Determinants of Organic Fertilizer Usage in the Post-Chemical Fertilizer Ban Period: Evidence from Mihinthale Divisional Secretariat, Sri Lanka

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Abstract

The use of organic fertilizers in agriculture has gained attention as a means of managing waste Organic farming is considered as an environmentally friendly agricultural practice since the heavy use of chemical fertilizer has been considered unhealthy for the environment. After the ban on importing chemical fertilizer by the government of Sri Lanka in 2021, the use of organic fertilizer has received extra attention in the country. In this context, the main purpose of this study is to examine the significant factors affecting the usage of organic fertilizers in Sri Lanka. A survey was conducted with a large sample based on the Mihinthale Divisional Secretariat in the Anuradhapura District which has about 4,169 farmers. A sample of 834 farmers were selected randomly among six Grama Niladhari Divisions based on the convenient sampling method. Data were collected using a structured questionnaire administered by two research assistants and analyzed using descriptive and inferential statistics. The study identified that waste management strategy, economic benefit, perceived health consciousness, practicing sustainable agriculture, and self-satisfaction significantly influence the usage of organic fertilizer in the Mihinthale Divisional Secretariat, Anuradhapura District. The findings of the study will help to improve the usage of organic fertilizer in Sri Lanka and contribute to designing sustainable agricultural policies locally and globally.

Keywords: Chemical Fertilizer, Determinants, Fertilizer Ban, Mihinthale Divisional Secretariat, Organic Fertilizer, Sri Lanka

1. Introduction

1.1. Background of Study

The usage of inorganic fertilizers in agriculture has led to myriad problems beyond economic consideration. Synthetic fertilizer usage in agriculture is often regarded as a problematic decision economically (Mahdi et al., 2010), socially (Serpil, 2012),

environmentally (Mahdi et al., 2010), and health-wise (Channa et al., 2011). When society became distracted from the importance of organic manure, it was discovered that soluble acidic-based Nitrogen, Phosphorus, and Potassium (N, P, K) were "fertilizers" for agriculture. With that, large industrial concerns started taking advantage of the N, P, K discovery to artificially prepare and market their industrially processed "fertilizers" which causes serious sociological, and ecological problems and harming sustainability as well (Pettit, 2008). The environmental impacts associated with synthetic fertilizer include water pollution, destruction of micro-organisms and friendly insects, crop susceptibility to disease attack, and reduction in soil fertility (Mahdi et al., 2010). However, Rodrigo (2014) suggests that the fertilizer subsidy should be reduced in several stages by gradually introducing organic fertilizers (Rodrigo,2014). In discussing its implementation in the real world, concerns about financial burden and negative environmental externalities along with food security concerns led the government of Sri Lanka to cut down the fertilizer subsidy by 25% in the 2012-2013 budget as per the aim of encouraging the farmers to use more organic fertilizers (Ministry of Finance and Planning-2012 cited in Rodrigo & Abeysekara, 2015).

Chemical fertilizers affect in the facets of water pollution, soil pollution, and air pollution (Serpil, 2012). The excessive Nitrogen fertilizing rates in the Nile Valley flood plains are likely the main causes of water contamination (Shamrukh, et al., 2001). A few centuries ago, local farmers were able to produce rice to feed the whole nation with the use of traditional pest control methods and fertilizers, in growing and securing their plants instead of pumping them with numerous chemicals. This study is of timely importance to farmers in Sri Lanka to reconsider their approach to fertilization techniques by giving higher priority to organic fertilizers. According to a survey conducted by the Research Institute of Organic Agriculture FiBL on certified organic agriculture worldwide, as at the end of 2015, organic agriculture was practiced in 179 countries, which was 172 in 2014 (Food and Agriculture Organization of the United Nations, 2015). Considering the Asian context, the total area dedicated to organic agriculture was almost four million hectares in the year 2015 in which there were more than 0.8 million producers (Willer & Lernoud, 2017). When compared to the world and the Asian context in the organic food industry, the level of organic agriculture in Sri Lanka stands far behind. Area-wise organic agricultural land (including in-conversion areas) in Sri Lanka in 2015 was 963.18 square kilometers (Willer & Lernoud, 2017).

The value of organic fertilizers in agriculture involves numerous benefits to human beings, the environment as well as the economy. Cost reduction (Food and Agriculture Organization of the United Nations, 2015), improving soil fertility (Chen,

2006; Food and Agriculture Organization of the United Nations, 2015), increasing soil water retention (Mahdi et al., 2010), sustainable crop production, improving soil productivity (Food and Agriculture Organization of the United Nations, 2015), and especially ensuring the protection of several probable diseases that may arise from chemical fertilizer usage (Chen, 2006) are some benefits behind the organic fertilizer usage.

Literature highlights the importance of organic fertilizer usage in agriculture in various aspects where the environmental aspect is frequently addressed. Literature on organic fertilizer usage displays a wide array of environmental benefits. The application of organic fertilizer enables soil fertility to improve by fixing atmospheric nitrogen, both, in association with plant roots and without it, and also solubilizes insoluble soil phosphates further producing plant growth substances in the soil (Mahdi et al., 2010). This results in the enhancement of soil biological activity which improves nutrient mobilization from organic and chemical sources and the decomposition of toxic substances (Food and Agriculture Organization of the United Nations, 2015). Moreover, as per Chen (2006) organic fertilizers suppress certain plant diseases, soil-borne diseases, and parasites while a more balanced nutrient supply of organic fertilizers helps to keep plants healthy. In the continuation crop residues can be composted and applied in their soils for an increased sustainable crop production (Food and Agriculture Organization of the United Nations, 2015). In this way, soil fertility can be improved with a net improvement in land productivity.

