THE EFFECT OF DIFFERENT GREEN AND ANIMAL MANURES ON THE GROWTH AND YIELD OF POTTED LETTUCE, CABBAGE AND CAULIFLOWER

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ABSTRACT

The objectives of the study were to determine the growth and yield and profitability of growing potted cabbage, cauliflower and lettuce as influenced by different green plant and animal manures. The seven experimental treatments included leaf manure of kamachile (*Pithecellobium dulce*), ipil-ipil (*Leucaena leucocephala*), madre de cacao (*Gliricidia sepium*); poultry manure, commercial compost, inorganic fertilizer and the control (without fertilizer). These treatments were laid out in a randomized complete block design (RCBD) with three replications. Results revealed that all agronomic characteristics of the three crops were significantly ($p < 0.05$) affected by the different manures applied. The data show that the growth and yield of lettuce, cabbage and cauliflower fertilized with kamachile manure, ipil-ipil manure, madre de cacao, poultry manure and inorganic fertilizer were significantly better than those of plants which were either unfertilized or fertilized with commercial compost. Cost and return analysis indicated that among the different manures in lettuce, ipil-ipil manure resulted in the highest ROI (Return on investment) of 103.71%. That of the unfertilized plants was -70.10%. In cabbage, only the addition of poultry manure gave a positive ROI (38.28 %). All the other treatments gave a negative ROI (-14.45% to -100%). The negative ROI indicate that the nutrients supplied by the manures are not enough to support the needs of cabbage and cauliflower for them to give economic yield.

INTRODUCTION

Cabbage (*Brassica oleracea* L. capitata group), cauliflower (*Brassica oleracea* L botrytis group) and lettuce (*Lactuca sativa* L) are usually grown in the highlands but can be grown in the lowland during the cool months of the year. These vegetables contain essential nutrients such as protein, niacin, ascorbic acid, carbohydrates, ash, calcium, potassium and phosphorus (Knot & Deanon, 1997) and thousands of different phytochemicals which help fight and prevent diseases such as colds, flu and even help shrink tumors and malignancies and stop cancer cell formation. Carrots, cabbage, cauliflower and broccoli are among the vegetables with very strong anti-cancer properties (Undan, et al, 2002) with the increase in population and decrease in land allotted to the growing of crops. These plants can be grown in pots at home, to provide families with a ready supply of fresh vegetables. These can be placed on rooftops, decks, balconies and/or doorstep. Since it is a small scale production, it can be managed organically.

The use of green manures, animal manures or the combination of these two would improve the fertility and work ability of the soil. Dry poultry manure contain 1.50% N, 1.00% P and 0.50% K based on proximate analysis (IIRR,1992) while results of proximate analysis by the Bureau of Soils indicated 2.01% N, 5.89% P and 2.44 % K. Leucaena (*L. leucocephala*) leaves as organic fertilizer can supply 4.29% N, 0.19 % P and 1.37% K while madre cacao leaves can provide 1.81% N, 1.81% P and 21.85% K (IIRR, n.d.). The incorporation of madre de cacao at three tons per hectare two weeks before transplanting can supply 90 kg N/ha based on a 3.10 % nitrogen analysis (Constantino & Mercado, 1991). Generally, it would take two to four weeks for green manures mixed with potted soils to decompose, and can be used as medium for planting. For this reason, many farmers opt to use commercial compost because it is available in the market and is ready for use.

Objectives of the study

This study was conducted to determine the growth and yield of potted cabbage, cauliflower and lettuce as influenced by different green plant and animal manures.

Specifically, this study aimed to:

1. determine the agronomic characteristics of cabbage, cauliflower and

lettuce fertilized with different green and animal manures; and,

2. determine the productivity and profitability of growing potted cabbage, cauliflower and lettuce using different green and animal manures.

Time and place of the study. The three crops were planted at different dates at three-week intervals at the back of the College of Agriculture Building. Lettuce was sown first on August 13 and harvested on October 24, 2007; Cabbage was from September 4, 2007 to February 25, 2008; while Cauliflower was from September 26, 2007 to January 22, 2008.

