Effect of Type of Fertilizer on Growth and Yield of Bet (*Piper betle L.*) Vines

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ABSTRACT

Betel (*Piper betle* L.) is a popular crop in Kuliyapitiya area and it is being cultivated for export market. Betel farmers currently apply different brands of fertilizer mixtures apart from fertilizer mixture recommended by Department of Export Agriculture. Therefore this study was conducted to investigate the effect of different types of popular Betel fertilizers on growth and yield of Betel vines. This experiment was conducted at Intercropping and Betel Research Station, Dampalassa, Narammala.

Betel vines were treated with 4 different types of fertilizers which are commonly used by the farmers along with the recommended fertilizer mixture of the department of Export Agriculture.

The results revealed that both leaf yield and growth rate were high in department-recommended fertilizer mixture and highest percentage of large leaves and highest leaf weight were recorded under the Gliricidia leaf treatment.

KEY WORDS: Betel vine, *Peeduna Kola*, *Kanda Kola*, Gliricidia, Commercial Fertilizer mixtures

INTRODUCTION

Betel vine (*Piper betle* L.) belongs to genus piper of the family Piperaciae. It is a diocious plant grown in Sri Lanka as a cash crop. Betel plants are indigenous throughout the entire Indian-Male region and cultivated in Madagascar, Bourbon, West Indies, India, and Sri Lanka. Sri Lankan Betel industry has a long-standing history dating back to 340 A.D (Kumara, *et al* 2003).

The three major districts producing export quality Betel leaves in Sri Lanka are Kurunegala, Gampaha, and Colombo. Our main importer of Betel is Pakistan. Other importers are Middle East and European countries. Maha Maneru, Kalu Bulath, Rata Dalu, Gal Dalu, Gata Thuba, Wel Bulath, Garandi Maneru, Naga Walli, Matipala are the common Betel varieties in Sri Lanka (Anon,2002).

This tropical crop can be cultivated successfully in elevations up to 1000m. It prefers warm, humid, conditions, but can tolerate some degree of water deficient conditions. It can cultivate under well distributed annual rainfall. With good management practices this crop can be cultivated in any Sri Lankan soil type. Laterite soil in Kurunegala and Gampaha Districts is the most suitable soil type for this cultivation. Soil and climatic conditions of Sri Lanka are very suitable to Betel cultivation. Therefore Sri Lanka produces good quality Betel (Anon, 2002).

Betel vines show dimorphic in branching habit as in Black pepper. The vegetative orthotropic climbing branches produce plagiotropic side branches. Usually vegetative branches are used for propagation. Leaves are about 15cm to 20cm long, broadly ovate, acuminate, oblignently, and cordage at base, thin and brittle, upper surface glossy, five or seven conspicuous lateral veins. Leaves that are produced from the plagiotropic branches are used for consumption (Mishra *et al.*, 1995

The betel leaf is used in a number of traditional remedies. For instance as treatment in stomach ailments, infections and as a general tonic. It is often chewed in combination with the betel nut (*Areca catechu*) as a stimulatory. It acts as a gentle stimulant. Some evidence have suggested that betel leaves have immune boosting properties as well as anti cancer properties (Balasubramainam, 1987).

Comparatively more risk is being associated with the cultivation of betel. One reason is the attack of Bacterial Leaf disease. No method is discovered yet to control this disease. Some times whole plantation can be affected by this disease within few days. Other than that lack of water is a main reason. Therefore it is difficult to maintain large plantations (Anon, 2002).

Technical information can be obtained from the Intercropping and Betel Research Station, Department of Export Agriculture, located at Dampalassa, Narammala. Harvesting should be done for the exportation of Betel leaves in three weeks interval. However for the local consumption, it should be two weeks interval. Therefore fertilizer application should be done in three weeks interval for the purpose of producing "*Kalu Bulath*" for the exportation. However there is a monopoly in the betel market consist of few number of exporters and brokers (Anon, 2002).

Field observations and experiences have shown that many farmers, in Kuliyapitiya area, use various types and rates of fertilizers that are available in the market. It is also observed that farmers do not apply department recommendations; instead they use either higher doses or higher rates of fertilizers on their cultivation that differ from farmer to farmer (Anon, 2002).

Since green leaves are the economic part of the plant, the nitrogen requirement of the crop is quite high (Satyabrata *et al.*, 1995). Farmers have got used to apply different commercial fertilizers in which Nitrogen content has got highly varied. The Department of Export Agriculture has already made a recommendation of straight fertilizer. However Betel farmers tend to use a wide variety of fertilizer mixtures

and there have been new introductions of different brands by recent past. The present study was initiated to investigate the effectiveness of different fertilizer types available in the current market for the production of Betel leaves (Anon, 2002).

