International Journal of Research
Available at https://edupediapublications.org/journals
e-ISSN: 2348-6848
p-ISSN: 2348-795X
Volume 05 Issue 15
May 2018

A Review on Consumer Level of Awareness on Excess Use of Agrochemicals in Sri Lanka

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Abstract

Agriculture is one of the major important sector in Sri Lankan economy. Agrochemicals or agrichemicals are the result of these improved agricultural technology depends on various chemical products that are used in agriculture. While agrochemicals increase the productivity of agricultural crops, they can have ability to make some negative impacts. Excess use of these chemicals have severe threats on human and the environment. Due to the lack of adequate knowledge, consumer awareness and training facilities, it is hard to identify effects of agrochemicals on human health and environment in Sri Lanka like developing countries. Finding consumer awareness on excess use of agrochemicals and application is crucial to reduce human effects and to ensure agricultural safety. This review has revealed and discussed that adverse effect and issues of agrochemicals on nature and level of consumer awareness of these effects. This review also evaluated consumer perceptions regarding the impacts of pesticides on human health and environment.

Keywords: Agrochemicals, consumer awareness, human health and environment.

1. Introduction

The agriculture in our country has a long glorious history. In Sri Lanka, agriculture is dominated by smallholders as over 64 percent of the farming families cultivate holdings of less than 0.8 hectares. Around 40 percent of the cultivated area is occupied by plantation crops, tea, rubber and coconut (UNESCAP, 2006). Out of the total land area of 6.5 million hectares 1.5 million (24 %) are recognized as agricultural land; 13.96% of the land is arable, 15.24% is used for permanent crops and 70.8% for other uses (Department of Census and Statistics, 2002).

The use of high yielding varieties, inorganic pesticides and fertilizers has caused to significant increase in agricultural production. The plantation agriculture introduced to our country by the invaders and from that onwards the plantation agriculture also a major sector in agriculture. Sri Lankan plantations use a

large quantity of agrochemicals on agricultural lands. Agrochemicals are the result of modern technology depends on inorganic fertilizers and pesticides. Today, the use of agrochemicals is an obligatory part of agricultural practices. Agrochemicals are widely used because of ease of application, efficacy, temporary economic return, etc. Due to the usage of agrochemicals consumers have got better result from their cultivations and high productivity from their cultivations. Therefore, agrochemicals have become a major component in agricultural sector. According to the government, the country is experiencing adverse effects of the use of chemical fertilizer and agrochemicals introduced to increase crop productivity and ensure the food security. However, indiscriminate use of agrochemicals has drastically increased the negative impacts on human health and the environment.

Human health effects due to routine occupational exposures in agrochemical application have not been well documented in Sri Lanka but assumed that continuous use of agrochemicals has caused human ill health and agricultural sustainability significantly. Wilson and Tiddsell (2001) have estimated the private cost of consumers' exposure to agrochemicals in Sri Lanka. They found that a consumer on average incurs a cost of around Rs 5465 per year due to exposure to agrochemicals. On the other hand, use of the avertive /defensive behavior approach estimates the cost to be around Rs 405 per year or 12 % of the monthly income of an average farmer per year.

The intangible and indirect costs such as discomfort, stress, pain and suffering are important costs that are associated with exposure to agrochemicals. Deaths from exposure to agrochemicals are not uncommon. According to the statistics in hospitals in Sri Lanka showed that an average of 14,500 individuals were admitted to government hospitals and around 1500 individuals were died in a year due to pesticide poisoning during the period of 1986-1996 (National Poison Information Centre, 1997). Due to the exposure of agrochemicals, the damage are occurred not only to human health, but also to the native fauna and the environment in general at very large. The effect on neighboring individuals is likely to be considerable since water sources and the entire environment are affected. As a consequence, the entire food chain can be affected. The damage done to consumers of cultivated food crops, though unknown, could also be high. Over use of agrochemicals recorded due to lack of knowledge about environmental ill effects.

Although acute pesticide poisoning occurs at alarmingly high rates in Sri Lanka, it is a major problem throughout the developing world. The worldwide incidence is about three million cases and 220,000 deaths each year. The largest amount is indicated in developing countries. Vegetable crop sector accounts for heavy use of agrochemicals are extensively used on upland cash crops due to higher susceptibility to pest and diseases and relatively higher economic returns from these crops. Usually, liquid formulation and wettable powders are applied as spray mixture while granules and powders are broadcasted simply by hand. Now a days, increased attention is being paid on to selection of suitable agrochemicals, its formulation method and judicious use of agrochemicals to minimize risk and detrimental effects on health and environment.

