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ABSTRACT

This study was conducted at the Ornamental Horticulture Research Area of the Benguet State University, La Trinidad, Benguet from December 2005 to September 2006; to determine the effects of different kinds and rates of organic fertilizers on the growth, flowering and yield of alstroemeria, and to determine the best organic fertilizer/s that will promote vegetative growth, flowering and improve yield in alstroemeria.

Results show that there were no significant interaction effects between the kinds and rates of organic fertilizers on the final height, and final number of stems per plant at flowering, number of days from transplanting to flower bud formation, number of flowers produced per plant, days from planting to flowering, vaselife, and the stem length of the cutflowers of alstroemeria. However, plants applied with Processed Chicken Manure (PCM) significantly produced higher number of stems as compared to application of organic fertilizers and the untreated plants.

Earlier flowering and production of significantly taller and longer cutflower stems were noted in plants applied with chicken manure.

On the other hand, the different kinds and rates of organic fertilizers significantly affected the number of days from transplanting to flower bud formation. Application of 8 tons/ha of chicken manure produced the highest flower bud count, highest volume of cutflowers and had earlier flowering.

Based from the results obtained, it is therefore concluded, that the use of Chicken Manure in alstroemeria production applied as organic fertilizer at the rate of 8 tons/ha led to the production of desirable growth and quality of alstroemeria cutflowers.

Based on the findings, the use 8 tons/ha chicken manure is highly recommended for quality alstroemeria cutflower production.

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INTRODUCTION

Alstroemeria a native to tropical America, is also referred to as “Lily of the Incas” and “Peruvian Lily”. This gorgeous perennial is a member of the Amaryllidaceae family and is related to the onion, daffodil, agapanthus and nerine. It is becoming one of the most important cutflower crop world wide due to its attractive flowers and excellent keeping quality.

There are three main varieties of alstroemeria; the butterfly type which has shorter stems and peduncles, the orchid type, which has longer stems and peduncles and the aurantiaca, but most of today's types are hybrids. Peruvian lily is composed of trumpet-shaped flowers, 1 ¼ to 2 inches in diameter, on one or more laterals. Many blooms are grouped atop stems 24-36 inches long. The main stems of these cut flowers are 2 to 3 feet long and branch into four to six short pedicels; each holding two to four flower buds. Colors include yellow, apricot, orange, salmon, pink, red, mauve, lavender, purple, cream, white and bi-colors. Alstroemeria cutflowers typically last one to two weeks.

Peruvian lilies can develop a large leaf mass and therefore dependence on water during the summer months are high. They are best grown in organically rich, medium wet, well drained soils in sunny locations. They are suitable for growing in pots and for garden and landscape uses however if planted in the ground permanently, plants will naturalize by creeping roots to form colonies in optimum growing conditions.

Presently, numerous cutflowers like anthurium, rose, chrysanthemum, carnation etc. are being grown in the Philippines, specifically in the cool areas like La Trinidad. These cut flowers are somewhat expensive yet, many farmers are still encountering

problems such that, inputs cannot be provided well because of high prices. This results to poor quality of the cut flowers and low volume of production of the many small growers.

Among the many ornamental plants, alstroemeria is one versatile crop because it is not only used as cutflowers in florist arrangements, but are also be used in landscape gardening of flower gardens as tender perennial or even a houseplant for interiorscape. This is due to the fact that this crop is fairly easy to cultivate and does not require special demands.

In the Netherlands, about 100 hectares are grown with alstroemeria; and in other parts of the world, it accounts for about 400 hectares. Alstroemeria is still a relatively new product on the world market and interest in it is growing. The flowers are beautiful and have a long vase life.

The study was conducted to:

1. determine the effects of different kinds and rates of organic fertilizers on the growth, flowering and yield of alstroemeria;

2. to determine the best organic fertilizer/s that will promote vegetative growth, flowering and improve yield in alstroemeria.

The study was conducted at the Benguet State University Ornamental Horticulture Research Area from December 2005 to September 2006.

REVIEW OF LITERATURE

Description of Alstroemeria

Alstroemeria is not endemic to the Philippines and all cultivars of (*Alstroemeria pelegrina* Linn.) are introductions from other countries. Other types of this Alstroemeria grown by enthusiast include the sweet Laura and Petite Plum which extremely vary in size and color of the flower. Colors include yellow, apricot, orange, salmon, pink, red, mauve, lavender, purple, cream, white and bi-colors.

These plants are rhizomatous perennials. The young plant starts growing from the main rhizome which will soon generate new lateral rhizomes that can also produce flowering shoots. Above the soil, the stems do not generate any lateral stems. Since the major part of the plant's development occurs underground. They grow to a height of 50-130 cm. Each erect stem grows foliage of a few lanceolate leaves, and ends in an umbel of 3-10 flowers. These have 6 petals with spots, striped markings and contrasting patches.

Fertilizer Application

Fertilizer application is an important factor that affects production of plants. The right method of application influences the production of better quality product.

Fertilizers are of two types: organic and inorganic or chemical fertilizer. Organic fertilizers are derived from organic wastes such as plant residues and animal wastes while inorganic consists of chemically prepared substance containing varying amounts of nitrogen, phosphoric acid and potash. Organic fertilizers have an advantage over chemical ones because they are renewable, inorganic fertilizer on the other hand re not

renewable, and soil fertility gradually declines as a result of their continued application (Balco, 1986).

