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Farmer Demand for Compost: A Case Study around Sundarapola Municipal Solid Waste Compost Production Plant

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ABSTRACT

Municipal waste is a major problem in a developing country like Sri Lanka. As a solution to this, municipal wastes are converted in to compost. Compost is a product of organic matter which is used to improve soil structure and to provide nutrients. It's difficult to sell compost because of its improper quality, contaminated with plant pathogens. Most production plants have failed due to lack of market for compost. The primary data for this study were obtained from 100 farmers by a questionnaire with face to face interview in 12 Grama Niladari Divisions around Sundarapola. Both descriptive and inferential statistics were used to analyze data. Multiple Linear Regression was applied to find out the association of 6 factors with the compost demand. The purpose of this study is to understand the nature of demand for compost. Regression results shows that income, land extent, sand content, price, cultivate type have significant impact on demand while price and sand content have a negative effect. Results of this study are important for farmers, private sector and government sector involved in producing compost.

KEYWORDS: Compost, Municipal waste, Waste management

INTRODUCTION

Municipal waste has become a major problem in many developing countries all over the world. This is due to increase in population and urbanization, and faced serious problems with municipal waste management. Households, institutions, public are the main sectors which create the municipal waste (Palatnik *et al.*, 2005), they have lack of space to dump their waste, and put somewhere in the road or give to the collectors of the urban council. When urban council collects these municipal wastes, dumped waste into the areas which are away from the town or less populated areas which in the town or doing land filling (Burntley, 2007). Waste particles leak to the ground water system and start the water pollution, and occur very serious health problems (Hasan, 2009). In Sri Lanka urban councils collect waste and dump without proper management. Municipal solid waste (MSW) cannot be burned because Sri Lanka is a tropical country. It results huge waste mountains creating and unpleasant environment with bad smell, mosquitoes problems and health problems. Spread the diseases, soil pollution occur and produce large amount of methane to the air (Ahmed and Zurbrugg, 2002).

In some instances garbage in this waste mountains float in to houses in rainy seasons. Causing respiratory problems, skin rashes and mental disorders in occupants. For example, in December 2012 the Meethotamulla Rahula Vidyalaya was closed as the garbage dump was very close to the school and it was very difficult for the school to function (Walpola, 2016).

To avoid the problem created by MSW, many countries along with Sri Lanka, convert such waste to compost which is one of the uses of those wastes by urban councils and other private organizations (Sharholy *et al.*, 2008).

Compost is the product of organic matter digested by organisms that use to improve soil structure and to provide nutrients like nitrogen, phosphorous, potassium and it contains range of beneficial materials (Rouse, 2008). The end markets of the compost can be agricultural, commercial and residential, erosion control and landscaping (Alzaydi *et al.*, 2013), act as pollution preventing matter (Cole *et al.*, 1995).

Sundarapola compost production plant produced compost using urban waste consists of many elements including inert material like sand, soil from street sweepings, household waste like vegetables peelings, waste food and garden waste, recyclable materials like metal, plastic and glasses. Fourty tons of urban waste daily arrived to here and produced five to eight tons per day.

In Sri Lanka municipal waste collection is doing without proper waste separation method at the first place. One of the problems for this compost plant is lack of a market for the compost which is produce in the production plant. So the large amount of end product of compost is gathered in the production plant without selling. So most of the production plants have fail due to this situation. They cannot even cover up their initial investment (Guerrero *et al.*, 2013).

The main objective of this study is to analyze the nature of demand for compost, in

close proximity Sundarapola compost production plant.

