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SOCIO-ECONOMIC FACTORS AFFECTING THE USE OF SOLID WASTE COMPOST PRODUCED IN KURUNEGALA AND KUNDASALE MUNICIPALITIES.

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Abstract:
Municipal Garbage Compost (M.S.W.C.) is popular with organic farming in the world. Nearly 100 authorities in Sri Lanka are involved in the production and the timing is right to identify the factors for using M.S.W.C. The cities of Kurunegala and Kundasale were selected to identify socio-economic factors that influence the use of M.S.W.C. Users (45) and non-users (35) M.S.W.C. selected using a simple random sampling method. Data collection was carried out using questionnaires and key informant interviews. The majority (51%) of M.S.W.C. users are in the 36-50 age category and 60% are in the high-income category. Hence, 47% of M.S.W.C. users are vegetable cultivators. The majority (84%) have higher knowledge about the supply of soil fertility nutrients and knowledge about production and application is at a moderate level. The Spearman correlation and multiple linear regression yields monthly income, agricultural land area, farming experience and knowledge of production methods and applications showed a significant relationship with the number of M.S.W.C. use. Discriminant function analysis yields knowledge about soil fertility, productivity, nutrient availability and attitudes about the benefits of using M.S.W.C. leading to M.S.W.C. users and non-users. Conducting interactive drama, multimedia and promotional videos to promote M.S.W.C.

Keywords:
Compost, Municipal solid waste, Socio-economic factors

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INTRODUCTION

Organic waste is one of the major streams of Municipal Solid Waste. Households, commercial establishments, agricultural activities, industries, institutions and the public contribute to municipal waste. Municipal Solid Wastes (M.S.W.) is one of the serious environmental issues in the urban areas and is a result of rapid urbanization, change in life pattern, economic and infrastructure development activities and population growth.

In our country, urban councils collect waste and dump without proper management, so it leads to creating huge waste mountains. This waste contains a high amount of organic matter and nutrients, which can be used as a source of manure in agriculture.

Compost production provides an opportunity for better management of waste as well as sustainability in agriculture. Organic agriculture can bring multiple benefits to health, economic and ecological aspects of people.

Adding compost to the soil is essential to improve soil structure, and it acts as a conditioner. It plays a key role in carbon storage and strongly influences nutrient retention and availability (Hamarashid et al., 2010). According to a survey on M.S.W. compost, organic Carbon (C) accounts for 20% of total C in the composted M.S.W. (He et al., 1995). It has been reported that Sri Lankan soil has a deficiency in C and compost is an excellent supplement to correct carbon deficiency.

By the end of 2014, about 100 compost sites were operating in different local government areas. These composting projects will support a healthier and greener environment, and it can support to reduce expenditure on importing synthetic fertilizer.

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As a solution to the municipal solid waste, Municipal Councils have already started compost making projects. The success of management of biodegradable solid waste by composting it entirely depends on the usage of compost by the farming community. That is because, without the demand for such compost, it is not possible to maintain. Acceptability of farming community is very low and slow adoption to use M.S.W. compost. So it is a need to identify the socio-economic factors affecting the use of municipal solid waste compost. As well as an analysis of socio-economic factors which affect the use of M.S.W. compost has not been identified.

The main objective of the study was to identify the socio-economic factors affecting the use of municipal solid waste compost and propose ways and means to popularizing it among farming communities.

METHOD

The study was conducted using a cross-sectional survey study approach. It was a comparative study between the Municipal solid waste compost users and non-users of M.S.W. compost. Here non-users of M.S.W. compost were used as the control group. Kurunegala and Kundasale municipal council were chosen for the study. There were 45 land users from Kurunegala municipal council while 35 land users from Kundasale municipal council. M.S.W. compost user was considered as a sampling unit. Land users in Kurunegala and Kundasale are considered as the population. It includes both M.S.W. compost users and M.S.W. compost non-users. Simple random sampling method was used, and the size of the sample is 80.

According to the information needed to obtain and the objectives of the study, a structured questionnaire was used to gather information. Many direct, indirect, open-ended and close-ended questions related with personal details, farm details, knowledge and attitude on M.S.W. compost use, sources of information, constraints to use M.S.W. compost and availability of compost in market. Likert-scale was used for some questions. The questionnaire was pre-tested using ten respondents and improvements were made according to the respondents' feedback before the data collection of the study. Stakeholder discussions were done with the Public Health Inspector (PHI) in Kurunegala municipal council and Environmental officer in Kundasale municipal council, M.S.W. compost sellers in Kurunegala and Kundasale and agricultural instructor in data collecting area. Secondary data were collected from different sources such as Environmental Situation Analysis report in Kurunegala, annual reports of Municipal council, research reports, papers and journals. Data were analyzed using the statistical package for Social Sciences (S.P.S.S.). Descriptive statistics were used to see the frequencies and mean percentage of sample characteristics. Inferential statistics were used to do Spearman correlation test, multiple linear regression, Mann Whitney u test and discriminant function analysis. Association between two variables were tested using correlation test. Regression test was done to predict the relationship between M.S.W. compost usage and other independent variables. To compare the mean difference of all variables among M.S.W. compost users and non-users T-test were used. The output of the qualitative data was directly used for the discussion.