Bucu (1991) stated that in general, the kinds of organic materials according to source are crop residues, green manure, swine manure, cattle manure, chicken manure, common compost, used mushroom compost, municipal refuse, residues after oil extraction and residues from processing animal products.

Marcelino (1995) found that organic fertilizers supplies same amount of the nutrient requirements of the crop and promotes favorable soil properties such as granulation, efficient aeration, easy root penetration and more improved water holding capacity of the soil. He also pointed out that farm manure is available to crops because of its nitrogen content and influence on the soil. Farm manure increases crop yield. The value of farm manure is determined not only by the organic matter it furnishes but especially by the quantity of nitrogen that it supplies. The organic fertilizer alters soil pH due to carbon dioxide excretion.

Earlier findings of Mang-osan (1996) on English daisy showed that application of 2 tons per ha chicken manure significantly produced taller plants, higher sucker count, promoted earlier flower development and produced more flower per plant. It also increased soil pH significantly.

Rodriques (1981) found that soils amended with chicken manure registered higher Ph (5.66) than soils with sagana 100 (4.54), an indication that commercial sagana 100 has higher acidifying effect. On the other hand, sagana 100 as an organic fertilizer contains the major as some trace elements essential for plant growth. More importantly, it contains humus and beneficial microbes that restore the biological balance in the soil.

Thus it works in three ways: it provides a direct supply of food to plants rejuvenates and reconditions soil and finally increases and promotes the growth of beneficial microbes. (Solido, 1974).

Legodio (2000) found that the different kinds and rates of organic fertilizer significantly affected the number of days from transplanting to flower bud formation, number of buds and cutflower yield per plant and cutflower yield per plot. Application of 4 tons / ha of chicken manure and sagana 100 produced the highest flower bud count, highest volume of cut flower and had earlier flowering.

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MATERIALS AND METHODS

Materials

Materials used were: alstroemeria rhizomes; garden soil; rice hull; organic fertilizers and these are Fully Decomposed Chicken Manure, PCM (Processed Chicken Manure), BSU Compost, Alnus Leaves Compost, Sagana 100, plastic pots and labeling materials.

Methods

This study was laid out in factorial Completely Randomized Design (CRD) with 4 replications. Factor A was the kind of fertilizer and factor B was the rate of application. The treatments were as follows:

Factor A- Organic Fertilizers

T_0- 2 parts garden soil + 1 part rice hull

T_1- Fully decomposed Chicken manure

T_2- PCM

T_3- BSU Compost

T_4- Alnus Leaves Compost

T_5- Sagana 100 Compost

Factor B- Rate of Application (t/ ha)

R_0- Control (0-0-0)

R_1- 4

R_2- 6

R_3- 8

R_4- 10

R_5- 12

The study was conducted under greenhouse condition. Cultural management practices such as weeding; crop protection and irrigation were applied uniformly to all test plants.

The data gathered were the following:

1. Final height of the plant (cm) at flowering. This was taken by measuring the height of the plant at the base to the tip of the flower at 50% anthesis.
2. Final number of stems per plant at flowering. The number of stems per plant was counted.
3. Number of days from planting to flower bud formation. This was obtained by counting the number of days from planting until flower bud formation is observed.
4. Number of flowers produced per plant. The flower produced per plant was recorded at harvestable stage.
5. Days from planting to flowering. This was obtained by counting the number of days from planting to flowering.
6. Cutflower stem length (cm). This was measured at 50%.
7. Vaselife. Cutflowers was harvested at 50 % anthesis where vaselife was obtained in the laboratory. Tap water was used.
8. Soil Analysis.

a. pH of the soil. The initial and final ph of the soil was taken before planting and after harvesting.

b. Organic matter content and NPK of the soil %. This was taken by determining the initial and final OM and NPK content of the soil.

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RESULTS AND DISCUSSION

Final Height at Flowering

Effect of kind of fertilizer. Significant differences on the final height of alstroemeria plants at flowering were noted as affected by the different kinds of fertilizer organics. Plants applied with chicken manure were significantly taller with a mean of 47.61 cm; while plants applied with alnus compost, BSU compost, and Sagana 100 were significantly shorter. Means plant heights were 34.46, 35.82 and 37.53cm; respectively.

Table 1. Final height of the plant at flowering

TREATMENT	MEAN (cm)
Kind of Organic Fertilizer	
Chicken Manure	47.61 [a]
Processed Chicken Manure (PCM)	41.58 [b]
BSU Compost	35.83 [c]
Alnus Leaves Compost	34.46 [c]
Sagana 100	37.53 [c]
Rate of Application	
Control	39.85 [a]
2 tons/ha	38.92 [a]
4 tons/ha	40.81 [a]
6 tons/ha	39.95 [a]
8 tons/ha	38.53 [a]
10 tons/ha	38.33 [a]

Means with the same letter are not significantly different in 5% level by DMRT

These indicate that the vegetative growth of alstroemeria was promoted with the application findings of fully decomposed chicken manure.

Effect of rate of fertilizer application. Table 1 shows there were no significant differences on the final height of alstroemeria plants at flowering as affected by the different rates of fertilizer application. Among the treated plants however, those applied with 4 tons/ of organic fertilizer per hectare were the tallest at 40.81 cm.

Interaction effect. The combined effects of the different kinds and rates of organic fertilizers used did not significantly affect the final height of the plant at flowering.