Although Sri Lanka has become self-sufficient in rice and some other crops, the adverse effects of chemical usage such as damage to bio-diversity, contamination of water and soil due to chemical substances leading to various health problems, particularly renal diseases in agricultural areas such as north central and eastern provinces. Central and uva provinces are becoming costly for the country. Agrochemical regulations are essential to minimize hazardous effects of agrochemicals to human, animals and environment. These agro-chemicals are now stored in the bodies of the vast majority of human beings regardless of age. They occur in the mother's milk and in the tissues of the unborn child. The agro-chemical residuals are concentrating along the food chain day by day, kidney diseases are not a rarity in Sri Lanka. Diabetes, hypertension and other known causal factors contribute towards chronic kidney diseases. All this has come about because of the sudden rise and prodigious growth of an industry for the production of man-made or synthetic chemicals with insecticidal properties. As well as agrochemical regulations are essential to protect the interest of consumers and national economy.

Application of agrochemicals should be carried out in a manner that would have the least effect. Therefore, measures are initiated to control excess use and abuse of agrochemicals and fertilizer consumption are timely requirement. As a result of this, it is an opportunity to review the consumer level of awareness on excess use of agrochemicals.

2. Agrochemicals

Agrochemical is a term for the various chemical products usually which includes several toxic agents, pesticides and also in animal farming

using antibiotics and hormones which enhances the productivity in agriculture. The potential for agrochemical application is considerably increased in developing countries where its advantages seem to have not been fully exploited. Usage of pesticides in Sri Lanka recorded as 0.4 kg/ha (Sultana and Nobukazu, 2001). Success of crop production mainly depends on optimum dosage, balanced fertilizer use, correct method and right time application of agrochemical. However, presently the use of pesticide is increasing. They offer the most attractive low cost method of increasing output per hectare of land and give the farmer a high economic return for his labor and investment.

2.1 Classification of Agrochemicals

Agrochemical is any chemical that is used in agricultural production to improve productivity and control of pest and diseases.

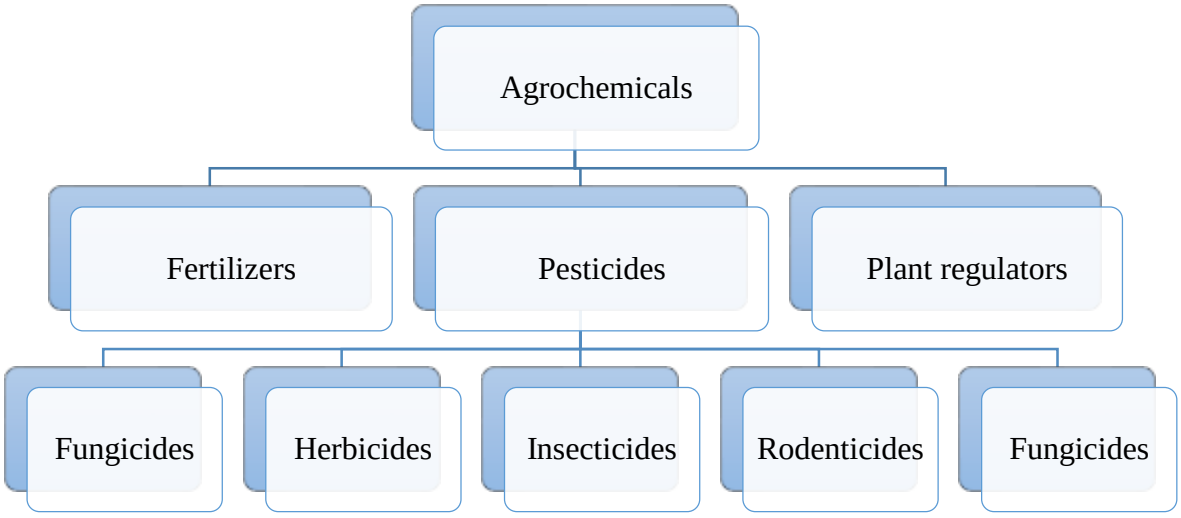

Figure 01: Classification of Agrochemicals

2.2 Usage of Agrochemicals

The use of agrochemicals have increased considerably in recent years. According to the Ministry of Agriculture and Rural development, the quantity of agrochemical used in agriculture increased three times in 1994 as compared to the late 1980 s. Agrochemicals have been an integral part of the process by reducing losses from the weeds, diseases and insect pests that can

markedly reduce the amount of harvestable produce. Webster et al., (1999) stated that "considerable economic losses" would be suffered without pesticide use and quantified the significant increases in yield and economic margin that result from pesticide use. In terms of food quality, it has been reported that a diet containing fresh fruits and vegetables far outweigh potential risks from eating very low residues of agrochemicals in crops (Brown, 2004).