METHODOLOGY

Plant manures such as ipil-ipil (*Leucaena leucocephala*), madre de cacao (*Gliricidia sepium*), and kamachili (*Pithecellobium dulce*), animal manure (poultry), commercial compost and inorganic fertilizer were used as experimental treatments to fertilize potted cabbage, lettuce and cauliflower. The treatments were laid out in a randomized complete block design (RCBD) with three replications. Ten kg of 2:1 part garden soil and sand were placed in each medium-sized (10 in. dia) plastic pots and incorporated with the designated manures/fertilizers. One kilogram of each of the green manures were allowed to decompose for two weeks. There were eight pots used for every treatment. The amount of poultry manure, commercial organic and inorganic fertilizers were based on the general recommendation of 240-60-60 kg of N, $P_2 0_5$ and $K_2 0$/ha. Seeds were sown in a mixture of 1:1:1 part garden soil, sand and humus. Lettuce were transplanted three weeks after sowing while Cabbage and Cauliflower seedlings at five weeks after sowing. Each crop was planted three week after each other.

Watering of plants was done only when needed. Weeds were controlled by hand pulling while insect pests were alternately controlled with neem oil extract, makabuhai and hot pepper extracts while leaf blight was controlled using the coleus and horseradish extracts.

Data collected include plant height, number of functional leaves, number of days to curd and head formation and to harvesting, percentage productive and non-productive plants and yield. Statistical analysis for a randomized complete block design was used and significant treatment mean differences were determined using the Duncan's multiple range test at the 5% level of probability. The ROI was calculated by dividing the net income by production cost.

RESULTS AND DISCUSSION

Lettuce

Number of leaves. Leaf count at one week after transplanting (WAT) (Table 1) showed that lettuce applied with poultry manure had significantly more leaves than plants in the other treatments. Data recorded at three to five WAT showed that plants from pots applied with fertilizer produced significantly more leaves than those plants without fertilizers.

Table 1. Number of Leaves of Lettuce Taken at Weekly Intervals.

Treatments	Weeks after Transplanting (WAT)				
	1	2	3	4	5
Kamachile manure	4.00[a]	6.40[a]	7.00[a]	9.13[a]	10.53[a]
Ipil-ipil manure	3.73[d]	6.00[a]	6.40[a]	9.40[a]	11.20[a]
Madre de cacao	3.87[c]	6.27[a]	6.87[a]	8.87[a]	11.20[a]
Poultry manure	4.20[a]	6.33[a]	6.87[a]	8.93[a]	10.13[a]
Commercial compost	3.87[c]	5.40[b]	6.47[a]	8.93[a]	10.40[a]
Inorganic fertilizer	3.87[c]	6.27[a]	6.27[a]	9.47[a]	11.13[a]
Control (Unfertilized)	3.47[a]	4.33[c]	4.20[b]	5.00[b]	6.13[b]

[abcd] Treatment means followed by the same letter superscript are not significantly different over each other at the 5 % level of probability.

Plant Height. Significant differences were observed in height (Table 2) of lettuce. Apparent differences on plant height were noted at four and five WAT, that is, plants applied with ipil-ipil and madre de cacao were as tall as those applied with inorganic fertilizer. The unfertilized plants were the shortest.

Table 2. Periodic Height of Lettuce

Treatments	1 WAT	2 WAT	3 WAT	4 WAT	5 WAT
	cm				
Kamachile manure	6.96^{ns}	12.23^{ab}	15.79^{a}	18.19^{b}	19.97^{b}
Ipil-ipil manure	6.96	12.59^{ab}	16.75^{a}	19.88^{a}	21.39^{a}
Madre de cacao	7.82	13.35^{a}	17.91^{a}	20.48^{a}	21.81^{a}
Poultry manure	6.74	12.54^{ab}	16.31^{a}	18.31^{b}	19.76^{b}
Commercial compost	7.76	12.06^{b}	16.27^{a}	18.32^{b}	19.53^{c}
Inorganic fertilizer	7.36	12.06^{b}	16.89^{a}	20.47^{a}	21.23^{a}
Control (Unfertilized)	5.94	8.92^{c}	10.16^{b}	10.55^{c}	12.15^{d}

^{abcd}Treatment means followed by the same letter superscript are not significantly different over each other at the 5% level of probability.

^{ns}not significant applied with ipil-ipil and madre de cacao were as tall as those applied with inorganic fertilizer. The unfertilized plants were the shortest.

