BIBLIOGRAPHY

GANADO, SHERWIN T. APRIL 2011. Growth and Yield of Two Malabar Spinach Cultivars (*Basella alba and Basella rubra*) Applied with Natural Fertilizers Benguet State Universty, La Trinidad Benguet.

Adviser: Silvestre L. Kudan, PhD.

ABSTRACT

This study was conducted at the Balili Experimental Area, Benguet State University, La Trinidad, Benguet from October 2010 to Febuary 2011. This study was conducted to specifically evaluate the growth and yield of red and green stemmed Malabar spinach 'Pulaan' and 'Luntian' applied with different natural fertilizers, determine the best natural fertilizers for Malabar spinach, determine the profitability of Malabar spinach using the different natural fertilizers, determine the interaction effect between the Malabar spinach cultivars and natural.

Malabar spinach 'Pulaan' produced slightly more shoots than the 'Luntian' with characteristically bigger and heavier shoots consequently producing significantly heavier yield of 4.32 kg from two plants in four months harvesting compared to the 2.68 kg from the 'Luntian'.

All the data gathered to measure the growth and yield of Malabar spinach show that the application of chicken manure + 14-14-14 (farmer's practice), had slightly higher values compared to the liquid bio-fertilizer, concentrated mineral drops, vermin compost,

plantmate and the no fertilizer application (Control). However, when the profitability was computed, the use of liquid bio-fertilizer had the highest return on expenses of Ph2.81 for every peso spent followed by the use of concentrated mineral drops

(Ph2.75), no fertilizer application (Contro) (Ph2.71), chicken manure + 14-14-14 (Ph2.66), plantmate (Ph2.57), and vermin compost (Ph2.52), due to the differences in the prices of the fertilizers.

There were no significant interactions between the cultivars and fertilizers in all the data gathered.

Based on the results of the study, 'Pulaan' Malabar spinach should be planted to obtain higher yield and the application of liquid bio-fertilizer to get higher profit.

TABLE OF CONTENTS

INTRODUCTION

There are many vegetables that can be grown in the province of Benguet but farmers only plant cabbage, chayote, potato, carrots in large volume and in little volume of minor crops like peas, herbs and none of malabar spinach which can be grown in La Trinidad. The practice of growing different crops is important not only pests control, nutrient deficiency prevention, but also ensures higher income by the farmers, variety of food choices by the consumers and more plants to protect the soil surface to prevent erosion.

In fertilizer application, for so long a time farmers have been depending so much on synthetic fertilizer materials. The applications of these materials are not even based on soil analysis so that only the kind and the amount needed is applied. Most often than not, the amount being applied is far more than what is required. This practice resulted to extremely acidic soil, very low organic matter content and other unfavourable condition for crop growth. There is a need to improve the sick soil condition through application of natural fertilizer materials.

Aside from the strong typhoons affecting vegetables, Benguet climatic condition favors the production of most vegetable crops with premium quality. Malabar spinach or "alugbati" is observed to be growing well under La Trinidad condition twining on fences and other plants but neglected. The plant was accidentally analysed to contain glucosinolates, a compound to prevent cancer.

Similarly, the results from the different natural fertilizer materials will be of help in promoting alternatives to the odorous, dry undecomposed chicken dung which is the only organic fertilizer material being used by Benguet farmers. Moreover, the build up of soil fertilizer with the use of natural fertilizer materials is the only way to make crop production sustainable to cope up with the increasing population. To comply with the Philippine National Standards in crop production, results of this study may be of help in improving the agriculture sector.

The study was conducted to specifically:

1. Evaluate the growth and yield of red and green stemmed Malabar spinach applied with the different natural fertilizers;

2. Determine the best natural fertilizer materials for Malabar spinach production;

3. Determine the profitability of Malabar spinach production applied with the different natural fertilizers;

4. Determine the interaction effect between the Malabar spinach cultivars and natural fertilizes used in the study.

The study was conducted at Balili Experiment area of Benguet State University, La Trinidad, Benguet from October 2010 to Febuary 2011.