Final Number of Stems per Plant at Flowering

Effect of kind of fertilizer. Significant differences were obtained on the effect of kind of fertilizer on the number of stems per plant at flowering. As shown in Table 2, alstroemeria plants applied with Processed Chicken Manure (PCM) produced the highest number of stems with a mean of 24.08 stems per plant which was significantly higher compared to the other treatments. Statistically however, it was comparable with the number of stems produced by the plants applied with BSU compost and fully decomposed chicken manure with means of 21.50 and 19.21 stems per plant; respectively.

Effect of rate of fertilizer application. Table 2 shows that significantly higher numbers of stems were obtained on all the plants applied with organic fertilizers at flowering compared to the untreated plants. Among the treated plants, those applied with 2 tons/ha had the highest number of stems counted per plant with a mean of 23.80. Higher number of stems were also recorded in the plants applied with 4 tons/ha and 6

tons/ha with 22.60 and 21.30 stems per plant respectively. The untreated plants produced the lowest number of flower stems at 10.60 per plant, which shows that plant nutrition significantly affects the number of stems produced in alstroemeria.

Interaction effect. There were no significant interaction effects between the kinds and rates of organic fertilizers applied in alstroemeria on the number of stems per plant at flowering.

Table 2. Final number of stems per plant at flowering

TREATMENT	MEAN
Kind of Organic Fertilizer	
Chicken Manure	19.21 [ab]
Processed Chicken Manure (PCM)	24.10 [a]
BSU Compost	21.50 [ab]
Alnus Leaves Compost	16.79 [b]
Sagana 100	18.12 [b]
Rate of Application	
Control	10.60 [b]
2 tons/ha	23.80 [a]
4 tons/ha	22.60 [a]
6 tons/ha	21.30 [a]
8 tons/ha	20.45 [a]
10 tons/ha	20.90 [a]

Means with the same letter are not significantly different in 5% level by DMRT

Number of Days from Transplanting to Flower Bud Formation

Effect of kind of fertilizer. Table 3 shows the effect of different kinds of organic fertilizer on the number of days from planting to flower bud formation. Plants applied with alnus compost and Sagana 100 had the highest mean of 131.37 and 131. 79 days which indicates that flower bud formation is significantly longer. Statistical analysis shows that there were no significant differences on the number of days from transplanting to flower bud formation.

Table 3. Number of days from transplanting to flower bud formation

TREATMENT	MEAN (days)
Kind of Organic Fertilizer	
Chicken Manure	117.79 [a]
Processed Chicken Manure (PCM)	121.92 [a]
BSU Compost	122.58 [a]
Alnus Leaves Compost	131.37 [a]
Sagana 100	131.79 [a]
Rate of Application	
Control	125.20 [a]
2 tons/ha	126.35 [a]
4 tons/ha	121.75 [a]
6 tons/ha	120.10 [a]
8 tons/ha	121.05 [a]
10 tons/ha	136.00 [a]

Means with the same letter are not significantly different in 5% level by DMRT.

Effect of rate of fertilizer application. Likewise, there were no significant differences observed on the number of days from transplanting to flower bud formation as affected by the different rates of fertilizer application.

Interaction effect. The combined effects of the kinds and rates of organic fertilizers on the number of days from transplanting to flower bud formation in alstroemeria were not significant.

Table 4. Number of flowers produced per plant

TREATMENT	MEAN
Kind of Organic Fertilizer	
Chicken Manure	2.79 a
Processed Chicken Manure (PCM)	2.83 a
BSU Compost	2.79 a
Alnus Leaves Compost	2.12 a
Sagana 100	2.79 a
Rate of Application	
Control	1.90 c
2 tons/ha	2.40 bc
4 tons/ha	2.90 ab
6 tons/ha	2.75 ab
8 tons/ha	3.10 a
10 tons/ha	2.85 ab

Means with the same letter are not significantly different in 5% level by DMRT.

Number of Flowers Produced per Plant

Effect of kind of fertilizer. Table 4 shows the effect of different kinds of organic fertilizers on the number of flowers produced per plant. Results shows that application of different kinds of organic fertilizers did not significantly affected the flower number per plant at flowering. Means ranged from 2.79 to 2.73 flowers per plant.

Effect of rate of fertilizer application. Results on table 4 reveals that the plants applied with 8 tons/ha of organic fertilizer had the highest number of flowers with a mean of 3.10. Higher number of flowers were also recorded on the plants applied with 4,6 and 10 tons of organic fertilizer per hectare with means of 2.90; 2.75 and 2.85 flowers per plant; respectively. The alstroemeria plants applied with 2 tons/ha organic fertilizer had only 2.40 flowers per plant comparable with the unfertilized plants with produced 1.90 flowers per plant (Table 4).

Interaction effect. There were no significant interaction effect obtained between the kinds and rates of organic fertilizers on the number of flowers produced per plant at flowering.

Days from Planting to Flower Bud Formation

Effect of kind of fertilizer. There were no significant differences observed on the number of days from flowering to 50% anthesis as affected by kind of organic fertilizer applied. Flower development in all plants was simultaneous which ranged from 126.458 to 144.144.083 days from the visible bud formation (Table 5).

Effect of rate of fertilizer application. Table 5 shows that flower development was simultaneous in all treated plants which reached 50% anthesis from 128.80 to 142.60 days from flowering.

