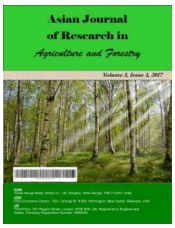

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Vegetable Farmer's Awareness and Perception of Pesticides on the Environment and Health in Eastern Sri Lanka

Ponniah Sivarajah[1*]

[1]*Department of Agricultural Economics, Faculty of Agriculture, Eastern University, Chenkalady-30350, Sri Lanka.*

Author's contributions

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

In Sri Lanka excessive use of pesticides in paddy and vegetable farming has caused much concern in terms of its impact on the environment and humans. A study was done in Eastern Sri Lanka to find out vegetable farmer's awareness of hazard levels of pesticides, perception of pesticide impact on the environment and their health, and awareness about different methods of pest control among farmers. A multi-staged random sample of 96 vegetable farmers in five Agrarian Service Center ranges in the Eastern Province of Sri Lanka was studied, during October to November 2017, using a structured questionnaire. Frequencies estimation and Chi Square tests were done to find relationships. The results indicated that the degree of awareness on the hazardous levels of pesticides was minimal, but their perceptions on the impacts of the pesticides on the environment, humans, animals and on food items sold was high among the vegetable farmers. There was a significant spatial variation in knowledge on hazardous level of pesticides used in vegetable production. Significant differences existed between areas studied on the perception of farmers of the impact of pesticides on humans, animals, food and environment. Most of the farmers were aware about crop rotation, chemical control and manual control

**Corresponding author: E-mail: sivarajahp@esn.ac.lk, sivaponniah@yahoo.com;*

methods to get rid of pests. Only a low percentage of farmers were aware about biological control, cultural control and seed treatment to curtail pest attack. There were significant spatial differences in farmers' awareness on available pest control methods. Policy makers and institutions intervening to regulate pesticides usage need to adopt multiple strategies to create awareness on the impact of pesticides on humans and the environment, through designing policies to enhance farm extension services and to encourage adoption of alternative methods of pest control.

Keywords: Pesticides; vegetable farmers; awareness; perceptions; environment; human health.

1. BACKGROUND

Agriculture is the backbone of Sri Lanka's economy which accounts for 1.7 million farm families and a population of about 22 million. Agriculture sector contributes about 5.8 % to Gross Domestic Product in Sri Lanka. In 2018, underpinned by favourable weather conditions, agriculture activities showed a growth of 4.8 %, mainly increases in the production of paddy, fruits, vegetables, coconut and other field crops [1]. Sri Lanka produces around 710,000 metric tons of vegetables and around 540,000 metric tons of fruits annually [2]. In Sri Lanka, many types of vegetables are grown in various regions. Up country region is ideal for temperate crops such as carrot, leeks, cabbage, chinese cabbage, cauliflower, salad leaves, beet, bean, bell pepper, salad cucumber, tomatoes, cherry tomatoes and strawberries while the Low Country areas are suitable for a variety of vegetables ranging from green chilli, red onion, pumpkin, cucurbits and bitter gourd [3]. The Consumer Survey Report-1986/87 of the Central Bank of Sri Lanka has indicated a 20% decline in consumption of vegetables due to consumer awareness of high level of chemicals in vegetables [4].

There are, however, dangers associated with the use of pesticides. Some pesticides, such as organophosphates, kill pests through a biological pathway that may also cause harm to humans [5]. The success of a crop is imperative for a farmer's livelihood in rural Sri Lanka. This need, coupled with heavy marketing strategies of agrochemical suppliers and low prices has led to a indiscriminate use of pesticides on food crops [6,7,8]. Increased indiscriminate use of pesticides however, has caused considerable concern about their effects on the cost of production, health, natural environment, and the quality of agricultural products [9]. Pesticide use is popular among the farmers who grow crops such as rice, tobacco, chillies, potatoes and exotic vegetables. All agro-pesticides used in the country are imported either as finished products or as technical material, which are then formulated locally. Due to the liberalization policies there has been increase in imports of pesticides over the past two decades [10,11].

Food is contaminated due to direct pesticides application to food crops before harvest. However most of these pesticides disappear within a short period, but some pesticides are recalcitrant and tend to remain in foods over a longer period. This is a serious problem in certain fresh vegetables sold at markets which can move up the along the food chain to cause health problems to humans later [11]. This study evaluates vegetable farmer's awareness of hazard levels of pesticides, perception of pesticide impact on the environment and human health, the use and awareness about different methods of pest control among farmers in Batticoloa district in Eastern Province, Sri Lanka.