Number of days from sowing to loose heading and harvesting. The application of ipil-ipil resulted in the earliest formation of loose heads (Table 3) while the unfertilized plants had the latest. Loose head formation in all other treatments took place almost at the same time. Plants applied with ipil-ipil, kamachili and inorganic fertilizer were harvested earlier than others. On the other hand, harvesting of plants in the madre de cacao, poultry manure, commercial compost and the control treatments was delayed for 2 to 4 days.

Yield. Generally, the application of green manures and inorganic fertilizer resulted in significantly highest computed yield ranging from 11,061.07 to 12,099.95 kg/ha. These were followed by the yields of lettuce applied with poultry manure and commercial compost at 8,022.62 and 4,755.54 kg/ha, respectively. As discussed earlier, the leaves of the fertilized plants were significantly more than the unfertilized plants which explain the significantly higher yield of the fertilized plants. The more leaves the more photosynthesizing organs, more manufactured food for the production of edible leaves. The lowest yield (1,200 kg/ha) was obtained from the unfertilized plants (Table 4).

It is apparent that the agronomic characters of lettuce had significantly influenced plant yield. The low yield in plants applied with compost could be attributed to the low nitrogen analysis of the materials (0.83% based on the fertilizer label).

Table 3. Average Number of Days from Sowing to Loose Heading and Harvesting.

Treatments	Loose Heading	Harvesting
	days	
Kamachile manure	52.83[b]	65.80[c]
Ipil-ipil manure	51.47[c]	65.60[c]
Madre de cacao	53.53[b]	68.33[ab]
Poultry manure	54.77[b]	68.63[ab]
Commercial compost	54.60[b]	70.00[a]
Inorganic fertilizer	52.87[b]	67.40[bc]
Control (Unfertilized)	61.00[a]	70.00[a]

c.v. (%) = 2.48

[abc]Treatment means followed by the same letter superscript are not significantly different over each other at the 5% level of probability.

Cost and Return Analysis. Among the treatments, the use of inorganic fertilizer resulted in the highest return on investment (ROI) of 171.81%, which is 68.10%, 74.01%, 82.13% and 122.81% higher than those of plants in the ipil-ipil manure, poultry manure, madre de cacao and kamachile treatments, respectively (Table 5). These results indicate that ipil-ipil manure can be a good substitute for inorganic fertilizer in growing potted lettuce.

Table 4. Computed Yield of Lettuce per Hectare.

Treatments	Replication			Mean
	I	II	III	
Kamachile manure	10,899.96	12,949.95	11,449.95	11,766.62[a]
Ipil-ipil manure	13,416.61	10,149.96	12,733.28	12,099.95[a]
Madre de cacao	9,866.63	11,933.29	11,999.95	11,266.62[a]
Poultry manure	9,183.30	7,533.30	7,349.97	8,022.19[b]
Commercial compost	3,766.65	5,083.31	5,416.65	4,755.54[c]
Inorganic fertilizer	9,899.96	10,383.29	12,899.95	11,061.07[a]
Control (Unfertilized)	900.00	1,199.99	1,500.00	1,200.00[d]

c.v. (%) = 14.16

[abcd]Treatment means followed by the same letter superscript are not significantly different over each other at the 5 % level of probability.

Table 5. Cost and Return Analysis for Lettuce

Treatments	Yield	Gross Income	Production Cost	Net Income	ROI
	kg/ha	P			-%-
Kamachile manure	11,766.62	211,799.60	1,416,661.00	701,330.60	49.00
Ipil-ipil manure	12,099.95	2,177,991.00	1,069,162.39	1,108,828.61	103.71
Madre de cacao	1,266.62	2,027,991.60	1,069,162.39	958,829.21	89.68
Poultry manure	8,022.19	1,443,994.20	729,997.08	713,997.12	97.80
Commercial compost	4,755.54	855,997.20	756,663.64	99,333.56	13.13
Inorganic fertilizer	11,061.07	1,990,992.60	732,497.07	1,258,495.53	171.81
Unfertilized	1,200.00	216,000.00	722,497.11	-506,497.11	-70.10

Price/kg = P180

Cabbage

Number of leaves. Significant differences were noted on periodic count of leaves of cabbage (Table 6). At two weeks after transplanting (WAT), plants with poultry manure ipil-ipil and kamachile manure had significantly more leaves but those plants with ipil-ipil and kamachile manure have almost similar number of leaves as those plants in the other treatments. Data at four WAT showed a significantly highest leaf count on plants with poultry manure and plant manures over those plants with commercial compost and the unfertilized plants.