1.2. Problem Identification

The discussion on increasing the usage of organic fertilizer has come to face with the government's decision to ban the usage of chemical fertilizers. A survey by Bandara et al. (2023) showed that before the ban only 13% of paddy farmers were using organic fertilizer, but after the ban this percentage increased to 89%.

It has been considered that chemical fertilizers generate many negative social and ecological impacts while harming sustainability. According to the Ministry of Agriculture, the excessive use of chemical fertilizer has led to blue childbirths while medical surveys reveal that thirty blind child births are reported per month in Sri Lanka, and the number of kidney and cancer patients is on the increase (Fonseka, 2021). The use of synthetic fertilizers incurs a huge cost (Rodrigo & Abeysekara, 2015) for the country, and it causes a pool of diseases like premature deaths (Wimalawansa, 2015). Tons of pesticides are used in Sri Lanka for the last 20-25 years: diseases such as kidney diseases, heart diseases, diabetes, and cancer have become common in Sri Lanka, and the government has to allocate a substantial amount of money for their medication as well (Channa et al., 2011; Wimalawansa, 2015).

Moreover, Kashi (2017) declares that Sri Lankan farmers started experiencing chronic kidney disease (CKD), fifteen to twenty years after introducing glyphosate to Sri Lanka. Further, the study states that the addition of residues of heavy metals, especially cadmium, lead, and arsenic into the water, and soil has been claimed as contributing factors to CKD. Consistent with the findings of Kashi (2017) and Channa et al. (2011) the authors state that agrochemicals as one of the major causes of chronic kidney diseases in Sri Lanka. The incidence of CKD has become a prominent issue in Sri Lanka which doubles every four to five years, with more than 5,000 deaths annually, and more than 150,000 people being currently affected by this kidney disease (Wimalawansa, 2015). Hence research on the use of organic fertilizers as an alternative to synthetic fertilizers has become essential.

Governments have decided to prohibit the import of chemical fertilizers to reduce negative health effects and save 400 million dollars a year spent on imports of chemical fertilizers (Hamza, 2021).

Although the previous government's decision aimed to reduce chemical usage in agriculture, severe criticisms were leveled at the decision as it was taken 'overnight'. The main criticism was that this kind of decision needs more feasible study before the implementation. Rapid adoption of organic farming in Sri Lanka exposed considerable difficulties and shortcomings in executing the policy at a national level (Stifel, 2025). Soon after the decision, many disputes from farmers were created because of the lack of fertilizers for agricultural activities of the Yala season. The production of organic fertilizer needed for all crops may not be possible at once, and it could take a considerable time to produce the necessary quantities (Fonseka, 2021). Also the author noted that availability of fertilizer in the markets and the financial resources of farmers also influence the purchase of the fertilizer. As a solution, the government has introduced fertilizer subsidies (distributed fertilizer at a cheaper price), farmers were not aware of how to use it sparingly.

Despite the several researches conducted on organic fertilizer usage in Sri Lanka, most have considered only its impact. of organic fertilizer usage. Also, many have disregarded discussing municipal solid waste management as a national-level problem, and researchers have hardly touched on the possibility of implementing composting as a waste management program that may help to reduce the usage of synthetic fertilizer. Further, with the global trend towards sustainability, composing programs have earned a special interest in Sri Lanka too. Identifying the gap, the main focus of this study is to examine the factors affecting organic fertilizer usage in Sri Lanka. In this context, this research attempts to address the research question given below: What are the factors affecting usage of organic fertilizers in agriculture?

2. Literature Review

2.1. Fertilizers

Fertilizer is an essential input in agriculture aiming at improving the productivity and designed to supplement the nutrients already present in the soil (Chen, 2006).

Inorganic fertilizer is considered one of the few agricultural technologies which have enormous potential in raising the productivity of poor smallholder farmers while also contributing in increasing income, accumulating assets, and empowering themselves economically (Benson et al., 2012). In the Sri Lankan context, the fertilizer subsidy accounts for all three major fertilizers Urea, Muriate of Potash (MOP), and Triple Super Phosphate (TSP). Organic fertilizers refer to the materials derived that are essentially carbon in nature using plant, animal, or their byproducts, and which will ultimately be beneficial to plants, and soil by improving the water holding capacity. The European Consortium of the Organic Based Fertilizer Industry states organic fertilizers are diverse formulations of products that plants with nutrients and/or expand organic matter in the soil.

As a global trend toward sustainability, farming gets the involvement of organic fertilizers in agriculture. Ha, Fernando and Mahajan (2019) emphasize the need to discourage chemical fertilizers and at the same time promote organic fertilizers as a healthy and eco-friendly decision. In Sri Lanka, Gliricidiya (*Gliricidia sepium*), a plant with preferable organic characteristics, could be used as a better naturally available alternative to such organic fertilizers used in India (Gunadasa, 2017). It is a commonly grown plant in both the countryside and urban areas. By adding the Gliricidiya leaves to the field, it enhances the carbonic content by 40%, accelerating the functioning of microorganisms while enhancing the wetness of the soil by 50% (Abeygunawardana, 2018). Moreover, Gliricidiya ensures the soil's ability to absorb rainwater (Gunadasa, 2017). Application of such methods would be an eco-friendly initiation for the agriculture system of Sri Lanka.

