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Local Government Engagement in Solid Waste Management cum Organic Fertilizer Production in Support to High Value Vegetable Production

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Waste accumulation and disposal in rural and urban setting continues to be a major problem in the country. The project aimed to showcase local government engagement in solid waste management and the use of solid waste in organic fertilizer production that can supplement inorganic fertilizer in high value vegetable production.
Progression of implementing strategies were effected starting from consultation with stakeholders; expression of commitment; capability building and assistance in the development and implementation of the local government unit's (LGU) Ecological Solid Waste Management (ESWM) Plan and the attendant intervention to improve organic fertilizer production process and product thereof.
A workable ESWM Plan was implemented by the concerned LGU. Segregated household/market wastes were mixed with quail or chicken manure, carbonized rice hull at 3:1:0.5 ratio. The *Trichoderma sp.* isolated from carabao manure was added at the rate of 2 kg per ton of pile to hasten the decomposition process.
Positive results were generated in the recommended technical intervention in organic fertilizer production with an improved total NPK of 6.72% and with shorter decomposition period. Efficacy testing on bitter gourd, tomato and cauliflower showed improvement in crop yield brought about by the addition of the organic fertilizer produced with intervention to half the recommended rate of inorganic fertilizer.

Keywords: Solid waste management, local government engagement, organic fertilizer, efficacy

Introduction

Waste accumulation and disposal in rural and urban setting has become and continued to be a major problem. The problem is complex and entails strong political will; discipline on the part of the populace; and the need for a massive education and information campaign to all sectors of the society to

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contribute for a successful waste management. The problem of increasing volume of waste and proper disposal facilities continue to burden our local government units (LGU). For every municipality, large portion of government funds every year are spent in collecting and disposal of garbage, yet, alarming environmental pollution, which is a threat to human health, continued to be felt. The Philippine government the Ecological Solid Waste Management Act of 2000 in order to solve the problem on solid waste in the country. In spite of this, waste accumulation continued to be a problem and unless concerted effort is done at grassroots level like schools and barangays, this problem will remain as a monster that the government has to fight indefinitely (Aganon *et al.,* 2005).

A study conducted by Aganon *et al.* (2000) showed that each household generates about 0.5 kg of waste/day. In Angeles City, Pampanga in the Philippines, 125 tons/day is generated with the biodegradable market wastes recorded at about 2 tons/day. With the abundant supply and available source of biodegradable wastes from Metro cities and municipalities, coupled with the unstoppable rise in prices of fossil-based fertilizers, organic fertilizer production through proven composting technologies can become a promising enterprise. Conversion of these wastes to organic fertilizer will not only reduce the volume of wastes to be disposed off but rather will be an important resource in ameliorating and sustaining the fertility of arable lands which have been degraded and/or nearing degradation due to improper soil management practices. Moreover, with the issuance of Executive Order 481 and the Organic Agriculture Act of 2010, in promoting organic agriculture, there is a foreseen demand for organic matter principally to be supplied through organic fertilizers that can be used in high value vegetable production.

Objectives The project aimed to showcase local government engagement in solid waste management and the use of solid waste in organic fertilizer production that can supplement inorganic fertilizer in high value vegetable production.

Materials and Methods

Fig. 1. reflects the methodology/implementing strategies undertaken by the project. The Central Luzon State University- Ramon Magsaysay Center for Agricultural Resources and Environment Studies (CLSU RM-CARES) conducted consultation with the local executives of the concerned LGU together with those involved in waste management and organic fertilizer production and other stakeholders such as farmers and technicians, in an effort to introduce the project and solicit their commitment. A Memorandum of

Agreement was forged to seal the commitment of the local executives in the implementation of the project and providing mobilization funds thereof.

