



Research Paper

## Impact of Sole Usage of Organic Fertilizer and Chemical Fertilizer on Rice Farmers' Quality of Life

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### Abstract

Paddy cultivation is the staple crop cultivation in Sri Lanka. Yala and Maha are the seasons that farmers used to cultivate their land and they use chemical fertilizer and organic fertilizers for paddy cultivation. There are negative and positive impacts on the sole usage of fertilizers for farmers' life. This study aims to determine and analyze the impact of sole usage of organic and chemical fertilizers on rice farmers' quality of life. Primary data was collected from the sample size of 50 farmers using random sampling method and the responses through a Likert scale questionnaire because this research is based on qualitative and quantitative data. Correlation and Regression analysis were done to describe the relationship between variables. To indicate the farmers' quality of life this study used income and health as dependent variables. Variables in income and health define farmers' quality of life and four hypotheses were tested. The result of this study shows that sole usage of organic fertilizer leads to an increase in farmers' health and a decrease in farmers' income. Sole usage of chemical fertilizers leads to decrease farmers' health and increase farmers' income. Then the sole usage of organic or chemical fertilizer does not increase farmers' quality of life. It is expected that reduce the dependency on sole usage of fertilizers, reduce the negative effects of fertilizer usage and increase farmers' quality of life.

**Keywords** – usage of organic fertilizer, Usage of chemical fertilizer, Farmers' quality of life, Income, Health

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### I. Introduction

The government of Sri Lanka focuses to increase the productivity of paddy production because rice is the staple food in Sri Lanka. Fertilizers are important factors for growing plants. Farmers use fertilizers to inject nutrients into plants externally. Organic fertilizer and chemical fertilizer are close substitute products in the agriculture sector (Aregay&Minjuan, 2012). According to the department of census and statistics, for fertilizer usage for the maha season 65% use only chemical fertilizer, 0.3% only organic fertilizers, and 33.8% both (Statistic, 2021).

These organic fertilizers or bio-fertilizers are live formulations that include micro-organisms (Bhattacharjee&Dey, 2014). Nitrogen-fixing bio-fertilizers, phosphorous solubilizing biofertilizers (PSB), Phosphate mobilizing bio-fertilizers, Plant growth biofertilizers (Suhag, 2016; Bhattacharjee&Dey, 2014), Rotten farm yard manure (FYM), compost (Arifet *al.*, 2014), and green manures are examples of organic fertilizers. Improvement of soil quality (Alim, 2012), health and nutrient, reduction of water and air pollution, improved quality of products, protect bio-diversity, reduce harmful effects on human health (Suhag, 2016) are benefits of biofertilizers. Farmers use low-cost renewable resources (Bhattacharjee&Dey, 2014) or organic bio-degradable waste like animal excreta and agricultural waste to create biofertilizers. Chemical fertilizers are created using artificial compound elements specifically to increase crop yield and reduce harm to the plants very quickly. Ammonium sulfates, Ammonium phosphate, Ammonium nitrate, Ammonium chloride, and Urea are some examples of chemical fertilizers. Chemical fertilizer is a cost-intensive production and it causes environmental pollution and creates human health problems (Suhag, 2016; Kakaret *al.*, 2020).

Quality of life refers to the availability of goods and services that the population has and it considers the quantity and quality of available materials. Standard of living and well-being are other denominations of quality of life. Both income and health are factors that are used to measure the quality of life (Windon, 2014; Ibharam&Salim, 2020). Income and health impact the rice farmers' quality of life (Hansasiripot, 2017). A low

level of productivity associated with low income and a high level of health issues cause a reduction in the quality of life (Windon, 2014).