2. MATERIALS AND METHOD

The Multi-Stage random sampling technique was used to identify and select vegetable farmers for the study. At the first stage the Batticaloa district in the Eastern Province, Sri Lanka (Batticaloa: 7° 43' N, 81° 42' E) was selected due to urbanization of coastal areas and higher vegetables demand more farmers were engaged in vegetable cultivation at the commercial level here. At the second stage farmers were selected based on the Agrarian Service Center (ASC) areas of the Batticaloa district where vegetable farming was a predominant livelihood. A field survey was carried out in five ASC divisions of Batticoloa district, using a pre-tested structured questionnaire. A total of 96 vegetables farmers were randomly selected proportionate to the population in the 5 ASC areas as follows Kaluwanchikudy (28), Palugaman (20), Kokkadicholai (10), Mandur (21) and Eravur (17).

Farmers were interviewed at their homes or on their farms. Frequency distribution for different traits were analyzed, measured and variables were also cross-tabulated for Chi Square tests to find relationships using the SPSS 20 version software.

3. RESULTS AND DISCUSSION

3.1 Socio-economic Characteristics of Vegetable Farmers

The vegetable farmers were aged in the mid-forties with moderate education. They had 20 years of experience in farming, while land used for vegetable farms was below one acre.

3.2 Awareness of Pesticide Hazard Levels

An analysis was done to assess the farmer level awareness of the hazard level of pesticides they used and the results indicated that 17% of farmers did know anything about hazard levels of pesticide based on labels on bottles/packets of insecticides. While 83% of the farmers had knowledge on identifying the hazardous level of pesticides based on the color of label on the bottles or packets of pesticides. Although the awareness on the hazard level of pesticides used is high, the indiscriminate use of pesticides continues [10,13,8] among farmers.

3.3 Knowledge on Hazard Levels

The analysis also indicated (Table 2) that there was a significant spatial variation (P=0.05) in knowledge on hazardous level of pesticides used in vegetable production. This was observed in the four locations (Mandur, Kokkadicholai (KKC), Kaluwanchikudy (KWK) and Palugamam (PGM) which had poor extension activities implemented due to the lack of extension staff and poor road infrastructure facilities in these areas.

Although about 71.8% of the farmers knew about the use of different colour labels on pesticide bottle to identify hazard levels, the survey revealed that only around 29.2% of farmers knew that red colour label indicated a high level of hazard. Thus, about 62.5% of farmers are indiscriminately using pesticides in vegetable production ignoring the hazardous effects on the environment and other living organisms. In Eravur 23.5%, Mandur 33.3%, Kokkadicholai 100%, Kaluwanchikudy 14.3% and Palugamam 15% of farmers were unaware about the colour labels on pesticide bottles which indicate hazardous levels. The high level of unawareness observed in Kokkadicholai area was due to low educational status of farmers (Table 1) and lack of access to extension services.

3.4 Perceptions about Pesticides Impact on Environment and Humans

Table 3 presents the perceptions of farmers on the impact of pesticides sold in the market on humans, animals, food products and the environment. The results of the survey indicated significant differences (P= 0.05) existed between areas studied on the perception of farmers of pesticides impact on humans, animals, food and environment. But it was also observed that farmer's perception of pesticides impact on humans was lower (65%) compared to others.

3.5 Awareness on Alternate Pest Control Measures

Table 4 presents the results of survey on the awareness of farmers about different/alternate pest control methods available. Most of the farmers (more than 61%) were aware about crop rotation, chemical control and manual control methods to get rid of pests. While only about 25 to 48% of farmers were aware about biological control, cultural control and seed treatment to curtail pest attack on vegetables due to not having access to extension services (Table 1) and training on pest management. It was observed that there were significant spatial differences (P=0.05) on farmers' awareness on available pest control methods.

It was observed that farmers awareness on seed treatment was the lowest (25%), followed by biological control (36.5%) and cultural control methods (48%). Seed treatment is a vital practice to be adopted in vegetable cultivation to reduce pest attack through contaminated seeds.