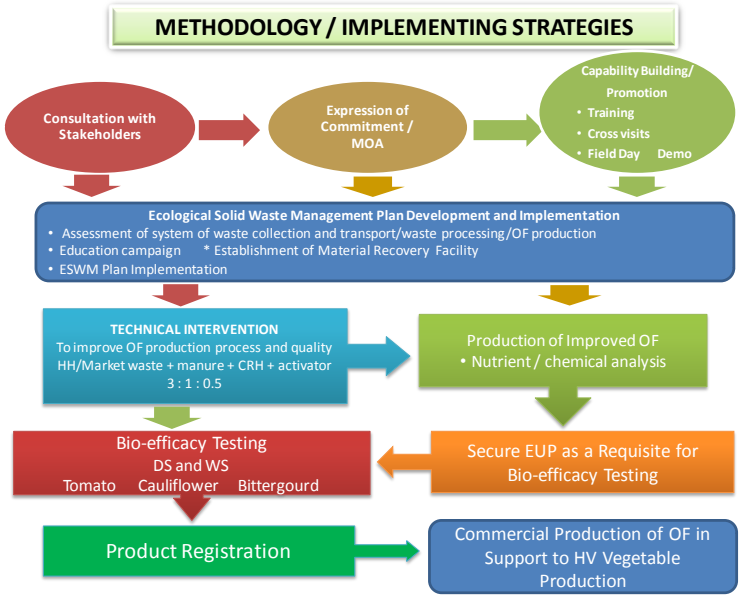

Fig. 1 Progression of implementing strategies undertaken by the project

Capability building thru trainings and cross visits were also undertaken to enhance the knowledge and skills of LGU personnel involved in organic fertilizer production as well as the farmer who served as cooperator in vegetable production. Field day and techno demo were also done as promotional strategies.

Assessment of the system of solid waste collection, transport and processing was done as an input to the preparation of the Ecological Solid Waste Management (ESWM) Plan of the concerned LGU and its implementation thereof, helping the city in the establishment of the Material Recovery Facility (MRF) and the conduct of educational campaigns.

Careful evaluation of the organic fertilizer production process was done in an effort to improve the quality of the organic fertilizer produced by the concerned LGU before project implementation. Technical interventions were applied in the form of reformulating the mixture of materials used, integrating turning/moistening and sieving in the process and using an activator (*Trichoderma* sp. isolated from carabao manure) produced by CLSU RM-CARES to enhance decomposition.

Test runs of the improved process were undertaken and the organic fertilizer produced was subjected to nutrient/chemical analysis (according to standards) as a requirement for the issuance of an Experimental Use Permit

(EUP) needed for the bio-efficacy testing. After fulfilling the bio-efficacy testing, all other requirements were fulfilled and submitted to the Fertilizer and Pesticide Authority (FPA) for registration which is a passport towards commercially producing organic fertilizer in support to high value vegetable production.

Bio-efficacy Testing Methodology

The crops included in the efficacy testing of the improved organic fertilizer were bitter gourd, cauliflower and tomato. The efficacy tests were conducted in Buensuceso, Arayat, Pampanga where the three vegetables were widely grown. The field trials cum demonstration field were conducted twice (dry and wet season) for each vegetable, with the selected farmer cooperator.

Bulk samples of composted materials produced prior to and post intervention were used in the efficacy testing. The minimum sets of treatments as prescribed by FPA for the efficacy test of each of the organic fertilizer produced were used as follows:

T_1 - No fertilizer application, Control
T_2- Full inorganic fertilizer recommended rate (IFRR)
Bitter gourd : 120-60-60 kg N, P_2O_5, K_2O /ha
Cauliflower: 150-60-60 kg N, P_2O_5, K_2O /ha
Tomato: 150-60-90 kg N, P_2O_5, K_2O /ha
T_3- Full organic fertilizer (OF) per ha, 10 tons/ha OF
T_4- ½ IFRR
T_5- ½ IFRR + OF w/ intervention
T_6- ½ IFRR + OF w/o intervention
T_7- IFRR + OF with intervention

Plot size for each of the efficacy testing was set at 4m x 5m with four replications for each treatment. Data on each efficacy tests were analyzed using analysis of variance in Randomized Complete Block Design (RCBD). Comparison among means was done using Duncan's Multiple Range Test at 5.0% level of significance.

Results and Discussion

Solid Waste Management Endeavors

ESWM Plan Development and Implementation/Capability Building

The Ecological Solid Waste Management Act of 2000 mandated the LGUs to initiate and implement a comprehensive and thorough solid waste

management program. Pursuant to the intent of the law, the local executive of the concerned LGU, re-organized the City Solid Waste Management Board composed of 22 members including the Chief Executive. The Board drafted a plan that provided the direction in adopting measures for the promotion and ensuring the viability and effective implementation of solid waste management in the concerned LGU. The project through the CLSU RM-CARES, assisted the LGU in the finalization and implementation of the ESWM plan and providing training in waste management to provide the necessary technical expertise on biodegradable waste management and in promoting organic fertilizer production as an adjunct project to ESWM. The ESWM Plan particularly aims to manage solid wastes that will render them harmless to mankind and its environment; reducing the amount of wastes generated at the source; segregating wastes; recycling the useful materials from the wastes; treating and disposing the non-recyclable wastes and ecological disposal of wastes through composting.

