BIBLIOGRAPHY

ANTONIO, ALMA C. March 2006. Effect of Different Kinds and Rates of Slow Release Fertilizers on the Growth and Flowering of Benguet Lily *(Lilium philippinensis)*. Benguet State University, La Trinidad, Benguet.

Adviser: Araceli G. Ladilad, PhD.

ABSTRACT

The study was conducted at the Ornamental Horticultural Research Area, Benguet State University, La Trinidad, Benguet from July to December 2005 to evaluate the effect of different kinds and rates of slow release fertilizer on the growth and flowering of Benguet lily and to determine the best slow release fertilizer for Benguet lily cutflower production.

Result show, that application of 6g of Multicote per 15 cm black plastic bag is the best slow release fertilizer for Benguet Lily since it promoted earlier flowering, promoted vegetative growth with tall plants and long cutflower stems. It is recommended as a slow-release fertilizer for Benguet lily cutflower production to produce taller plants with longer stems.

TABLE OF CONTENTS

INTRODUCTION

Nature of the Study

Liliums are familiar cutflower and potted plants in the country. One of this is Benguet lili (*Lilium philippinensis*) of the Cordillera which is considered indigenous, (Hermano, 2000). During the World War II, an American pioneer identified the plant and he was the first to cultivate this and saw the potential as a cutflower crop (Cimatu, 2000). The plant grows predominantly in the province of Benguet and other highland areas in the Cordilleras. It is one of the endemic plants in the region. Its white fragrant flower symbolizes beauty, purity and peace (Artajo, 2000). Due to the continues collection of the plant from its native habitat and lack of domestication efforts, Benguet lily became an endangered species. It has become rare, vulnerable and dependent on rainwater in the wild (Olarte, 2001). The Benguet lilies, however, are seldom used since their flowers are few and seasonal due to the absence of technology of growing them. Inspite of this, it was once proposed to be the provincial flower of Benguet (Hermano, 2000). It was described as having round bulbs, erect stems, scattered leaves and large trumpet-shapes blossoms and flowers profusely during the month of July to August by L. Wilson as interviewed by Cimatu (2000). Artajo (2000) also described it as a plant with white fragrant blossoms that attracts travelers along the highway and hillsides of Benguet and the Cordilleras. The flowers measures 5-7 cm long with either one or two blossoms on a stalk. During weddings and on other special occasions, the flowers are used to decorate church altars.

Benguet lily belongs to the family Liliaceae that are hardy perennials. It is a relative of the equally popular Easter lily (*Lilium longiflorum*). The distinguishing characteristics between them are the leaves and flowers which are very much narrower in

the Benguet lily than the Eastern lily (Asuncion et al, 1976). In addition, the former can be propagated by bulbs, seeds or by bulblets. The flower is dormant for several months and become active and grows until it produces flowers in the month of July to August (Cimatu, 2000). The bulbs undergo a natural vernalization and grow the following year, (Hermano et al, 2003).

Importance of the Study

Most plants will be lost or will revert to less desirable forms unless they are domesticated and propagated under controlled that preserve the unique characteristics that make them useful (Hartmann et al, 1986).

It was reported in 1995 that the population of Benguet lily plants was declining due to over collection, becoming rare and endangered due to the efforts of man to domesticate it which has brought about rapid depletion of the species in its natural habitat, (Ampaguey et al, 2003). The flower is very delicate; it dies once it is taken from its natural habitat, (Olarte, 2001).

Benguet lily can be propagated through tissue culture but due to the lack of skilled personnel and the materials needed; bulb scales can be a substitute in its mass propagation which can be easily adopted by growers. However, the most popular propagating material for growing this crop is through the use of bulbs. This study is important because there has been no study conducted on slow release fertilizer applied on Benguet lily.

Objectives of the Study

The study will be conducted to:

1. evaluate the efficacy of slow release fertilizers on the vegetative growth and flowering of Benguet lily;
2. to determine the volume and quality of the cut flowers produced as affected by different fertilizer treatments; and

Place and Time of the Study

The study was conducted at the Ornamental Horticultural research area, Benguet State University, La Trinidad, Benguet from June to December 2005.

REVIEW OF LITERATURE

Importance of Fertilizers

Fertilizer is one of the most important of the total recipe to grow plants. Plants do not need water, air, light, nutrition, soil and temperature, all in right ratio at the right time during the right period (Scotts, 1996). In 1972, Watts stated that the rate of application of chemical fertilizers depends upon such factors as: 1) Characteristics of the soil; 2) the previous crop grown and the number in which it was fertilized; 3) the moisture condition; 4) the possibility or irrigation; 5) the amount of land available; and 6) the amount of fertilizer to be applied in the soil depending on the recommended rate of application and the percentage nutrient content or grade of the fertilizer.