REVIEW OF LITERATURE

Description of Malabar Spinach

Malabar Spinach belongs to *Basellaceae* family (Rubatzky and Yamaguchi, 1997). It is a perennial vine found in the tropics where it is widely used as a leaf vegetable. It is fast-growing, soft stemmed vine, reaching 10m in length. Its thick, semi-succulent, heart-shape 5 to 10 cm leaves have a mild flavor and mucilaginous texture. The stem of the cultivar *Basella alba* is green and *Basella rubra* is reddish-purple (Grubben and Denton, 2004). Malabar Spinach is one of the most popular indigenous leafy vegetables in the Philippines. Originally from India, it is usually found in settled areas, in hedges, old cultivated areas, etc., throughout the Philippines. It is extensively grown in market gardens and home gardens and is being sold even in supermarkets in Visayas and Mindanao. It is also cultivated in tropical Asia, Africa, and Malaya (Bureau of Agricultural Statistics [BAS], 2006). Malabar spinach is in the Basellaceae family, not the spinach family. The taste is similar to spinach, however this crop is a very warm-season crop unlike standard spinach grown in the Northeastern US. This crop is native to tropical Asia, probably originating from India or Indonesia and is extremely heat tolerance (Rubatzky and Yamaguchi, 1997).

Nutritional Importance

Malabar Spinach has a pleasant, mild spinach flavor that some may find earthy. It is slimy when overcooked, which makes it an excellent thickening agent in soups and stews. Common market product, a popular leafy and stew vegetable, a good substitute for spinach.

The green and purple cultivated varieties are preferable to the wild ones. Both the young shoots and stems are eaten. The purplish dye from the ripe fruit is used as food color and as rouge for the face. The cooked roots are used to treat diarrhea, while cooked leaves and stems are used as laxative. The flowers are used as antidote for poison. A paste of the root is used as a rubefacient or applied to swellings. A paste of the leaves is applied externally to treat boils. Per 100 grams (g) edible portion, alugbati leaves contains 16 kcal energy, 1.4 g protein, 0.4 g fat, 2.6 g carbohydrates, 135 mg calcium, 12 mg phosphorus, 6.2 mg iron, 6,390 (U.I) vitamin A, 0.04 mg thiamine, 0.12 mg riboflavin, 0.6mg niacin, 85mg ascorbic acid (Mitra, 1985).

Medicinal Importance

Malabar spinach is recommended as an antidote, aperients, astringent, demulcent, diuretic, febrifuge and laxative. Astringent – the cooked roots are used in the treatment of diarrhea. Laxative – the cooked leaves and stems are used. The plant is febrifuge, its juice is a safe aperient for pregnant women and a decoction has been used to alleviate labor (Demis, 2009). Excellent source of calcium and iron; good source of vitamins A, B, and C, with a high roughage value. Roots are employed as rubefacient. Poultice of leaves used to reduce local swelling. Sap is applied to acne eruptions to reduce inflammation. Decoction of leaves used for its mild laxative effects. Pulped leaves applied to boils and ulcers to hasten suppuration. Sugared juice of leaves useful for catarrhal afflictions. Leaf-juice, mixed with butter, is soothing and cooling when applied to burns and scalds (Oomen and Grubben, 1978).

Climate and Soil Requirement

Malabar spinach grows well under full sunlight in hot, humid climates and in areas lower than 500 m above sea level. Growth is slow in low temperatures resulting in low yields. Flowering is induced during the short-day months of November to February. Malabar spinach grows best in sandy loam soils rich in organic matter with pH ranging from 5.5 to 8.0 (Grubben and Denton, 2004).

Production

Malabar spinach is a warm season crop and should be direct seeded when all danger of frost has passed and night temperatures are above 60 degrees F. Plant seeds 1 inch deep, 1 inch apart in rows in 2.5 feet apart thin germinated seedlings to 1 foot. Malabar spinach can also be started as transplants eight weeks before the last frost.

Malabar spinach is fast growing and tolerates high rainfall. This is a fast growing vine plant and produces best when trellised. Stem tips (6-8 inches) are harvested 55-70 days after seeding. Repeated harvests of new growth stems can be made throughout the season (Rubatzky and Yamaguchi, 1997).