MATERIALS AND METHODS

The experiment was carried out at the Intercropping and Betel Research Station, Department of Export Agriculture, Dampalassa, Narammala located in the Intermediate zone of North Western province of Sri Lanka, from December 2004 to May 2005.

Betel stem cuttings were planted in the sunken beds under the recommendations of Department of Export Agriculture. An individual plot size was 4 feets into 12 feets and accommodating 3 raw, spaced 1feet apart with 1.5 feet spacing within rows. Standard cultivation practices were followed. Initially 7.5 cm thicknesses of cow dung layer, was added to the plots and mixed well with soil. Supplementary watering was made at 5mm equal depth for all the non rainy days.

Following treatments were used in the experiment.

T_1- Department of Export Agriculture recommendation for Betel (N: P_2O_5:K_2O: MgO = 21:7:14:4) 420g per 100 sticks

T_2 - Commercial Fertilizer - 1(N: P_2O_5:K_2O: MgO = 9:13:9:3) 1000g per 100 sticks

T_3 - Commercial Fertilizer - 2 (N: P_2O_5:K_2O: MgO = 9:9:9:2) 1000 per 100 sticks

T_4 - Commercial Fertilizer – 3(N: P_2O_5: K_2O: MgO = 12:11:18:3) 1000g per 100 sticks

T_5 - Gliricidia Leaves-13.5kg of fresh leaves per 100 sticks

The experiment was laid out in a RCBD with five fertilizer treatments, arranged in 3 replications. Each bed had 36 sticks and the total of 540 sticks for the experiment. Data were recorded from 15 sticks (randomly selected) from 3 rows of each plot.

The following growth measurements were taken.

1. Plant height (cm) from the base to the top most node.
2. Leaf weight (g)
3. Leaf length and width (cm)
4. Number of leaves at each harvest

Among the characters studied plant height was measured in the field by using a tape. Wet weights of leaves, percentage of the large leaves were measured in the field laboratory after harvesting.

Plant height recordings were commenced 6 weeks after planting and continued at 3 weeks intervals up to 15 weeks. Harvesting of leaves was commenced at the 10th week after planting. After the harvesting, leaf weights were taken and numbers of large leaves were counted. Weighing was done using top loading balance.

After the harvesting, 100 leaves were selected randomly from each plot. The harvested leaves were sorted according to the size of the leaves. The leaves more than 18cm in length and more than 12cm in width were considered as large leaves. The rest were considered as small leaves. Percentages of large leaves were calculated.

Large Peedunu kola: Leaves of plageotropic branches having approximately higher than the length of 18 cm and width of 12 cm at the widest point.

Small Peedunu kola: Leaves of plageotropic branches having approximately lower than the length of 18 cm and width of 12 cm at the widest point

The results were analyzed by using the SAS version 8.

RESULTS AND DISCUSSION

Table 1. Mean Leaf (Peedunu Kola) Yield of two harvest

Treatment	Number of Leaves per vine
T_1	274 ^{a}
T_2	172 ^{b}
T_3	186 ^{b}
T_4	229 ^{ab}
T_5	231 ^{ab}
LSD	**65**
CV	**16**

Figures denoted by different letters are significantly different by LSD ($p< 0.05$)

Overall mean number of leaves (*peedunu kola*) collected from two harvests is shown in table 1. Maximum number of leaves were observed at T1 (274) and the minimum was at T2 (172). However, the differences in total leaf number among T2 and T3 were not statistically significant. Similarly the differences in total leaf number among T4 and T5 were also not significant. This indicates that the commercial fertilizer mixture 1(T2) and commercial fertilizer 2 (T3) has a low performance during the first year of Betel cultivation.

As Betel leaves are marketed as bundles, there fore this is an important parameter in local market than export market. Therefore, farmers those who target the local market try to maximize the number of leaves per vine.

Table 2. Percentage of large leaves (*Peeduna Kola*) per harvest per vine

Treatment	Percentage of the Large Leaves
T_1	24.4 ^{a}
T_2	22.6 ^{ab}
T_3	10.0 ^{b}
T_4	12.3 ^{ab}
T_5	26.6 ^{a}
LSD	**14.3**
CV	**39.7**

Figures denoted by different letters are significantly different by LSD ($p< 0.05$)

The percentages of large leaves in a harvest are also an important parameter and bigger leaves fetch a premium price. The maximum percentage of 26.6 was observed at T5 while the minimum of 10.0 was at T3. The differences in T1 and T5 were not significant for this parameter. As the same time the differences between T2 and T4 were also not significant. The application of Gliricidia leaves as mulch seems to improve percentage of large leaves. This is an equal

percentage of large leaves and this is almost equal to the percentage of Department of Export Agriculture mixture, T1.