METHODOLOGY

Theoretical Framework

To identify the relationship of the factors that affect compost quantity demanded, a Multiple Linear Regression model was used as below,

$$Y = \beta_0 + \beta_1 I + \beta_2 LE + \beta_3 SC + \beta_4 Pr + \beta_5 Pa + \beta_6 OFC + \epsilon$$

Where,

Y	=Quantity/month
I	=Income/month
LE	=Land extent (ac)
SC	=Sand content (%)
Pr	=Price (willingness to pay)
Pa	=Paddy =1 (dummy variable)
OFC	=Other fertilizer cost
$\beta_0 - \beta_6$	=Coefficients to be estimated
ε	=Error term

Quantity (kg) is the total usage on the entire land cultivate by each farmer. Income which was generated from the cultivating the crop using compost in Rupees was used as income of the farmers. Land extent (ac) was obtained by cultivating land area of the crop only by using of compost. Sand content is the percentage of sand in the compost as indicated by the respondent. Price was measured as willingness to pay, at what price consumers wish to purchase in rupees per 1 kg of compost. A dummy variable for paddy cultivation was also included where the variable is equal to 1 if the farmer cultivate paddy. Other fertilizer cost (Rs/kg) is the unit cost of other fertilizer used in their lands.

Data Collection

There are 115 compost production plants in Sri Lanka. So one of them (Sundarapola compost production plant) was selected for this research. The primary data were collected from 12 Grama Niladari (GN) Division which are situated around the Sundarapola compost production plant in Kurunegala to capture the immediate market for compost (Folefack *et al.*, 2012). Based on the population, farmers were randomly selected from each Grama Niladari Division. A questionnaire based survey was used with face to face interviews for data collection. Prior to the real survey, a pilot survey was conducted with a representative sample of ten respondents for the purpose of validating the questionnaire.

The survey questionnaire consisted of questions that were intended to collect information on farmer's income, cropping land extent, compost usage and other fertilizer usage. Finally information were gathered from 100 respondents was used in the analysis.

Data Analysis

The data were analyzed using both descriptive and inferential statistics with the statistical package Stata. Descriptive analysis was performed to get a clear picture on characteristics of the sample and compost usage of the farmers.

RESULTS AND DISCUSSION

Descriptive Statistics of the Sample

Descriptive statistics of the sample are in Table 1.

Table 1. Socio demographic characters of respondents

Parameter	Percentage (%)
Income	
More than 8000	34
Less than 8000	66
Crop type	
Paddy	31
Other	69
Obtaining type	
Self-production only	75
Purchase only	14
Both	11
Land extent	
More than 1ac	33
Less than 1 ac	67
Purchasing type	
Cash basis	84
Credit basis	16
Problems when usage	
Occur	47
Doesn't occur	53

Out of the total number of respondents, the majority were under the income of less than Rs. 8000 (66%) of the farmers. Thirty four percent was under the more than 8000 Rupees. With respect to the other crops, paddy cultivation was 31% and 69% of the farmers grown vegetables, fruits, mix crops. Paddy cultivators that used compost are in highr number, so categorize them as paddy and other crops. Collection of other crops are higher, but independently lower than paddy. Most of the farmers (75%) produced compost by their own. Paddy farmers can produce compost very easily by paddy straw after harvesting paddy. Others produced using leaves, animal manure, grasses, food wastage, banana stem. Self-production process is a cost minimization process and can be produced in larger amount of compost within three to four months. Most of the farmers used this method due to effectiveness and they can obtain secure compost for their cultivation.

Fourteen percent of farmers purchased compost for their usage. They purchased in 5, 15 and 25 kg bags according to their consumption. It's useful for quick usage, when there is not enough time for self-production, no space available and no materials available. Eleven percent of the farmers obtained compost in both types.

Figure 1 shows that cultivating land distribution among 12 GN Divisions. It stated at which land extent famers cultivate in each GN Divisions. Sixty seven percent of the cultivate land areas are less than 1 ac, which mainly consists of cultivation other than paddy. This may be due to lack of space because higher population and urbanization. Thirty three percent of the land extent is more than 1 ac, which mainly consists of paddy but a few are vegetable cultivation.