A material recovery facility (MRF) was also established by the concerned LGU as an important facility in solid waste management, allowing for the proper segregation and processing of solid wastes generated in the LGU. The LGU provided the counterpart fund in the establishment of the MRF and the equipment necessary in organic fertilizer production amounting to PhP 793,000.00 which brings to fore the LGU's commitment of money apart from the time, effort and personnel complement needed in the attainment of the common goals and objectives of this project. It is important to note that a five-day training program on "Organic Fertilizer Production and Organic Crop Production" was done wherein five staff of the MRF of the concerned LGU together with 30 agricultural technicians and farmers from Arayat, Pampanga were trained. The participants gained knowledge and skills on the best practices on organic fertilizer production from biodegradable wastes and its utilization in vegetable cultivation. The training also promoted and demonstrated the practice of waste segregation, waste reduction, recycling and re-use; and the advantages of using organic fertilizer (foliar and solid) in crop production.

System of waste collection and transport

Wastes generated from households and market of the concerned LGU were segregated/sorted. The project team assisted the LGU in education campaign re wastes segregation. Mixed wastes were brought to the MRF and segregated before dumping to the landfill. While continuous education campaign is in effect, mixed wastes averaged 50.0% yet.

Waste processing before intervention

Prior to project implementation, the composting process and the organic fertilizer produced by the concerned LGU through the Environment Management Systems Office (EMSO) was documented and carefully studied to be able to come up with an appropriate technical intervention. Before project intervention**,** the segregated wastes brought to the MRF were shredded, drenched with activator and piled. Piling followed no logistic method. Once shredded, the wastes were piled over the other layer. This way, older wastes were layered with the latest wastes which cause uneven maturity. No turning during the composting period was undertaken. When 70.0% of the wastes were no longer recognizable, the product was dried under the sun. No shredding was employed making the quality of the fertilizer very poor. Clearly, low quality organic fertilizer was produced due to the inferior physical and chemical characteristics. The piles were not turned during the composting process, leaving uneven decomposition of the organic materials. Besides, at harvest time, no sieving was instituted leaving the organic fertilizer product coarse with uneven particle sizes and clods. As to nutrient content, the product contains very low NPK content which is way less than the required 7.0%. The low nutrient content is attributed to the mixture used. All the organic materials are rich in fibers such as coconut husk, banana heart and banana bracts which are rich in carbon, potassium but not nitrogen.

Technical intervention in producing quality organic fertilizer

As a result of the assessment done, the intervention designed by the project team was accepted for implementation**.** Wastes segregated at the MRF were mixed with animal manure (quail manure or chicken manure whichever is available at the time of composting) carbonized rice hull at 3:1:0.5 ratio, then shredded and piled.

The activator (*Trichoderma* sp. from carabao manure) was added at the rate of 2 kg per ton of file to hasten decomposition. Consequently, the intervention resulted to a shorter composting duration of 3 months as compared to 6 months without intervention. Results of the analysis of the organic fertilizer produced with intervention, showed a total NPK of 6.72% with nitrogen content of 2.21%; phosphorous, 0.65%; and potassium, 3.86%; with 26.17% organic carbon. The laboratory test also revealed the absence of *E. coli* and *salmonella* in the organic fertilizer analyzed. These positive results are requisites for FPA registration of the product apart from the efficacy testing.

Promotion Through Field Day and Techno Demo

Field day was conducted both at the MRF site of the concerned LGU and at the efficacy test site in Arayat, Pampanga. During the Field Day, the procedure in the production of organic fertilizer was showcased as well as the efficacy test on bitter gourd, cauliflower and tomato. A total of 100 participants attended and out of the 100 participants, 20 were purposely selected consisting of 10 farmers and 10 extension workers for a group discussion to determine their views and concerns on solid waste management. On the area of garbage problem, the participants recognized rampant littering and improper waste disposal as major concerns that are hazardous to health and that the present initiative is important in achieving cleanliness and keeping the LGU residents free from foul odor emitted by improperly disposed wastes, which can also become a haven for insects, rats and animals that spread diseases. Composting as a strategy to waste management is advantageous as a source of fertilizer, according to the participants.

