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An Investigation into the Vermicomposting of Sugarcane Bagasse and Rice Straw and its Subsequent Utilization in Cultivation of *Phaseolus vulgaris* L. In Guyana

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Abstract: The present study was carried out during the year 2006-2007 at University of Guyana, Georgetown. Experiments were aimed at production and quantitative comparison and rate of production of vermicomposts from sugar cane bagasse, rice straw and a combination of sugar cane bagasse and rice straw. Results indicated that the combination of bagasse and rice straw showed the highest percentage of production. The vermicomposts were assessed for nutrient value and subjected to studies on plant growth parameters of *Phaseolus vulgaris* L. and were compared with treatments using cow dung and chemical fertilizer. The results indicated that vermicompost is a competitive biofertilizer and showed better growth patterns in *Phaseolus vulgaris* L. than chemical fertilizers and can retain nutrients for longer period. *Phaseolus vulagris* L. with vermicompost had better fruit quality in terms of physical dimension, biochemical constituents. There was significant improvement in the soil quality in the experimental plots with treated with vermicompost produced from bagasse and rice straw [BV+RSV].

Key words: Vermicomposting · Sugarcane bagasse · Rice straw · Earthworms · Microbial interaction · Guyana

INTRODUCTION

Compost is becoming an important aspect in the quest to increase productivity of food in an environmentally friendly way. Vermicomposting offers a solution to tonnes of organic agro-wastes that are being burned by farmers and to recycle and reuse these refuse to promote our agricultural development in more efficient, economical and environmentally friendly manner. Both the sugar and rice industries burn their wastes thereby, contributing tremendously to environmental pollution thus, leading to polluted air, water and land. This process also releases large amounts of carbon dioxide in the atmosphere, a main contributor to global warming together with dust particles. Burning also destroys the soil organic matter content, kills the microbial population and affects the physical properties of the soil [1]. Organic farming system is gaining increased attention for its emphasis on food quality and soil health. Vermicompost and vermiculture associated with other biological inputs have been actually used to grow vegetables and other crops successfully and have been found to be economical and productive [2,3].

MATERIALS AND METHODS

The present study was carried out during the year 2006-2007 at University of Guyana, Georgetown. The vermicomposting units were be set up at the University of Guyana compound.

Vermicomposting units were set up using vermitech pattern [2]. Plastic crates were used as the container and placed in a shaded elevated area as to facilitate the effective water drainage. A basal layer of vermibed comprising broken bricks then a layer of sand to the thickness of 6 to 7.5 cm was set up to ensure proper drainage. This was then covered with a layer of loamy soil up to the height of 15 cm, after it was moistened. Into this soil, 50 locally collected earthworms, *Eisenia foetida,* were inoculated. Small lumps of fresh or dry cattle dung was then scattered over the soil. The soil was then covered with 10 cm of agro waste. The entire unit was kept moist

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by sprinkling of water twice weekly and turned once weekly up to the 7th week.

Three Units Were Set up as Follows:

Unit 1 : 150 g Sugar cane bagasse + 1 kg of cow dung
Unit 2 : 150 g Rice straw + 1 kg of cow dung
Unit 3 : 75 g Rice straw + 75 g sugar cane bagasse + 1 kg cow dung

The vermicompost was then harvested and placed to air-dry for chemical analysis together with untreated soil and raw sugar cane bagasse and rice straw using standard procedure for pH, EC_w, Organic carbon, Total kjeldahl nitrogen, Available phosphate, Calcium, Magnesium and Potassium [4]. The analysis of the compost samples was done at Central Laboratory, Research Center, Agriculture Department, LBI Compound, GuySuCo. The analysis of food components from the plants and plant products were done at Food and Drug Analysts Department.

