Development of eco-profitable agricultural products by system integration of biomass and other household farm wastes in the Philippines

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Rationale

Plant biomass and other household farm wastes are abundant sources of alternative, affordable and sustainable energy, recyclable articles, and biofertilizers. In the Philippines, however, there is an imbalance in the production, conversion, and utilization of these wastes resulting to environmental degradation and climate change [2]. Heavy use of agro-chemicals and intensive rice cultivation resulted to soil fatigue and ecological disturbance in the biodiversity of fauna and flora [4,5]. The Philippine Rice Research Institute (PhilRice) has been promoting the use of rice straw and rice hull either as mulching and soil amendment materials for organic farming or as feedstock for direct combustion and gasification [1]. However, this intervention is still inadequate and fragmented. Therefore, there is a need to integrate the management of farm wastes to produce sustainable and ecologically profitable products. This paper describes the conversion and utilization of wastes for agriculture. Industrial product development is discussed in another report.

Methodology

Plant biomass were tree limbs, leaves, molasses, rice straw, rice hull, and rice bran. Other household farm wastes were animal manures, food leftovers, fruit peels and vegetable trimmings, and fish entrails. System's approach to holistic waste management was carried out. Fig. 1 shows the general framework on integrating biomass and other household farm wastes to produce sustainable and ecologically profitable outputs. Some biological and physical processes of waste conversion utilized the Effective Microorganism (EM) Technology [3], a concoction of naturally occurring microorganisms. EM solution was made up of 3% EM-1 and 5% molasses. A base microbial inoculant was formulated by anaerobically fermenting rice bran with 40% EM solution for five days.

Animal feed supplement: Five parts of chopped food wastes, mixed with at least two parts of base microbial inoculant, were fermented anaerobically for five days. The nutrient content was analyzed. Ten percent of the fermented product was used as feed supplement for hogs.

Soil amendments and organic fertilizer: Five parts of animal manure and other biomass wastes, three parts of carbonized rice hull (CRH), and two parts of base microbial inoculant were mixed and moistened by about 40% EM solution. The mixture was fermented for five to seven days in two ways; anaerobic fermentation of compacted mixture in polyethylene bags, and semi-anaerobic fermentation of covered mixture spread and pressed 12~13 cm thick. In the in-situ treatment of biomass, rice straw and crop residues were saturated with water, spread over with CRH and base microbial inoculant, and applied with EM solution. The mixture was incorporated with the soil after five days. Rice seeding was done after 15 days of land preparation. Plant growth and yield were evaluated.

Biological control agents, catalysts, and enzymes: Activated EM solution was formulated by diluting and anaerobically fermenting 3% EM-1 and 3% molasses in coconut water or rice wash for five to seven days. The activated solution was used as foliar spray and irrigated water for vegetables at 1:200~1:1000 dilution ratio. It was also used for cleaning and removing putrid odor in the poultry and hog farms. On the other hand, anaerobically fermented wastewater was used for irrigation. Fermented herbal or ordinary plant parts produced liquid extracts that were used as foliar spray and control agent to treat seed pathogens and enhance seedling vigor of rice seedlings. Anaerobic fermentation of fish entrails, meat trimmings, and animal blood produced amino acids and organic concentrates that were used as plant foliar spray. Data were analyzed.

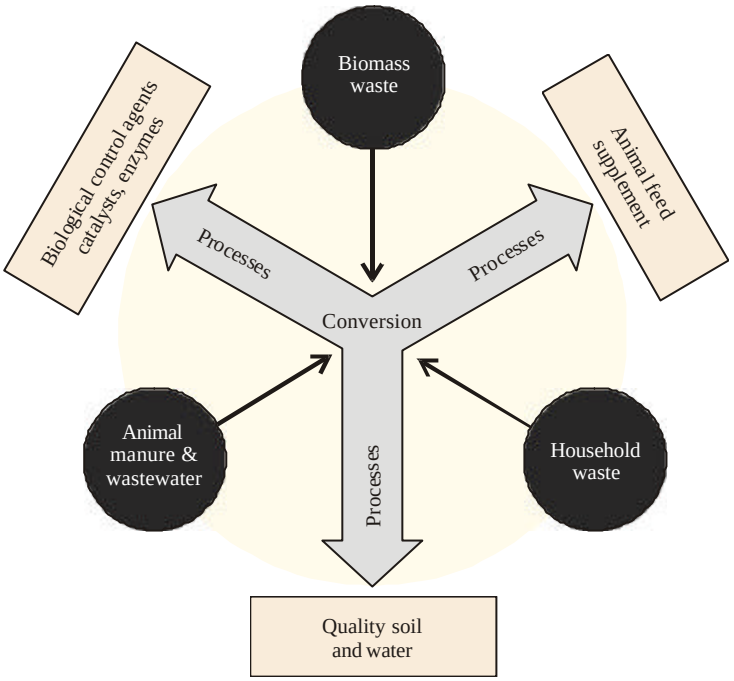

Fig. 1 General framework on integrating biomass and other household wastes in the production of eco-profitable products

Conclusion

The project has proven that low cost sustainable agricultural products are easily produced within the household farm. These farm inputs help maintain and preserve soil and water quality and productivity, and enhance biodiversity in order to produce safe food, mitigate drought, and reduce methane gas emission in the Philippines.

References

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