Agrochemicals are very essential in amelioration of vector-borne diseases. Insecticide is used extensively to control the insects that spread diseases such as malaria. Malaria is one of the leading causes of morbidity and mortality in the developing world (Ross, 2005). Insecticides are used extensively to protect buildings and preserve wooden structures from damage by termites and other wood boring insects.

2.3 The Misuse or abuse of Agrochemicals

The misuse or unsafe use of agricultural agrochemicals is not limited to developing countries. Toxic agricultural agrochemicals that are meant for outdoor uses are often used indoors even in developed and industrialized nations for the control of household pests.

An extensive indoor application of methyl parathion, a restricted-use agricultural pesticide, led to the temporary relocation of more than 250 households in Jackson County, Mississippi, U. S. in 1997 (Olurominiyi and Emily, 2011). Some of the factors responsible for dangerous use of agrochemicals that are especially common in developing countries like Sri Lanka include;

- Poor reading habit of the literate consumers or illiteracy of the rural consumers, therefore inability to read and follow label instructions and guidelines.
- No stringent regulations and the lack of enforcement of existing ones, and the importation of toxic agricultural agrochemicals that have been banned or whose use are severely restricted in developed and industrialized countries.
- The use of leaking equipment.
- The use of domestic utensils for measuring and dispensing agrochemicals.
- Exposure to pesticide drifts, failure to wear personal protective equipment (PPE) such as gloves, long pants and respirators.
- Inflexible, scheduled application of agrochemicals irrespective of the level of pest infestation "calendar spraying".

- Storage of agrochemicals in family bedrooms and in unlocked cabinets that can easily be accessed by children.
- Improper disposal of empty pesticide containers.
- The use of empty containers for domestic purposes – e.g., storing foodstuff and water for both humans and domestic animals.

2.4 Impacts of Agrochemical

Agrochemical related issues have become the foremost concern in Sri Lanka. However, indiscriminate use of agro chemicals, especially of chemical pesticides has caused negative externalities such as health hazards to human and other beneficial organisms, pollution of the environment and water, resistance to pesticides, and outbreaks of secondary pests (Dutcher, 2007). No segment of the population is completely protected against exposure to agrochemicals and the potentially serious health effects, though a disproportionate burden is shouldered by the people of developing countries and by high risk groups in each country. The deaths and chronic diseases due to pesticide poisoning is about 1 million per year (WHO, 2006). In tropical countries, side effects of pesticides occur more frequently and are more visible than in temperate regions. Climatic conditions also make the utilization of protective gear very uncomfortable. Undesired side effects are long lasting in nature and imposed damage costs have to be borne by the society as a whole.

2.5 Effects of Agrochemicals on Environment

When agrochemicals are exposed, there is tendency of causing havoc to the environment. Most of the agrochemicals reach a destination other than their target. Pesticide contaminates land and water when it escapes from production sites and storage tanks, when it runs off from fields, when it is discarded, when it is sprayed aerially and when it is sprayed into water to kill unwanted plants (Tashkent, 1998). If peradventure, agrochemicals enter aquatic environment, there are dangers to fish, birds, wild animals and plants in that habitat. The original molecule often is modified as it enters and interacts with the environment. Agrochemicals often are degraded in water (hydrolysis), by sunlight (photo degradation), and by soil and aquatic microorganisms (microbial degradation).

Knowledge of transformation rates and the products and toxicity of transformation are the key to assessing ecological risk. Application rates and techniques have direct bearing on how a pesticide enters the environment.

A pesticide applied at a rate of ounces or less per acre has a lower potential for exposing fish and wildlife than the same chemical applied at a rate of pounds per acre. In addition, persistent agrochemicals such as DDT pesticide may bio accumulate, move through the food chain and eventually be ingested by and adversely affect birds, wild animals and domestic livestock. Methyl bromide which is currently being replaced by phosphine for the fumigation of stored cocoa beans has been identified as an ozone-depleting substance (Oluromini yi and Emily, 2011). Due to the application of agrochemical processes like spraying or injected methods, several non-target organisms may come in contact with the agrochemicals on the environment. Khan and Law (2005) have provided an extensive review of the adverse effects of pesticides and other chemicals on the enzyme and hormone systems of fish, amphibians and reptiles.

