

PILOT STUDY: COVERSION OF THE SMOKEY MOUNTAIN DUMPSITE WASTE TO ORGANIC FERTILIZER, MANILA, PHILIPPINES

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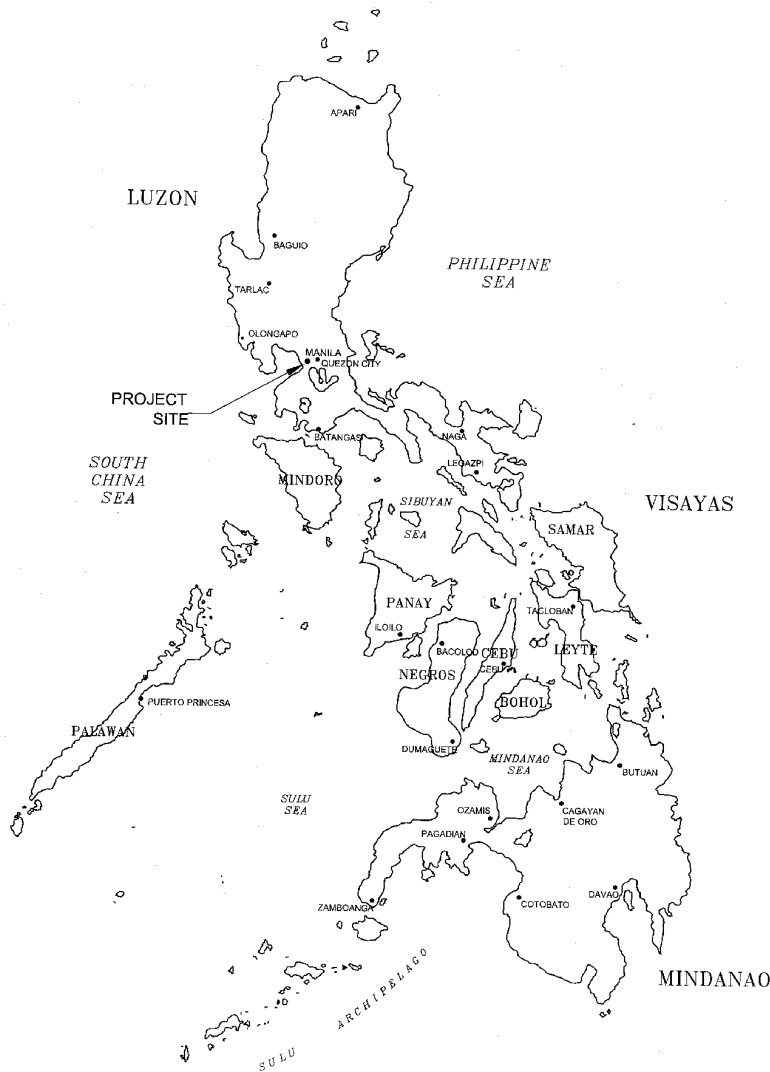
SUMMARY: For approximately 40 years the Smokey Mountain Dumpsite was in operation in the north section of Manila in the Philippines. The dump was a significant source of air and water pollution and was closed in 1996. A project was implemented to remove the waste and build low income apartment buildings within the old landfill footprint. Halfway through the project, funding ran out and alternative ways to remove the waste were analyzed. A pilot program was initiated to process the waste and turn it into organic fertilizer. After screening, inoculation, and treatment, the waste material was analyzed and found to meet the Philippine requirements for nutrient concentration for organic fertilizer. The processed material was then bagged and applied to soil test plots. Vegetables were grown in the treated soil as well as untreated soil. Observation and comparison of the various test plots found that the vegetables grown in the soil augmented with the organic fertilizer were over four times larger than those with no fertilizer. Based on the pilot program, it was demonstrated that processed refuse could be formulated into an organic fertilizer with beneficial uses.

1. INTRODUCTION

The famed Smokey Mountain Dumpsite located in Manila, Philippines has been the subject of documentaries regarding mismanagement of solid waste disposal sites in developing countries. Smokey Mountain got its name from the fact that it was a mountain of garbage located in the north section of Manila adjacent to Manila Bay that was constantly smoking due to the continuous oxidation of decomposing waste and refuse fires. The open dump was in operation for 40 years until it finally closed in 1996. The dump also contained a number of people who lived on and around it who depended on the scavenging of recyclables as their means of livelihood. Figure 1 shows the location of the project in the Philippines.

Ramos, the Philippine President at the time, then had a plan of converting this infamous dump to a beneficial use wherein the surrounding residents would also benefit. The plan was to remove the

Figure 1



waste, and convert the land into residential housing for the poor. The housing consisted of apartment buildings constructed within the landfill footprint where the refuse had been removed.

The plan was successful until the political situation changed and the project was stopped mid way, due to lack of funding. At least 2.5 million cubic meters of still decomposing waste remained, which the developer did not know what to do with.

With the lack of funds, several innovative proposals were presented on what to do with the waste that remained at the site. One of the proposals consisted of converting the organic portion of the waste into a soil conditioner or organic fertilizer. An organic fertilizer manufacturer and consulting engineering company in conjunction with the developer proposed to perform a pilot study to convert Smokey Mountain waste into organic fertilizer.