The end product of waste management effort is organic fertilizer production and the participants, regarded it as a step on saving from the expensive chemical fertilizers; keeps produce safe for consumption; adapted to the soil in the project area; and can be used as repellant to pest when used. Indeed, both the extension workers and the farmers were one in recognizing the need to manage wastes with the attendant socio-economic and environmental benefits.

Bio-efficacy Testing of Organic Fertilizer

Efficacy Test on Bitter Gourd

At first trial (Table 1) on bitter gourd, ½ IFRR + OF with intervention produced the heaviest weight of marketable fruits (13.8 kg) and highest computed yield (18.4 t/ha). Significant benefit is achieved with the application of ½ IFRR + OF with intervention (18.4 t/ha yield) as shown by the 130 and 82 percent yield increase, respectively over that of using organic fertilizer alone (8.0 t/ha) and ½ IFRR fertilizer alone (10.1 t/ha). All fertilized plants were heavier and highest yielder compared to the control plants. Obviously, nutrition has a lot to do with weight and yield of fruits. The increases in weight and fruit yield were associated with a gross amount of nutrients provided by the different kinds of fertilizer treatments. Further, Chen (2011) indicated that fertilizers are designed to supplement the nutrients already present in the soil and that the use of chemical and organic fertilizers or biofertilizer has its advantages and disadvantages in the context of nutrient supply, crop growth and environmental quality. The advantages need to be integrated in order to make optimum use of

each type of fertilizer and achieve balanced nutrient management for crop growth.

Table 1. Treatment effects on weight and yield of bitter gourd (1st trial)

Treatment	Ave. Weight of Fruit per Plant (gm)	Weight of Marketable Fruit (kg)	Weight of Non-marketable Fruit (kg)	Percent Marketable Yield (%)	Computed Yield (t/ha)
Control	27.4[d]	0.6[d]	0.2[a]	77.1[b]	0.9[d]
IFRR (120-60-60 kg NPK/ha)	56.2[ab]	9.4[abc]	0.9[a]	92.2[a]	12.5[abc]
OF	46.0[c]	6.0[c]	0.3[a]	94.6[a]	8.0[c]
½ IFRR	48.9[bc]	7.6[bc]	1.6[a]	83.7[a]	10.1[bc]
½ IFRR + OF w/ intervention	55.1[ab]	13.8[a]	2.2[a]	86.4[a]	18.4[a]
½ IFRR + OF w/o intervention	54.5[ab]	11.6[ab]	1.3[a]	90.1[a]	15.5[ab]
IFRR + OF with intervention	58.8[a]	11.4[ab]	0.5[a]	96.8[a]	15.3[ab]
CV%	8.4	27.9	92.3	5.6	27.9

Means in each column having similar letter(s) are not statistically different at 5% level by DMRT.

On the second trial (Table 1a), bitter gourd plants fertilized with IFRR + OF with intervention produced the heaviest weight of marketable fruits (12.3 kg) and garnered the highest computed yield (16.4 t/ha) among the rest of the treatments. Furthermore, all the fertilized plants performed better than the unfertilized plants. The results indicate that increasing amount of nutrients from the combination of full dosage of recommended amount of inorganic fertilizer in combination with organic fertilizer with intervention provided to the crop, resulted to increasing yield of bitter gourd. Results of the study conducted by Thriveni, *et al*, 2015 support the findings in the first and second trials indicating that the application of 100 per cent N:P:K from inorganic sources combined with organic sources such as vermicompost and biofertilizers turned to be the best treatment for increasing growth, early flowering, yield and quality attributes of bitter gourd.