Propagation

Alugbati is usually planted in home gardens using cuttings. Use mature stem cuttings 20-25 cm long with at least 3 internodes. Soak the cuttings in water overnight or store in a damp, shady area for 1-2 days. Plant 2-4 cuttings at 15-20 cm between hills and 20-30 cm between rows. Water before and after planting and if the soil is dry and mulch with grass clippings or rice straw. For market gardens, sow seeds in rows or broadcast on well-prepared seedbeds. Transplant seedlings at 20 cm x 20 cm distance between plants at 3 weeks after sowing and water regularly to ensure high survival rate.

Varieties

There are three common types of Malabar spinach: *Basella alba* with green stem and oval to almost round leaves; Basella rubra with red stems and green, oval to round leaves; and a third type, which is a hybrid of the two. The Institute of Plant Breeding of the University of the Philippines Los Banos (IPB-UPLB) has released two stopgap varieties in 1981 through its Germplasm Registration and Release Office: the red-stemmed 'Pulahan' and the green-stemmed 'Luntian.'

Glucosinolates

Substances occurring widely in plants of the genus *Brassica* (e.g. broccoli, Brussels sprouts, cabbage); broken down by the enzyme myrosinase to yield, among other products, the mustard oils which are responsible for the pungent flavor (especially in mustard and horseradish). Some glucosinolates interfere with the metabolism of iodine by the thyroid gland, and hence are goitrogens. There is evidence that the various glucosinolates in vegetables may have useful anti-cancer activity, since they increase the rate at which a variety of potentially toxic and carcinogenic compounds are conjugated and excreted (David, 2005).

Liquid Bio-Fertilizers

These liquid Bio-Fertilizers have the shelf life of two years. The application of these liquid formulations in the field is very simple and easy. They are applied using hand sprayers, power sprayers, fertigation tanks and as basal manure mixed along with FYM etc. Liquid Bio-Fertilizer contains special cell protectants or substances that encourage formation of resting spores or cysts. It also contains special nutrients that ensure longer shelf life, better survival on seeds and soil and tolerance to adverse conditions. The organisms employed in the Liquid Bio-Fertilizer are stabilized during production, distribution and storage, the activity is enhanced after the contact and interaction with the target crops.

MATERIALS AND METHODS

Materials

The materials used in the study were Malabar spinach cuttings of the two cultivar, garden tools, and the fertilizer materials specified in the treatments, weighing scale, tape measure, identifying tags.

Experiment Design and Treatments

The experiment was laid out following the split-plot design, wherein Factor A was the cultivars and Factor B was the fertilizers which were represented as follows:

Factor A-Cultivar	Description
C_1	red-stemmed Malabar spinach ‘Pulaan’
C_2	green-stemmed Malabar spinach ‘Luntian’

Factor B- Fertilizer		Nutrient Analysis
F_1	No fertilizer application (check)	
F_2	Vermi compost (500g per plant hill)	N: 1.66%, P2O5: 1.57%, K2O: 0.14%
F_3	Plantmate (120g per plant hill)	N: 2.0%, P: 3.0%, K: 3.0%
F_4	Concentrated Mineral Drops (8 ml per16 liters of water	C: 249 mg/ml, B: 0.406, mg/ml, K: 14 mg/ml, Su: 26.6 So: 11.6 mg/ml, Li: 0.544 mg/ml, Ca: 0.0947 mg/ml
F_5	Liquid Bio-fertilizer (30ml per 16 liters of water	N: 5%, P_20_5: 7%, K_20: 8%, MgO: 0.73%, CaO: 0.68%, S: 2.0%
F_6	Farmer’s Practice (half liter/ hill of chicken dung+250g/ hill of 14-14-14 (control)	14%N, 14% P, 14% K

Land Preparation

An area of 1 m x 100 m was cleaned from weeds, dug and levelled. It was divided into two equal lengths of 50 m each which was assigned for the red-malabar spinach and the green- stemmed malabar spinach. The 50 m area was further divided into three for the blocks and each block was also subdivided into six to represent the treatments. The vermi compost, plantmate and chicken dung was applied to their assigned area and mixed with the soil before planting.

Planting the Cuttings

Vine cuttings of red-stemmed and the green-stemmed malabar spinach was secured from Balili farmers and was planted on the prepared area where each cultivar occupied 50 m long plot. The distance of planting each vine cutting was 50 cm and each treatment combinations had two sample plants.