Pot experiment of *Phaseolus vulagris* L. was carried out in triplicate by using vermicomposts, cow dung, chemical fertilizers and chemical pesticide and a control. Each plant was treated at the first week, three weeks after and then just at the beginning of flowering period as follows:

Treatment	Symbol	Amount added/g
Soil	{CON}	No addition
Bagasse Vermicompost	{BV}	100
Rice Straw Vermicompost	(RV}	100
Bagasse + Rice Straw Vermicompost	{BV + RSV}	100
Cow Dung	{CD}	100
Chemical fertilizer (Urea)	{CHM}	13.6

Growth parameters (number of leaves, plant height, number and distance between nodes) were taken every week. Upon maturity the fruits were harvested, counted, weighed and preserved for analysis. Plants were then uprooted to record physical parameters. Fruits were subjected to quantitative estimation of protein and fat. Soil samples were subjected to chemical analysis (pH, EC_w, Organic carbon, Total kjeldahl nitrogen, Available phosphate, Potassium, Calcium and Magnesium [4].

RESULTS AND DISCUSSION

The vermicomposts were harvested after a 50- day period for the first set. This period was reduced by 5 and 9 days, respectively for the other two harvests. There was consistent increase in the production of vermicomposts in each unit from each successive harvest (Table 1). This can be attributed to the increase in the population of the earthworms, each unit started with 300 earthworms. However, this increase was greater and even more consistent in the rice straw and bagasse + rice straw units. Earthworms preferred cow dung along with plant litter and other plant debris in combination thereby converting it into the organic matter rich vermicompost at faster rate [5, 2, 6-8].

The pH remains slightly alkaline for all the samples but the most alkaline was the vermicompost from the combination of bagasse and rice straw {BV +RSV} (Table 2). Carbon is higher in {CON} as it was in undecomposed state. C: N ratio was observed to be 5.46, 6.91, 7.09 and 9.43 for {RSV}, {BV + RSV}, {BV} and {CON}, respectively (Table 2). The C: N ratio is an indication of litter degradation in soils and it is an

Table 1: Productivity of Vermicomposts from the Different Materials

Organic Material	Amount/ Kg	Cow dung / Kg	Average harvests / Kg	Average productivity / %
Bagasse	0.4	0.6	0.54 ± 0.14	54
Rice Straw	0.4	0.6	0.74 ± 0.02	74
Bagasse + Rice Straw	0.2 + 0.2	0.6	0.76 ± 0.02	76

Table 2: Comparison of Cow dung with Vermicomposts (Mean ± SD)

Parameters	{Con}	{BV}	{RSV}	{BV + RSV}
pH	7.40 ± 0.01	7.28 ± 0.03	7.51 ± 0.01	7.59 ± 0.01
EC (dSm^{-1})	1733.33 ± 24.09	533.33 ± 4.16	615.67 ± 7.09	563.67 ± 5.51
Organic carbon%	17.95 ± 0.73	6.52 ± 0.56	6.24 ± 0.46	6.64 ± 0.66
Nitrogen (%)	1.90 ± 0.03	0.92 ± 0.04	1.14 ± 0.06	0.96 ± 0.05
Phosphate (ppm)	190.78 ± 5.37	143.16 ± 1.94	178.97 ± 8.79	156.51 ± 19.29
Calcium (ppm)	5.65 ± 0.21	5.51 ± 0.04	6.35 ± 0.73	5.05 ± 0.06
Magnesium (ppm)	17.29 ± 2.11	16.43 ± 0.72	18. 27 ± 2.02	14.66 ± 0.47
Potassium (ppm)	62.10 ± 0.46	147.83 ± 5.34	25.47± 2.27	174.00 ± 4.19
Zinc (ppm)	62.90 ± 0.21	69.96 ± 0.22	79.64 ± 0.36	68.90 ± 0.44
Iron (ppm)	36.32 ± 1.74	11.92 ± 0.93	12.17 ± 0.68	8.45 ± 0.50
Copper (ppm)	1.23 ± 0.05	0.52 ± 0.18	0.55 ± 0.07	0.42 ± 0.02
Manganese (ppm)	251.38 ± 4.89	59.69 ± 0.17	83.01 ± 0.45	54.19 ± 0.08