Table 1. Vegetable farmers- Socio-economic characteristics

Variables	Eravur(17)	Mandur (21)	KKC (10)	KWK (28)	PGM (20)	Total (96)
1.Age (years)	42.3 (10.5)	44.7(14.4)	46.5(8.18)	46.1(10.32)	41.3(10.63)	44.8(11.61)
2.Years of schooling (years)	5.6(2.68)	7.2(2.07)	4.7(2.6)	7.9(2.9)	7.3(2.9)	8.4(2.9)
3.Income-vegetables (Rupees/month)	9,445(4,162)	10,335(8,338)	10,133(8,382)	12,085(4,501)	8,000(4,765)	11,240(8,697)
4.Experience- vegetable farming (years)	19.56(8.92)	18.37(14.8)	23.93(12.9)	17.9(11.8)	20.4(10.5)	21.5(11.5)
5.Family Size (Nos.per family)	4.89(1.23)	4.6(1.53)	4.9(1.28)	4.3(1.49)	4.7(1.09)	4.6(1.33)
6.Family members involved-vegetable (Nos.)	3..44(3.4)	3.1(1.5)	3.8(1.1)	3.5(1.2)	4.1(1.1)	3.6(1.3)
7.Extent of vegetables cultivated (acres)	0.85(0.28)	0.8(0.32)	0.77(0.38)	0.75(0.45)	0.72(0.24)	0.79(0.46)
8.Extent of land owned (acres)	0.94(0.47)	1.07(0.76)	0.77(0.36)	0.99(0.57)	0.79(0.3)	0.92(0.62)
9.No. of vegetables grown (Nos./family)	04(1.21)	04(1.74)	04(1.11)	03(0.79)	04(1.13)	04(1.35)
10.Extension contacts (%)	50.8	65	39	75	58	58.2

(Within brackets are Standard Deviations)