2.2. Theories

The theory of Planned Behavior, Normative Activation Theory (NAT) and Ecological Modernization Theory are used to explain farmers' behavior and other related factors in using organic fertilizer.

2.2.1. Theory of Planned Behavior (TPB)

The TPB could be used to explain factors influencing the farmers' behavior (Lapple & Kelley, 2013 as cited in Yanakittkul, & Aungvaravong, 2020). The TPB considers three factors which include, attitudes toward behavior, subjective norms, and perceived behavior control, which influence the intention toward the use of organic

fertilizer (Lapple & Kelley, 2013 cited in Yanakittkul, & Aungvaravong, 2020). The attitudes toward farming behavior refer to the concept that a farmer who has a positive attitude toward farming behavior will intend to perform that behavior (Yanakittkul & Aungvaravong, 2020). Furthermore, if a farmer perceives reference group-norms which reflect social pressures and values these expectations positively, the behavior will be encouraged. Perceived behavior control towards farming behaviour is used to assess a farmer's ability to perform actions they can control, based on their intentions for farming (Ajzen, 1991; Yanakittkul & Aungvaravong, 2020).

2.2.2. Normative Activation Theory (NAT)

The Normative Activation Theory (NAT) was developed by Schwartz in 1977 (cited in Xie, 2021) explained how personal norms are activated to guide behaviors. The theory has two factors namely situation and personality. Situational factors are awareness of consequences, responsibility, and perceived ability to act whereas personality factors are awareness of the impacts of action or inaction and personal responsibility. These factors influence personal norms, which then drive pro-social behaviors like recycling, sustainable transportation, or ethical decision-making" (Xie, 2021). The theory is in alignment with organic farmers' behaviors which leads to their norms in a positive way for the environmental protection that promotes sustainable agriculture. Furthermore, the theory explains "awareness of consequences and ascription of responsibility have a significant positive impact on farmers' behavior, which promote the utilization of organic fertilizers" (Xie, 2021).

2.3. Empirical study

2.3.1. Determinants of the usage of organic fertilizer

Organic fertilizers have gained attention due to many reasons such as the need for a sink to dispose of the generated waste, to reduce soil exposure to soil degradation, and the negative effects of commercial chemical fertilizers (Quynh, 2018). Economic, social, marketing, cultivation, and government influences the practice of organic farming (India et al., 2019). Further the authors noted that raising awareness and market demand will increase organic production.

Mahdi et al. (2010) explore the facts of opting for bio-fertilizers the means of negatives of synthetic fertilizers, and the positives of bio-fertilizers and noted that the use of synthetic fertilizers as a point leading to a variety of disadvantages including contamination of soil, water pollution, distortion of micro-organisms, leaving plants more prone to diseases, and reduction in soil fertility. At the same time, bio-fertilizers are introduced as a fertilizer with higher demand than that of its availability, along with the high price of synthetic fertilizers, which is unaffordable for small and marginal farmers and depletion of soil fertility, concern about environmental hazards, and sustainable agriculture (Mahdi et al., 2010).

Converting solid organic materials into organic fertilizers as a means of managing organic waste which helps to solve the problem of waste disposal (Wu et al., 2014). Composting is a solution for gradually rising solid waste disposal in urban spaces and an inexpensive alternative to organic fertilizers (Quynh, 2018). Regardless of its importance in economic terms, the consistent addition of organic waste as municipal waste and crop residues make an important contribution to maintaining the fertility, soil health, and productivity of agricultural soil (Tandon, 1999 cited in Mahdi et al., 2010). Saat (2013) revealed that developed countries generate more waste and use high-tech recycling in treating waste while developing countries produce more organic waste and less recyclable waste. In such a situation Sri Lanka would have a long way to proceed in organic fertilizer production and usage.

Wu et al. (2014) point out inorganic fertilizers as a high-cost solution, with their lack of availability in the market causing competitive farmers to fail in applying the inorganic fertilizers to the crop field at the optimum time. On the contrary, the study identifies organic fertilizers as comparatively low-cost, easily available alternatives to solving the garbage disposal problem also at the same time (Mahdi et al., 2010; Wu et al., 2014).

Government support in terms of resources, credit, markets, and subsidies helps promote organic farming. Therefore, extension agents, farm groups, and the government play key roles in the adoption of organic farming (Sapbamrer & Thammachai, 2021). Training programs organized by academic institutions, non-governmental organizations, or government bodies assist farmers in learning the methods and techniques needed for organic farming (Karki et al., 2011; Thapa & Rattanasuteerakul, 2011; Sriwichailamphan & Sucharidtham, 2014; Singh et al., 2015; Kerdsriserm et al., 2016; Lopez et al., 2005 cited in Sapbamrer & Thammachai, 2021).

Due to the harmful impacts of chemical inputs in conventional farming on human health, farmers have shifted toward organic farming (Cukur et al., 2019). Similarly, health and environmental awareness influence farmers to switch to organic farming (Karki et al., 2011. Consumers have accepted organic products, as they believe that organic products are better in terms of health and environmental impacts than conventional farming (Sapbamrer & Thammachai, 2021; Smith & Paladino, 2010). Organic foods are considered as healthier, safer, tastier, and higher in quality than conventional foods (Magnusson et al., 2001; Michaelidou & Hassan, 2008). Consumers are willing to pay more on organic foods because they perceive them as healthier and more nutritious (Winter & Davis, 2006). Several research noted that organically produced foods have a nutrient composition superior to that of

conventional foods (Worthington, 2001; Magkos et al., 2003). However, this finding was found to be inconsistent as well (Bourn & Prescott, 2002).