Care and Management

The plants were irrigated from planting the vine cuttings which was done twice a week up to the termination of the study. Weeding was done as soon as weeds were seen growing to compete with the plants.

The application of concentrated mineral drops and the liquid bio-fertilizer to their assigned plants was done every 10 days following the application rates in the treatments.

Harvesting

Shoots were harvested when the plant were established and was done every time there are shoots to be harvested. The length of shoots harvested was 8 inches in all the treatment plants. The shoots were pocked in polyethylene bags at 500 g each and were marketed to the BSU organic market.

Data Gathered

The data gathered, tabulated, computed and means subjected to separation test using the Duncan's Multiple Range Test (DMRT) were the following:

1. Days from planting the cuttings to first harvesting. This was the number of days from planting the vine cuttings to the day shoots can be first harvested.

2. Number of shoots produced per plant. This was the numbers of shoots harvested from the first to the last shoot harvest in four months duration of harvesting. The total counts of shoots were divided by two sample plants.

3. Diameter of vines (cm). Ten sample shoots per treatment each month were measured then added and divided by the number of shoots measured during the study to get the average diameter of vines.

4. Total yield (kg). This was the weight of shoots harvested in four months harvesting from the first harvest to the termination of the study.

5. Weight per shoots (g). This was obtained dividing the total weight of shoots by the total number of shoots harvested.

6. Profitability. The inputs for each treatment were recorded and the return on expenses was computed using the formula:

$$\text{Return on Expenses} = \frac{\text{Total Sales per Treatment-Expenses per Treatment}}{\text{Total Expenses per Treatment}}$$

RESULTS AND DISCUSSION

Number of Shoots Produce per Plant

Effect of cultivars. The shoots harvested from malabar spinach 'Pulaan' had higher counts compared to the malabar spinach 'Luntian' as shown in Table 1. Statistical analysis shows slight difference between the two cultivars in the number the number of shoots produced per plant. This means that the two cultivars can produce similar number of shoots per plant in five months.

Effect of natural fertilizer materials. Table 1 shows that the different fertilizer materials used in the study did not differ in the number of shoots produced per plant. However, the plants not applied with fertilizer material had the lowest counts of shoots while the farmer's practice of applying chicken dung + 14-14-14 had the highest count of shoots per plant. The insignificant differences in the number of shoots per plant may suggest that the soil contain sufficient nutrient elements for the plants.

Interaction effect. No significant interaction effect existed between the cultivars and the natural fertilizer materials on the number of shoots produced per plant.

Diameter of Vines

Effect of cultivar. As presented in Table 2 the vines of malabar spinach 'Pulaan' is significantly wider than the malabar spinach 'Luntian'. Apparently this difference is a varietal characteristic as the 'Pulaan' has shooter nodes and broader leaves, while the 'Luntian' has longer internodes.

Table 1. Number of shoots produced per plant

TREATMENT	MEAN
Cultivar	
'Pulaan'	563.72[a]
'Luntian'	496.28[a]
Organic Fertilizer	
No fertilizer application (check)	397.83[a]
Vermi compost	527.67[a]
Plantmate	523.00[a]
Concentrated mineral drops	569.17[a]
Liquid bio-fertilizer	530.50[a]
Chicken dung + 14-14-14 (farmer's practice)	601.50[a]

Means with the same letter are not significantly different at 5% levels of DMRT.

Effect of natural fertilizer materials. The vines of plants not applied with fertilizer had the smallest measurement compared to those applied with fertilizer as shown in Table 2. The differences in vine measurements however did not statistically differ. Again, the level of soil fertility before applying the different fertilizer treatments may be high thus; the effect of the applied fertilizer did not very significantly.

Interaction effect. No significant interaction effect exists between cultivars and the natural fertilizer materials on the diameter of vines.

Table 2. Diameter of vines

TREATMENT	MEAN (cm)
Cultivar	
'Pulaan'	.48[a]
'Luntian'	.41[b]
Organic Fertilizer	
No fertilizer application (check)	.38[a]
Vermi compost	.45[a]
Plantmate	.45[a]
Concentrated mineral drops	.46[a]
Liquid bio-fertilizer	.47[a]
Chicken dung + 14-14-14 (farmer's practice)	.45[a]

Means with the same letter are not significantly different at 5% levels of DMRT.

