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An Inquiry into Farmer Perception on "Fortified Compost"

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ABSTRACT

Distinguishing proof of purchaser inclinations is vital in outlining products with the most extreme buyer request to capture the market share. This investigation assessed buyers' expressed inclinations for compost attributes through conjoint analysis. Ranked information were investigated utilizing Rank Ordered Logistic Regression (ROLOGIT) model. A five-point Likert scale for ordinal psychometric estimation of attributes in fortified compost product was also analysed. The results of ROLOGIT revealed that all four attributes (form of compost, distribution method, availability of faecal sludge and price of the product) have demonstrated a significant effect on choosing a compost product. For the form of compost; respondents were willing to pay and additional sum of Rs. 4.18 if the product is in 'dust' form rather than in 'pellet' form. Also, 1.49 and 5.06 of marginal willingness to pay (MWTP) acquired for on-farm gate distribution strategy and availability of faecal sludge respectively. Contrary to the expectation, farmers show a very high willingness to pay for the attribute 'presence of faecal sludge' with an additional amount of Rs. 5.06. According to the Likert scale analysis close to 60.67 % of the respondents are willing to purchase the product in the next season. Hence, results of this study can be used to define a strategy regards to urban waste administration with the aggregation of compost production by developing new business models.

KEYWORDS: Conjoint analysis, Farmer preference, Fortified compost, Marginal willingness-to-pay

INTRODUCTION

As an agriculture-based country, Sri Lankan agricultural lands have been cultivated for more than 100 years continuously. Thus, soil fertility of such lands has been drastically decreased, making the yield levels to drop. This prompts farmers to apply more fertilizer which in turn increase the reduction in soil fertility rate without their knowledge.

But organic fertilizer such as animal manure, crop residues, green manure and compost can act as a soil structure enhancement, water holding capacity increaser and soil toxin neutralizer in order to lessen this soil fertility problem. However, their impact on yield is not quicker as in chemical fertilizer. Therefore, the integrated nutrient management system is the best way forward and was seen as the reduced input of chemical fertilizers and the combined use of chemical fertilizers with organic materials. Management systems that depend on organic inputs as plant nutrient sources had a different pattern of behaviour of nutrient availability from those involving the use of chemical fertilizers. For sustainable crop production, combined different things together; use of chemical and organic material that makes plants grow better was proved to be highly helpful (Chen, 2006).

Also, management of municipal solid waste (MSW) and faecal sludge (FS) is fast becoming a major problem in Sri Lanka. This is becoming a massive problem because of the increasing rate of urbanization.

However, the high organic fraction and high moisture content of MSW were suitable for producing good compost (Vidanaarachchi *et al.*, 2006).

Thus, this waste problem can be minimized up to some extent via co-composting those wastes together. Also, such a product can be marketed for a reasonable price which is lower than the existing prices of chemical fertilizers.

The world prices of Nitrogen (N), Phosphorus (P) and Potassium (K) minerals are currently increasing at an increasing rate. This phenomenon occurred due to rising energy cost in the world; production and delivery costs of such minerals are increasing. Therefore, to reduce the ever-rising cost of production due to this increase in prices, best way is to reduce application of such minerals. Thus, an integrated nutrient management plays a massive role.

A fortified compost product is a product consisting of a mixture of co-compost (MSW + FS) and enriched with N P K minerals. It has benefits over other compost products such as; less bulkiness, dustless and safeness in applying. However, before introducing such a product to the market, it is essential that farmer

preference for such product is to be obtained.

Therefore, this study was initiated to assess farmer preference on fortified compost. Specific objectives of this research are to assess preference in terms of willingness to pay (WTP) for specific attributes of a fortified compost product and estimate the demand for product 'profiles' that may be able to offer to farmers.

METHODOLOGY

Conceptual Framework

This study assumes that the value placed on product attributes, social and human capital and physical capital as the main factors that may influence farmer preference to fortified compost. Because these are theoretical constructs and cannot be directly measured, these were operationalized by creating 'proxy' variables that may capture the nature of these theoretical constructs.

To assess the value placed on product attributes four variables were used: the form of compost, price per kg, distribution method and faecal sludge availability in the product. These variables were selected according to the 4Ps (product, price, place and promotion) concept in marketing in order to capture the market as required in this study.

Socio-demographic factors such as age, gender, education level and monthly income of the farmer were used to capture social and human capital of the farmers. For physical capital, three independent variables; total cultivated land area, owned or rented land and machinery used in cultivation were used.

Choice-based Conjoint Analysis

As this research involves the study of farmer preference and choices in a set of choice situations, the conjoint analysis technique was used. It is a stated preference non-market valuation method which is derived from Lancaster's theory of values. It says that the consumer values the quantity of product attributes at his disposal through the purchase of a commodity. Thus, the random utility function is given by;

$$U_{ij} = V(Z_j, S_i) + e(Z_j, S_i) \quad \text{.....(1)}$$

Where; (U_{ij}) is the utility of i^{th} respondent generated by j^{th} item, (V) is a deterministic component, (Z) is attribute, (S) is social & economic characteristic and (e) is error component.