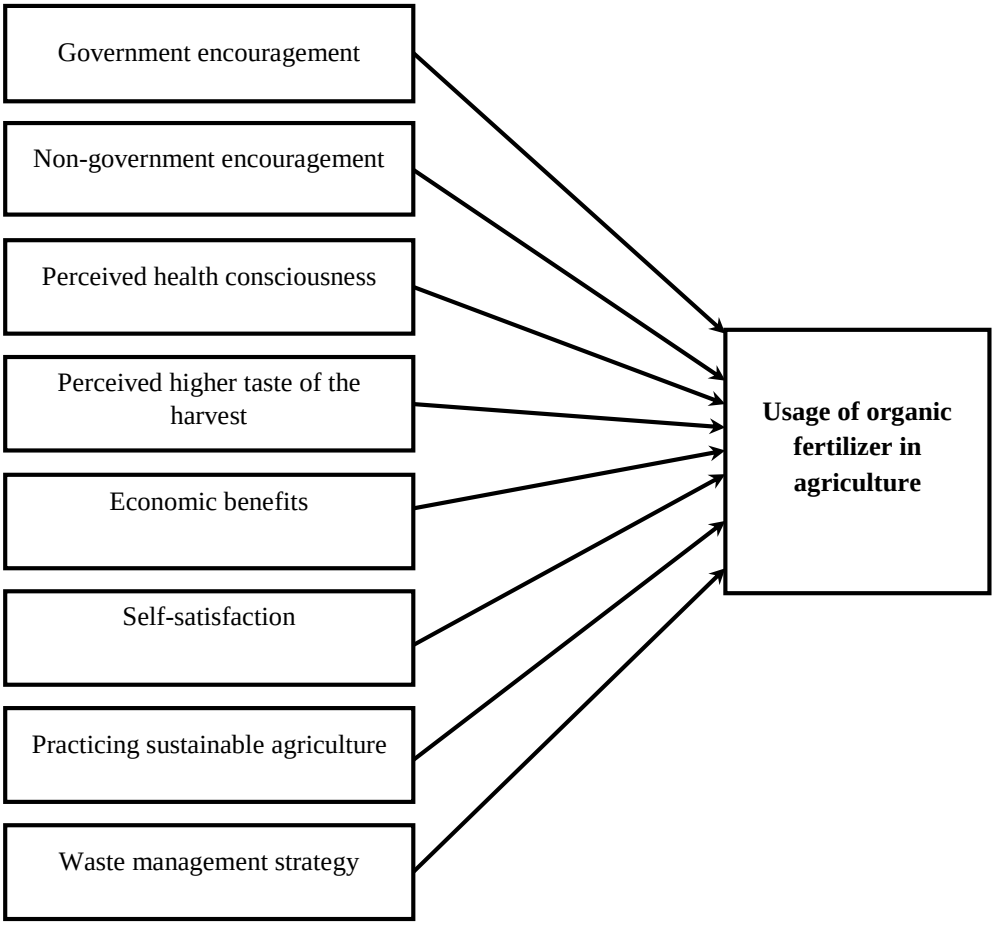
Economic and environmental factors significantly influenced farmers' adoption of organic farming (Azam & Shaheen, 2019). Hence, it can be argued that economic benefits influence the encouragement of organic farming (Mahdi et al., 2010; Wu et al., 2014; Quynh, 2018).

Organic farmers experience more life satisfaction and job satisfaction than conventional farmers (Mzoughi, 2014). Furthermore, this positive relationship applies to both recently and earlier-converted farmers, with subjective well-being positively related to income, profitability, job satisfaction, social recognition, and health (Mzoughi, 2014). Farmers' satisfaction has increased during the conversion to organic farming (Bouttes et al., 2020).

Long-term use of bio-fertilizers is considered eco-friendly, efficient, and productive, and more accessible than chemical fertilizers for small-scale farmers (Venkataraman & Shanmugasundaram, 1992, as cited in Mahdi et al., 2010). Also, the concern about sustainable agriculture, environmental hazard, and the productivity of land has led the farmers to use organic fertilizers (Mahdi et al., 2010; Wu et al., 2014).

Based on the literature review, significant factors affecting the usage of organic fertilizer have been hypothesized and illustrated in the conceptual framework in Figure 01.

Figure 01: Conceptual Framework Explaining Factors Affecting Using Organic Fertilizers in Agriculture



Source: Based on Literature Review and Field Data

Hypothesis Development

Based on the conceptual framework, the following main hypotheses were derived to explain the determinants of the usage of organic fertilizer in agriculture.

H1: Government encouragement significantly influences the usage of organic fertilizer in agriculture.

H2: Non-government encouragement significantly influences the usage of organic fertilizer in agriculture.

H3: Perceived health consciousness significantly influences the usage of organic fertilizer in agriculture.

H4: Perceived higher taste of the harvest significantly influences the usage of organic fertilizer in agriculture.

H5: Economic benefits significantly influence the usage of organic fertilizer in agriculture.

H6: Self-satisfaction significantly influences the usage of organic fertilizer in agriculture.

H7: Practicing sustainable agriculture significantly influences the usage of organic fertilizer in agriculture.

