

An overview of heavy metal availability due to agrochemical uses in paddy cultivation in Sammanthurai malkampiddy area

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Introduction

The growth of the agricultural sector is seen as essential in developing countries [2]. De Silva et al, (2007) classify Sri Lanka as an agricultural country because the majority of the rural people are still engaged in agriculture for their main livelihood and the principle agricultural produce is paddy. Agrochemicals are key inputs in agriculture for crop protection and better yield, even though they are usually toxic and can pose significant environmental risks as well as costly. Padmajani et al., (2014), reported that Sri Lankan farmers use stronger concentrations of pesticides with increased frequency of applications. According to Perera et al., (2016), several agricultural chemicals have been reported to contain toxic trace (heavy metals, mainly Cd and As) elements in Sri Lanka. Further, all paddy farmers utilize different types of agrochemicals to expect high yields. Sammanthurai is one of the leading areas in paddy farming in the Ampara district [5]. At this background, our study focused on analyzing certain heavy metals in the canal water, which runs through the paddy fields at Malkampiddy, where intense paddy cultivation is taking place for two seasons per year.

Methodology

Study Area. This study was conducted at Malkampiddy grama niladhari division, Sammanthurai.

Questionnaire survey. A structured questionnaire survey was enumerated among 73 farmers from Malkampiddy Grama niladhari division, Sammanthurai, which was used as a research instrument to get information, mainly on type, rate and amount of agrochemicals used in their paddy fields.

Data obtained were analyzed quantitatively by using Excel 2013 and Minitab 17.

Water sample. Nine, each 100 ml water samples were collected from the canal that runs through the paddy fields at various locations near paddy field out-lets, in clean plastic bottles on 15th February 2021 from 9.30 am to 12:00 pm. They were filtered through 0.45 mm Millipore membrane filter (Whatman no. 541) into 250 ml of pre-washed Reagent bottles, acidified with 10 M, concentrated HNO₃, stored in a cool box, and transferred to the University of Peradeniya for analyzing heavy metals (Pb, Cd, Cu, Zn) using atomic absorption spectrophotometer (AAS).

Results and Discussion

According to the survey results, a very high percentage (95.89%) of farmers in Sammanthurai in general and Malkampiddy in particular, recorded to use agrochemicals in paddy culture. Prasannath and co-workers reported that all the (100 no. of) farmers applied chemical pesticides in paddy cultivation, during a cropping season they surveyed, in Alayadivembu DS division, in Ampara district. The different types are described in Table 1, below. It is noted that a very small percentage (4.28%) of them still use glyphosate, used as a weedicide to control weeds. Although the ban imposed on importation of glyphosate to the country is in place, some amounts of glyphosate are available in the market, may be due to the entry of illegal products with no quality control. Another notable observation is the use of urea (92.85%) as a fertilizer in their paddy fields.

Table 1. Types of agrochemicals used by the Malkampiddy farmers.

Types of Agrochemical	Commercial name	Agrochemical	Percentage (%)
Weedicide (42.6%)	Sorbit	Pritilachlor	78.57
	Madari	Thiamenthoxam	35.71
	Profit	Pritilachlor and Propanil	50.00
	Roundup	Glyphosate	4.28
Fertilizer (23.46%)	Urea	Carbamide	92.85
Herbicide (33.57%)	Marcel	Carbosulfan	11.42
	Atmaire	Imidachloprid	21.42
	BPMC	Fenbucar	57.14
	Reagent	Fipronil	14.28
	Actara	Thiamenthoxam	28.57
Fungicide (0.35%)	Eresar	Hacsaconasole	1.42
No any Agrochemical used			4.11

Table 2. Heavy metal concentrations present in the water samples, drawn on Feb. 15, 2021.

Sample no	Heavy metal (mg/l)			
	Cd	Cu	Zn	Pb
1	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00
Average Concentration	0.00	0.00	0.00	0.00
Safe level Concentration (Shanbehzadeh, 2014)	0.005 ± 0.001	0.015 ± 0.001	1.300 ± 0.001	2.000 ± 0.001

Study on heavy metal analysis been done extensively by many researchers. However, no such work has been done in Ampara district so far, where the paddy cultivation is done hugely in Sri Lanka. We attempted to initiate such

research in this region and reported the results in Table 2, with limited resources and time.

Conclusion

The paddy farmers largely depend on agrochemicals; weedicides (42.6%) in large extend and fungicide (0.35%) to a lower amount. It was revealed that a few numbers of them are even using banned agrochemicals, such as glyphosate. Analysis of water samples at 95% confidence level didn't show the presence of any heavy metals (Cd, Pb, Zn, and Cu). However, the measures taken to analyze paddy soils could not be materialized within this attempt. Although our study (water samples) disclose safe from heavy metals, expansion with soil, water, rice grains, and more number of attempts may give a better outcome in the future.

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