Table 3: Plant Height (cm) (Mean ± SD)

Treatmentssss	Week 1	Week 2	Week 3	Week 4	Week 5	t - test
{CON}	24.60 ± 0.50	44.00 ± 1.00	96.67 ± 50.60	164.27 ± 76.35	175.00 ± 15.72	N
{BV}	23.33± 0.87	65.00 ± 20.07	124.00± 12.17	182.00 ± 19.08	215.33± 14.64	S
{RSV}	27.73 ± 3.31	58.33 ± 35.44	113.00 ± 47.44	223.33± 32.02	247.67 ± 42.77	S
{BV + RSV}	20.47 ± 4.29	45.33 ±18.50	81.33 ± 45.37	202.67 ± 48.88	250.67 ± 44.43	S
{CD}	30.20 ±15.09	73.76 ± 50.56	105.00 ± 57.38	213.33 ± 66.61	227.67 ± 31.13	S
{CHM}	34.07 ± 7.56	77.00 ± 13.89	123.33 ± 28.29	166.40 ± 23.08	224.00 ± 73.78	S

Confidence level 95 %: S {Significant}; N {Not Significant

Table 4: Number of leaves (Mean ± SD)

Treatments	Week 1	Week 2	Week 3	Week 4	Week 5	t - test
{CON}	20.00 ± 0.00	29.67± 1.15	39.67 ± 4.04	65.00 ± 11.79	67.00 ± 15.39	N
{BV}	20.00 ± 0.00	30.00 ± 1.73	48.33 ±13.58	51.00 ± 11.36	92.00± 9.64	S
{RSV}	21.67 ± 4.51	29.00 ± 5.20	47.33 ± 12.86	74.00 ± 5.57	93.33 ± 1.53	S
{BV + RSV}	20.00 ± 0.00	28.67 ± 4.93	51.00 ± 14.73	70.33 ±12.66	90.33 ± 8.62	S
{CD}	24.00 ± 5.00	26.33 ± 5.51	43.00 ± 15.39	71.00 ± 20.07	79.67 ± 8.62	S
{CHM}	24.00 ± 3.46	28.67 ± 3.51	43.67 ± 3.51	53.67 ± 4.04	111.00 ± 8.66	S

Confidence level 95 %: S {Significant}; N {Not Significant}

Table 5: Number of Nodes (Mean ± SD)

Treatments	Week 1	Week 2	Week 3	Week 4	Week 5	t - test
{CON}	6.00 ± 0.00	9.33 ± 0.58	12.33 ± 1.15	21.00 ± 3.61	21.67 ± 5.13	N
{BV}	5.00 ± 0.00	9.33 ± 0.58	13.00 ± 0.00	16.33 ± 3.79	30.00 ± 3.61	S
{RSV}	6.00 ±1.00	9.00 ± 1.73	15.00 ± 4.36	24.00 ± 2.00	27.00 ± 6.08	S
{BV + RSV}	5.67 ± 0.58	9.00 ± 1.73	16.33 ± 4.62	22.67 ± 4.16	34.33 ± 153	S
{CD}	7.00 ± 2.00	9.67 ± 2.52	14.00 ± 4.58	17.00 ± 9.64	27.33 ± 3.79	S
{CHM}	7.00 ±1.00	9.00 ± 1.00	15.00 ± 1.00	17.33 ± 1.15	36.33 ± 2.89	S

Confidence level 95 %: S {Significant}; N {Not Significant}

Table 6: Stem Circumference (cm) (Mean ± SD)