After the estimation of the parameters of the model, the marginal willingness-to-pay value was calculated via;

$$MWTP = -1\ (\beta\ attribute / \beta\ monetary\ attribute) \quad \text{...(2)}$$

Where; $\beta_{attribute}$ is the coefficient of each attribute estimated from the regression and $\beta_{monetary\ attribute}$ is the coefficient of the price variable included in the conjoint experiment.

Conjoint analysis was concerned with determining the joint effect of levels of two or more attributes of stimuli on the total evaluative judgments of a set of stimuli. Conjoint methods have been applied in a large number of applied marketing research projects especially in product design optimizations (Green and Srinivasan, 1990).

Likert Scale Analysis

Also, ordinal psychometric measurement of attributes in fortified compost was done via a five-point Likert scale. It is a model that used to estimate relationships between an ordinal dependent variable and a set of independent variables. An ordinal variable is a variable that is categorical and ordered, in this case, "strongly disagree", "disagree", "neutral", "agree" and "strongly agree" indicate the ordinal dependent variable (Boone and Boone, 2012). The Likert scale ratings were analysed graphically.

Data Collection and Analysis

Data were collected from 300 vegetable farmers. The survey was conducted in Nuwara-Eliya district representing all 5 divisional secretarial divisions. Rank ordered logistic regression was employed to assess the relationships between the choice and the attributes (a form of compost, distribution method, availability of FS and price of compost). STATA 14 was used as the statistical software.

Nuwara-Eliya district (Figure 1) was used, as it is the district in Sri Lanka, which has the highest representation of vegetable farmers in the country. This survey focuses on vegetable farmers. It is the cluster identified as easiest one to penetrate the market for compost products.

Figure 1. Map of the location of Nuwara-Eliya district

Face to face interviews was conducted among 300 randomly selected respondents in Nuwara-Eliya district vegetable farmers representing all 5 DS divisions (Figure 2).

Figure 2. Data collected divisional secretariats

Questionnaire

Data were collected via a pre-tested questionnaire. The questionnaire consists of four interrelated parts.

[a] Personal Details: This section contains demographic factors (age, gender, educational level, farming monthly income and monthly income from off-farm work).

[b] Farming Details: Contains crop details (a type of crop cultivated, number of farming seasons, total land area cultivated, type of land, number of years cultivated up to now, soil type of land, usage of machines for the cultivation and type of soil input – inorganic or organic).

[c] Likert Scale Statements: Likert scale statements consist 8 statements to test the perception of the farmer.

[d] Choice cards: Eight choice cards were generated using SPSS 16. All 8 cards were used without blocking.

The value placed on product attributes was estimated via marginal willingness-to-pay (MWTP) values obtained through a choice based conjoint analysis. The attributes and their levels as given in Table 1 and a sample choice card is shown in Figure 3.

Table 1. Attributes and their levels used

Attributes	Levels of attribute
Form of compost	Dust
	Pellet
Distribution method	On Farm-Gate
	Local Stores
Comprising faecal sludge	Yes
	No
Price/kg	Rs. 7/=
	Rs. 12/=
	Rs. 15/=
	Rs. 17

Choice cards (Figure 3) generated was presented to the respondents who rate them.

Compost Type 1	Compost Type 2
Compost is in **dust** form	Compost is in **dust** form
Only sold in local stores	Brought to your farm
HAS faecal sludge in this compost	**NO faecal sludge** in this compost
Price = Rs. 12 per Kg	Price = Rs. 15 per Kg
☐	☐

Figure 3. Sample card shows a combination of compost attributes rank by respondents in the conjoint study

RESULTS AND DISCUSSION

Descriptive Statistics of the Sample

Out of 300 participants, 73 % of the respondents were males while 52.67 % of the respondents were in the age category of higher than 50 years. More than Rs.50,000/= of farming income had 38.33 % of the respondents and 60.33 % of the respondents was educated up to ordinary level (Table 2).

Table 2. Descriptive Statistics of the Sample

Parameter	Percentage (%)
Age (Years)	
< 35	10.00
35-50	37.33
50 <	52.67
Education	
Primary	16.00
Up to Ordinary Level	60.33
Up to Advanced Level	21.33
Graduated	1.67
Post graduated	0.67
Farming Income (Rs.)	
< 20000	18.00
20000-30000	21.33
30000-40000	9.33
40000-50000	13.00
50000 <	38.33
Gender	
Male	73.00
Female	27.00

Most did not have off-farm income (68 %) and only 32.33 % were members in farmer associations.

When cropping details were considered, majority of farmers cultivated cabbage and most farmers cultivated three seasons per year (56.67 %). A majority cultivated in their own lands (81 %). In the selected cluster most, prominent soil types were clay soil (36.33 %) and loamy soil (36.33 %).