Interaction effect. There were no significant interaction effects between the kinds and rates of different organic fertilizers on the number of days from planting to flowering.

Table 5. Days from planting to flowering

TREATMENT	MEAN
Kind of Organic Fertilizer	
Chicken Manure	126.46 [a]
Processed Chicken Manure (PCM)	128.37 [a]
BSU Compost	133.50 [a]
Alnus Leaves Compost	138.42 [a]
Sagana 100	144.08 [a]
Rate of Application	
Control	130.20 [a]
2 tons/ha	135.90 [a]
4 tons/ha	129.55 [a]
6 tons/ha	137.95 [a]
8 tons/ha	128.80 [a]
10 tons/ha	142.60 [a]

Means with the same letter are not significantly different in 5% level by DMRT

Stem Length

Effect of kind of fertilizer. The effect of different kinds of organic fertilizer on the stem length of alstroemeria cutflowers is shown in Table 6. Statistical analysis shows that the application of the different kinds of organic fertilizers had highly significant effects on the stem length of cutflowers produced per plant. Plants applied with chicken manure had the longest cutflower stem with a mean of 51.10 cm. This was followed by the plants applied with Sagana 100 with a mean stem length of 44.55 cm. While the shortest stems were recorded in plants applied with BSU compost with only 37.10 cm stem lengths.

Table 6. Stem length of cutflowers

TREATMENT	MEAN (cm)
Kind of Organic Fertilizer	
Chicken Manure	51.10 [a]
Processed Chicken Manure (PCM)	41.85 [c]
BSU Compost	37.10 [d]
Alnus Leaves Compost	39.57 [cd]
Sagana 100	45.55 [b]
Rate of Application	
Control	39.58 [b]
2 tons/ha	43.43 [a]
4 tons/ha	43.47 [a]
6 tons/ha	43.56 [a]
8 tons/ha	43.85 [a]
10 tons/ha	42.99 [a]

Means with the same letter are not significantly different in 5% level by DMRT

Effect of rate of fertilizer application. Table 6 shows that significantly longer cutflower stems were measured from all plants applied with organic fertilizers compared to the untreated plants. Among the treated plants however, those applied with 2, 4, 6 and 8 tons/ha had a comparable means of 43.43, 43.47, 43.56 and 43.85 cm. This was followed by the plants applied with 10 tons/ha with a mean 43.99 cm. The untreated plants had the shortest stems with mean of 39.58 cm which shows that plant nutrition significantly affected the stem length of the alstroemeria cutflowers.

Interaction effect. There were no significant interaction effects obtained between the kinds and rates of organic fertilizers applied on the stem length of alstroemeria cutflowers at harvest.

Vaselife (days)

Effect of kind of fertilizer. The durations of aesthetic value of alstroemeria cutflowers harvested at 50% anthesis and held in tap water only is shown in Table 6. Results show that since all the cutflowers were held at the same temperature and relative humidity conditions in the holding room, differences on the vaselife of cutflowers obtained from the different treatments were not significant. Means ranged from 13.83 to 14.29 days from holding.

Effect of rate of fertilizer application. Likewise, there were no significant differences observed on the vaselife of alstroemeria as affected by the different rates of fertilizer application. Results also revealed that there were no significant differences on the vaselife between the treated and the untreated plants.

Table 7. Vaselife

TREATMENT	MEAN (days)
Kind of Organic Fertilizer	
Chicken Manure	14.29 [a]
Processed Chicken Manure (PCM)	13.75 [a]
BSU Compost	13.92 [a]
Alnus Leaves Compost	13.83 [a]
Sagana 100	14.04 [a]
Rate of Application	
Control	14.10 [a]
2 tons/ha	13.55 [a]
4 tons/ha	14.00 [a]
6 tons/ha	14.35 [a]
8 tons/ha	14.15 [a]
10 tons/ha	13.65 [a]

Means with the same letter are not significantly different in 5% level by DMRT.

Interaction effects. The combined effects of the kinds and rates of fertilizer used did not significantly affect the vaselife of the alstroemeria cutflowers held in tap water only.

Soil Analysis

Table 8 shows the results of the initial and final soil analysis obtained before planting. Soil pH in soils applied with different kinds of organic fertilizers was observed to increase with increased rate of application. The increase of the soil pH indicates that

Table 8. Soil analysis

TREATMENT	pH	OM (%)	N (%)	P (ppm)	K (ppm)
Initial	5.1	1.7	0.07	45	64
Chicken Manure					
Control	5.1	2.2	0.8	44	64
2 tons/ha	5.3	2.4	0.9	62	152
4 tons/ha	5.3	2.8	0.10	82	586
6 tons/ha	5.5	2.9	0.115	52	628
8 tons/ha	5.8	3.1	0.125	62	676
10 tons/ha	6.8	3.1	0.175	80	692
Processed Chicken Manure					
Control	5.1	2.2	0.8	44	64
2 tons/ha	5.2	2.6	0.18	54	82
4 tons/ ha	5.4	3.0	0.56	64	124
6 tons/ha	5.8	3.6	0.120	78	186
8 tons/ha	6.0	3.8	0.148	84	236
10 tons/ha	6.0	3.8	0.80	88	268
BSU Compost					
Control	5.1	2.2	0.8	44	64
2 tons/ha	5.6	3.0	0.10	46	68
4 tons/ ha	5.9	3.5	0.125	54	142