RESULT AND DISCUSSION

Use of Municipal Solid Waste (M.S.W.) compost

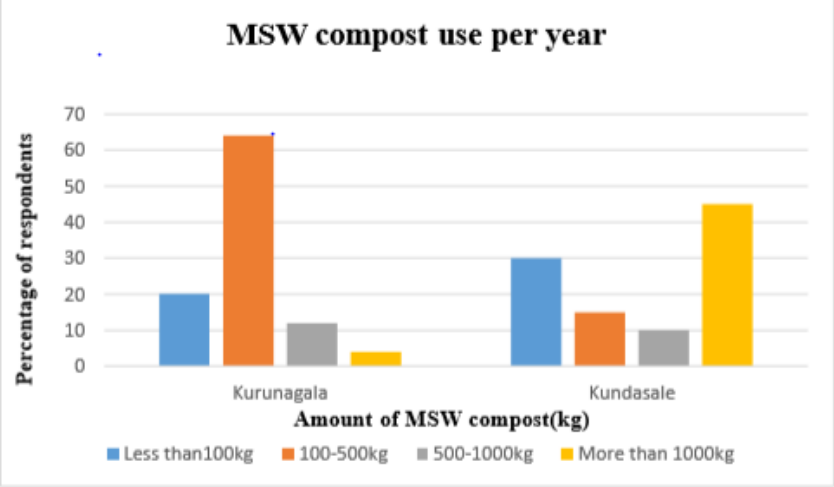

Figure 1. Distribution of respondents according to the amount of M.S.W. compost use per year and location.

Relationship between amount of M.S.W. compost use and socio-economic factors were measured using the spearman rank-ordered correlation test.

Table 1. Association between predictors and outcome.

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Variable	Amount of M.S.W. compost use per year(kg/yr)		
	r	p-value	Remark
Age	0.231	0.126	Not significant
Gender	-0.220	0.147	Not significant
The education level of the user	-0.257	0.088	Not significant
Highest education of the family	-0.284	0.058	Not significant
Monthly income of the user	0.395*	0.007	Significant
Total monthly income of the user	0.082	0.590	Not significant
Farming experience	0.581*	0.000	Significant
Cultivated land extent	0.455*	0.002	Significant
Type of farming	-0.320	0.062	Not significant
Level of engagement	-0.242	0.109	Not significant
Knowledge of soil fertility and productivity improvement and nutrient supply	0.271	0.072	Not significant
Knowledge of the method of production and application	0.410*	0.005	Significant
Attitude on the advantage of using M.S.W. compost	0.029	0.849	Not significant

* Correlation is significant at the 0.05 level (2-tailed).

Comparison of socio-economic factors of M.S.W. compost users and non-users Mann Whitney u test were used.

Table.2 Mean comparison between M.S.W. compost users and non- users

Item	Mean (User)	Mean(Non-user)	t value	p-value
Age (years)	51	52	-0.49	0.52
Education level	3.36	2.31	2.65	0.30
Highest education of the family	4.47	4.31	0.33	0.50
Monthly income of the users(Rs)	63997	93277	2.35	0.02*
Total income of the family (Rs)	113397	89615	0.09	0.36
Cultivated land extent (ac)	1.04	1.51	-0.97	0.97
Farming experience (years)	13	21	-3.07	0.00*

*significant at the 0.05 level(2 tailed)

Multiple linear regression analysis was used to predict the relationship between M.S.W. compost users and independent variables.

Table. 3 Relationship between M.S.W. compost users and independent variables.