Treatments	Week 1	Week 2	Week 3	Week 4	Week 5	t- test
{CON}	2.27 ± 0.25	2.30 ± 0.62	2.00 ± 0.00	2.73 ± 0.57	2.43 ± 0.21	N
{BV}	2.33 ± 0.15	2.87 ± 0.25	2.53 ± 0.31	2.83 ± 0.21	3.37 ± 0.31	N
{RSV}	2.40 ± 0.40	2.77 ± 0.25	2.47 ± 0.29	3.17 ± 0.15	3.73 ± 0.32	N
{BV + RSV}	2.40 ± 0.10	2.50 ± 0.26	2.37 ± 0.06	3.10 ± 0.10	3.99 ± 0.32	N
{CD}	2.67 ± 0.40	2.40 ± 0.26	2.20 ± 0.17	3.07 ± 0.12	2.30 ± 0.10	N
{CHM}	3.23 ± 0.58	2.60 ± 0.30	3.27 ± 0.15	2.90 ± 0.10	2.97 ± 0.12	N

Confidence level 95 %: S {Significant}; N {Not Significant}

Table 7: Plant morphometry (Mean ± SD)

Treatments	Shoot length (cm)	Root length (cm)	Number of leaves	Surface area (cm^2)	Leaf Abscission
{CON}	175.00 ± 15.72	38.00 ± 8.89	67.00 ± 15.72	2680 ± 537.03	8.33 ± 0.58
{BV}	221.67 ± 9.02	42.67 ± 3.51	92.67 ± 12.22	3745.90 ± 795.05	7.33 ± 1.53
{RSV}	251.00 ± 40.45	45.67 ± 9.07	83.33 ± 17.67	3158.75 ± 1087.92	7.33 ± 1.53
{BV + RSV}	233.67 ± 32.13	43.33 ± 13.32	86.00 ± 15.87	3755.01 ± 503.72	6.67 ± 0.58
{CD}	229.33 ± 31.53	32.67 ± 16.80	65.67 ± 10.97	2804 ± 881.08	7.67 ± 0.58
{CHM}	224.00 ± 73.78	29.00 ± 7.00	111.00 ± 8.660	5032.65 ± 296.72	17.0 ± 1.41

Table 8: Fruit Parameters (Mean ± SD)

Treatments	Number of fruits	Fruit Length (cm)	Fruit Circumference (cm)	Number of seeds	Mass of fruit (g)
{CON}	2.00 ± 1.00	32.56 ± 2.22	2.19 ± 0.25	8.58 ± 2.24	9.32 ± 0.94
{BV}	3.00 ± 1.00	35.63 ± 3.59	2.80 ± 0.15	13.11 ± 0.54	12.57 ± 1.61
{RSV}	2.33 ± 0.58	38.84 ± 2.91	2.68 ± 0.03	13.83 ± 2.47	11.30 ± 1.52
{BV + RSV}	5.00 ± 1.00	37.74 ± 3.69	2.41 ± 0.32	13.53 ± 1.29	9.90 ± 3.32
{CD}	1.67 ± 1.53	18.20 ± 16.63	1.65 ± 1.43	6.58 ± 6.39	6.15 ± 5.66
{CHM}	2.67 ± 1.53	24.67 ± 6.29	2.20 ± 0.36	7.50 ± 3.04	7.05 ± 1.94

indicator of efficient and effective composting, the final value is important to determine the value of the finished compost as a soil amendment for growing crops. Carbon provides the primary energy source and nitrogen in critical for microbial growth. As the composting process proceeds the carbon content is expected to decrease because of it conversion to carbon dioxide while nitrogen is kept intact. Very high C: N ratio (above 80) greatly reduced the rate of natural composting. In this case, earthworm has effectly increased the rate and thus having a greater turnover [9].

