such as cut flower. Gibberellins are used to increase fruit size, increase cluster size in grapes, delay ripening of citrus fruits, speed up flowering of strawberries and stimulates starch breakdown in barley used in beer making. In addition, ethane is used to control fruit ripening, which allows hard fruit to be transported with out much bruising. The fruit is allowed to ripen after it is deliver to the market. Genetic engineering also has produce fruits unable to form ethane naturally. These fruit will ripen only if exposed to ethane, allowing for extended shipping and storage of produce (Microsoft Premium Encarta, 2005).

Agriculture scientist at PCARRD (Philippine Council for Agriculture, Forestry and Natural Resources Research and Development) continues to support the use of chemical flower inducers, KNO₃, in mango. UPLB horticulturists found a snow-white substance, KNO₃, which is the principal ingredient in making dynamite, very effective in inducing mango trees to flower. In fact, this revolutionized mango production in the Philippines especially for the leading mango growing provinces. The use of KNO₃ as the active ingredient in the induction of flowering in mango resulted in the lengthening of the mango season, improvement of the productivity of mango trees, and increased farm income (PCARRD Monitor, 1997).

Flower induction is the first indication of maturity. It is an initial chemical reaction that begins the flowering process. It occurs before any physical changes takes place in the plant. The factors that trigger blooming are well known to some species but unknown to others. Generally, a plant becomes older and larger, its likelihood of flowering increases. It was further stressed that flowering is sometimes caused by environmental factors such as temperature or night length. In nature, these factors program flowering into a seasonal pattern so that it occurs at sometime each year. Conditions that causes flowering can also be stimulated by the interruption of man to induce flowering at pre-selected time. For example, controlling the environmental conditions is a common practice on commercial greenhouses for the timing of

flowering of such plants as poinsettias and Easter lilies for holiday sales Rice and Rice (1993)

Rely and Shry (2002) reported that when propagating plant from cutting it is important that a large percentage of plants root, and that they root quickly as possible. Thus, the use of root promoting hormones is recommended. There are some plants that root very easily from cuttings with out any chemical treatment. They require only a moist, well-aerated medium and high humidity to root. Many plants must have same assistance if any or very many of the cuttings are to root successfully.

In general, hydrangeas like moist and well-drained soil. Due to size of bloom, the stems can bend and break if exposed to strong winds, so a sheltered location is best, or plan to stake them. They enjoy mid day shade, but like direct morning and late afternoon sun. Dappled woodland shade would be ideal. Soil enriched with organic matter, and mulching is a good idea to conserve moisture. Hydrangeas will also respond to annual pruning by sending out new growth and flowers

3.0 MATERIALS AND METHODS

3.1 Materials

The materials used were the following: *Hydrangea macrophylla* cuttings (200 pieces), 5 inches diameter pots and 8 inches tall (200pcs), soil media, root promoting hormones (ANAA), sharp knife, a pair of pruning shears, fertilizers [Triple 14], fungicide (Vondozeb), fishnets, coconut fronds, sprinkler, knapsack sprayer, foot rule, tape measure, flower forcing products (Byfolan, Crop Giant, Turton, Siam).

3.2 Methods

3.2.1 Preparation of experimental site

The study was conducted at the nursery of the West Visayas State University-College of Agriculture and Forestry, Lambunao, Iloilo, Philippines. An area of 50 square meters was utilized. The site is relatively flat or gently sloping to provide easy access and simplify plant management. The area was surrounded and covered with fishnets to avoid animals and birds' disturbance and damage. Coconut fronds were used to provide shade for the plants during establishment and later were removed during the start of application of different flower inducers.

3.2.2 Preparation of Soil Media

The soil media was composed of 75% humus, 15% sandy soil and 10% vermicasting. It was pulverized and sterilized to prevent the occurrence of soil borne diseases. It was mixed thoroughly and placed

into the container pots, about 1 inch below the brim of each pot.

3.2.3 Sources of Planting Materials

The planting materials of the same species were taken from Oracon, Nueva Valencia, Guimaras. Two hundred pieces of top stem cuttings of hydrangea were taken from a healthy, pliable, single stemmed shoots of healthy mother plant that had made at least 6 inches of new growth during the current year. A very sharp pruning shears was used in cutting the stems. A slanted bottom cut just below the node leaving 3-4 pairs of leaves was done. Lower leaves were removed and growing tip pinched out, as it is vulnerable to rotting. Tip removal was also done to encourage the formation of the roots. After cutting has been made, it was placed in a container with water to prevent them from drying up as it is severed from the parent material.

3.2.4 Treating the Cuttings with Rooting Hormones

The rooting hormones [ANAA] were used following the manufacturer's recommendation. (Two tablespoons of ANAA was diluted in a gallon of water). After which, cuttings were placed in the rooting hormone solution for soaking over night and was sprayed with a fungicidal solution [Vondozeb] to prevent rotting.