Weight of Individual Shoots

Effect of cultivars. As shown in Table 3, the weight per shoot of malabar spinach 'Pulaan' was significantly heavier than the malabar spinach 'Luntian'. This significantly heavier shoots of 'Pulaan' is due to its characteristically bigger vines compared to the 'Luntian'. This also explains the significantly heavier yield over the 'Luntian' malabar spinach.

Effect of natural fertilizer materials. The heaviest weight of individual shoots was weighed from plants applied with vermi compost and farmer's practice while the lightest shoots was harvested from plants without fertilizer application, but the differences among

Table 3. Weight of individual shoot

TREATMENT	MEAN (g)
Cultivar	
'Pulaan'	3.82[a]
'Luntian'	2.65[b]
Organic Fertilizer	
No fertilizer application (check)	3.06[a]
Vermi compost	3.29[a]
Plantmate	3.24[a]
Concentrated mineral drops	3.25[a]
Liquid bio-fertilizer	3.28[a]
Chicken dung + 14-14-14 (farmer's practice)	3.29[a]

Means with the same letter are not significantly different at 5% levels of DMRT.

the treatments were very slight (Table 3). This means that the fertilizer materials used had not improved further the fertility level of the soil.

Interaction effect. No significant differences were noted on the weight per shoots of malabar spinach which means that not one of the cultivars responded better to the fertilizers or none from the fertilizer materials used provided nutrient elements better than the soil shown by the plant not applied fertilizer (control).

Total Yield

Effect of cultivar. The computed yield from two cultivars of malabar spinach shows highly significant difference (Table 4). 'Pulaan' malabar spinach significantly out yielded the 'Luntian' by 1.64 kg. from two plant sample in months harvesting. This difference is mainly influenced by the significantly bigger vines of 'Pulaan' which is a varietal characteristic.

Table 4. Total yield from two sample plants

TREATMENT	MEAN (kg)
Cultivar	
'Pulaan'	4.32^{a}
'Luntian'	2.68^{b}
Organic Fertilizer	
No fertilizer application (check)	2.73^{a}
Vermi compost	3.53^{a}
Plantmate	3.38^{a}
Concentrated mineral drops	3.69^{a}
Liquid bio-fertilizer	3.70^{a}
Chicken dung + 14-14-14 (farmer's practice)	4.00^{a}

Means with the same letter are not significantly different at 5% levels of DMRT.

Effect of natural fertilizer materials. The highest yield was produced by plants applied with chicken dung and 14-14-14 (farmer's practice) and the lowest yield was harvested from the plants not applied with fertilizer (control) but the difference among the fertilizer treatments showed insignificant differences (Table 4). As mentioned earlier, the experiment area has high organic matter content and nutrients already.

Interaction effect. No significant interaction existed between the cultivar and the different natural fertilizer materials in terms of the total yield.

Profitability

Table 5 shows computation of sales and expenses from the different treatment of 6 sq m. Plants applied with liquid bio fertilizer obtained the highest net income showing a return on expenses of 280.61% or 2.81 for every peso spent in the production. This was followed by the application of concentrated mineral drops, no fertilizer application, farmer's practice plantmate and the vermi compost has the lowest return on expenses.

The farmer's practice produced the highest yield and sales while the plants without fertilizer application, the lowest but the higher expenses incurred by the farmer's practice lowered the profit which was surpassed by the control or no fertilizer application.

Means with the same letter are not significantly different at 5% levels of DMRT.