Betel farmers used to harvest at 21 days interval for export market and leaves are sorted into the above categories like small leaves and large leaves, using above dimensions. The farm gate/local market selling prices of the betel leaves are based on the above groups. Therefore they always try to maximize the percentage of large leaves (Table 2).

Table 3. Mean leaf weight (*Peedunu kola*)

Treatment	Mean leaf weight (g)
T_1	3.6 ^{ab}
T_2	3.5 ^{b}
T_3	2.9 ^{c}
T_4	3.3 ^{b}
T_5	4.0 ^{a}
LSD	**0.43**
CV	**6.6**

Figures denoted by different letters are significantly different by LSD ($p < 0.05$)

The maximum mean leaf weight of 4.0 was observed at T5 and minimum was at T3 (2.9). Almost similar and significantly lower mean leaf weight values were observed at each T1, T2 and T4 (Table 3). The leaf weight of a Betel leaf is also one of the important parameters, as price of export leaves are indirectly associated with it.

Even though, farm gate sales are decided on the number of leaves having dark-green colour and brittleness. The real quality of "*Kalu Bulath*" is expressed on weight basis at export level. For an example, a basket of 9kg having 25-28 bundles is considered as the best quality in comparison to a basket of 9kg having 35-40 bundles.

Table 4. Mean Vine elongation rate

Treatment	Elongation rate (cm/week)
T_1	9.2 ^{a}
T_2	6.1 ^{b}
T_3	6.3 ^{b}
T_4	7.1 ^{b}
T_5	8.7 ^{a}
LSD	**1.4**
CV	**9.6**

Figures denoted by different letters are significantly different by LSD ($p < 0.05$)

Elongation rate is almost similar to the mean leaf weight distribution and having significantly higher growth rate in both T1 (9.2) and T5 (8.7) than rest of the treatments. Vine elongation rate in T2, T3 and T4 plants showed a no difference during the study period (Table 4). But T2, T3, and T4 were significantly different from T1 and T5.

It is general expectation of a farmer to obtain better growth and higher quantity and quality of yield after application of different organic, inorganic and combination of both these fertilizers.

Leaf yield and growth rate of Betel showed higher mean values under the application of department recommended fertilizer mixtures than that of other three. It may be due to higher percentage of Nitrogen and Potassium of the prior.

Gliricidia leaves act as mulch in addition to a fertilizer in the treatment. It is believed as a reason for higher leaf weight and higher percentage of large leaves. However application of Gliricidia is not suitable in the long run. As it is an organic fertilizer, there is a possibility to change the soil nutrient balance. Department recommendation is identified to be suitable in the long run. Therefore proper extension is essential in this regard.

CONCLUSIONS

Results of present experiment have shown that highest leaf yield is associated with department recommended fertilizer application. The highest mean growth rate was also found from department Recommendation. The highest mean leaf weight and highest percentage of large leaves were found from Gliricidia treatment (T5). Commercial fertilizer treatment 1, 2 and 3 (T2, T3 and T4) showed lower performances on yield and growth of Betel vines.

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REFERENCES

Anon, (2002). Technical bulletin on betel cultivation number 11. Department of Export Agriculture, Kandy Road, Peradeniya, Sri Lanka, pp. 1-20.

Balasubramainam, R.S. (1987). Microclimate manipulation in betel vine gardens. India, 05/05/2005. http://WWW.botanical.com/botanical/mgmh/b/betel133.html.

Kumara, B.M.V.S.H., Seneviratha, J.A., and Gajanayaka, K.G.M.C.P.B. (2003). Effect of different levels of cattle manure in potting media on sprouting and growth of Betel stem cuttings. In: proceedings of 3rd Agricultural symposium. June 4th, 2002, Wayamba University of Sri Lanka, pp. 97-102.

Mishra, S.K., Chaurasia, R.S., and Balasubramainam, V.R. (1995). Effect of graded levels of slow release fertilizers on the yield and quality of betel leaves. Journal of Plantation Crops, 23 (1), pp. 48-51.

Satyabrata Maiti., Kadam, A.S., Sengupta, K., Punekar, L.K., Das, J.N., Saikia, L., Biswas, S.R and Reddy,K.M. (1995). Effect of sources and levels of nitrogen on growth and yield of Betelvine (*Piper betle* L.). Journal of Plantation Crops, 23 (2), pp. 122-125.