Table 8. Continued…

TREATMENT	pH	OM (%)	N (%)	P (ppm)	K (ppm)
6 tons/ha	6.0	2.5	0.18	54	128
8 tons/ha	6.2	2.0	0.175	67	144
10 tons/ha	6.2	3.5	0.188	72	156
Alnus Leaves Compost					
Control	5.1	2.2	0.8	38	64
2 tons/ha	5.4	2.5	0.10	52	94
4 tons/ ha	5.4	3.0	0.122	66	172
6 tons/ha	5.6	3.2	0.125	78	216
8 tons/ha	5.8	3.4	0.125	80	246
10 tons/ha	6.2	3.6	0.175	94	310
Sagana 100					
Control	5.1	2.2	0.8	42	64
2 tons/ha	5.3	2.4	0.10	46	88
4 tons/ ha	5.7	2.5	0.20	56	178
6 tons/ha	5.9	2.6	0.120	62	212
8 tons/ha	6.0	2.8	0.125	88	246
10 tons/ha	6.2	2.8	0.125	98	288

Manure at the rate of 10 tons/ha. Final soil pH in the other treatments ranged from 5.1 to 6.2 compared to the initial pH readings of 5.1 prior to planting. Likewise, other soil there was higher calcium content in these organic fertilizers particularly the chicken manure. Brady (2000) stated that calcium influences the decrease in the solubility of iron, aluminum and manganese as well as the concentration of hydrogen ions, thus increasing the availability of phosphate, molybdenum, magnesium, as well as calcium needed for plant growth. Calcium also eliminates toxic compounds present in acidic soils which happened on the soils applied with these different kinds and rates of organic fertilizers. Results show that the final soil pH had increased in all treatments with increasing rate of application. Higher final soil pH of 6.8 was obtained in plants applied with Chicken conditions such as organic matter content, nitrogen, phosphorus, and potassium were also increased with the increase in the rate of organic fertilizer application.

Organic matter (OM), Nitrogen (N), Phosphorus (P), and Potassium (K) contents of the soil had all increased. Results indicate that organic fertilizer application can increase the soil fertility and the amount of fertilizer applied to the plants was sufficient for plant growth and development. There was a significant nutrient decrease on untreated plots because the nutrients used up by the plants were not replenished.

SUMMARY, CONCLUSION AND RECOMMENDATION

This study was conducted at the Ornamental Horticulture Research Project Area of the Benguet State University, La Trinidad, Benguet from December 2005 to September 2006 to determine the effects of different kinds and rates of organic fertilizers on the growth, flowering and yield of alstroemeria and to determine the best organic fertilizer/s that will promote vegetative growth, flowering and improve yield in alstroemeria.

Summary

Results show that there were no significant interaction effects between the kinds and rates of organic fertilizers on the final height, final number of stems per plant at flowering, number of days from transplanting to flower bud formation, number of flowers produced per plant, days from planting to flowering, vaselife, and the stem length of the cutflowers of alstroemeria.. However, plants applied with Processed Chicken Manure (PCM) significantly produced more stems as compared to application of the other organic fertilizer treatments and the untreated plants.

Earlier flowering and production of significantly taller plants and longer cutflower stems were noted in plants applied with chicken manure.

On the other hand, the different kinds and rates of organic fertilizers significantly affected the number of days from transplanting to flower bud formation. Application of 8 tons/ha of chicken manure produced the highest flower bud count, highest volume of cutflowers and had earlier flowering.

Conclusion

Based from the results obtained, it is therefore concluded, that the use of Chicken Manure in alstroemeria production applied as organic fertilizer at the rate of 8 tons/ha led to the production of desirable growth and quality of alstroemeria cutflowers.

Recommendation

Based from the above findings, the application of organic fertilizer (Chicken Manure) is recommended for cutflower production in Alstroemeria. Applying chicken manure in the production area at the rate of 8 tons/ha at least once a year is very economical and advantageous to alstroemeria plants for their optimum growth, development, and flowering.

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APPENDICES

Appendix Table 1. Final height at flowering

TREATMENT	REPLICATION I	II	III	IV	TOTAL	MEAN
Chicken manure						
Control	55.88	48.51	40.38	48.51	193.2	48.3
2 tons/ha	48.76	63.75	41.91	40.89	195.31	48.82
4 tons/ha	52.07	59.69	60.96	44.70	217.42	543.35
6 tons/ha	53.34	51.30	41.40	48.06	194.1	48.52
8 tons/ha	42.92	48.06	41.91	43.18	176.07	44.10
10 tons/ha	40.64	46.99	40.64	38.1	166.37	41.60
Processed Chicken Manure (PCM)						
Control	35.30	36.83	61.97	39.37	173.47	43.36
2 tons/ha	39.62	41.91	44.70	40.64	166.87	41.71
4 tons/ha	35.30	42.41	40.38	42.92	161.01	40.25
6 tons/ha	41.40	45.46	36.83	32.25	155.94	38.98
8 tons/ha	36.83	30.48	48.51	50.29	166.11	41.52
10 tons/ha	45.97	42.92	39.87	45.72	174.48	43.62
BSU Compost						
Control	35.81	30.98	37.33	33.27	137.39	34.34
2 tons/ha	34.29	34.03	30.73	35.56	134.61	33.65
4 tons/ha	31.75	38.35	33.52	38.60	142.22	35.55
6 tons/ha	43.43	38.1	34.29	36.83	152.65	38.16
8 tons/ha	39.37	37.59	35.56	39.87	152.39	38.09
10 tons/ha	34.29	34.79	38.60	33.02	140.7	35.17
Alnus Compost						
Control	30.73	38.60	46.73	27.94	144	36
2 tons/ha	27.94	35.81	30.48	34.29	128.52	32.13
4 tons/ha	30.49	31.75	38.35	35.56	137.15	34.28
6 tons/ha	38.35	33.52	41.91	36.83	150.61	37.65
8 tons/ha	30.73	30.48	33.02	40.89	135.12	33.78
10 tons/ha	33.52	34.49	32.51	31.24	131.56	32.89
Sagana						
Control	38.35	27.94	45.72	36.83	148.84	37.21
2 tons/ha	42.16	30.73	45.72	34.54	153.15	38.28
4 tons/ha	54.86	34.29	31.24	38.1	158.49	39.62
6 tons/ha	40.89	42.67	36.83	25.4	145.79	36.44
8 tons/ha	33.52	33.02	36.32	38.1	140.96	35.44
10 tons/ha	32.51	31.75	38.1	51.05	153.41	38.35