H8: Waste management strategy significantly influences the usage of organic fertilizer in agriculture.

3. Methodology

A survey was conducted to identify the significant factors affecting the usage of organic fertilizer in agriculture. The study area is based on the Mihinthale Divisional Secretariat in the Anuradhapura District in Sri Lanka. The population of the study is 4,169 general farmers in the Mihinthale Divisional Secretariat in the Anuradhapura District in Sri Lanka. The sample selected was 834 general farmers from the Mihinthale Divisional secretariat who are representing 20 percent of the population. The sample was selected based on the Grama Niladari Divisions of the Mihinthale Divisional Secretariat in Anuradhapura District. Out of all twenty-five Grama Niladari Divisions (GND) of the Mihinthale Divisional Secretariat, 24 percent of Grama Niladari Divisions were selected based on the convenient sampling method. These GNDs are Maradankalla, Doramadalawa, Pothana, Ihalagama, Wellaragama and Kannattiya. A sample of 834 farmers was selected randomly among these six GNDs.

The data was collected using a structured questionnaire administered with the assistance of two research assistants and several enumerators. The data were analyzed using both descriptive statistics and inferential statistics such as correlation analysis and regression analysis.

4. Analysis and Discussion

4.1. Analysis of Demographic Variables

Among the total of 834 farmers, the majority were female (53.84%) and the rest of the sample was male (46.16%). Majority of the families (55.3%) in the sample have three to four members, while 19.1% which is the lowest percentage, have more than

four members in the family. In addition, about 25.7% of families have one to two members. The main source of the sample is farming or cultivation (62.6%), and 28.5% have an occupation. While 8% are self-employed, 0.8% are already retired. The farmers' main source of income is also farming or cultivation (44.8%). About 23.6% of families earn Rs. 100,000 or below, and 21% of respondents' annual income between Rs. 100,001 -200,000. About 14.1% of the families' annual income belongs to Rs. 300,001 – 400,000 and Rs. 500,001 or above level. About 35% use both organic and chemical fertilizers for the same crop. About 28% of the respondents are using only organic fertilizers to cultivate and the lowest percentage of respondents use only chemical fertilizers (1.8%). The majority of the respondents cultivate vegetables using organic fertilizers (43.6%) and some families do paddy cultivation (24.3%) and Chena cultivation (4.4%) and fruits (1.4%) by using only organic fertilizers. The majority of farmers cultivate crops of less than one acres (54.2%) by only using organic fertilizers. About 32.9% of the farmers cultivate crops in one to two arces, 9.7% of the farmers cultivate crops in three to four acres and 2.5% of farmers cultivate in five or more acres by using only organic fertilizers. The majority which is 79.5% of farmers have been using organic fertilizers for less than 01year. There are 14.9% farmers from one to two years, and 3.6% of farmers from three to four years using organic fertilizers. However, the farmers who started using organic fertilizers about 05 years ago or more have the least percentage (2%). The majority of respondents who engage in farming or cultivation earn comparatively lower income levels (Rs. 100,000 or below annual income) than those who have an occupation, doing business/self-employed, or retired.

Table 01: Demographic Variables of the study (N=834)

Variable	**Count/Frequency**	**Percentage (%)**
Gender		
• Female	449	53.84
• Male	385	46.16
Number of members in the family		
• 1 to 2	214	25.7
• 3 to 4	461	55.3
• 5 or above	159	19.1
Main income source		
• Farming or cultivation	522	62.6
• Occupation/Doing a job	238	28.5
• Business or Self- employed	67	8.0
• Other – Retired	7	0.8

Other income sources		
• Business or Self-employment	89	10.7
• Farming or Cultivation	374	44.8
• More than one source of income	12	1.4
• No other income source	302	36.2
• Occupation/Doing a job	57	6.8
The annual income of the family (Rs.)		
• 100,000 or below	197	23.6
• 100,001 - 200,000	175	21.0
• 200,001 - 300,000	147	17.6
• 300,001 - 400,000	118	14.1
• 400,001 - 500,000	79	9.5
• 500,001 or above	118	14.1
Cultivation method		
• Use both organic and chemical fertilizers for different crops	293	35.1
• Use both organic and chemical fertilizers for the same crops	293	35.1
• Use only chemical fertilizers	15	1.8
• Use only organic fertilizers	233	27.9
Crops cultivated using only organic fertilizers		
• Chena cultivation	37	4.4
• Fruits	12	1.4
• Vegetables	364	43.6
• Paddy cultivation	203	24.3
• None	18	2.2
• Other cultivation	5	0.6
• Two types of crops cultivation	178	21.3
• More than two crops of cultivation	17	2.0
Land area cultivated using only organic fertilizers (in acres)		
• 5 or above	21	2.5

• 3 to 4	81	9.7
• 1 to 2	274	32.9
• Less than 1	452	54.2
• None	6	0.7
Duration of using organic fertilizers		
• Less than 1 year	663	79.5
• 1 to 2 years	124	14.9
• 3 to 4 years	30	3.6
• 5 or above years	17	2.0

Source: Field Data

4.2. Descriptive Analysis of Research Variables

4.2.1. Reliability of the Measures

To ensure the reliability of the measures, a reliability test (Alpha Value) was conducted. An alpha level of 0.7 or above is generally considered to be acceptable (Cronbach, 1951; Karunasena & Deng, 2012). A construct reliability between 0.6 and 0.7 is acceptable (Hair et al., 2006). All the reliability coefficient values of the variables are higher than 0.6 according to Table 2, ensuring the reliability of the measures.