Table 1a. Treatment effects on weight and yield of bitter gourd (2nd trial)

Treatment	Ave. Weight of Fruit per Plant (gm)	Weight of Marketable Fruit (kg)	Weight of Non-marketable Fruit (kg)	Percent Marketable Yield (%)	Computed Yield (t/ha)
Control	34.7^{c}	1.7^{d}	0.2^{c}	86.1^{a}	2.3^{d}
IFRR	43.2^{bc}	7.8^{bc}	0.7^{abc}	90.6^{a}	10.4^{bc}
OF	44.6^{bc}	5.2^{c}	0.5^{bc}	88.9^{a}	6.9^{c}
½ IFRR	42.8^{bc}	5.2^{c}	0.7^{abc}	87.5^{a}	7.0^{c}
½ IFRR + OF w/ intervention	48.2^{ab}	8.4^{b}	1.2^{a}	87.9^{a}	11.2^{b}
½ IFRR + OF w/o intervention	45.8^{ab}	6.3^{bc}	0.9^{ab}	87.5^{a}	8.4^{bc}
IFRR + OF w/intervention	56.2^{a}	12.3^{a}	1.2^{ab}	91.0^{a}	16.4^{a}
CV%	12.6	23.9	41.8	5.3	23.9

Means in each column having similar letter are not statistically different at 5% level by DMRT

Efficacy Test on Cauliflower

In Table 2, application of ½ IFRR + OF with intervention during the first trial, performed comparable effect with that of using ½ IFRR with or without intervention in producing the highest percentage of marketable yield. Also, no significant differences were obtained on percent marketable yield using either half or full recommended IF when combined with OF with intervention. All fertilized plants have high percentage of marketable yield compared to the unfertilized control plants. Results indicate that nutrients present in the improved organic fertilizer with intervention satisfy the requirement of cauliflower plants and in that case, application of even half the amount of the recommended inorganic fertilizer would be enough.

Table 2. Treatment effects on weight and yield of cauliflower (1st trial)

Treatment	Ave. Weight of Head (gm)	Percent Marketable Yield (%)	Computed Yield (t/ha)
Control	181.2^{c}	37.8^{d}	3.1^{d}
IFRR (150-60-60 kg NPK/ha)	338.2^{ab}	77.2^{c}	7.0^{c}
OF Alone w/ intervention	281.3^{bc}	80.0^{bc}	5.6^{c}
½ IFRR	319.5^{ab}	83.3^{abc}	6.5^{c}
½ IFRR + OF w/ intervention	438.8^{a}	93.9^{a}	10.0^{ab}
½ IFRR + OF w/o intervention	378.5^{ab}	86.1^{abc}	8.0^{bc}
IFRR + OF w/ intervention	451.5^{a}	91.7^{ab}	11.0^{a}
CV%	21.1	8.1	18.6

Means in each column having similar letter(s) are not statistically different at 5% level by DMRT

In Table 2a, the effects on percent marketable yield of cauliflower using combined half or full inorganic fertilizer + organic fertilizer with or without intervention were statistically comparable in the 2nd trial. Control plants have the lowest percent marketable yield (2.3 t/ha) among other treatments. Recommended rate of inorganic fertilizer (IFRR) + OF with intervention produced the highest computed yield of 5.76 t/ha but statistically comparable with the application of ½ IFRR + OF with intervention (5.6 t/ha). This result may be due to the fact that maximum absorption of nutrients by plants from the soil up to the roots of the plants occurred with the addition of organic fertilizer with intervention. Meera *et al.,* 2017 found out that the improved yield of cauliflower as a consequence of integrated use oforganic manure and chemical fertilizers with plant growth promoting rhizobacteria (PGPR) could be due to enhanced photosynthetic and metabolic activity, which led to increase in various plant metabolites responsible for cell elongation (Hatwar *et al.,* 2003).

Table 2a. Treatment effects on weight and yield of cauliflower (2nd trial)

Treatment	Ave. Weight of Head (gm)	Percent Marketable Yield (%)	Computed Yield (t/ha)
Control	238.3^{c}	32.9^{d}	2.3^{e}
IFRR (150-60-60 kg NPK/ha)	393.3^{ab}	49.2^{bc}	4.6^{b}
OF Alone w/ intervention	356.7^{b}	44.6^{c}	3.1^{d}
½ IFRR	353.3^{b}	41.7^{c}	3.6^{c}
½ IFRR + OF w/ intervention	443.3^{ab}	60.4^{a}	5.6^{a}
½ IFRR + OF w/o intervention	395.0^{ab}	54.6^{ab}	4.5^{b}
IFRR + OF w/ intervention	480.0^{a}	55.5^{ab}	5.8^{a}
CV%	14.00	9.77	5.81

Means in each column having similar letter(s) are not statistically different at 5% level by DMRT