Increasing the investment in chemical fertilizer increase the productivity level and farmers' income (Aregay&Minjuan, 2012) and worst effect on human health (Chandra, 2005) such as cancer, low immunity level, kidney disease, skin-related illness, lung infections, bone diseases, and wheezing (Ajmalet al., 2018) caused the usage of chemical fertilizers over a long period of farming. Chemical fertilizer has a higher amount of arsenic comparatively organic fertilizers and high levels of arsenic increase chronic kidney disease and the use of organic fertilizer reduced human health hazards (Jayasumanaet al., 2015;Ibharim&Salim, 2020).But only biofertilizers can increase productivity with high cost (Chandra, 2005) and only the chemical fertilizer does not supply proper yield for a long period (Alim, 2012). In the 20<sup>th</sup> century usage of chemical fertilizers increase crop productivity in half of the world (Li and Wu, 2021) and gain higher income (Sud, 2020). Higher productivity improves income and an increase in income and health status improves the farmers' quality of life.

## II. Methodology

Rambukkana divisional secretariat in Sri Lankawas used as the study area for this research. Daliwala and Pinnawala are two agricultural service areas in this area. Paddy cultivation is the main crop of this divisional secretariat and most of the farmers cultivate their land in their traditional ancestral lands. Very few farmers use organic fertilizers and many others use chemical fertilizers for their paddy cultivation for a long period. In the near term, farmers had to use organic fertilizers instead of chemical fertilizers due to the ban imposed by the government on the import of chemical fertilizers. As this area belongs to the wet zone and paddy cultivation is done only in the Inter-monsoon rain and both Yala and Maha season are cultivated with fertilizer subsidies. 3846 total population of paddy farming families and 4497 acres belonging to this division. For this research sample size of 50 families was selected out of these families used a list of farmers was obtained from the farmer regulator through a random sampling procedure in Alugolla Grama Niladhari divisions. It belongs land usage for the Yala season is 25 acres and 1 acre for fallow land in 2021. Some farmers in this area cultivate another land that does not lie in the Alugolla area but in Rambukkana divisional secretariat. Because of that, this Grama Niladhari division owns little land space for cultivating paddy. Then farmers buy and use close land spaces for their paddy cultivation with their part-time job and small land ownership does not highly correlate with income and health.

This study used sole usage of organic fertilizers and chemical fertilizers as independent variables, Farmers' income, and Farmers' health as dependent variables. Variables in income and health define farmers' quality of life and four hypotheses were tested.

- a) **H1:** There is a positive relationship between the usage of chemical fertilizer and farmers' income.
- b) **H2:** There is a negative relationship between the usage of organic fertilizer and farmers' income.
- c) **H3:** There is a negative relationship between the usage of chemical fertilizers and farmers' health.
- d) **H4:** There is a positive relationship between Usages of organic fertilizer and farmers' health.

Both primary and secondary data were used for this research and it is based on both quantitative data and qualitative data. Then 5 point Likert scale questionnaire was used for collecting primary data through the sample. Secondary data were based on research articles, Govijanasewa annual reports, Department and census statistics reports, Internet, journal articles and Sampathpathikada, etc. Software of SPSS 21.0 version was used to analyse the data and, Pearson correlation analysis, and simple linear regression models ( $Y = \beta_0 + \beta_1 X_1$ ) were used to measure the relationship between both independent variables and dependent variables.

## III. Results and Discussion

Correlation analysis was used to measure the linear relationship between dependent variables and independent variables. Table 1 illustrate the result of correlation analysis related to the sole usage of organic fertilizer and chemical fertilizers with income and health. Usage of organic fertilizer and income has a moderate negative correlation (-.306) and usage of organic fertilizer and health has a moderate positive correlation (.308). Considering the usage of chemical fertilizer with income has a moderate positive correlation (.330) and health has a weak negative correlation (-.295) under the  $p < 0.05$  significant level.