There was significant increase in plant height over the five week period with treatments {BV+RSV}, {RSV}, {CD}, {BV} and {CHM} (Table 3). The greatest increase was observed with treatment {BV+RSV} followed by {RSV} then {CD}. Vermicomposts contain more than just micro and macro nutrients; they also have essential growth promoter hormones like auxins, cytokinins, gibberllins, ethylene and enzymes, vitamins that are microbially induced and excreted by earthworms and useful microorganisms like bacteria [10,11]. Chemical fertilizers on the other hand constituted mainly macronutrients soluble salts with no hormones. Also these nutrient have a high solubility rate as such a great deal is lost through leaching. This resulted in fast growth in the initial stages of planting and reduces subsequently due to lack of nutrients [8,9]. Treatment {CHM} had a significant increase in the number of leaves followed by {BV}, {RSV}, {BV + RSV} then {CD} (Table 4). The highest number of leaves in {CHM} is due to availability of nitrogen and phosphate in the chemical fertilizer. These fertilizers serve the purpose of "quick fix" with no regards for future consequences. The leaves had a higher surface area and were much greener. {CHM} treatment plant appeared healthier at the beginning but fade out to yellowing, evidence of lack of nutrients [12,9]. As with the number of leaves, the nodal count was also highest in the {CHM} treated plants followed {BV + RSV}, {BV}, {RSV} and then {CD} (Table 5). Circumference growth in *Phaseolus vulgaris* L. was insignificant in with all the treatments and showed a highly fluctuated pattern (Table 6). This is because the plant is a climber and as it grew the stem progressively had a reduced circumference. However, the mean stem circumference was highest in the {CHM} initially but reduced drastically. This is because of the high nitrogen, phosphate and potassium content. However, as growth proceeded, the circumference reduced due to nutrition exhaustion and leaching. The treatment {BV + RSV} had the thickest circumference because of its ability to retain nutrition for longer periods [12,9].

Number of leaves and surface area was greater in treatment {BV+RSV} and leaf abscission was minimum in treatment {BV+RSV} (Table 7). The root /shoot ratio is higher for {BV} {CHM} and {RSV} and then followed by {BV + RSV} and {CD} and {CON} (Table 7). In this case the root / shoot ratio was high because the vermicomposts consisted of nutrient that would promote such growth or had microorganisms which made available the nutrients [12]. It was evident that chemical fertilizer disrupts natural biological activity in the soil. Activity of Rhizobium/ nitrifying bacteria is affected and inhibited [12, 9, 13].

Vermicompost in the treatment {BV + RSV} indicated the best harvest in term of number of fruits while the fruit length was maximum in treatment {RSV}(Table 8). The fruit with the greatest mean circumference was harvested from treatment {BV} followed by {RSV} and {BV + RSV} (Table 8). The number of seeds is related to the fruit length. The longest fruits the more seeds it contained in its pod. This is an indication of the quality of fruit grown organically because the treatments {RSV}, {BV+RS} and {BV} had the highest number of seeds (Table 8). This is because the phosphate, nitrogen and other essential nutrients found in vermicompost. These nutrients are retained for a longer period, allowing for late absorption by the plant during bearing season. On the other hand, CHM (chemical fertilizers) must be added more frequently because it dissolved fast and leached out of the soil [9,13]. The highest mass of fruit was observed with treatment {BV} followed by {RSV} and {BV + RSV} (Table 8). Organic fertilizers have been known to promote growth of nitrogen fixing and phosphate solubilising bacteria. These are critical in plant overall growth thus, influencing fruit development [9, 13, 14]. Protein content of the fruits was consistent for treatments {CON}, {RSV}, {BV + RSV} and {CD} while lower levels were observed in {BV} followed by {CHM} (Table 9). *Phaseolus vulgaris* L. is known to have high amount of protein content. The amount of fat present in the fruit was variable but consistent with all the treatments.