2.3.5 Planting and establishment

The treated cuttings were planted in the potted media. One stem cutting was planted in each pot. A stick dibble was used as guide in inserting the stems to the soil media to avoid damage at the base of the cuttings. Almost half of the cuttings length was planted but not more than two inch deep. Pots were spaced one half meter apart to avoid overlapping leaves later growth of the plant. The medium around the base was pressed lightly to provide aeration and enhance root development. The newly planted cuttings were watered to provide moisture to the newly planted cuttings. They were also watered with a fungicidal solution. Aftercare of the plants was employed. Watering was done only when necessary to avoid rotting. Fungicidal solution (Vondozeb) at the rate of 3-6 tablespoon per 16 liters of water was applied at 7-10 days interval as well as the supplementary feeding during the growing season. The cleanliness of the area will also be maintained. Potted hydrangeas were established under a shade of a building for the first 60 days of growth. A structure made up of bamboo and coconut fronds was constructed at the experimental area before transferring the plants to

provide shade and prevent the hydrangeas from dehydration.

3.2.6 Fertilizer Application

A slow release balanced fertilizer was used as supplements of the plants four to six grams (4-6g) of Osmocote (controlled released balance fertilizer) was mixed in two liters of soil media or was applied to each of the pots based on the manufacture's recommendation.

3.2.7 Experimental Design and Treatments

The study was conducted with five treatments, namely: Treatment A- Bayfolan,, B- Crop Giant, C- Turton, D- Siam and E- Control (no foliar flower inducers applied). An area of 50 square meters was utilized in the study. It was divided into 20 replicates and each replicate had an area of 2.5 meters replicated four times following the Randomized Complete Block Design (RCBD)

3.2.8 Field Layout

The experimental area was divided into four blocks. Each block was equally subdivided into five plots representing the treatments. The treatments were replicated four times and each replicate consisted 10 pots making a total 200 pots for all treatments. The field layout is shown in the following figure.

Block	Treatment				
I	B	A	C	D	E
II	B	E	C	D	A
III	A	B	E	D	C
IV	B	C	A	D	E

Table 1: Field Layout

Legend: Treatment A-Byfolan B-Crop Giant C-Turton
D- Siam E- Control

2.2.9 Methods of Gathering Data

The following are the parameters used in the study:

1. Initial number of shoot- data on the initial number of shoots was taken from each sample plant 15 days after planting. It was taken by counting the number of emerged shoots from the untreated plants.
2. Initial height- Sixty days after planting, or 45 days after flower inducer treatment, plant height in centimeter was measured using a foot rule.
3. Plant height- Plant height was taken at 15 days interval after taking the initial height until 90 days.
4. Number of shoots per plant- Number of shoots per plant was taken at 15 days interval after flower inducer treatment until 90 days.

3.2.10 Statistical Analysis

All data gathered was tabulated and analyzed following the analysis of variance for Randomized Complete Block Design (RCBD) and significant

results was further analyzed using the Duncan's Multiple Range Test (DMRT).

4.0 RESULTS AND DISCUSSION

4.1 Height

As shown in Table 1 statistical analysis of the data on initial height of plants shows no significant differences among treatments.

Data on plant height at 15, 30 and 45 days after flower inducer treatments revealed the same trend, in which plants in treatment C applied were the tallest and plants in treatment E were the shortest. However, statistical analysis of the data revealed no significant differences among treatments.

At 60, 75 and 90 days after flower inducer treatment, significant results were obtained. Plants in Treatments B applied with Crop Giant significantly were the tallest and plants in the control treatment were the shortest. However, statistical analysis of the show that no significant differences was observed among treatments.

Table 1: Summary table on the average heights of plants using different flower inducers

No. of Days	Treatments Flower Inducer					>
	A	B	C	D	E	
Initial	23.5	23.05	26.75	24.45	23.02	ns
15	25.5	25.40	28.65	26.95	24.45	ns
30	27.7	27.30	30.9	29.70	27.25	ns
45	30.25	29.85	31.7	31.75	28.75	ns
60	32.45 ^{ab}	36.45 ^a	32.25 ^{ab}	33.95 ^a	30.15 ^b	*
75	35.1 ^b	40.05 ^a	33.0 ^b	35.7 ^{bc}	32.05 ^b	*
90	38.25 ^b	41.65 ^a	37.0 ^b	37.45 ^b	35.25 ^c	*

Legend: A-Byfolan B-Crop Giant C-Turton D- Siam E- Control
> level of significance

4.2 Number of shoots

Table 2 presents the average number of shoots. Data show that the control treatment consistently got the lowest number of shoots. However, subjecting it to statistical analysis, results are comparable to the treated treatments.

Table2: Summary table on the average number of shoots per plant.

No. of Days	Treatments (Flower Inducer)					>
	A	B	C	D	E	
Initial	2.50	3.3	2.70	2.49	2.48	ns
15	2.95	3.60	3.15	2.96	2.90	ns
30	3.40	4.15	3.80	3.39	3.20	ns
45	3.65	4.35	4.20	4.55	3.35	ns
60	4.75	5.20	4.87	4.72	3.68	ns
75	5.75	6.10	4.85	5.50	4.35	ns
90	7.30	7.90	7.20	8.35	5.75	ns

Legend: A-Byfolan B-Crop Giant C-Turton D- Siam E=Control
> level of significance

4.3 Average Number of Flowers and Diameter of Biggest Full Bloom Flowers

Data on Table 3 show that plants treated in Crop giant) had the highest number of flowers while plants in the control treatment got the lowest. Statistical analysis of data, however show in an insignificant results.