Table 5. Economic analysis per treatment from 6 sq m area

ITEM	TREATMENT					
	NO FERTILIZER APLLICATION (CONTROL)	VERMI COMPOST	PLANT-MATE	CMD	LIQUID BIO-FERTILIZER	FARMER'S PRACTICE
YIELD (KG)	16.38	21.15	20.30	22.12	22.20	24.02
SALES (Ph)	982.80	1,269.00	1,327.20	1,332.00	1,332.00	1,441.20
INPUTS:						
X-tekh					76.96	
Compost		90.00	72.00			
CMD				81.00		
Chicken dung						55.00
14-14-14						72.00
LABOR COST:						
Land preparation	33.00	33.00	33.00	33.00	33.00	33.00
Planting	16.00	16.00	16.00	16.00	16.00	16.00
Irrigation	58.00	58.00	58.00	58.00	58.00	58.00
Weeding	33.00	33.00	33.00	33.00	33.00	33.00
Harvesting	125.00	130.00	129.00	133.00	133.00	137.00
Expenses (Php)	265.00	360.00	341.00	354.00	349.96	404.00
Net Income (Php)	717.80	909.00	877.00	973.20	982.04	1,073.20
ROE	271.24	252.20	257.18	274.92	280.61	265.64
RANK	3	6	5	2	1	4

*Note: The selling price of Malabar spinach shoots per kilogram was Php 60.00

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

The study was conducted at Balili Organic Farm of Benguet State University, La Trinidad, Benguet from October 2010 to February 2011 to evaluate the growth and yield of 'Pulaan' and 'Luntian' Malabar spinach applied with different fertilizers, determine the best natural fertilizer materials for Malabar spinach production, determine the profitability of Malabar spinach applied with the different natural fertilizers, and determine the interaction effect between the Malabar spinach cultivars and natural fertilizer materials.

As to cultivars, result shows that 'Pulaan' had characteristically bigger vines of 0.48 cm compared to the 'Luntian' vines of 0.41 cm. In terms of weight, 'Pulaan' shoot measuring 8 inches or 20.32 cm has 3.82 g compared to 'Luntian' of 2.65. The number of shoots produced per plant is also more from 'Pulaan' than the 'Luntian'. This cultivar differences resulted to significantly higher yield from 'Pulaan' Malabar spinach.

Among the fertilizers used in the study, there were no significant differences observed in all the data taken. However, plants not applied with fertilizer consistently obtained the lowest in all the data gathered. This means that the nutrient contents of the different fertilizers applied were able to enhance growth and yield of the Malabar spinach (*alugbati*) only that the experiment area may contain sufficient nutrient elements or the amount of fertilizers is not enough to give significant increase in yield.

There were no significant interaction effects between the two cultivars and the different fertilizers used in the study. This means that not one of the cultivars responded

better than the other one to the different fertilizer materials applied or the fertilizer material had not further stimulated the growth and development of the crop.

It was computed that the application of liquid bio-fertilizer obtained the highest net income with a return on expenses of Ph2.81 for every peso spent in the production and this was followed by the application of concentrated mineral drops with Ph 2.75 for every peso spent. The no fertilizer application closely followed with Ph 2.71, then the farmer's practice (Ph 2.66), plantmate (Ph 2.57) and vermin compost (Ph 2.52).

Conclusion

Based from the results presented and discussed, 'Pulaan" Malabar spinach "*alugbati*" is more productive and profitable than the 'Luntian' and the application of liquid bio-fertilizer may obtain higher net income over the other fertilizers.

Recommendation

It is therefore recommended that 'Pulaan' Malabar spinach should be planted to obtain higher yield and the application of liquid bio-fertilizer to get higher profit. It is also recommended that these result be verified in other locations for validation of results.

APPENDICES

Appendix Table 1. Number of shoots produced per plant

TREATMENT	BLOCK			TOTAL	MEAN
	I	II	III		
RED-STEMMED					
Control	528	553	519	1600	533.33
Vermi compost	295	709	635	1639	546.33
Plantmate	376	751	391	1518	506
CMD	698	562	441	1701	567
Liquid Bio-fertilizer	440	646	634	1720	573.33
Farmer' Practice	607	767	595	1969	656.33
GREEN-STEMMED					
Control	250	197	340	787	262.33
Vermi compost	450	601	476	1527	509
Plantmate	622	366	632	1720	540
CMD	698	558	458	1714	571.33
Liquid Bio-fertilizer	508	546	591	1645	548.33
Farmer' Practice	413	737	490	1640	546.67

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	PROB
Factor A	1	40938.778	40938.778	2.3103	0.1416^{ns}
Factor B	5	150716.667	30143.333	1.7011	0.1727^{ns}
AB	5	92053.222	18410.644	10390	0.4177^{ns}
Error	24	425279.333	17719.972		
TOTAL	35	708988.000			