2.6 Consumer Perceptions

As early as 1965, consumer's attitudes towards pesticide use in farms were explored (Bearler and Willits, 1968; Sachs et al., 1987). Methods used to explore these topics have been varied, included different kind of surveys. According to the research, there are number of reasons that consumer choose to purchase organic food products, as well as some barriers.

Result indicated that perceptions towards awareness of consumers is contributing to preserving the environment. It seems that perception towards organic food and belief that organic food is environmentally friendly are not independent from each other. Yiridoe et al. (2005) has admitted that some of the general concerns with regard to consumer's perception towards organic food product were included food safety, environmental impact, human health, taste, nutritional value and visual appeal. Although two factors were described to have a strong significant contribution to intention of buying organic food product, other finding such as belief that organic food is safer and availability of product information (with moderate to significantly low relationship) also support the intention to buy organic food products.

However, other factors (awareness about government support and action and sensitivity) were found to be insignificantly related to the intention to use the agrochemicals. This may be due to that although people claim to be knowledgeable of the government action in supporting the pesticides as well as effect the environment; this cannot be a clear measurement of their willingness to change their conventional

consumption pattern. Studies have shown those most significant factors affecting nature is not the official government policy but public awareness or public concern for environment and the readiness to bear the cost of minimizing are the adverse impacts of their activities.

It can be argued that consumer who are increasingly concerned and realized the essentials of environmental issue are considered as "green consumers"; those consumers who make their buying decision at least partly on the basis of personal environmental criteria.

2.7 Environmentally concerned beliefs, attitudes and government interventions

A series of beliefs which can be cognitive or evaluative can combine to create an attitude (Heberlein, 1981). Beliefs are important in the formation of value which is an enduring belief that a specific mode of conduct or end-state of existence is personally or socially preferable (Rokeach, 1973). The link between attitudes, intentions and behavior has been explained primarily by Ajzen and Fishbein (1980). This theory is based on the assumption that human beings usually behave in a sensible manners where they will take into account information available to them and consider the consequences of their actions. Thus, people are expected to act in accordance with their intentions. The personal factor is the attitude toward the behavior, which is the individual's positive or negative evaluation of performing the behavior of interest. Whereas the social determinant of intention is the person perception of social pressure to perform the behavior under consideration. People generally intend to perform a behavior when they evaluate it positively and belief that important others think they should perform it. This factor deals with subjective norms which are determined by the person's beliefs that "referent" individuals or groups approve of their performing the behavior.

According to the 9th Malaysia Plan (2006-2010), chapter 22, the use of chemical and hazardous substances showed an increase, particularly in the agricultural sector. The volume of fertilizer use increased from 2.2 million tons in 2001 to 4.0 million tons in 2004. Through Skim Akreditasi Ladang Malaysia (SLAM) and Skim Organik Malaysia (SOM), government has introduced better farming practices to reduce the use of chemicals and hazardous substances.

Although the government has introduce safer handling measures, penalties for non-compliance with safety labels and promotion of safety features in production and sales by revising the Agrochemicals Act 1974 in September 2004, not all of the information is made available and well

communicated to the consumers. Environmental concern is a strong attitude towards preserving the environment. Based on the pioneering research of Dunlap and Van Liere (1978), environmental concern is also defined as a global attitude with indirect effects on behavior through behavioral intention (Gill, Crosby and Taylor 1981). People psychological responses towards the environment as individuals and consumers are also referred to as environmental concern attitude. Some writers have referred to "ecological concern", which refers to the degree of emotionality, the amount of specific factual knowledge, and the level of willingness as well as the extent of the outcomes of these (behavioral intention, recycling behavior and purchase intention on organic food products) on pollution issues (Maloney and Ward, 1973).

3. Conclusions

Agrochemicals are often considered as a quick, easy, and inexpensive solution for controlling weeds and insect pests and increase yield in agricultural lands. In recent years, adverse effect of agrochemical contamination is a world-wide problem. Overuse and misuse of agrochemical by the farmers were harmful to human health, animal health, environmental and industrial health of people. Therefore, special attention needs to be paid to developing countries. This is because of the estimated annual instances of pesticide poisoning and deaths. Pesticide residues are found in soil, surface and ground water across the country and creates severe problem. Consequently, agricultural pesticides represent the fastest growing market. Also, the adverse human health effects of pesticide poisoning are particularly high in many of these countries due to the low nutritional status and the scarcity of health care facilities especially in the rural areas where the most of agricultural activities occur. It is therefore recommended that Government should as a matter of urgency provide possible and strategic measures for the control of pesticide usage in order to check occupational, environmental and industrial hazards in developing countries like Sri Lanka.

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