**Table 1: Summary of Pearson correlation Analysis**

Variables	Correlation value	Significant value
Usage of organic fertilizer and income	-.306*	.031
Usage of organic fertilizer and health	.308*	.030
Usage of chemical fertilizer and income	.330*	.019
Usage of chemical fertilizer and health	-.295*	.037

Notes: Standard error represents the value of \*  $p < 0.05$

The simple linear regression analysis used to measure and quantify the relationship between independent and dependent variables. Table 2 shows the results of four simple linear regression models. According to table 2, each one-unit increase in usage of organic fertilizer decrease farmers' income by (-.204) times units and usage of organic fertilizer negatively impacts farmers' income. 9% of variants in the usage of organic fertilizer were predicted from the level of farmers' income. Considering health, each one-unit increase in usage of organic fertilizer increases farmers' health by .331 times units and usage of organic fertilizer positively impacts farmers' health. 9% variants in the usage of fertilizer increase farmers' income by .262 times units and usage of chemical fertilizer positively impacts farmers' income. 10% of variants in the usage of chemical fertilizer were predicted from the level of farmers' income. Considering health, each one-unit increase in the usage of chemical fertilizer decrease farmers' health by (-.370) times units, and usage of chemical fertilizer negatively impacts farmers' health. 8% of variants in the usage of chemical fertilizer were predicted from the level of farmers' health. Organic fertilizer were predicted from the level of farmers' health. Each one-unit increase in usage of chemical

**Table 2: Summary of Regression Analysis**

Independent variables	Constant value	Unstandardized coefficient	Significant value	R square
Sole usage of organic fertilizer (considering farmers' income)	2.447	-.204	.031	.093
Sole usage of organic fertilizer (considering farmers' health)	1.556	.311	.030	.095
Sole usage of chemical fertilizer (considering farmers' income)	3.334	.262	.019	.109
Sole usage of chemical fertilizer (considering farmers' health)	3.115	-.370	.037	.087
<b>Dependent variables:</b> Farmers' income, Farmers' health				

Notes: Standard error represents the value of  $p < 0.05$

The sole usage of organic fertilizer and chemical fertilizers' impact on the income and health of rice farmers' quality of life. Non-suitable waste for produced organic fertilizer cause to damage crop yield and decreases the income of the farmers (Ibharim&Salim, 2020). According to the, Pearson correlation analysis results showed that usage of organic fertilizer and farmers' income has a (-0.306) moderate negative correlation. 9% variant in the usage of organic fertilizer was predicted from the level of farmers' income and the standard coefficient value represented each one-unit increase in the usage of organic fertilizer leads to a decrease in farmers' income by (-.204). Then the result described that usage of organic fertilizer leads to reduce farmers' income (Arifet *et al.*, 2014). The significant value of this study was .031 and it was less than .05 and the first alternative hypothesis was accepted. However reduction in farmers' income leads to reduce farmers' quality of life (Nguyen *et al.*, 2020). Then usage of organic fertilizer considering income leads to a decrease in farmers' quality of life.

Some organic wastage decreases the quality of crop production and leads to a decrease in farmers' health (Ibharim&Salim, 2020). However organic fertilizer has not included more heavy metal content as a chemical fertilizer (Jayasumana *et al.* 2015). Then the usage of organic fertilizer can reduce health problems (Sharma&Singhvi, 2017). According to the Pearson correlation analysis, the result showed that usage of organic fertilizer and farmers' health has a (0.308) moderate positive correlation. 9% variant in the usage of organic fertilizer was predicted from the level of farmers' health. The standard coefficient value implied that each one-unit increase in the usage of organic fertilizer leads to an increase in farmers' health by (.311). The significant value of this study was .030 and which is less than .05 and the second alternative hypothesis was accepted. According to this result usage of organic fertilizer leads to an increase in farmers' health. Then the increase in farmers' health leads to an increase in farmers' quality of life (Ibharim&Salim, 2020; Nguyen *et al.*, 2020; Sharma&Singhvi, 2017; Mikunthan *et al.*, 2013) and reduces health risks that cause to the usage of chemical fertilizer (Jayasumana *et al.*, 2015). Then the usage of organic fertilizer considering health leads to an increase in farmers' quality of life.