4.2.2. Validity of the Measures

All the variables were selected based on strong literature to support the theoretical validity of the study; face validity of this project was enriched with well-grounded literature. Content validity was also ensured by including several dimensions of all the variables. A factor analysis was conducted to ensure the construct validity (convergent and discriminant). After the factor analysis, some of the items were removed which had lower factor loading. The final results of the factor analysis are shown in Table 02.

Table 02: Reliability Test and Factor Analysis

Variables	Average Variance Extracted Value (AVE)	Total Variance Explained Value (TVE)	Reliability (Cronbach's Alpha)
Government encouragement (GE) (12 items)	0.787193	85.416	0.948
Non-government encouragement (NGE) (12 items)	0.763458	87.890	0.968

Perceived health consciousness (PHC) (12 items)	0.722983	72.296	0.898
Perceived higher taste of the harvest (HT) (12 items)	0.8649	86.558	0.843
Economic benefits from the harvest (EB) (12 items)	0.744758	82.298	0.771
Self-satisfaction (12 items)	0.80554	80.594	0.911
Practicing sustainable agriculture (PSA) (12 items)	0.883103	88.297	0.967
As a solid waste management strategy (WM) (12 items)	0.675139	78.566	0.955
Dependent Variable Usage of organic fertilizer in agriculture (UOF) (12 items)		52.343	0.732

Source: Field Data

All factor loadings exceeded the minimum threshold of 0.50, indicating acceptable item reliability (Hair et al., 2016). AVE was computed as the average of the squared standardized factor loadings of the indicators associated with each latent construct.

The items of the nine variables had values of Average Variance Extracted (AVE) higher than 0.5 indicating acceptable convergent validity (Fornell & Larcker, 1981). Composite Reliability (CR) values exceeded 0.70, confirming satisfactory internal consistency reliability. As shown in Table 03, AVE is greater than 0.5 and Composite Reliability is higher than 0.6, which ensures the convergent validity of the variables.

Table 03: *Analysis of Convergent Validity*

	GE	NGE	PHC	HT	EB	SS	PSA	WMS
Average Variance Extracted (AVE)	0.787193	0.763458	0.722983	0.8649	0.744758	0.80554	0.883103	0.675139
Composite Reliability (CR)	0.977859	0.974769	0.928748	0.927556	0.944987	0.943082	0.974191	0.961387

Source: Field Data

GE= Government encouragement, NGE= Non-government encouragement, PHC= Perceived health consciousness, HT= Perceived higher taste of the harvest, EB=Economic benefit, SS= Self-satisfaction, PSA= Practicing sustainable agriculture, WMS= Waste management strategy

The Fornell-Larcker criterion is a decision rule based on a comparison between the squared construct correlations and the AVE (Fornell & Larcker, 1981). According to Table 04, all constructs (all the variables) AVE values in diagonal were greater than the Squired Multiple Correlation (SMC), with other constructs in off diagonal, which ensures that all constructs (variables) met the acceptable standard of Discriminant Validity (Fornell & Larcker, 1981; Hair et al. 2016). Therefore, the Discriminant Validity of the variables and the internal consistency of these measures are ensured.

Table 04: Comparison between AVE and Squared Multiple Correlation(SMC)

	GE	NGE	PHC	HT	EB	SS	PSA	WMS
GE	**0.787193****							
PHC	0.049729*	0.007921*	**0.722983****					
HT	0.004761*	0.004624*	0.120409*	**0.8649****				
EB	0.000169*	0.077284*	0.062001*	0.064009*	**0.744758****			
SS	0.046656*	0.000625*	0.054289*	0.099225*	0.009216*	**0.80554****		
PSA	0.086436*	0.005625*	0.018769*	0.026244*	0.014884*	0.121104*	**0.883103****	
WMS	0.033489*	0.001521*	0.075625*	0.081225*	0.1296*	0.0169*	0.002209*	**0.675139****

******Average Variance Extracted (AVE)
* Squared Multiple Correlation (SMC)

GE= Government encouragement, NGE= Non-government encouragement, PHC= Perceived health consciousness, HT= Perceived higher taste of the harvest, EB= Economic benefit, SS= Self-satisfaction, PSA= Practicing sustainable agriculture, WMS= Waste management strategy

The study conducted parametric tests for hypotheses testing and validating the model developed through the conceptual framework. Accordingly, the Pearson correlation coefficient, the multiple linear regression analysis was conducted to test the hypotheses and to identify the causal relationship between the independent and dependent variables.

4.2.3. Pearson Correlation Coefficient

Pearson's correlation coefficient test was conducted to examine the correlation among the variables. Correlation measures the strength of the relationship between two variables (Malhotra, 2011) as shown in Table 05. For the correlation analysis, all eight independent variables were considered with the dependent variable.