Efficacy Test on Tomato

A significant variation in computed yield of tomato was attributed to the fertilizer treatments during the first efficacy trial (Table 3). Highest yield was produced by the application of ½ IFRR + OF with intervention with a yield of 14.6 t/ha. This was 43 percent higher than yield from plots applied with ½ IFRR + OF without intervention (10.2 t/ha) and 72 percent higher than yield from plots applied with the recommended rate of inorganic fertilizer alone (8.5 t/ha). Comparable result was obtained from the application of IFRR (150-60-90 kg NPK/ha) + OF with intervention with a yield of 13.3 t/ha. This confirms that

with the addition of organic fertilizer, more nutrients are absorbed by the tomato plants resulting to greater yield. Gmaa (2015) found out that tomato yield, average fruits number per plant and average fruit weight were significantly enhanced by biofertilizers treatments and conventional treatment as compared with control or without biofertilizer treatment in two experimental seasons. Enhancing fruits number, average fruit weight and total yield per plant by biofertilizers application may be due to that applying biofertilizers increased microorganisms in the soil which converting the ability of mobilizing the unavailable forms of nutrients elements to available forms.

Table 3. Treatment effects on the wield and yield components on tomato. (1st trial)

TREATMENT	Number of fruits to a kg yield	Marketable fruits per 10 plants		Non-marketable fruits per 10 plants		Computed yield/ha
		Number	Weight (kg)	Number	Weight (g)	(t)
Unfertilized (Control)	48[a]	135[f]	3.3[e]	18[c]	279.8[a]	**4.3[d]**
IFRR (150-60-90 kg NPK/ha)	37[b]	231[d]	6.5[d]	24[ab]	350.8[a]	**8.5[cd]**
OF (10 tons/ha)	38[b]	219[e]	6.2[d]	21[abc]	324.1[a]	**8.2[cd]**
½ IFRR	36[b]	220[e]	6.2[d]	21[abc]	311.2[a]	**8.2[cd]**
½ IFRR + OF w/ intervention	34[b]	383[a]	11.1[a]	17[c]	255.0[a]	**14.6[a]**
½ IFRR + OF w/o intervention	39[b]	288[c]	7.7[c]	22[abc]	327.2[a]	**10.2[bc]**
IFRR + OF w/intervention	37[b]	355[b]	10.1[b]	26[a]	367[a]	**13.3[ab]**
CV (%)	**11.9**	**2.1**	**2.1**	**12.9**	**13**	**22.7**

Means in each column having similar lette(s)r are not statistically different at 5% level by DMRT

The treatment effects during the second efficacy trial (Table 3a) on tomato showed that the application of the organic fertilizer with intervention in combination with the recommended rate of inorganic fertilizer produced the highest yield of 11.0 t/ha. Analysis revealed that the result was comparable with the application of ½ inorganic fertilizer plus OF with intervention (10.3 t/ha). In this case, note that the application of inorganic fertilizer alone (6.2 t/ha) resulted to a comparable yield effect on the unfertilized treatment (3.4 t/ha). This shows that improvement in crop yield was brought about by the addition of organic fertilizer particularly the one produced with intervention. In a study by Mfombep et al., 2016, both the organic and inorganic soil amendments increased growth and yield of tomato, but the effect was more significant in

plots treated with poultry manure at 60 t ha-1 two weeks before planting. However, drowth effects were not clear-cut across sites and were probably mitigated by site-specific differences in rates of nutrient-leaching.

Table 3a. Treatment effects on the yield and yield components in tomato. (2nd trial)

TREATMENT	Number of fruits to a kg yield	Marketable fruits per 10 plants		Non-marketable fruits per 10 plants		Computed yield/ha
		Number	**Weight (kg)**	**Number**	**Weight (g)**	(t)
Unfertilized (Control)	34^{ab}	57^{b}	1.7^{b}	1^{a}	36.6^{ab}	**3.4^{b}**
IFRR (150-60-90 kg NPK/ha)	33.6^{ab}	103^{ab}	3.1^{b}	1^{a}	36.6^{ab}	**6.2^{b}**
OF (10 tons/ha)	32.6^{ab}	80^{b}	2.4^{b}	1^{a}	6.6^{d}	**4.9^{b}**
½ IFRR	37.6^{a}	161^{a}	3.1^{b}	2^{a}	46.6^{a}	**6.2^{b}**
½ IFRR + OF w/ intervention	31.6^{b}	161^{a}	5.1^{a}	1^{a}	20.0^{c}	**10.3^{a}**
½ IFRR + OF w/o intervention	31^{b}	112^{ab}	3.6^{ab}	1^{a}	33.3^{b}	**7.3^{ab}**
IFRR + OF w/intervention	29.6^{b}	163^{a}	5.5^{a}	1^{a}	33.3^{b}	**11^{a}**
CV (%)	**8.61**	**30.33**	**30.81**	**40.08**	**18.51**	**30.81**