Table 6. Average Number of Leaves of Cabbage Taken at Bi-weekly Intervals.

Treatments	Weeks after Transplanting			
	2	4	6	8
Kamachile manure	8.47^{ab}	10.13^{ab}	12.40^{a}	16.93^{a}
Ipil-ipil manure	8.47^{ab}	10.07^{ab}	11.67^{a}	15.87^{ab}
Madre de cacao	7.93^{b}	9.40^{abc}	10.87^{a}	14.60^{b}
Poultry manure	9.00^{a}	10.93^{a}	9.80^{ab}	15.33^{ab}
Commercial compost	7.87^{b}	8.27^{cd}	7.73^{b}	10.87^{c}
Inorganic fertilizer	7.67^{b}	9.33^{bc}	11.00^{a}	14.43^{b}
Control (Unfertilized)	7.80^{b}	7.47^{cd}	7.73^{b}	11.07^{c}
c.v. (%)	5.61	8.54	13.70	20.18

^{abcd}Treatment means followed by the same letter superscript are not significantly different over each other at the 5 % level of probability.

When plants were towards maximum vegetative stage (6 to 8 WAT), plants fertilized with plant manures, inorganic fertilizer and poultry manure had significantly the highest number of leaves. However, those plants (6 WAT) in pots added with poultry manure had about the same number of leaves as those plants without fertilizer and those plants applied with commercial compost. Data at 8 WAT revealed that plants fertilized with kamachile manure produced the most leaves and were as many as those from plants fertilized with ipil-ipil manure and poultry manure. Moreover, these were significantly more than those of plants fertilized with commercial composts and of the unfertilized plants.

Plant height. Plant height showed significant variations among the different treatments (Table 7). Data at two WAT showed that plants applied with plant and animal manures were taller than those in the other treatments. It follows almost the same trend on the fourth WAT except those grown in madre de cacao. On the sixth and eighth WAT, plants supplied with different fertilizers were as tall as each other except those with commercial compost.

Table 7. Periodic Height of Cabbage

Treatments	Weeks after Transplanting			
	2	4	6	8
Kamachile manure	10.47^{ab}	17.93^{ab}	20.33^{ab}	20.90^{ab}
Ipil-ipil manure	10.50^{ab}	18.33^{ab}	21.17^{a}	21.87^{ab}
Madre de cacao	10.07^{abc}	16.47^{b}	20.77^{a}	20.60^{abc}
Poultry manure	11.77^{a}	20.77^{a}	21.77^{a}	22.23^{a}
Commercial compost	8.07^{d}	13.40^{c}	15.27^{c}	15.93^{c}
Inorganic fertilizer	8.50^{cd}	16.83^{b}	17.77^{abc}	22.10^{a}
Control (Unfertilized)	9.30^{bcd}	13.30^{c}	15.43^{bc}	16.90^{bc}

c.v. (%) = 9.45

^{abcd}Treatment means followed by the same letter superscript are not significantly different over each other at the 5 % level of probability.

Number of days from sowing to heading and harvesting. All fertilized plants except those added with commercial compost (Table 8) formed heads. The unfertilized plants likewise did not develop head. Plants fertilized with ipil-ipil manure, poultry manure, kamachile manure and inorganic fertilizer were harvested earlier than those fertilized with madre de cacao manure. The lower nutrient nitrogen supplied by madre de cacao (1.81%) (IIRR, n.d.) was not enough to promote plant growth that resulted in the late maturity.

Table 8. Days from Sowing to Heading and Harvesting.*

Treatments	Heading	Harvesting
	---------- days ----------	
Kamachile manure	90.80[a]	154.93[b]
Ipil-ipil manure	92.47[a]	151.43[b]
Madre de cacao	102.20[a]	170.00[a]
Poultry manure	88.80[a]	154.13[b]
Commercial compost	0.00[b]	0.00[c]
Inorganic fertilizer	86.07[a]	153.40[b]
Control (Unfertilized)	0.00[b]	0.00[c]

c.v. (%)=2.82

Data were transformed by square root transformation prior to analysis of variance.

[abcd]Treatment means followed by the same letter superscript are not significantly different over each other at the 5 % level of probability.