Gardner (1949) stated that complete fertilizer carry nutrient elements such as nitrogen, phosphorus and potassium which plants need for optimum growth and development. A general fertilizer with reasonable slow release nitrogen should be added to ensure there is adequate supply to the roots and at no time are the bulb resources being exhausted, (Fox, 1985). Furthermore, Mendiola (1976) found that application of the proper amount of nitrogen in plants encourage stem development.

Inorganic fertilizers release quantities of nutrient elements that can be easily absorbed by the roots of which the results can be seen within a few days, (Bautista et al., 1983). Unlike organic fertilizers which must be rooted and decayed before they become beneficial to plants (Watts, 1972). Furthermore, Edmond et al (1964) as cited by Buyas (1994) found that basal application of N-P_2-O_5-K_2O was needed to promote growth of stems and leaves of plants. Chaong (1987), as cited by Day-a (1999), found that application of 75-75-75 or 100-100-100 KG NPK/ha improves plant height increases the

number of leaves produces at anthesis, affects the production of longer flower stems, bigger blossoms, higher number of suckers per plant and increases yield of cutflower in Benguet lily.

Joiner (1982)reported that nutrients can be liquid or dry readily available as slow release fertilizers are widely used in foliage industries since they supply adequate amount of nutrients for extended period of time (3 to 12 months) especially on slow growing plants. Slow release fertilizers release nutrients slowly but a portion is available immediately therefore , good quality plants can be obtained when properly applied. However, it causes damage when excess amount is added.

Prince and Cunningham, (1989), as cited by Miller (1992) stated that lilies are heave feeders and pre-plant fertilizer incorporation is suggested as a starting point and should be fertilized up to the time of harvest. Further, they found out that termination of fertilizer at visible bud or at two weeks after visible buds, caused increases of lower leaf chlorosis relative to plants that were fertilized until harvest. However, French and Alsburg (1989) recommends application of slow release fertilizers on lilies since it can provide the majority of the nutrients for the growing season at a single application.

MATERIALS AND METHODS

Materials

The materials used in the study were Benguet lily bulbs, fertilizers, measuring sticks, foot rule, pots weighing scale, labeling materials and atomizer.

Methods

The experimental method used in the study was the Random Complete Block Design (RCBD), replicated three times. There were five samples per treatment replication. The treatments used were as follows:

T_1- Control (no fertilizer application)

T_2- Osmocote (14-14-14) at the rate of 6g/15 cm

T_3- Agroblen (18-6-12) at the rate of 6g/15 cm

T_4- Multicote (17-17-17) at the rate of 6g/15 cm

Planting. Bulbs of Benguet lily with shoots and initials were planted or grown in plastic pots measuring 15 cm in diameter.

Fertilizer application. The different fertilizers were applied once, three weeks after planting.

Growing media. The soil used were obtained from where the Benguet lilies are gathered

Care and Maintenance. Cultural management practices such as weeding, crop protection and irrigation were done uniformly as recommended.

Data Gathering. The data that was gathered were tabulated, computed, and the means compared using the Duncan's Multiple Range Test (DMRT) will be the following.

A. Vegetative Growth

1. Final height at Flowing (cm). These were obtained by measuring the final height of the plant from the base up to the to of the flower at 25% anthesis.
2. Number of Leaves ser plant at Flowering. This was gathered by counting the number of leaves at flowering.

B. Reproductive Growth

1. Number of Days from Planting to Flower Bud Formation. This was the duration from planting to the formation of 1 cm bud size.

C. Cutflower Quality

1. Stem Length (cm). This was obtained by measuring the length of the cutflower stems at harvest.

D. Occurrence of Insect Pest and Diseases. The occurrence of insect pest and diseases was observed

E. Initial Soil Analysis. Initial soil analysis was taken before planting of bulbs.

F. Documentation of the Study. This will be obtained through pictures.

RESULTS AND DISCUSSION

Final Height

Significant differences were obtained on the final height measured at 25% anthesis as affected by different slow release fertilizers applied 3 weeks after planting. Application of Multicotes promoted vegetative growth by producing the tallest plants with a mean of 69.00 cm at flowering among the fertilized plants. The untreated plants were the shortest with a mean of 57.87 cm.

Table 1. Final height at flowering (cm).

TREATMENT	MEAN
Control (untreated)	57.87b
Osmocote (14-14-14)	68.73a
Agroblen (18-6-12)	66.53a
Multicote (17-17-17)	69.00a

Number of Leaves per Plant at Flowering.

Table 2 shows that there were no significant effects on the different kinds of show release fertilizers applied with regards to the number of leaves per plant at flowering. However, application of Agroblen enhanced the development of more leaves with a mean of 36.80 per plant followed by Multicote with a mean of 33.80 compared to 31.93 and 32.6 leaves from Osmocote treated plants and the control plants, respectively.