ANOVA TABLE

SOURCE OF VARIANCE	DF	SS	MS	Fc	TABULATED F 0.05	0.01
Factor A	4	2706.398	676.60	18.4551	2.71	4.01
Factor B	5	92.869	18.574	0.5066	2.31	3.22
A X B	20	564.860	28.243	0.7704	1.69	2.08
Error	90	3299.567	36.662			
TOTAL	119	6663.694				

Coefficient of Variation = 15.37%

Appendix Table 2. Final number of stems at flowering

TREATMENT	REPLICATION I	II	III	IV	TOTAL	MEAN
Chicken manure						
Control	13	9	8	10	40	10
2 tons/ha	22	69	12	19	122	30.5
4 tons/ha	17	29	49	16	111	27.75
6 tons/ha	23	18	9	23	73	18.25
8 tons/ha	12	19	13	11	55	13.75
10 tons/ha	9	15	12	24	60	15
Processed Chicken Manure (PCM)						
Control	18	14	14	13	59	14.75
2 tons/ha	21	21	15	48	105	26.25
4 tons/ha	20	33	24	22	99	24.45
6 tons/ha	23	19	32	27	101	25.25
8 tons/ha	24	17	25	39	105	26.25
10 tons/ha	29	22	26	32	109	27.25
BSU Compost						
Control	11	15	12	9	47	11.75
2 tons/ha	15	30	30	19	94	23.5
4 tons/ha	30	28	18	20	96	24
6 tons/ha	27	31	19	27	104	26
8 tons/ha	17	21	28	16	82	20.5
10 tons/ha	29	18	17	29	93	23.25
Alnus Compost						
Control	7	8	7	12	34	8.5
2 tons/ha	8	21	15	25	69	17.25
4 tons/ha	15	22	15	22	74	18.5
6 tons/ha	5	27	18	28	78	19.5
8 tons/ha	22	15	16	16	69	17.25
10 tons/ha	17	30	21	11	79	19.79
Sagana						
Control	6	9	4	13	32	8
2 tons/ha	19	27	12	28	86	21.5
4 tons/ha	28	14	18	12	72	18
6 tons/ha	5	24	15	16	70	17.5
8 tons/ha	16	25	34	23	98	24.5
10 tons/ha	20	18	15	24	77	19.25

ANOVA TABLE

SOURCE OF VARIANCE	DF	SS	MS	Fc	TABULATED F 0.05	0.01
Factor A	4	800.217	200.054	2.7879	2.71	4.01
Factor B	5	2244.842	448.968	6.2567	2.31	3.22
A X B	20	1019.283	50.964	0.7702	1.69	2.08
Error	90	6458.250	71.758			
TOTAL	119	10,522.592				

Coefficient of Variation = 42.48%

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

TREATMENT	REPLICATION I	II	III	IV	TOTAL	MEAN
Chicken manure						
Control	116	91	139	93	439	109.75
2 tons/ha	114	117	93	90	414	103.5
4 tons/ha	135	116	104	110	465	116.25
6 tons/ha	125	150	158	165	598	149.5
8 tons/ha	87	91	95	159	432	108
10 tons/ha	183	95	98	101	477	119.25
Processed Chicken Manure (PCM)						
Control	102	146	104	153	505	127.27
2 tons/ha	165	123	97	118	503	125.75
4 tons/ha	122	96	130	111	459	114.75
6 tons/ha	124	118	124	116	482	120.5
8 tons/ha	131	101	132	97	461	115.25
10 tons/ha	119	149	131	117	516	129
BSU Compost						
Control	95	136	126	129	486	121.5
2 tons/ha	153	124	98	119	494	123.5
4 tons/ha	125	151	126	96	498	124.5
6 tons/ha	58	154	101	115	428	107
8 tons/ha	124	101	99	129	453	113.25
10 tons/ha	129	149	118	187	583	122.58
Alnus Compost						
Control	108	196	108	136	548	137
2 tons/ha	129	111	114	164	518	129.5
4 tons/ha	131	128	99	147	505	126.25
6 tons/ha	108	130	119	109	466	116.5
8 tons/ha	112	175	132	152	571	142.75
10 tons/ha	121	186	102	136	545	136.25
Sagana 100						
Control	146	116	91	173	526	131.5
2 tons/ha	153	128	179	138	598	149.5
4 tons/ha	93	119	177	119	508	127
6 tons/ha	104	157	68	99	428	107
8 tons/ha	174	133	98	99	504	126
10 tons/ha	148	124	152	175	599	149.75