Means in each column having similar lette(s)r are not statistically different at 5% level by DMRT

Conclusion and Recommendation

The project generated a workable methodology/implementing strategy that relied on the important engagement and collaboration of the concerned LGU and the CLSU RM-CARES with the end view of managing solid waste and transforming these waste into useful organic fertilizer that can be used in high value vegetable production. The technical interventions utilized in the project proved to be crucial in improving the organic fertilizer production process and the product thereof.

The efficacy testing of organic fertilizer on bitter gourd, tomato and cauliflower showed improvement in crop yield brought about by the addition of organic fertilizer with intervention to half the recommended rate of inorganic fertilizer.

Much needs to be done however, in improving collection and segregation at source in the concerned LGU. As such, CLSU RM-CARES shall continue to assist the LGU in solid waste management endeavors particularly in information, education and communication campaign and in organic fertilizer production towards commercialization. The clustering of barangays in the LGU shall be vigorously pursued for improved solid waste management as well as establishment of barangay-based material recovery facility that can be used as an important facility in solid waste management, allowing for proper segregation, recycling and processing of solid waste into organic fertilizer.

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References

Aganon, C.P. And O. Ramos. (2000). Changes in soil properties associated with application and burning of rice hull in peri-urban vegetable production areas in Central Luzon. 22nd Annual Scientific Meeting of the National Science and Technology. July 5-6. Manila Hotel, Manila, Philippines.

Aganon, C.P. , R.V. Romero, A.G. Mactal And E.S. Romero. (2005). Contributions of animal wastes and crop residues to nutrient requirements of vegetable-legume-rice sequence. Abstracts of Completed R and D Projects, Carbonel, N. R. F.L Porciuncula and M.E. M. Orden, editors. Central Luzon State University, Science City of Munoz, Nueva Ecija, Philippines.

Chen, J-hshuan. (2011). The combined use of chemical and organic fertilizers and/or biofertilizer for crop growth and soil fertility. Department of Soil and Environmental Sciences,National Chung Hsing University,250 Kuo-Kuang Road, Taichung. Taiwan ROC.retrieved from http://www.fftc.agnet.org/htmlarea_file/library/ 20110808103954/ tb174.pdf.

Environmental Management Bureau-DENR. (2009). RA 9003 or the Ecological Solid Waste Management Act of 2000. Department of Environment and Natural Resources, Philippines.

Hatwar GP, Gondane SU, Urkude SM, Gahukar OV. (2003). Effect of micronutrients on growth and yield of chilli. Soils & Crops. 13:123-125.

Gmaa, S.S. (2015). Effect of organic and bio-fertilization in tomato. International Journal of Advanced Research, Volume 3(2015), Issue 10, 1799 – 1805.

Meera Devi, GP Upadhyay, Garima and RS Spehia. (2017). Biological properties of soil and nutrient uptake in cauliflower (*Brassica oleracea* var *botrytis* L.) as influenced by integrated nutrient management. Journal of Pharmacognosy and PhytochemistryJournal of Pharmacognosy and Phytochemistry; 6(3): 325-328.

Mfombep, P. M., B. A. Fonge, A. Atembe-afac and P. T. Tabot. (2016).Soil type and amendment influence on growth and yield of tomatoes *Lycopersicon esculentum* L. in the humid Mt Cameroon region. International Journal of Current Research in Biosciences and Plant Biology. 2349-8080 (Online) Volume 3, Number 8 (August-2016).

V Thriveni, Hn Mishra, Sk Pattanayak, Gs Sahoo and T Thomson. (2015). Effect of inorg fertilizers and biofertilizers on growth, flowering, yield and quality attributes of *Momordica charantia L.* International Journal of Farm Sciences 5(1) : 24-29.

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