Table 2. Number of leaves per plant at flowering

TREATMENT	MEAN
Control (untreated)	32.60a
Osmocote (14-14-14)	31.93a
Agroblen (18-6-12)	36.80a
Multicote (17-17-17)	33.80a

Days From Planting to Flower Bud Formation.

Likewise, Table 3 shows that there were no significant effects on the different kinds of slow release fertilizers with regards to the number of days from planting to flower bud formation at 1cm bud size. Means range from 29.40 to 33.07 days from planting of bulbs.

Table 3. Days from planting to flower bud formation (1 cm bud size)

TREATMENT	MEAN
Control (untreated)	30.53a
Osmocote (14-14-14)	29.40a
Agroblen (18-6-12)	31.27a
Multicote (17-17-17)	33.07a

Stem Length

The effect of the different slow release fertilizers applied with regards to the cutflower stem length at 50% anthesis is shown in Table 4. Application of Multicote produced significantly the longest cutflower stem which had a mean of 59.00 cm. This was followed with a mean of 58.73 cm. Short stems as measured from the control or unfertilized plants with a mean stem length of only 47.60 cm at 50% anthesis.

Table 4. Cutflower stem length at harvest.

TREATMENT	MEAN (cm)
Control (untreated)	47.60a
Osmocote (14-14-14)	58.73a
Agroblen (18-6-12)	56.53a
Multicote (17-17-17)	59.00a

a.

b.

Plate No.1. Overview of the Experiment: (a) at seedling stage and (b) at flowering.

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

The study was conducted at the Ornamental Horticulture Research Area, Benguet State University, La Trinidad, Benguet from July to December, 2005 to evaluate the growth and flowering of Benguet Lily as affected by different kinds and rates of slow release fertilizers, compared to the untreated or unfertilized plants; and to determine the most effective slow release fertilizer for Benguet lily cut flower production.

Results revealed that significantly taller plants were produced with longer stems in all fertilized plants compared to the control (unfertilized) . However, there were no significant differences obtained on the number of leaves at flowering and number of days from planting to flower bud formation (1 cm bud size) in all the treatments. Application of Multicote promoted vegetative growth and producing the tallest plants. Likewise, application of multicote produced the longest of cutflowers stem harvested with a mean of 59.00.

The initial soil analysis before planting of the bulbs showed that the soil had a pH of 6 which is slightly acidic. The soil contains high amount of Nitrogen, medium amount of Phosphorous and it had a sufficient amount of Potassium.

Conclusion

It is therefor concluded that the application of slow release fertilizer Multicote to Benguet lily plants significantly improved the vegetative growth producing taller plants with longer stems and increased cut flower yield compared to the other slow release fertilizer formulations applied including the control.

Recommendation

Based on the findings of the study, application of 6 g/15 cm of multicote is the best slow release fertilizer for Benguet lily, it is recommended as a slow-release fertilizer for Benguet lily cut flower production to produce taller plants with longer stems and higher cut flower yield per grown area.

LITERATURE CITED

AMPAGUEY, D.W., I.D. CADELINA, M.D. DIMAS, A.B. MANG-OY and J.A. PALAEZ. 2003. In-vitro propagation of Benguet lily (*Lilium philippinensis*). BSES Thesis . BSU, La Trinidad, Benguet. Pp. 1-3, 5-7.

ARTAJO, E.A. 2000. City of Dipology Dipolog Flower Url. http://www.slip/http://www.slip.net/-geri/g. Pages/ph. Batanes 01.Html.

ASUNCION, R.G. ,K.R. FLORES and F.D. SAN MIGUEL.JR. 1976. Introduction to Floriculture and landscape gardening. Practical Arts. Sta.Cruz.,Manila; Saint Mary's Pub. Pp.59,63.

BAUSTISTA, O.K.,H.V VALMAYOR, P.C., TABORA, R.R. ESPINO, J.B. SANGALANG. 1983. Introduction to Tropical Horticulture. UPLB, Los Baños, Laguna. P. 231.

BUYAS, N.A. 1994. Effects of Organic and Inorganic Fertilizer on the Growth and Flowering of Inglish Daisy. B.S. Thesis. BSU, La Trinidad, Benguet. P.55.

CIMATU, F.E. 2000. What's the story, Benguet Lily? Philippine Daily Inquirer.15:75.

DAY- A, J.M. 1999. Growth, flowering and yield of chrysanthemum as affected by slow release fertilizer. BSU Thesis. BSU, La Trinidad, Benguet. P.9.

FOX, O. 1985. Growing lilies, Great Britain: Croom Helm Pub. P.33.