Variable	Coefficients		t	p
	Standardized	Unstandardized		
Age	2.198	-85.016	-1.753	.090
Gender	-0.088	-816.237	-.872	.390
Education level	-0.101	206.384	-.625	.537
Highest education of the family	0.049	105.069	.345	.732
Monthly income of the users	0.006	.027	4.891	.000
Monthly total income of the family	0.248	.012	1.054	.300
Level of engagement	0.101	877.349	.819	.419
Cultivated land extent	0.812	2144.508	6.184	.000
Farming experience	0.189	114.484	1.950	0.048
Type of farming	-0.029	-94.315	-.238	.813
Knowledge of soil fertility and productivity improvement and nutrient supply	1.101	1972.151	3.250	.003
Knowledge of the method of production and application	0.953	1599.027	2.983	.006
Attitude on the advantage of using M.S.W. compost	0.378	374.249	2.021	0.047

According to the above output following model can be obtained
Y= 428.736+0.027X1 +2144.508X2 +114.484X3+1972.151X4+1599.027X5

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Y- Amount of M.S.W. compost use per year ß- constant X1- Monthly income X2- Cultivated land extent X3- Farming experience X4- Knowledge on soil fertility and productivity improvement and nutrient supply X5 Knowledge on the method of production and application

A discriminant function analysis was conducted to predict the factors which affect to discriminate the two groups. Predictor variables were knowledge on soil fertility, productivity and nutrient supply and attitude on the advantage of using M.S.W. compost. The discriminate function revealed a significant association between groups and all predictors, accounting for 84.27% of between group variability.

Constraints to the use of M.S.W. compost in the study area. The constraints to the use of M.S.W. compost were identified in the study area and ranked to determine the most important of these constraints as presented in below table.

Tabel.4 Constraint to use of M.S.W. Compost

Constraints	Percentage
Lack of awareness on availability within the market	26%
No certification	20%
Low nutrient level	16%
Presence of physical contaminants	13%
Irregular supply	11%
Offensive odour	07%
High sand content in the final compost product	05%
Non-uniformity in quality batch	02%

Farmers' suggestions on possible improvements to M.S.W. compost

Table.5 suggestions on possible improvements to M.S.W. compost

Suggestions	Percentage of respondent
Increase nutrient content	31%
Reduce odour	22%
Involvement of extension officers	19%
Reduce inert content	13%
Reduce sand content	05%
Proper labelling	07%
Reduce particle size	03%

In the sample, the majority 70% were male in both samples, and their age distribution varies from 36 to 72 years. The majority (51%) of the respondents are between the age of 36-50 years, with the mean age of 51 years. It indicates that majority of the farmers are middle-aged. Mean age of the Kurunegala respondents is 52 while Kundasale 50. The majority (45%) of non-users belong to age group 51-65. So farmers who are using M.S.W. compost are relatively younger than non-users. Younger people like adventurous situation such as discovering new input, like to get risks, like to get experiences from new technology than the older generation. Most of the older people like the way that always practised from tradition.

M.S.W. compost users' majority (26.7%) belongs to income level ranging between LKR 50,000 to 100,000, and 11% have an income level above LKR 100,000. However, non users majority income level is less than >10,000. The reason for this situation may be when to consider about the M.S.W. compost users the level of engagement in farming (62.2%) are engaged as part-time farmers. They get income from both on-farm and off-farm sources. However, non-users it is vice versa their majority are full-time farmers. These values show that middle-income respondents are more interested in using M.S.W. compost. As well as when considering about the total monthly income of the family, it is also range between LKR 50,000 to 100,000 and 31% and 42.9% are the majorities of M.S.W. compost users and non users respectively. When considering the total monthly income of the family, it includes all the income of the households and both on farming and off farming income. So there is no difference between users and non users.

The education qualification of the majority is (44%) for both M.S.W. compost users and non users, and it is G.C.E. (O/L) and the highest level of education of the family it is up to G.C.E. (A/L) (44.4%) for both users and non users. When comparing the level of education and the highest level of education between Kurunagala respondents and Kundasale respondents, In Kurunagala majority (40%) education level and

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(48%) highest education of the family are degree holders respectively. To decide on a family, it affects the level of education of all the family members. Education of the farmers is assumed to have an important impact on using new technologies. It enables an individual to make independent choices and to act based on the decision. Higher levels of education led to higher rates of using new technologies in agriculture. Usage of M.S.W. compost is a new and recently introduced technique in the agricultural field.

Principal crops are referred to as crops commonly grown in a large quantity for commercial purpose by the farmers in the study area. The majority (33.8%) of the respondents use M.S.W. compost for home gardening. When comparing this situation between Kurunegala and Kundasale, Kurunegala majority 44% use this compost for home gardening while Kundasale 60% use for vegetable cultivation. In marketing arrangement Kundasale sell compost as a bulk to the private organization then they enriched and sold into Nuwaraeliya, so the highest percentage of vegetable cultivators are using M.S.W. compost. The highest proportion of M.S.W. compost users farm size is less than 0.5 acres.