ANOVA TABLE

SOURCE OF VARIANCE	DF	SS	MS	Fc	TABULATED F 0.05	0.01
Factor A	4	2772.335	693.084	0.8265	2.71	4.01
Factor B	5	4475.386	895.077	1.0673	2.31	3.22
A X B	20	14854.939	742.747	0.8857	1.69	2.08
Error	90	75476.385	838.626			
TOTAL	119	97,579.045				

Coefficient of Variation = 23.30%

Appendix Table 4. Number of flowers produced per plant.

TREATMENT	REPLICATION I	II	III	IV	TOTAL	MEAN
Chicken manure						
Control	3	2	2	2	9	2.25
2 tons/ha	3	5	2	3	13	3.25
4 tons/ha	3	3	3	3	12	3
6 tons/ha	2	2	2	2	8	2
8 tons/ha	4	3	4	2	13	3.25
10 tons/ha	2	3	4	3	12	3
Processed Chicken Manure (PCM)						
Control	2	1	2	2	7	1.75
2 tons/ha	2	3	2	2	9	2.25
4 tons/ha	4	3	3	4	14	3.5
6 tons/ha	3	4	3	3	13	3.25
8 tons/ha	3	4	3	4	14	3.5
10 tons/ha	4	3	1	3	11	2.75
BSU Compost						
Control	2	1	2	2	7	1.75
2 tons/ha	1	3	2	2	9	2.25
4 tons/ha	3	3	3	4	14	3.5
6 tons/ha	4	4	3	3	13	3.25
8 tons/ha	3	4	3	4	14	3.5
10 tons/ha	3	3	1	3	11	2.75
Alnus Compost						
Control	2	2	1	1	6	1.5
2 tons/ha	2	3	1	1	7	1.75
4 tons/ha	2	1	2	4	9	2.25
6 tons/ha	1	1	2	2	6	1.5
8 tons/ha	1	3	3	3	10	2.5
10 tons/ha	3	4	2	4	13	3.25
Sagana 100						
Control	2	3	1	1	7	1.75
2 tons/ha	3	3	3	1	10	2.5
4 tons/ha	4	3	2	2	11	2.75
6 tons/ha	3	4	3	5	15	3.75
8 tons/ha	5	1	3	4	13	3.25
10 tons/ha	2	1	2	6	11	2.75

ANOVA TABLE

SOURCE OF VARIANCE	DF	SS	MS	Fc	TABULATED F 0.05	0.01
Factor A	4	8.617	2.154	2.4159	2.71	4.01
Factor B	5	18.842	3.768	4.2262	2.31	3.22
A X B	20	19.283	0.964	1.0803	1.69	2.08
Error	90	80.250	0.892			
TOTAL	119	126.992				

Coefficient of Variation = 35.52%

Appendix Table 5. Days from planting to flower bud formation.

TREATMENT	REPLICATION I	II	III	IV	TOTAL	MEAN
Chicken manure						
Control	123	102	101	101	427	106.75
2 tons/ha	122	121	151	103	497	124.25
4 tons/ha	144	124	112	122	502	125.5
6 tons/ha	132	158	165	172	627	156.75
8 tons/ha	96	103	103	168	470	117.5
10 tons/ha	194	104	106	108	512	128
Processed Chicken Manure (PCM)						
Control	109	154	112	160	535	133.75
2 tons/ha	173	131	105	126	535	133.75
4 tons/ha	130	104	139	118	491	122.75
6 tons/ha	131	125	132	124	512	128
8 tons/ha	137	109	139	105	490	122.5
10 tons/ha	127	129	138	124	518	129.5
BSU Compost						
Control	103	144	133	129	509	127.25
2 tons/ha	161	130	105	127	523	130.75
4 tons/ha	132	159	133	102	526	131.5
6 tons/ha	164	161	109	123	557	139.25
8 tons/ha	131	110	99	136	476	119
10 tons/ha	137	158	124	194	613	153.25
Alnus Compost						
Control	114	203	117	143	577	144.25
2 tons/ha	137	119	122	164	542	135.5
4 tons/ha	139	136	108	147	423.8	105.95
6 tons/ha	115	139	127	117	498	124.5
8 tons/ha	119	183	139	159	555	138.75
10 tons/ha	129	193	110	143	575	143.75
Sagana 100						
Control	153	125	98	180	556	139
2 tons/ha	160	137	179	145	621	155.25
4 tons/ha	102	125	188	127	542	135.5
6 tons/ha	112	165	179	109	565	141.25
8 tons/ha	185	140	105	110	540	135
10 tons/ha	161	131	160	182	634	158.5

ANOVA TABLE

SOURCE OF VARIANCE	DF	SS	MS	Fc	TABULATED F 0.05	0.01
Factor A	4	8.617	2.154	2.4159	2.71	4.01
Factor B	5	18.842	3.768	4.2262	2.31	3.22
A X B	20	19.283	0.964	1.0803	1.69	2.08
Error	90	80.250	0.892			
TOTAL	119	126.992				