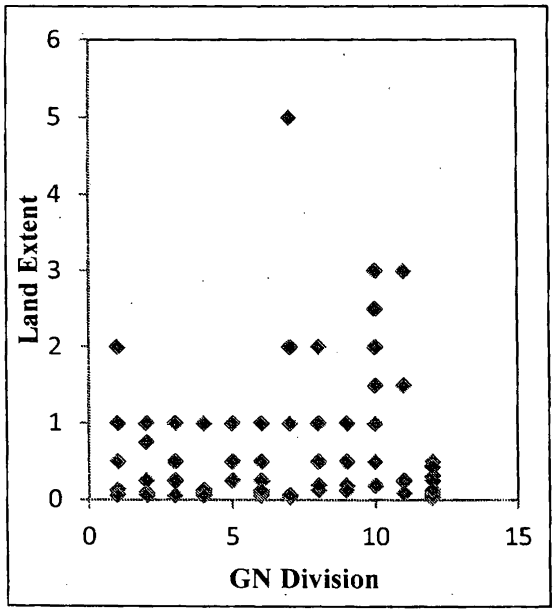

Figure 1. Cultivating land extent using compost. *1-Kurunegala North East, 2-Kalahogedara, 3-Mavidalupotha, 4-Kurunegala West, 5-Bamunugedara, 6-Wewagedara, 7-Aswedduma, 8-Dematagahapelessa, 9-Udabadalawa, 10-Thiththawella, 11-Kawdawatta, 12-Udadigana*

Most of the respondents tend to purchase unique compost product and most of the companies produced it and market with a good and reliable output. So, farmers who are loyal to such brand names and only consider that product for purchased. Because they are sure that product will give the best results and won't cause any harmful effects for the cultivation.

The majority of the respondents (84%) are more likely to purchase compost on cash basis while some respondents that cultivate in large amounts wish to purchase on credit basis (16%), Due to the large quantity of compost requires and farmer cannot tolerate such huge cost that spend for it.

Figure 2 shows that there's a seasonality of usage. It indicates the number of respondents who stated the months in which their usage is highest.

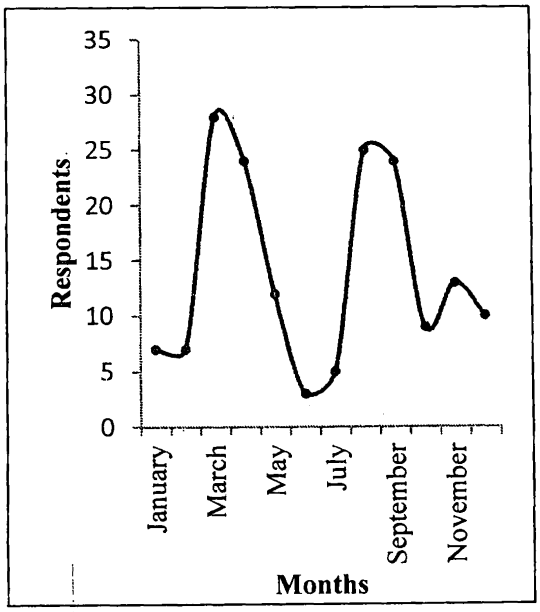

Figure 2. Seasonality of using compost

This seasonality is observed because paddy farmers cultivate paddy in two season, *Yala* and *Maha*. During March and August to September, compost usage is peak than the rest of the months in the year. So demand increases for compost in these months because of the *Yala* and *Maha* cultivation season. Other cultivation crops can use compost in any month of the year or can use more than one month per year. Therefore the other crops have no greater contribution to the compost demand in *Yala* and *Maha* season. But some of them can contribute to the impact of seasonality in *Yala* and *Maha*.

Farmers get the information about compost mainly from media, Govi Jana Seva, training programmes. They should learn how to produce compost with good quality from these sources, how to select better materials, what is the sand and moisture content that must obtain in quality compost in self-production, as well as how to select best fertilizer that are in the market place.