Soil pH significantly increased for all the vermicomposts treatments while {CD} had increase but not significant (Table 10). {CHM} resulted in a decrease in the pH thereby making the soil more acidic. Soil pH is one of the most important soil properties that affect the availability of nutrients. Macronutrients tend to be less available in soils with low pH and micronutrients tend to be less available in soils with high pH [15]. Treatments {BV + RSV}, {RSV} and {BV} indicated significant increase in organic carbon (Table 11). Vermicomposts are rich in organic carbon content and have the ability to release these in to the soil very slowly. Significant increases in nitrogen were observed in [BV} may be attributed to enhanced activity of nitrogen fixing bacteria [9, 12] (Table 12). Significant increase was observed for treatments {BV + RSV} and {RSV} with regards to phosphates (Table 13). It may be because of the presence of phosphate solubilizing bacteria, which increase the phosphate content of the soil. There was significant increase in potassium levels in treatments {CHM}, {CD}, {BV+RSV}, {RSV} and {BV} respectively (Table 14). There were significant increases in magnesium concentration for {BV + RSV}, {RSV} and

Table 9: Biochemical analysis of fruits (Mean ± SD)

Treatments	Protein / %	Fat /%
{CON}	31.71 ± 0.47	2.14 ± 0.00
{BV}	25.40 ± 2.69	2.13 ± 0.16
{RSV}	31.65 ± 11.67	2.07 ± 0.06
{BV + RSV}	31.55 ± 0.04	2.61 ± 0.42
{CD}	31.51 ± 0.75	2.45 ± 0.11
{CHM}	21.52 ± 1.00	2.25 ± 0.06

Table 10: Soil pH (Mean ± SD)

Treatments	Initial soil	Final soil	Increase	t- test
{CON}	5.61 ± 0.04	5.61 ± 0.15	0.00	N
{BV}	5.61 ± 0.04	6.11 ± 0.07	0.50	S
{RSV}	5.61 ± 0.04	6.19 ± 0.01	0.58	S
{BV + RSV}	5.61 ± 0.04	6.30 ± 0.10	0.69	S
{CD}	5.61 ± 0.04	5.85 ± 0.13	0.24	N
{CHM}	5.61 ± 0.04	5.31 ± 0.34	-0.30	N

Confidence level 95 %: S {Significant}; N {Not Significant}- indicate decrease

Table 11: Organic carbon (%) (Mean ± SD)

Treatments	Initial soil	Final soil	Increase	t- test
{CON}	2.85 ± 0.71	6.53 ± 0.32	3.68	S
{BV}	2.85 ± 0.71	8.97 ± 0.69	6.12	S
{RSV}	2.85 ± 0.71	14.82 ± 1.53	11.97	S
{BV + RSV}	2.85 ± 0.71	18.68 ± 0.21	15.83	S
{CD}	2.85 ± 0.71	9.45 ± 2.67	6.60	N
{CHM}	2.85 ± 0.71	8.94 ± 0.97	6.09	N

Confidence level 95 %: S {Significant}; N {Not Significant}

Table 12: Total nitrogen (%) (Mean ± SD)

Treatments	Initial soil	Final soil	Increase	t- test
{CON}	0.90 ± 0.04	2.47 ± 0.3	1.57	N
{BV}	0.90 ± 0.04	3.52 ± 0.86	2.62	S
{RSV}	0.90 ± 0.04	2.38 ± 0.02	1.48	N
{BV + RSV}	0.90 ± 0.04	2.13 ± 0.41	1.23	S
{CD}	0.90 ± 0.04	1.87 ± 1.00	0.97	N
{CHM}	0.90 ± 0.04	1.94 ± 0.69	1.04	N

Confidence level 95 %: S {Significant}; N {Not Significant}

Table 13: Available phosphate (ppm) (Mean ± SD)

Treatments	Initial soil	Final soil	Increase	t- test
{CON}	155.17 ± 26.15	20.17 ± 3.63	-135	N
{BV}	155.17 ± 26.15	159.65 ± 86.51	4.48	N
{RSV}	155.17 ± 26.15	307.65 ± 10.71	152.48	S
{BV + RSV}	155.17 ± 26.15	559.37 ± 85.83	404.2	S
{CD}	155.17 ± 26.15	60.30 ± 53.62	-94.87	N
{CHM}	155.17 ± 26.15	317.68 ± 106.29	-162.51	N

Confidence level 95 %: S {Significant}; N {Not Significant}- indicate decrease

Table 14: Potassium (ppm) (Mean ± SD)