The Scope of the Pilot Study was as follows:

- ◆ Initial Separation of Fines and Coarse Material by Trommelling
- ◆ Secondary Screening

- ◆ Sampling and Laboratory Analysis
- ◆ Biological Treatment / Herbal Treatment Application
- ◆ Tertiary Screening
- ◆ Nutrient Balancing and Final Conditioning
- ◆ Bagging
- ◆ Control Test Plots

The purpose of the pilot study was to determine the viability of converting a well decomposed waste into a usable fertilizer material, particularly in a country where food security is a concern and where chemical fertilizers are still the norm. Chemical fertilizers in the Philippines cost as much as three times that of organic fertilizer. There are also long term benefits in using organic fertilizer due to its known positive impact on soil.

2. INITIAL SEPARATION AND SECONDARY SCREENING

Approximately two truck loads (15 cubic meters) of Smokey Mountain waste were processed through a mobile Trommel at the dumpsite. The trommelled waste was then transported to the designated processing area which was approximately 40 meters by 40 meters in size for secondary screening. Secondary screening was required in order to further reduce the volume that needed to be inoculated with enzymes. This was also done to reduce the burden of manually mixing the inoculated waste. Manual mixing was done in order to have better control and also because the volume was small. The screening process reduced the original 15 cubic meters of waste down to 5 cubic meters of waste that was ready to be converted to organic fertilizer.

3. SAMPLING AND LABORATORY ANALYSIS

A sample of the screened waste material was obtained for analysis of nutrients prior to application of inoculates and herbal treatment. The results are shown below in Table 1:

Table 1 - Nutrients Prior to Application of Inoculates and Herbal Treatment

NUTRIENT	CONCENTRATION
Nitrogen	1.1%
Phosphorus	2.7%
Potassium	1.7%
TOTAL	5.5%

As can be observed, the initial sampling results indicated that the screened material had a total nutrient concentration of 5.5% and did not meet the specifications for organic fertilizer in the Philippines which is 7%. The waste would require further treatment and conditioning to bring up the nutrients to required levels.

4. INOCULATION AND HERBAL TREATMENT

After screening and sampling, the processed waste pile was inoculated with aerobic enzymes and a herbal treatment (for odor control). The inoculant was applied at a rate of 1kilogram per ton of waste, once per week. The herbal treatment was applied once at a dose of 1liter per cubic meter of waste.

After the inoculation and herbal treatment, the waste pile was allowed to ferment and cure for two and one-half weeks. The stockpile was turned over every three days to maintain aerobic conditions. In addition the stockpile was moisture conditioned to maintain at least 25% to 35% moisture.

5. TERTIARY SCREENING

On the third week, the treated and cured material underwent tertiary screening. The purpose of the tertiary screening was to screen out any deleterious materials such as broken glass, nails, ceramics, or other unsuitable materials from the processed waste.

6. NUTRIENT BALANCING AND FINAL CONDITIONING

After tertiary screening, the material was ready for macro-micro nutrient balancing. This was needed to enhance the nutrient components of the product. In order to meet the Philippine specifications for organic fertilizer, the nitrogen, phosphorus, and potassium (NPK) concentrations in the material must be at least 7%. If this is not met, these elements need to be adjusted and enhanced. Copper, manganese, and iron are also three of the essential elements that need to be enhanced for the product to be completely balanced. After final balancing and enhancement, the processed material can then be used as a fertilizer. The processed material also underwent further conditioning by adjusting its pH and moisture content to obtain a final product.

7. PRODUCT SAMPLING, ANALYSIS, AND BAGGING

A sample was obtained of the finished product and delivered to a laboratory for analysis of metals and nutrients. It should be noted that even if the product meets the NPK minimum concentration requirements, it has to be free of heavy metals. The waste at Smokey Mountain seemed to be low in heavy metal concentrations from previous analysis by the developer. However, metals analysis of the final product was performed since it is intended for actual use as a fertilizer. Based on the lack of heavy metals and the NPK values being above the required 7%, the finished product was acceptable and ready for bagging.

Table 2 - Nutrients After Balancing and Final Conditioning

PARAMETER	CONCENTRATION
Nitrogen	1.3%
Phosphorus	4.4%
Potassium	7.7%
Total	13.4%
Heavy Metals:	
Antimony	ND
Arsenic	ND
Barium	ND
Cadmium	ND
Mercury	ND
Selenium	ND
Silver	ND
ND=Not Detected	

Overall, approximately 3,000-1kilogram organic fertilizer bags were produced from the original processed waste.

8. TEST PLOTS

In order to determine the effectiveness of the organic fertilizer, several test plots were constructed and planted with a variety of vegetables in soil where the product fertilizer was applied. For each variety, an equal number of test plots were planted with no application of fertilizer. There was a significant difference in the appearance and size of the plants, particularly the leafy ones, in test plots that included the organic fertilizer. The plants that were treated with Smokey Mountain organic fertilizer were almost four times the size of those that were not treated, and were obviously healthier.

After the vegetables had reached maturity, the crop was ready for harvest. Among the guests invited to harvest the vegetable plants was the Mayor of the City of Manila, Lito Atienza.

9. CONCLUSIONS

As evidenced by the test plots, the pilot study was a success. Full scale implementation of the project is pending, due to lack of funding by the government. In addition, the organic fertilizer market in the Philippines is in the early stages of development. There still seems to be lack of interest on the part of farmers to use organic fertilizers. In addition, the government does not have any programs or mandates that require its use or at least subsidize its use. Assistance from the government would help develop a market for organic fertilizer resulting in a reduction of waste throughout the Country.