The majority (84.4%) of the respondents were highly knowledgeable about soil fertility productivity and nutrient supply (score of 4-13), with the remainder (15.6%) having a moderate level of knowledge. The mean score was 3. This situation is similar to both Kurunegala and Kundasale. The implication is that the farmers have good knowledge of organic farming, and the knowledge could influence them towards a favourable perception of usage of M.S.W. compost.

The majority (73.3%) of the respondents were moderately knowledgeable about the method of production and application of M.S.W. compost, with the remainder (26.7%) having a high-level knowledge (score 2-6). The mean score was 3.27. This situation is similar to both Kurunegala and Kundasale. The implication is that the farmers need the extension services. So farmers can access the relevant information on the use of compost, timing, application methods, rates of application in order to obtain maximum plant growth and yield. Normally farmers are relying on what their neighbours were practising, but it is not good.

Sources of information on M.S.W. compost are channels through which farmers gain access to information on farming activities and other aspects. Information sources were evaluated by presenting respondents with a list of sources developed from the literature and asking them to indicate which ones they used for accessing the information on M.S.W. compost, their application method, intensity etc. Hundred percent of respondents have accessed information on M.S.W. compost Through a friend or relative farmer. Access the information through extension agent is 0%. As well as no respondent from both Kurunegala and Kundasale have participated in a training programme or campaigns regarding M.S.W. compost.

From the respondents (55%) from Kurunegala and (78%) from Kundasale had easy access to compost buying centre. This indicates that there is still a need to make more accessible for the farming community. From interviewed 27% from Kurunegala suggest that establishing depots closer to the farmer community will be helpful to improve the demand for M.S.W. compost. As well as 22% from Kurunegala reported that it is better to sale this M.S.W. compost in a separate place instead of a compost production plant. Offensive odour is a major constraint for the use of M.S.W. compost, so this situation can be solved if actions are taken to have sale centres.

According to figure 1, the maximum amount of M.S.W. compost use per year is 25000kg, and the minimum amount is 30kg annually in Kurunegala while in Kundasale maximum 10700kg and minimum 10kg. The majority (64%) of the respondent use M.S.W. compost as 100-500kg per year in Kurunegala while in Kundasale use more than 1000kg per year annually. Because when considering the Kundasale municipal council, they have a partnership with the pvt company to sell their compost. So they send this compost to the Nuwaraeliya area for vegetable cultivation, so they use a high amount of compost annually than Kurunegala. In Kurunegala majority use this compost for home gardening.

According to table 01, it shows that monthly income of the user, farming experience and cultivated land extent is positively correlated and significance. Farmers with more experience tend to use M.S.W. compost than the less experienced farmers. This should be expected as farmers who have committed several years into farming should know the how, why, and when to apply M.S.W. compost to their farm. The time period that farmers engaged in agriculture indicates the extent of practical knowledge. There is an association between cultivated land extent and use of M.S.W. compost also.

According to table 2**,** monthly income and farming experience shows the significant mean difference between M.S.W. compost users' group and other compost users' group. The estimates of the regression analysis as shown in table 3 indicates that monthly income, cultivated land extent, farming experience, knowledge on soil fertility and productivity improvement and nutrient supply and knowledge on method of production and application were statistically significant. These factors are the most important factors influencing the amount of M.S.W. compost use per year and they are positively correlated. The regression analysis reported an R-square of 0.797 with a statistically significant. Other factors age gender was found to be negatively correlated with the amount of M.S.W. compost use per year and statistically insignificant.

CONCLUSION

From the results of the quantitative and qualitative analysis, it can be concluded that amount of M.S.W. compost use is significantly increasing with factors such as monthly income, cultivated land extent, farming experience and knowledge on method of production and application. Further, results of discriminant

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function analysis revealed that predictor variables namely; knowledge on soil fertility, productivity and nutrient supply and attitude on advantages of using M.S.W. compost lead to discriminate the two groups of M.S.W. users and non users. Age, gender, education level and level of engagement in farming have no explanatory significance towards the amount of M.S.W. compost use. Lack of awareness on availability within the market, no certification and low nutrient value are major constraints to use M.S.W. compost. It is suggested to improve the use of M.S.W. compost are increase nutrient content, reduce odour and involvement of extension officers.

Following recommendations could be made, Introduce formal systems for the government or any other certification authority for suitability in agriculture, Introduce mechanisms for agricultural extension services and private sector service providers to liaise with compost producer. Arrange marketing facilities through Agrarian Service Centers at the village, Improve the quality of compost by enrichment to suit different crop types and conducting interactive drama and practical usage of multimedia and promotional videos to promote M.S.W. compost among the farming community.

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