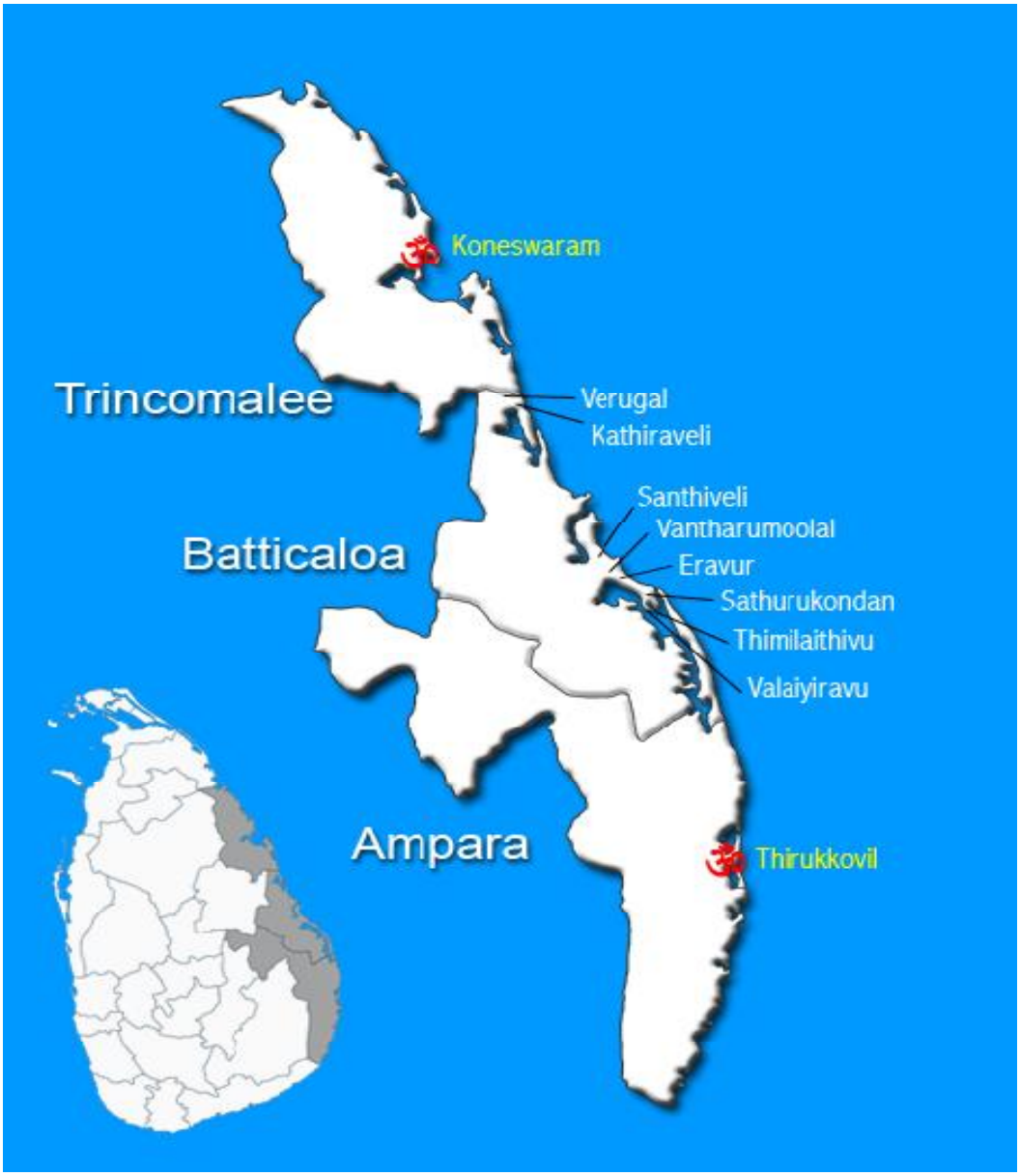

Fig.1. Map showing location of Eastern province & Batticaloa District, Sri Lanka
(*Source: Eastern Provincial Council, 2017) [12]*

Table 2. Farmer awareness on hazard levels (N=96)

Pesticide hazard level	Frequency	Percent
1.Slightly hazardous (Green label)	1	1.2
2. Medium hazardous (Blue label)	7	8.5
3. Hazardous (Yellow label)	32	39.0
4. Highly hazardous (Red label)	28	34.1
5. Don't know	14	17.1
Total	96	100.0

Table 3. Farmer's knowledge on hazardous level of pesticides (N=96)

Label Color	Hazard Level	Eravur (17)	Mandur (21)	KKC (10)	KWK (28)	PGM (20)	Total (96)	Chi Sq/ ratio
1.Green	Slightly Hazardous	5.9%	0	0	0	0	1%	143.48**
2.Blue	Medium Hazardous	41.2%	0	0	0	0	7.3%	
3.Yellow	Hazardous	5.9%	66.7%	0	0	85%	33.3%	
4.Red	Highly Hazardous	23.5%	0	0	85.7%	0	29.2%	
5.Not known	No idea	23.5%	33.3%	100%	14.3%	15%	29.2%	

*Significant level at P = 0.05***

Table 4. Farmers perception of pesticides impact on Environment, Food Products and Humans

Impact of Pesticides	Eravur(17)	Mandur(21)	KKC(10)	KWK (28)	PGM(20)	Total(96)	Chi sq/ratio
1.Humans	76.5%	90.5%	40%	50%	65%	65.6%	12.58**
2.Animals	100%	100%	100%	100%	80%	95.8%	15.86**
3.Environment	94.1%	100%	100%	39.3%	90%	79.2%	38.89**
4.Food /edible products	70.6%	95.2%	100%	100%	90%	91.7%	13.77**

*Significant at P = 0.05***

Table 5. Farmer's awareness of alternate pest control methods available

Pest Control Methods	Eravur(17)	Mandur(21)	KKC(10)	KWK(28)	PGM(20)	Total (96)	Chi Sq/ratio
1.Bio –control	0	76.2%	60.0%	21.4%	35%	36.5%	29.21**
2.Cultural control	0	90.5%	60%	32.1%	60%	48%	35.43**
3.Crop rotation	5.9%	100%	60%	71.4%	90%	68.8%	45.4**
4.Chemical control	100%	100%	80%	71.4%	70%	83.3%	13.09**
5.Manual control	0	95.2%	100%	50%	75%	61.5%	46.59**
6.Seed treatment	0	19%	40%	46.4%	15%	25%	15.19**

*Multiple responses, Significant level at P = 0.05***

4. CONCLUSIONS AND RECOMMENDATIONS

The study showed that the degree of awareness on the hazardous levels of pesticides, based on their knowledge on the colour codes of pesticides was minimal, but their perceptions on the impacts of the pesticides on the environment, humans, animals and on food items sold was high among the vegetable farmers. There was a significant spatial variation in knowledge on hazardous level of pesticides used in vegetable production. A majority of farmers are indiscriminately using pesticides, ignoring the hazardous effects on the environment and living organisms. Significant differences existed between areas studied on the perception of farmers of the impact of pesticides on humans, animals, food and environment. Most of the farmers were aware about crop rotation, chemical control and manual control methods to get rid of pests. Only a low percentage of farmers were aware about biological control, cultural control and seed treatment to curtail pest attack. There were significant spatial differences in farmers' awareness on available pest control methods.

Policy makers and institutions intervening to regulate pesticides usage need to adopt multiple strategies to create awareness on the impact of pesticides on humans and the environment. Further, the results are potentially relevant in designing policies to enhance farm extension services and to encourage adoption of alternative methods of pest control available to farmers. It is also vital for the government to invest in developing integrated pest management programs to mitigate the use of pesticides in vegetable cultivation.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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