Results of Multiple Linear Regression

Multiple Linear Regression was applied to study whether there is any association of income, land extent, sand content, price, cultivation type, other fertilizer cost with the dependent variable quantity. Table 2 shows estimated coefficients, their P values and calculated Elasticities.

Results showed that income have a significant impact on demand at 5%. Calculated elasticity value for income is 0.536 indicates

that a rise in income by 10% would lead to an increase in demand for compost by 5.36%.

The land extent of the crops that are cultivated using compost was also positive significant 5%. Calculated elasticity value is 0.271 denotes that a 10% increase in land extent would lead to an increase in 2.7% of compost usage. So demand is affected by the land extent which is cultivated.

Table 2. Estimation results from the multiple linear Regression

Variable	Coefficient	P value	Elasticity
I	0.005	0.000	0.536
LE	22.47	0.001	0.271
SC	-1.054	0.092	-0.429
Pr	-1.638	0.033	-0.311
Pa	42.183	0.000	0.241
OFC	0.011	0.481	0.012
Constant	36.888	0.050	
N=100			
R^2=65.85%			

I- income, LE- land extent, SC- sand content, Pr- price, Pa- paddy, OFC- other fertilizer cost

The sand content of the compost is significant at 10%. The sand content elasticity is negative which means if sand content increases by 10% demand get decreases by 4.29% when other independent variables are kept constant. Sand percentage denotes quality of compost. Higher the sand percentage, lower the quality. Maximum sand percentage that must be obtained in compost is 10% (Wijewardana., 2011). Also some of the researchers found that quality is a very important parameter when considering compost demand (Pandyaswargo and Premakumara., 2014). Most MSW compost including those produced at Sundarapola plant have higher sand percentage. There one possible way to increase demand would be to reduce sand percentage in compost. Also when discuss about the quality, customer seeking to purchase a product with proper packaging, not contaminated with pathogens, properly treated and free from metals.

The price of the compost is also significant at 5% error level, which means when all the other independent variables are kept constant, if the price increases by 10%, demand will decrease by 3.11%.

Other fertilizers are competitive products for compost. Increasing of other fertilizer cost must increase the demand for compost because these are substitutes. This is evident by the positive sign obtained for this variable though, it is not significant.

The significant coefficient in paddy cultivation indicates that compared to other crops, paddy uses 42kg more of compost on the average. At 95% confidence level, obtain probability value is 0.000, which was significant. With compared to the other cultivation, paddy cultivation has greater impact on compost demand.

Negative Aspects of Compost

Fourty seven percent of the farmers stated that there's a problem when using compost and 53% said that there's no problems occur when using compost. The indicated problems that occur when using compost is given in Figure 3. From 47%, most of the respondents stated that compost does not give quick results. Other fertilizer like chemical gives quicker results than compost. So they said that it will take long duration to get the results from compost and cannot be used in nutrient deficiency and it won't treat for deficiency symptoms. And improper treated compost can cause infection for the entire cultivation. Some complain that damping off occur when using compost. At that situation can cause crop losses and economic loss for the farmers (Figure 3)