^{ns} = not significant

Coefficient of variation = 25.12%

Appendix Table 2. Diameter of vine (cm)

TREATMENT	BLOCK I	BLOCK II	BLOCK III	TOTAL	MEAN
RED-STEMMED					
Control	.40	.43	.41	1.24	.41
Vermi compost	.48	.48	.48	1.42	.47
Plantmate	.4	.48	.48	1.43	.48
CMD	.48	.49	.48	1.45	.48
Liquid Bio-fertilizer	.49	.58	.55	1.62	.54
Farmer' Practice	.49	.49	.47	1.45	.48
GREEN-STEMMED					
Control	.30	.37	.39	1.06	.35
Vermi compost	.41	.44	.42	1.27	.42
Plantmate	.43	.40	.43	1.26	.42
CMD	.44	.43	.42	1.29	.43
Liquid Bio-fertilizer	.42	.42	.45	1.29	.43
Farmer' Practice	.43	.43	.38	1.24	.41

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	PROB
Factor A	1	0.032	0.032	55.3092	0.0000**
Factor B	5	0.001	0.000	0.3874	ns
AB	5	0.000	0.000	0.1556	ns
Error	24	0.014	0.001		
TOTA	35	0.047			

** = highly significant

ns = not significant

Coefficient of variation = 5.29%

Appendix Table 3. Weight per shoot (g)

TREATMENT	BLOCK I	BLOCK II	BLOCK III	TOTAL	MEAN
RED-STEMMED					
Control	3.71	3.68	3.62	11.01	3.67
Vermi compost	3.68	4.12	3.87	11.67	3.89
Plantmate	3.96	4.01	3.82	11.79	3.93
CMD	3.76	3.70	3.82	11.28	3.76
Liquid Bio-fertilizer	3.78	3.83	3.91	11.52	3.84
Farmer' Practice	3.86	3.67	3.98	11.51	3.84
GREEN-STEMMED					
Control	2.50	2.49	2.38	7.37	2.45
Vermi compost	2.80	2.59	2.67	8.06	2.69
Plantmate	2.61	2.48	2.57	7.66	2.55
CMD	2.64	2.72	2.87	8.23	2.74
Liquid Bio-fertilizer	2.60	2.86	2.71	8.17	2.72
Farmer' Practice	2.97	2.70	2.59	8.26	2.75

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	PROB
Factor A	1	11.178	11.178	653.7835	0.0000**
Factor B	5	0.015	0.003	0.1794	^{ns}
AB	5	0.206	0.041	2.4139	0.0658^{ns}
Error	24	0.410	0.017		
TOTAL	35	11.810			

** = highly significant

^{ns} = not significant

Coefficient of variation = 3.99%

Appendix Table 4. Total yield (kg)

TREATMENT	BLOCK I	BLOCK II	BLOCK III	TOTAL	MEAN
RED-STEMMED					
Control	3.98	4.06	3.96	11.94	3.98
Vermi compost	2.17	5.85	4.91	12.93	4.31
Plantmate	2.98	6.02	2.98	11.98	3.99
CMD	5.24	4.16	3.37	12.77	4.26
Liquid Bio-fertilizer	3.33	4.94	4.95	13.22	4.41
Farmer' Practice	4.68	5.62	4.74	15.04	5.01
GREEN-STEMMED					
Control	1.94	1.13	1.82	4.44	1.48
Vermi compost	2.52	3.12	2.58	8.22	2.74
Plantmate	3.25	1.82	3.25	8.32	2.77
CMD	3.69	3.03	2.63	9.35	3.12
Liquid Bio-fertilizer	2.64	3.13	3.21	8.98	2.99
Farmer' Practice	2.45	3.99	2.540	8.98	2.99

ANALYSIS OF VARIANCE

SOURCE OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN OF SQUARES	COMPUTED F	PROB
Factor A	1	24.321	24.321	27.0045	0.0000**
Factor B	5	5.611	1.122	1.2460	0.3190ns
AB	5	2.050	0.410	0.4552	ns
Error	24	21.615	0.901		
TOTAL	35	53.598			

** = highly significant

ns = not significant

Coefficient of variation = 27.08%