Table 05: Correlation

		Usage of Organic Fertilizer	Government encouragement	Nongovernment encouragement	Perceived Health Consciousness	Higher taste	Economic benefit	Self -satisfaction	Practicing sustainable agriculture	Waste management strategy
UOF	Pearson Correlation	1								
	Sig. (2-tailed)									
GE	Pearson Correlation	-.110**	1							
	Sig. (2-tailed)	.002								
NGE	Pearson Correlation	.000	.258**	1						
	Sig. (2-tailed)	**.989**	.000							
PHC	Pearson Correlation	.318**	-.223**	-.089*	1					
	Sig. (2-tailed)	.000	.000	.010						
HT	Pearson Correlation	.246**	-.069*	.068	.347**	1				
	Sig. (2-tailed)	.000	.048	.051	.000					
EB	Pearson Correlation	.361**	.013	.278**	.249**	.253**	1			
	Sig. (2-tailed)	.000	.702	.000	.000	.000				
SS	Pearson Correlation	.183**	.216**	.025	.233**	.315**	.096**	1		
	Sig. (2-tailed)	.000	.000	.473	.000	.000	.006			
PSA	Pearson Correlation	.141**	.294**	.075*	.137**	.162**	.122**	.348**	1	
	Sig. (2-tailed)	.000	.000	.031	.000	.000	.000	.000		
WMS	Pearson Correlation	.667**	-.183**	-.039	.275**	.285**	.360**	.130**	.047	1
	Sig. (2-tailed)	.000	.000	.262	.000	.000	.000	.000	.171	

Source: Field Data

r = Pearson correlation coefficient of the sample

sig. = significant value (p)

**Correlation is significant at the 0.01 level (2-tailed)

GE= Government encouragement, NGE= non-government encouragement, PHC= Perceived health consciousness, HT= Perceived higher taste of the harvest, EB= Economic benefit, SS= Self-satisfaction, PSA= Practicing sustainable agriculture, WMS= Waste management strategy, UOF=Usage of organic fertilizer

According to Table 03, there is no multicollinearity between the independent variables ($r<0.9$). All the independent variables except non-government encouragement ($p > 0.01$) have a linear relationship with the dependent variable of the usage of organic fertilizer variable (significant at the 0.01 level ($p < 0.01$)), which can be considered for regression analysis.

4.2.4. Multiple Linear Regression Analysis

Multiple regression analysis was conducted to examine the significant factors affecting the usage of organic fertilizer. As per the results from the correlation analysis, the independent variable "non-government encouragement" is not

significant and has no relation with the dependent variable; hence, it has been removed from further analysis.

Table 06: Regression Analysis

Model 1	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
Regression					.000[b]		
(Constant)	-54.974	15.172		-3.623	.000		
GE	-.067	.140	-.014	-.479	.632	.779	1.284
PHC	2.590	.687	.108	3.770	.000	.760	1.317
HT	-.774	1.288	-.017	-.601	.548	.772	1.295
EB	1.578	.389	.112	4.061	.000	.817	1.225
SS	1.217	.645	.054	1.887	.059	.760	1.315
PSA	1.639	.624	.073	2.626	.009	.806	1.240
WMS	3.978	.190	.589	20.914	.000	.786	1.272
R	.697[a]						
R Square	.485						
Adjusted R Square	.481						
Durbin-Watson	1.734						

Source: Field Data

p* (sig) < 0.01 = Significant at the 0.01 level
sig. = significant value (p)

GE= Government encouragement, PHC= Perceived health consciousness, HT= Higher taste of the harvest, EB=Economic benefit, SS= Self-satisfaction, PSA= Practicing sustainable agriculture, WMS= Waste Management Strategy

Variance inflation factor (VIF) was used to detect the multi-collinearity in the model. According to Table 06, the VIF values of all the explanatory variables are less than 05, indicating that there is no severe multicollinearity. The VIF values less than five (05), imply no multi-collinearity within the data (Akinwande et al., 2015). Since the Durbin Watson statistics is in between 1.50-2.50, there is no auto-correlation presence (Durbin & Watson, 1951).

According to Table 06, waste management strategy, economic benefit, perceived health consciousness, practicing sustainable agriculture, self-satisfaction variables significantly influence the usage of organic fertilizer at a 0.05 level.

It could be concluded that 48.1% of variations in the usage of organic fertilizer can be explained by the independent variables; waste management strategy, economic

benefit, perceived health consciousness, practicing sustainable agriculture, self - satisfaction. Among them, waste management strategy seems to be the most significant factor affecting the usage of organic fertilizer in agriculture.

4.3. Discussion

The findings of the study were confirmed by several previous studies. The notion of organic fertilizer helping the prevention of diseases, it significantly affects its usage in agriculture (Smith & Paladino, 2010; Karki et al., 2011; Sapbamrer & Thammachai, 2021). Similarly, authors confirmed that higher nutrition significantly affects the usage of organic fertilizers in agriculture (Worthington, 2001; Magkos et al., 2003; Winter, 2006). Organic foods are considered healthier, safer, and better than conventional foods (Magnusson et al., 2001). Similarly, many authors revealed that the economic benefit significantly affects the usage of organic fertilizers in agriculture (Cukur & Isin, 2008; Ceylan et al., 2010; Mahdi et al., 2010; Wu et al., 2014; Quynh, 2018; Azam & Shaheen, 2019). Organic fertilizer usage is less costly and affordable to small and marginal farmers (Mahdi et al., 2010; Sri Lanka Export Development Board., 2015; Food and Agriculture Organization of the United Nations, 2015). Moreover, there are several authors revealed that self-satisfaction significantly influences the usage of organic fertilizers in agriculture (Rickson et al., 1999; Mzoughi, 2014; Bouttes et al., 2020). Practicing sustainable agriculture significantly affects the usage of organic fertilizer and it has been identified by several authors (Cukur et al., 2019; Sapbamrer & Thammachai, 2021). Similarly, health awareness and environmental awareness have affected the decision of farmers to switch to organic farming (Smith & Paladino, 2010; Karki et al., 2011; Azam & Shaheen, 2019; Sapbamrer & Thammachai, 2021). Personal and social norms influence the behavior of the farmers usasge of organic fertilizer in agriculture (Xie, 2021). Several researchers have identified organic agriculture is not just a resolution for more affluent countries but is useful even in poorer countries as it helps to attain sustainable development (Willer & Youssefi, 2007; Ahlem & Hammas, 2017). Several authors have identified that organic fertilizer as a waste management strategy which significantly contributes to its usage (Tandon, 1999 cited in Mahdi et al., 2010; Wu et al., 2014; Quynh, 2018).