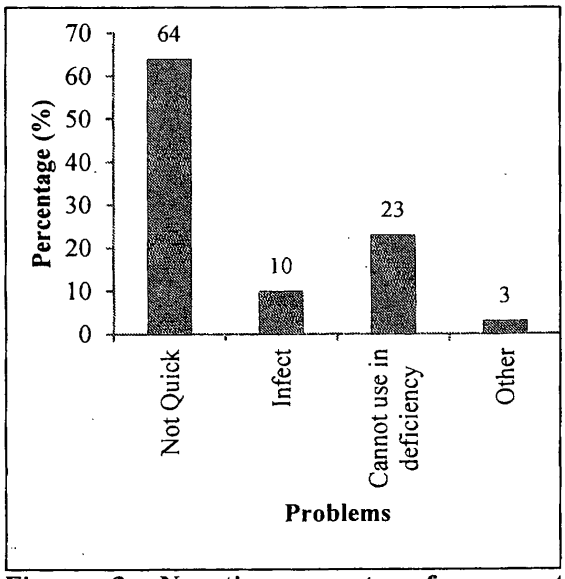

Figure 3. Negative aspects of compost indicated by the farmers

CONCLUSIONS

When obtaining compost, farmers were concerned mainly about quality followed by price. So quality and price can play a major role when increasing or decreasing of a demand for compost. Farmers with large extents and higher income would demand more compost. With respect to the farmers that cultivate other crops, paddy farmers have significant effect for compost demand.

This study showed that there are more segments to sell compost. When consider about the paddy farmers, they use more compost than others. So paddy farmers much more interact

for the compost demand than other farmers. And also this shows that compost demand is higher in *Yala* and *Maha* season. This stated that self-produce farmers are higher than purchase farmers. And purchased product must have quality assured label and fulfill the customer requirements. The other main segments can be stated based on land size of cultivation. If higher land owned farmers demand more compost than lower land owned farmers.

This indicated that farmers are more sensitive to quality than price. However, one major problem in MSW compost is their low quality due to of excessive sand content because of road sweepings. This has to be corrected to create more demand on the other hand if improving quality is much difficult, there is no option other than selling at a very low price, which may not be practical.

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REFERENCES

Ahmed, N. and Zurbrugg, C. (2002). Urban organic waste management in Karachi, Pakistan. 28th WEDC Conference in Kolkata, 18-22 November.

Alzaydi, A., Alsolaini, S. and Ramadan, M., (2013). Demand, practices and properties of compost in the western region of kingdom of Saudi Arabia. *Australian Journal of basic and Applied Sciences*, 7 (7), 768-776.

Burntley, S.J. (2007). A review of municipal solid waste composition in the United Kingdom. *Journal of Waste Management,* **27** (10), 1274–1285.

Cole, M.A., Liu, X. and Zhang, L. (1995). Effect of compost addition on pesticide degradation in planted soils. In: Bioremediation of recalcitrant organics.

Folefack, A.J.J. and Adamowski, J.F. (2012). Application of the von Thunen model in determining optimal locations to transport compost for crop production outside of Yaounde, Cameroon, *Journal of Human Ecology*, **39** (2),125-143.

Guerrero, L.A., Maas, G. and Hogland, W. (2013). Solid waste management challenges for cities in developing countries. *Waste Management,* **33**, 220-232.

Hasan, M.R., Tetsuo, K. and Islam, S.A. (2009). Landfill demand and allocation for municipal solid waste disposal in Dhaka city. *Journal of Civil Engineering (IEB),* **37** (2), 133-149.

Palatnik, R., Ayalon, O. and Shechter, M. (2005). Profile household demand for waste recycling services, Natural resource and Environmental Research center, University of Haifa, 31905, Israel.

Pandyaswargo, A.H. and Premakumara, D.G.T. (2014). Financial sustainability of modern composting: the economically optimal scale for municipal waste composting plant in developing Asia. *International Journal of Recycle Organic Waste in Agriculture*, **3**, 66

Rouse, J., Rothenberger, S. and Zurbrugg, C. (2008). Marketing compost, A guide for compost producers in low and middle income countries. Department of water and sanitation in developing countries.

Sharholy, M., Ahmad, K., Mahmood, G. and Trivedi, R.C. (2008). Municipal solid waste management in Indian cities. A review. *Journal of Waste Management,* **28**, 459-467.

Walpola, R. (2016). Stinking to high heaven. Available from: http://www.ceylontoday.lk/90-114005 news-detail-stinking-to-high heaven.html (Assessed 26 April 2016)

Wijewardana, H. (2011). Standards of compost. (Brochure) Compost production. Department of Agriculture.