Diameter and weight per head and percent marketable head. The data (Table 9) revealed that cabbage plants applied with kamachile manure, ipil-ipil manure, poultry manure and inorganic fertilizer had significantly produced the widest and heaviest heads and the highest percentage of marketable heads. The insufficient nutrient nitrogen in pots with commercial compost (0.83% N) and pots without fertilizer resulted in non head formation, thus, no harvesting was done.

Table 9. Mean Diameter of Head, Weight per Head and Percent Marketable Heads.*

Treatments	Diameter	Weight	Marketable Heads
	___ cm ___	___ g ___	___ % ___
Kamachile manure	7.39[a]	157.27[a]	86.67[a]
Ipil-ipil manure	6.91[a]	110.60[ab]	80.00[a]
Madre de cacao	5.38[b]	81.88[b]	10.00[b]
Poultry manure	6.86[a]	124.60[ab]	73.33[a]
Commercial compost	0.00[c]	0.00[c]	0.00[c]
Inorganic fertilizer	6.58[a]	105.73[ab]	60.00[a]
Control (Unfertilized)	0.00[c]	0.00[c]	0.00[c]

c.v. (%) = 3.73

*Data were transformed by square root transformation prior to analysis of variance.

[abc]Treatment means followed by the same letter superscript are not significantly different over each other at the 5 % level of probability.

Plant yield. The highest yield (Table 10) was obtained from plants applied with kamachile manure which did not significantly ($P<0.05$) differ from those fertilized with poultry manure, ipil-ipil manure and inorganic fertilizer. Among plants which produced heads, those in the madre de cacao treatment yielded the lowest, although this is not significantly lower than the yields of plants in the ipil-ipil, poultry manure and the inorganic fertilizer treatments. Plants fertilized with commercial compost and those without fertilizer failed to produce cabbage heads.

Cost and return analysis. Based on the cost and return analysis (Table 11), potted cabbage production has a net loss value for almost all of the treatments except for those grown with poultry manure. The application of poultry manure resulted in a net income of P172,461.80 giving a return on investment of 38.28%.

Table 10. Yield of Cabbage per Hectare*

Treatments	Replication			Mean
	I	II	III	
	kg/ha			
Kamachile manure	9,520.00	8,830.00	5,240.00	7,863.33 [a]
Ipil-ipil manure	5,440.00	4,210.00	6,940.00	5,530.00 [ab]
Madre de cacao	4,912.50	3,030.00	4,340.00	4,094.00 [b]
Poultry manure	5,630.00	7,810.00	5,250.00	6,230.00 [ab]
Commercial compost	0.00	0.00	0.00	0.00 [c]
Inorganic fertilizer	5,590.00	5,170.00	5,100.00	5,286.67 [ab]
Control (Unfertilized)	0.00	0.00	0.00	0.00 [c]

c.v. (%) = 1.89

*Data were transformed by square root transformation prior to analysis of variance.

[abcd]Treatment means followed by the same letter superscript are not significantly different over each other at the 5 % level of probability.

Cauliflower

Number of leaves. At two WAT, plants fertilized with inorganic fertilizer had significantly the most number of leaves while non significant mean differences were when plants were at four WAT (Table 12). At six WAT, more leaves were found on plants fertilized with kamachile manure, ipil-ipil manure, inorganic fertilizer and poultry manure than in plants in the other

treatments. At eight WAT, plants with inorganic fertilizer, kamachile and ipil-ipil manure were significantly the tallest. Plants with madre de cacao, commercial compost and with no fertilizer were the shortest.

Table 11. Cost and Return Analysis for Cabbage

Treatments	Yield	Gross Income	Production Cost	Net Income	ROI
	kg/ha		P		%
Kamachile manure	7,863.33	786,350	1,088,000.00	- 301650.00	- 27.72
Ipil-ipil manure	5,530.00	553,000	820,000.00	- 267000.00	- 32.56
Madre de cacao	4,094.00	409,400	820,000.00	- 410600.00	- 50.07
Poultry manure	6,230.00	623,000	450,538.20	172461.80	38.28
Commercial compost	0.00	0	632,500.00	- 632500.00	- 100.00
Inorganic fertilizer	5,286.67	528,667	618,000.00	- 89333.00	- 14.45
Unfertilized	0.00	0	612,000.00	- 612,000.00	- 100.00

Note: Cabbage heads were sold at P100/kg based on the prevailing market price of pesticide-free cabbage on February 2008.