Table 3: Summary table on the average number of flowers and the biggest diameter full bloom flowers.

Treatment	No. of Flowers per Pot (A)	Diameter of the Biggest Full Bloom Flower (cm) (B)	Level of Significance	
			A	B
Byfolan	5.32	5.71	ns	ns
Crop giant	6.36	6.20	ns	ns
Siam	5.45	5.48	ns	ns
Turton	6.21	5.53	ns	ns
Control	5.01	4.62	ns	ns

5.0 SUMMARY CONCLUSIONS AND RECOMMENDATION

5.0 Summary

The study entitled, Knowledge Management on the Use of Different Flower Inducers on the Growth of Flowering Plants Hydrangea (*Hydrangea macrophylla*) was conducted from May 2008 to February 2009" The study used four kinds of flower inducers namely: Byfolan, Crop Giant (Treatment B), Siam (Treatment C), and Turton (Treatment D) applied as foliar spray to the hydrangeas after four months of establishment and testing for plant tolerance. The applications were based on the manufacturer's recommendation. There was one control treatment (Treatment E) wherein no flower forcing chemical was used. The soil media used were 75% compost, 15% garden soil and 10% vermicasting. The cuttings used were the top stem cuttings. A slow release fertilizer was mixed to the soil media of each pot following the manufacturer's recommendation. Initial height and number of shoots were gathered before the application of flower inducers. Data on the number of shoots and height were gathered starting 15 days after treatment and gathered at 15 days interval until 90 days of its growing season. Data on number of flowers and the biggest bloom flowers were gathered at flowering time about 8 months after planting. Results of the study revealed that plant height from 15 to 45 days after flower inducers treatment the result is not significant, while from 60 to 90 days after treatment significant results were obtained. Final height of plants at 90 days after treatment, Treatment B sprayed with Crop giant significantly were the tallest while plants in Treatment E-control were the shortest. Data on the average

shoots, average number of flowers and biggest full bloom flowers showed no significant differences among treatments.

5.2. Conclusions

Based on the results of the study, the researchers conclude that the use of different flower inducers significantly increase the final height wherein plants sprayed with Crop giant significantly were the tallest. The untreated plants were the shortest. Furthermore, the researchers conclude that the different flower inducers used in the study have no significant influence on the average number of shoots per plant, average number of flowers and the biggest full bloom flowers.

5.3. Recommendations

Based on the above-stated conclusions, the researchers recommend similar studies to confirm the results. Further studies on hydrangea using other flower inducers and increasing its concentration to determine the effects on the number of shoots developed, aside from the height, the diameter of the biggest full bloom flowers and the number of flowers per pot to compare the result of the study is recommended. Furthermore, a research on the effects of different soil pH to the color of the flowers of hydrangea is also recommended for study.

REFERENCES

- “All About Flower Inducer”. Modern Agriculture and Industry(2002). p.22.
- Arconada, R. and Mamon, B. (2005) “Status of Flower Industry in the Province of Iloilo” Unpublished Bachelor’s Thesis, West Visayas State University- College of Agriculture and Forestry, Lambunao, , Iloilo.
- Beaulieu, D. (2004) Flowers of Europe. Retrieved January 2008 from [http:// answers. yahoo. com](http://answers.yahoo.com).
- Chaiklakyian,M.(2002), Groilers Encyclopedia of Knowledge. USA, International Edition. Volume 7, pp.359-360.
- Fuentes E. O. (2000).New RP Ornamental Plants.” Davao Floriculture Journal p110.
- Gapoy, G.G. (2009)” Effect of Different Animal Manures on the Growth of Flowering Plants: Chrysanthemum (Chrysanthemum spp.)” Unpublished Bachelor’s Thesis, West Visayas State University- College of Agriculture and Forestry, Lambunao, , Iloilo 2009
- Geanago, J. B. (2009) “Vegetative Growth Response of Hydrangea to Different Foliar Fertilizer” Unpublished Bachelor’s Thesis, West Visayas State University- College of Agriculture and Forestry, Lambunao, Iloilo.
- Mendoza R.J.T. (2004). “Status of Flower Industry in Region VI” Unpublished Bachelor’s Thesis, West Visayas State University- College of Agriculture and Forestry, Lambunao,Iloilo.
- Mendoza, F.B. (2003). The Culture of Flowering Plants. The Agricultural Journal, (12(20) :26-28, December 2003.
- Microsoft Encarta Premium Suite, 2005.
- PCARRRD Monitor (1997) PCARRRD Continues to Support the Use of Chemical Flower Inducer in Mango”, Department of Science and Technology, Volume 25.
- Reily, Edward H. and Caroll Shry, Jr. (2002). Rooting Hormones, Introductory to Horticulture, 6th Edition, pp.51
- Rice, Jr. Robert P. and Laura Williams Rice(1993,) Practical Horticulture, Prentice Hall Career and Technology, Englewood Cliffs, New Jersey, 2nd Edition.