The analysis of the study has identified several factors that do not significantly affect the usage of organic fertilizer. Accordingly, three factors; government encouragement, non-government encouragement and perceived higher taste of the harvest have been identified as insignificant by the quantitative analysis of the study.

5. Conclusion

This study identified the significant factors affecting the usage of organic fertilizers in Sri Lanka. Accordingly, the quantitative analysis which was conducted with a large sample (834 sample of general farmers) from the Anurdhapura District, identified that waste management strategy, economic benefits, perceived health consciousness, practicing sustainable agriculture, and self-satisfaction were statistically significant with the dependent variable usage of organic fertilizer. The study confirmed that 48.1% variation in the usage of organic fertilizer can be explained through the significant independent variables. Among those variables, waste management strategy is the highest significant variable with the dependent variable, which individually explains 44.5% of the dependent variable. Based on the findings, the study finally proposes policy measures to encourage the usage of organic fertilizer in agriculture. The findings of the study will help to improve the usage of organic fertilizer in agriculture to restore environmentally friendly farming in Sri Lanka.

5.1. Theoretical Implications

This study enhances theoretical understanding of the determinants of organic fertilizer usage by integrating the Theory of Planned Behavior and Ecological Modernization Theory

According to the Theory of Planned Behavior, the findings have confirmed that the behavior of farmers can be explained in terms of attitudes toward the behavior, subjective norms, and perceived behavior control. The variables, perceived health consciousness, economic benefits, and self-satisfaction represent the attitudes toward the behavior, as they reflect farmers' positive evaluation of using organic fertilizer. Waste management strategy, linked to perceived behavioral control, was the most significant determinant. It reflects farmers' ability, resources, and technical capacity to convert agricultural waste into organic fertilizer.

According to the Normative Behavior Theory, individuals' actions are guided by personal and social norms. In this context, farmers who are more aware of health and environmental benefits or who gain satisfaction from responsible practices are likely to follow internalized personal norms, while the broader community expectations shape social norms that encourage organic fertilizer usage. Therefore, in the future, it will be necessary to promote farmers' awareness on organic fertilizer usage and ascription of responsibility, to enhance farmers' personal norms, and to improve the level of farmers' social norms, in order to greatly promote farmers' engagement in organic fertilizer usage.

5.2. Practical Implications

The study provides the following policy implications to improve the usage of organic fertilizer in agriculture based in the Mihinthale Divisional Secretariat, Anuradhapura District in Sri Lanka.

- Encourage farmers to use organic fertilizers

Farmers should be made aware of the nutrient information consistent with organic harvest, and how those nutrients benefit their health to prevent diseases and improve the health of elderly people, and their children. That awareness could improve the farmers' perception of the usage of organic fertilizer to a satisfactory level.

- Assist and facilitate farmers to use organic fertilizers and increase economic benefits

Farmers should be made aware on how to improve their income by using organic fertilizer. Initially, they should be provided with good awareness about economic benefits of using organic fertilizer prepared by themselves, and also by selling the organic harvest at a good price (which has considerable demand). Furthermore, farmers could be given particular training about organic cultivation and how to make organic fertilizers at home. The government and other organizations could provide required equipment at a fair price or under a loan scheme for preparing organic fertilizer and cultivation. Further, they could assist farmers for finding markets and selling their harvest locally and internationally.

- Improve farmers' self-satisfaction

The government / non-government organizations can always motivate farmers to use organic fertilizer. They can always appreciate farmers' efforts in preparing and using organic fertilizer and engaging in organic cultivation which is difficult and time-consuming compared to non-organic cultivation. Especially, the farmers who are engaging in organic cultivation can be recognized and specialized among the other general farmers by giving some privilege to them in the village, which can easily improve their self-satisfaction. Through this the other farmers will also get encouraged to move into organic farming.

- Introduce organic fertilizer as a good solution to waste management

Using waste at home for preparing organic fertilizer is a good waste management strategy. Therefore, the government and other organizations can raise awareness in the farmers that the usage of organic fertilizer is a better solution for their accumulating waste at home and village. Also, the farmers can be provided with the required equipment (at a fair price or under a loan scheme), knowledge and training

on how to technically convert waste into fertilizer in a hygienic way. Through these programs, farmers can be taught what kind of waste should be used and how those wastes can be used to prepare fertilizer by using resource persons and workshops or training programs.

6. Limitations and Further Research

This study was conducted only for Mihinthale Divisional Secretariat in Sri Lanka using a cross-sectional design. Therefore, the findings of the study apply only to that divisional secretariat. The sample size of the study is 834 and if the sample size was larger, the findings will be more reliable.

Future research can be conducted based on the whole country with a larger sample. Another study can be conducted with qualitative data to explore for validating the research findings. Furthermore, a longitudinal research design can be employed to gain a clearer understanding of changes in organic fertilizer usage and its determinants over time.

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