An increase in chemical fertilizer usage increases crop productivity and protects farmers' income. The result of Pearson correlation analysis indicated that both variables have a (0.330) moderate positive correlation. 10% variant in the usage of chemical fertilizer was predicted from the level of farmers' income. The standard coefficient value depicted that each one-unit increase in the usage of chemical fertilizer leads to an increase in farmers' income by .262. The significant value of this study was .019 and it was less than .05 and the third alternative hypothesis was accepted. According to this result usage of chemical fertilizer positively correlate with farmers' income (Aregay, 2012), an increase in chemical fertilizer usage leads to an increase in paddy

productivity (Bhattacharjee&Dey, 2014; Suhag, 2016) and farmers' income (Aregay, 2012). Overuse of chemical fertilizer does not gain high productivity but usage of chemical fertilizer increase yield (Mikunthanet *al.*, 2013), and reducing dependency on chemical fertilizers can gain high profits because of the cost reduction (Kakaret *al.*, 2020). However, an increase in farmers' income leads to an increase in farmers' quality of life. (Hansasiripot, 2017). Then the usage of chemical fertilizer considering income leads to an increase in farmers' quality of life.

Health hazards such as gastric, cancer, testicular cancer, low immunity level, kidney disease, and skin-related illness are caused to the usage of chemical fertilizers over a long period. It leads to an increase in heavy metal content (Ajmalet *al.* 2018) and overuse of chemical fertilizer (Mikunthanet *al.* 2013) causes to reduce farmers' health. Considering the impact of sole usage of chemical fertilizer on farmers' health, the result of Pearson correlation analysis indicated that both variables have a (-0.295) weak negative correlation. 8% variant in the usage of chemical fertilizer was predicted from the level of farmers' health. The standard coefficient value indicated that each one-unit increase in the usage of chemical fertilizer leads to a decrease in farmers' health by (-.370). According to this result usage of chemical fertilizers leads to a decrease in farmers' health. The significant value of this study was .037 and was is less than .05 and the fourth alternative hypothesis was accepted. Excessive use of chemical fertilizer cause to decrease in farmers' health (Chandiniet *al.*, 2019). An increase in farmers' health leads to an increase in farmers' quality of life and health problems or disabilities reduce farmers' health and leads to make a negative effect on farmers' quality of life. An increase in chemical fertilizer usage increases crop productivity but mainly causes to decrease in farmers' health and infected various health hazards (Ajmalet *al.*, 2018). Then the usage of chemical fertilizers considering health leads to a decrease in farmers' quality of life.

The present study discovered that the usage of organic fertilizer and chemical fertilizers has a negative and positive effect on rice farmers' life. According to the research study usage of organic fertilizer increase farmers' health and leads to a decrease in farmers' income level and the usage of chemical fertilizer increase farmers' income and leads to a decrease in farmers' health. Farmers' high income and better health cause to increase in farmers' quality of life (Ibharim&Salim, 2020; Nguyen *et al.*, 2020). This study proved that usage of organic fertilizer increase farmers' health but does not increase income level and the usage of chemical fertilizer cause to increase farmers' income and reduces farmers' health. Then the result of this study described that sole usage of chemical or organic fertilizer cannot increase or decrease farmer health and income together. Because in this area most of the farmers are not cultivate paddy full-time. They cultivate paddy with a part-time job and less land ownership also causes the reduction of health hazards and income from fertilizer usage. Then, sole usage of organic and chemical fertilizers did not increase or decrease farmers' quality of life and did not change farmers' quality of life.

#### **IV. Concluding Remarks**

The impact of organic and chemical fertilizer usage on rice farmers' quality of life on the results of this study identified that usage of organic fertilizer has a positive correlation with health and a negative correlation with income. Then it identified that usage of organic fertilizer increased farmers' health and reduce farmers' income. The usage of chemical fertilizer provides the opposite case of the organic fertilizer usage result. The usage of chemical fertilizer has a positive correlation with income and a negative correlation with health. Then it identified that usage of chemical fertilizer increase farmers' income and reduces farmers' health. To increase farmers' quality of life both income and health should be increased. The result of this study showed that sole usage of fertilizers could not increase both farmers' income and health together. Then the sole usage of fertilizer does not encourage farmers' quality of life.

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