High amount of fertilizer was used by the farmers while the majority used both inorganic and organic fertilizers (70 %) as the soil input in their lands. Twenty-seven percent of

respondents use only inorganic fertilizer in their lands and at the same time, 2.67 % of respondents use organic fertilizer only. In the case of the farmer experience with the usage of faecal sludge added fertilizer majority did not have any experience (93 %).

Likert Statement Analysis

Forty-seven percent of respondents were agreed that they haven't any hesitancy to purchase a product that includes faecal sludge. Majority of respondents were strongly agreed to purchase fortified compost at a low price than chemical fertilizer (77.33 %) while some are agreed to purchase at the same price (45 %). Also, most respondents were disagreed to purchase the product at a high price (38 %). Due to the improvement of soil quality, reduction of waste problem and environmentally friendly manner; 74.67 %, 42.67 % and 73 % respondents were strongly agreed to purchase fortified compost, respectively. In the case of demand, 60.67 % strongly agreed to purchase fortified compost in next season by confirming the market for the product (Figure 4).

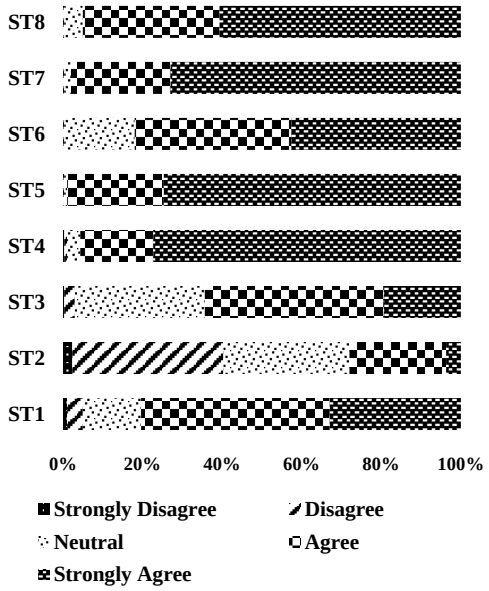

Figure 4. Response for Likert statements
Note: ST – Statement.

Rank-Ordered Logistic Regression

In this model, dummy coding was used for all categorical variables. The output showed that there is a significant relationship between choice and price of the product. Similarly, it also showed that the choice relies on the form of a compost product. Moreover, choice and product distribution method exhibit a significant reliance while choice and the availability of faecal sludge additionally speaks to a significant relationship between them (Table 3).

Table 3. Results from ROL regression

Attribute	Coefficient	P > |z|	MWTP
Form of compost	-0.9409356	0.000	-4.18
Distribution method	0.334319	0.000	1.49
Comprising faecal sludge	1.139582	0.000	5.06
Price/kg	-0.2251172	0.000	*

Note: Prob > chi2 = 0.0000, Significance level - 0.05

Marginal willingness to pay values were calculated by the attribute coefficient values divided from the price coefficient. For the form of compost; respondents were willing to pay and additional sum of Rs. 4.18 if the product is in 'dust' form rather than in 'pellet' form. Thus, it showed that farmers do not like the product in pellet form. If the product is distributed to the farm gate, they are willing to pay and additional Rs. 1.49 for the product. Contrary to the expectation, farmers show a very high willingness to pay for the attribute 'presence of faecal sludge' with an additional amount of Rs. 5.06.

According to the probability that an alternative was ranked first among choice cards, compost product which was in dust form into the on-farm gate distribution method with the incorporation of faecal sludge at a price of Rs.7/= getting the highest percentage (65.52 %) to become first in ranking (Figure 5).

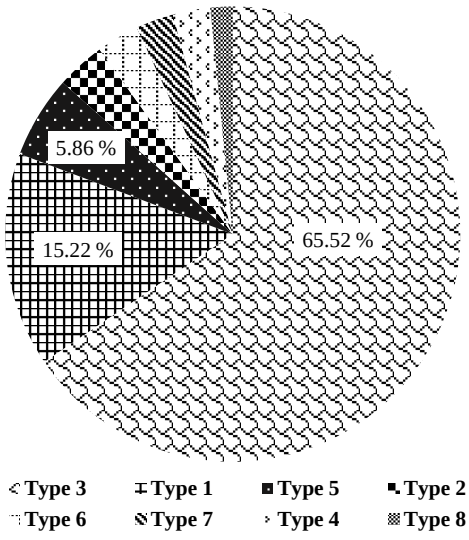

Figure 5. Percentage that an alternative is ranked first among choice cards

CONCLUSIONS

Prevailing urban waste mismanagement issue in Sri Lanka can be minimized by producing compost product using municipal solid waste and faecal sludge, because this

study revealed that there was a high demand for such a product among respondents. Results indicated that majority of farmers are willing to purchase this product for the next season.

The ideal product profile for vegetable farmers in Nuwara-Eliya is a compost in dust form with faecal sludge sold at farm gate. This product should be priced at Rs. 7/= per kilogram.

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