Table 12. Number of Leaves of Cauliflower Taken at Bi-weekly Intervals

Treatments	2 WAT	4 WAT	6 WAT	8 WAT
Kamachile manure	6.50^{b}	6.60^{ns}	11.00^{a}	13.60^{ab}
Ipil-ipil manure	6.20^{bc}	6.50	10.73^{a}	12.93^{ab}
Madre de cacao	5.10^{d}	5.50	7.60^{b}	9.80^{c}
Poultry manure	6.60^{b}	6.90	9.70^{a}	12.20^{b}
Commercial compost	5.50^{cd}	5.70	8.30^{b}	9.60^{c}
Inorganic fertilizer	7.40^{a}	6.90	10.67^{a}	13.87^{a}
Control (Unfertilized)	5.70^{cd}	5.50	7.47^{b}	8.67^{c}

^{abcd}Treatment means followed by the same letter superscript are not significantly different over each other at the 5 % level of probability.

^{ns}not significant at the 5 % level of probability

Height. As shown in Table 13, plant height at two WAT was not significantly affected by the different fertilizers used. When plants were at four and six WAT, plants applied with inorganic fertilizer, ipil-ipil, kamachile and poultry manure were significantly the tallest. Furthermore, data at the 8 WAT revealed that plants fertilized with inorganic fertilizer were as tall as those plants in pots with ipil-ipil manure, but were significantly taller than plants fertilized with kamachile manure. The shortest plants were those without any fertilizer.

Table 13. Periodic Height of Cauliflower Taken at Bi-weekly Intervals

Treatments	2 WAT	4 WAT	6 WAT	8 WAT
	cm			
Kamachile manure	10.90^{ns}	20.17^{a}	27.90^{a}	33.82^{b}
Ipil-ipil manure	11.23	20.87^{a}	27.40^{a}	35.12^{ab}
Madre de cacao	9.59	13.63^{bc}	17.97^{bc}	26.48^{cd}
Poultry manure	11.77	19.63^{a}	25.63^{a}	29.67^{c}
Commercial compost	10.51	16.23^{b}	20.23^{b}	25.29^{d}
Inorganic fertilizer	12.63	22.37^{a}	28.80^{a}	37.91^{a}
Control (Unfertilized)	9.08	11.33^{c}	15.63^{c}	22.11^{c}

c.v. (%) =2.05

^{abcd}Treatment means followed by the same letter superscript are not significantly different over each other at the 5 % level of probability.

^{ns}not significant at the 5 % level of probability

Days from sowing to curd development and harvesting. In Table 14, revealed that plants fertilized with kamachile manure, inorganic fertilizer, ipil-ipil manure and poultry manure had significantly formed curds and were harvested earlier than the rest of the treatments. Curd development of plants in these treatments was earlier by 16.13 to 19.70 days while harvesting was earlier by 9.60 to 13.93 days compared to the unfertilized plants.

Table 14. Number of Days from Sowing to Curd Development and Harvesting

Treatments	Curd Development	Harvesting
	days	
Kamachile manure	88.80^{b}	108.07^{c}
Ipil-ipil manure	90.08^{b}	112.40^{bc}
Madre de cacao	103.73^{a}	118.33^{ab}
Poultry manure	91.37^{b}	109.67^{c}
Commercial compost	106.00^{a}	121.67^{a}
Inorganic fertilizer	89.67^{b}	111.90^{c}
Control (Unfertilized)	108.50^{a}	122.00^{ab}

c.v. (%) = 3.03

^{Abc}Treatment means followed by the same letter superscript are not significantly different over each other at the 5 % level of probability.

Diameter and weight of curd per plant and percent marketable curds . The widest and the heaviest curds (Table 15) were obtained from plants fertilized with kamachile manure and inorganic fertilizer. However, those plants applied with inorganic fertilizer produced curds of the same diameter and weight as those of plants fertilized with ipil-ipil manure. The smallest and the lightest curds were produced by the unfertilized plants. The highest percentage of marketable curds were obtained from plants fertilized with kamachile, ipil-ipil and inorganic fertilizer.