Coefficient of Variation = 35.52%

Appendix Table 6. Stem length

TREATMENT	REPLICATION I	II	III	IV	TOTAL	MEAN
Chicken manure						
Control	48.26	43.43	40.89	47.75	180.33	45.08
2 tons/ha	49.78	56.89	41.91	45.97	194.55	48.63
4 tons/ha	59.69	54.61	46.99	42.67	203.96	50.99
6 tons/ha	61.21	58.67	54.61	40.89	215.38	53.84
8 tons/ha	57.65	57.15	56.13	58.67	229.9	57.4
10 tons/ha	50.29	52.57	47.24	50.29	200.39	50.09
Processed Chicken Manure (PCM)						
Control	35.81	34.03	54.61	34.03	158.58	39.64
2 tons/ha	45.21	42.41	42.67	44.19	168.48	42.12
4 tons/ha	40.89	44.45	43.43	40.89	169.66	42.41
6 tons/ha	41.40	41.14	40.91	43.94	167.39	42.84
8 tons/ha	44.95	38.86	40.13	44.70	168.64	41.16
10 tons/ha	41.91	43.94	41.14	38.86	165.85	41.46
BSU Compost						
Control	33.47	32.25	40.13	37.84	143.69	35.92
2 tons/ha	40.13	39.87	34.29	38.60	152.89	38.22
4 tons/ha	35.05	44.70	39.37	33.27	152.39	38.09
6 tons/ha	33.29	34.79	35.30	44.45	147.83	36.95
8 tons/ha	36.06	38.35	37.30	39.11	150.82	37.70
10 tons/ha	34.54	37.84	36.32	34.03	142.73	35.68
Alnus Compost						
Control	34.03	45.97	44.19	34.03	158.22	39.55
2 tons/ha	40.64	37.59	38.86	44.19	161.28	40.32
4 tons/ha	36.32	38.86	41.65	41.40	158.23	39.55
6 tons/ha	39.87	40.89	37.08	38.60	156.44	39.11
8 tons/ha	33.78	35.05	37.33	39.87	146.03	36.50
10 tons/ha	40.89	40.64	45.97	41.9	169.4	42.35
Sagana 100						
Control	44.19	34.03	41.91	30.75	150.88	37.72
2 tons/ha	47.24	43.68	49.27	45.21	185.4	46.35
4 tons/ha	49.02	46.73	40.13	49.27	185.15	46.28
6 tons/ha	45.46	48.51	41.65	48.51	184.13	46.03
8 tons/ha	46.73	39.11	48.06	48.06	181.96	45.49
10 tons/ha	44.95	43.94	46.22	46.48	181.59	45.39

ANOVA TABLE

SOURCE OF VARIANCE	DF	SS	MS	Fc	TABULATED F 0.05	TABULATED F 0.01
Factor A	4	2688.398	672.099	34.1643	2.71	4.01
Factor B	5	313.957	62.791	3.1918	2.31	3.22
A X B	20	357.199	17.860	0.9079	1.69	2.08
Error	90	1770.529	19.673			
TOTAL	119	5130.083				

Coefficient of Variation = 42.48%

Appendix Table 7. Vaselife (days)

TREATMENT	REPLICATION I	II	III	IV	TOTAL	MEAN
Chicken manure						
Control	14	13	16	14	57	14.25
2 tons/ha	11	12	15	12	50	12.5
4 tons/ha	13	13	15	15	56	14
6 tons/ha	14	14	16	14	58	14.5
8 tons/ha	16	16	17	15	64	16
10 tons/ha	15	14	14	15	58	14.5
Processed Chicken Manure (PCM)						
Control	15	14	13	13	55	13.75
2 tons/ha	13	14	15	13	55	13.75
4 tons/ha	13	13	16	15	57	14.25
6 tons/ha	16	14	14	12	56	14
8 tons/ha	17	11	13	16	57	14.25
10 tons/ha	12	14	12	12	50	12.5
BSU Compost						
Control	15	14	14	13	56	14
2 tons/ha	14	17	13	15	59	14.75
4 tons/ha	12	15	12	13	52	13
6 tons/ha	11	14	14	15	54	13.5
8 tons/ha	13	12	17	12	54	13.5
10 tons/ha	13	16	16	14	59	14.75
Alnus Compost						
Control	14	16	13	14	57	14.25
2 tons/ha	14	13	14	11	52	13
4 tons/ha	17	16	11	15	59	14.75
6 tons/ha	15	12	16	13	56	14
8 tons/ha	11	13	14	16	54	13.5
10 tons/ha	10	15	15	14	54	13.5
Sagana 100						
Control	15	15	14	13	57	14.25
2 tons/ha	14	14	15	12	55	13.75
4 tons/ha	14	13	14	15	56	14
6 tons/ha	16	17	13	17	63	15.75
8 tons/ha	13	15	13	13	54	13.5
10 tons/ha	12	12	13	15	52	13

ANOVA TABLE

SOURCE OF VARIANCE	DF	SS	MS	Fc	TABULATED F 0.05	0.01
Factor A	4	396.617	99.154	0.9272	2.71	4.01
Factor B	5	597.967	119.593	1.1183	2.31	3.22
A X B	20	1900.783	95.039	0.8887	1.69	2.08
Error	90	9625.000	106.944			
TOTAL	119	12,520.367				

Coefficient of Variation = 69.48%