Treatments	Initial soil	Final soil	Increase	t- test
{CON}	45.67 ± 1.50	56.85 ± 3.04	11.18	N
{BV}	45.67 ± 1.50	54.55 ± 2.05	8.88	S
{RSV}	45.67 ± 1.50	57.80 ±1.98	12.13	S
{BV + RSV}	45.67 ± 1.50	59.95 ± 6.29	14.28	S
{CD}	45.67 ± 1.50	68.15 ± 4.88	22.48	S
{CHM}	45.67 ± 1.50	151.30 ± 6.65	105.63	S

Confidence level 95 %: S {Significant}; N {Not Significant}

Table 15: Magnesium (ppm) (Mean ± SD)

Treatments	Initial soil	Final soil	Increase	t- test
{CON}	11.83 ± 0.62	14.80 ± 0.18	2.97	S
{BV}	11.83 ± 0.62	17.34 ± 0.50	5.51	S
{RSV}	11.83 ± 0.62	18.18 ± 0.81	6.35	S
{BV + RSV}	11.83 ± 0.62	19.36 ± 1.06	7.53	S
{CD}	11.83 ± 0.62	14.88 ± 0.00	3.05	N
{CHM}	11.83 ± 0.62	13.94 ± 0.85	2.11	N

Confidence level 95 %: S {Significant}; N {Not Significant}

Table 16: Calcium (ppm) (Mean ± SD)

Treatments	Initial soil	Final soil	Increase	t- test
{CON}	9.03 ± 0.19	9.75 ± 0.03	0.72	N
{BV}	9.03 ± 0.19	9.82 ± 0.86	0.79	N
{RSV}	9.03 ± 0.19	10.38 ±0.87	1.35	N
{BV + RSV}	9.03 ± 0.19	10.60 ± 0.51	1.57	N
{CD}	9.03 ± 0.19	15.80 ± 7.73	6.77	N
{CHM}	9.03 ± 0.19	9.01 ± 0.56	-0.02	N

Confidence level 95 %: S {Significant}; N {Not Significant}- indicate decrease

{BV} (Table 15). All the samples except {CHM} indicated an increase in calcium concentration though not significant. {CHM} had reduced amount because what ever little was there used up and there no replacement because it is highly soluble in Ca^{2+} form [8, 9] (Table 16). Thus vermicompost produced from combination of sugarcane bagasse and rice straw showed better results in terms of productivity of vermicompost and its subsequent application on *Phaseolus vulgaris* L in many plant growth parameters and productivity levels that is a result of nutrients available in vermicompost {BV + RSV} that a play critical role in improvement soil quality [16].

CONCLUSION

Composting of bagasse, rice straw and a combination of bagasse with rice straw were successful. However, the composting process of the combination was faster and the productivity was higher. For combination, the average productivity was 76 % followed by rice straw with 74 % and bagasse with 54 %. Generally, the physiochemical properties of the rice straw and the combinations were conducive and enhance growth and yield of *Phaseolus vulgaris* L. The final soil analysis also indicated signs of improvement in nutrient content. It cab be concluded that growth parameters for chemical grown crops and organically grown crops are comparable. Chemical fertilizers, especially nitrogen based, shown spectacular growth and productivity in the field but this is short lived. The high level of these chemical added to the soil are not usually absorbed completely by the plants. The balance cannot remain in the soil for the next season. They are either leached or formed complexes with high levels of metal ions to form undesirable complexes [16]. Constant use of chemical fertilizer increases leaching because of depletion of organic carbon [9]. On the other hand, a vermicompost form fine stable granular organic matter that assist in the aeration, released mucus that are hygroscopic absorbs water and prevents water logging and improves water holding capacity. Vermicompost added to the soil releases nutrient slowly and consistently and enables the plant to absorb these nutrients more readily. Soils enriched with vermicompost provide additional substances that are not found in the chemicals [10, 16].

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