FRENCH and ALSBURG. 1989. Comparison of controlled fertilizer for the production of Rhododendron 'Anna Rave Whitney'. Hort. Sci. 15:91.

GARDNER, J.R. 1949. Basic Horticulture, New York: The Macmillan Book Co. P.146.

HARTMANN, H.T., D.E. KESTER and F.T. DAVIES, JR. 1986. Plant propagation, principles and practices. Englewood Cliffs, New Jersey: Prentice Hall. Pp.479-481; 488-489.

HERMANO, F.G. Sr. 2000. Lily production. A commercial production technoguide for highland Philippines. A Consultant's Manual. Pp.1,3-7, 15-17.

JOINER, J. 1982. Foliar plant production. New Jersey: Prentice Hall. P.164.

MENDIOLA, N.B. 1976. Principles of crop production in Southeast Asia. Caloocan City: United Circulation, Inc. P.71.

MILLER, B.W. 1992. Easter and hybrid lily production. Portland, Oregon: Timber Press, Inc. Pp. 43,69,105.

OLARTE, A. 2001. Battle for official flower of Benguet goes on. Phillipine Daily Inquirer. February 28, 2001. Pp. 17-18.

SCOTTS, C. 1996. Growing medium andfertilization regime influences growth and essentialoil of rosemary. Hort. Sci. 26:91.

WATTS, R.L. 1972. Vegetable gardening. New York: Orange Jade Pub. Pp.158, 511.

APPENDICES

Appendix Table 1. Final height of the plant at flowering (cm)

TREATMENT	REFLICATION			TOTAL	MEAN
	I	II	III		
T_{0-} Control	58.6	58.2	56.8	173.60	57.87b
T_2- Osmocote	65.4	67.0	73.8	206.20	68.73a
T_3- Agroblen	64.4	65.0	70.2	199.60	66.53a
T_4- Multicote	71.0	67.4	68.6	207.00	69.00a
TOTAL				786.40	
MEAN					65.53

ANALYSIS OF VARIANCE TABLE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	Computed F	Tabular F	
					0.05	0.01
Replication	2	20.207	10.103			
Factor A	3	246.107	82.036	10.16**	4.76	9.78
Error	6	48.433	8.072			
TOTAL	11	314.747				

Coefficient of Variance: 4.34%

Appendix Table 2. Number of Leaves at 1cm. flower bud formation (cm)

TREATMENT	REFLICATION			TOTAL	MEAN
	I	II	III		
T_{0-} Control	24.4	38.6	34.8	97.80	32.60a
T_2- Osmocote	29.0	34.6	32.2	95.80	31.93a
T_3- Agroblen	31.8	37.0	41.6	110.40	36.80a
T_4- Multicote	31.8	31.8	35.O	101.40	33.80a
TOTAL				405.40	
MEAN					153.13

ANALYSIS OF VARIANCE TABLE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	Computed F	Tabular F	
					0.05	0.01
Replication	2	88.487	44.243			
Factor A	3	41.770	13.923	0.93ns	4.76	9.78
Error	6	89.540	14.923			
TOTAL	11					

Coefficient of Variance: 11.43%

Appendix Table 3. Number of days from planting to flower bud formation.

TREATMENT	REFLICATION			TOTAL	MEAN
	I	II	III		
T_{0-} Control	26.8	31.2	33.6	91.60	30.53a
T_2- Osmocote	28.4	29.2	30.6	88.20	29.40a
T_3- Agroblen	31.0	31.4	31.4	93.80	31.27a
T_4- Multicote	32.6	34.4	32.2	99.20	33.07a
TOTAL				372.80	
MEAN					31.07

ANALYSIS OF VARIANCE TABLE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	Computed F	Tabular F	
					0.05	0.01
Replication	2	11.527	5.763			
Factor A	3	21.307	7.102	2.42ns	4.76	9.78
Error	6	17.593	2.932			
TOTAL	11	50.427				

Coefficient of Variance: 5.51%

Appendix Table 4. Stem length (cm)

TREATMENT	REFLICATION			TOTAL	MEAN
	I	II	III		
T_{0-} Control	48.0	47.0	46.0	142.80	47.60b
T_2- Osmocote	55.0	57.0	63.8	176.20	58.73a
T_3- Agroblen	54.0	55.0	60.2	169.60	56.53a
T_4- Multicote	61.0	57.4	58.6	177.00	59.00a
TOTAL				665.60	
MEAN					55.46

ANALYSIS OF VARIANCE TABLE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE	Computed F	Tabular F	
					0.05	0.01
Replication	2	22.127	11.063			
Factor A	3	258.533	86.178	11.14**	4.76	9.78
Error	6	46.407	7.734			
TOTAL	11	327.067				

Coefficient of Variance: 5.01%