Table 15. Mean Diameter and Weight of Curd and Percent Marketable Curds

Treatments	Diameter	Weight	Marketable Curds
	___ cm___	___ g ___	___ % ___
Kamachile manure	7.69[a]	70.46[a]	93.33[a]
Ipil-ipil manure	7.36[b]	64.33[b]	93.33[a]
Madre de cacao	3.93[d]	21.46[d]	0.00[c]
Poultry manure	5.97[c]	40.60[c]	26.67[b]
Commercial compost	2.71[e]	12.37[e]	0.00[c]
Inorganic fertilizer	7.56[ab]	67.36[ab]	93.30[a]
Control (Unfertilized)	2.27[f]	5.48[f]	0.00[c]

c.v. (%) = 23.08

[abcde]Treatment means followed by the same letter superscript are not significantly different over each other at the 5 % level of probability.

Yield. The application of kamachile manure resulted in the highest yield of 3, 533 kg/ha but this was not significantly higher than those of plants with inorganic fertilizer which yielded 3,366.67 kg/ha. Cauliflower applied with ipil-ipil manure produced almost the same yield as the inorganic fertilizer-treated plants. These yields were lower compared to the yields obtained by Landero in 2005. The discrepancy in the yield could be due to the reduction in the amount of soil used from 15 kg to 10 kg.

Table 16. Yield of Cauliflower per Hectare

Treatments	Replication			Mean
	I	II	III	
	kg/ha			
Kamachile manure	3,890.00	3,225.00	3,455.00	3,523.33[a]
Ipil-ipil manure	2,960.00	3,050.00	3,640.00	3,216.67[b]
Madre de cacao	910.00	1,060.00	1,250.00	1,073.33[d]
Poultry manure	1,400.00	2,280.00	2,421.00	2,030.00[c]
Commercial compost	557.00	401.00	898.00	618.67[e]
Inorganic fertilizer	3,660.00	3,565.00	2,875.00	3,368.33[ab]
Control (Unfertilized)	264.00	234.00	224.00	240.67[f]

c.v. (%) = 17.75

[abcdde]Treatment means followed by the same letter superscript are not significantly different over each other at the 5 % level of probability.

Cost and return analysis. Potted cauliflower production using the different manures resulted in a negative return on investment (ROI) including those plants fertilized with inorganic fertilizer (Table 17).

Table 17. Cost and return analysis for cauliflower.

Treatments	Yield	Gross Income	Production Cost	Net Income	ROI
	kg/ha		P		%
Kamachile manure	3,523.33	634,199.40	1,088,000.00	- 453,800.60	- 41.71
Ipil-ipil manure	3,216.67	579,000.60	820,000.00	- 240,999.40	- 29.39
Madre de cacao	1,073.33	193,199.40	820,000.00	- 626,800.60	- 76.43
Poultry manure	2,030.00	365,400.00	450,538.20	- 85,138.20	- 18.90
Commercial compost *	618.67	111,360.60	632,500.00	- 521,139.40	- 82.39
Inorganic	3,368.33	606,299.40	618,000.00	- 11,700.60	- 1.89
Unfertilized	240.67	43,320.60	612,000.00	- 568,679.40	- 92.92

Note: Cauliflower curds were sold at P180/kg based on the prevailing market price of pesticide-free cabbage on January 2008.

DISCUSSION

Generally the agronomic characteristics and yield of lettuce applied with organic fertilizer were better than the unfertilized plants. Moreover, among the fertilized lettuce, those applied with ipil-ipil had the highest ROI.

The incorporation of kamachile and ipil-ipil in cauliflower and cabbage resulted in the heaviest heads and curds which were almost the same as those of plants applied with inorganic fertilizer.

However, those applied with poultry manure had the highest ROI because it entailed least labor cost in the procurement and application.

Furthermore, the use of organic manure is promising in vegetable production because this improves soil aggregation, nutrient availability and water holding capacity (Havlin, et. al. 2005).

CONCLUSION AND RECOMMENDATION

Based on the results of the study, the use of ipil-ipil manure in potted lettuce is recommended since it has the highest ROI. Kamachile and ipil-ipil manure showed promising results in cabbage and cauliflower production. These plant manures have potential as organic fertilizers. From these results, a follow up study using higher amounts of soil and manures is recommended to meet the needs of the plant from head and curd formation until harvest.

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