

## Strategies to Minimize Pesticide Pollution in Major Vegetable Tracks of Pathanamthitta District, Kerala, India.

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**ABSTRACT:** Pesticides are chemicals used to eliminate or control a variety of agricultural pests that can damage crops and livestock and reduce farm productivity. Although pesticides play a significant role in increasing food production, exposure to pesticides can be harmful to humans. This article reviews the main problems that the use of these compounds causes to environment and health and also discusses the strategies for reducing pesticide pollution.

**Keywords:** pesticides, natural pesticides, adjuvants, IMP

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### I. Introduction

Pesticides which play an important role in modern agriculture practices are used for management of pests which are destructive. They are defined as any substance that is used for controlling, preventing, destroying, repelling or mitigating any pest [1]. The discovery of insecticidal activity of DDT by Paul Muller opened a new era in pest management both in agriculture and public health sectors [2]. The hundreds of new synthetic chemicals which were brought by recent research and development, benefit not only the agriculture, but also function as the potential environmental pollutants. There will be negative consequences for human health in the exposure to pesticides. The pesticide residues in food commodities is the fast growing global problem with serious consequences on human health [3]. Without knowing the ill effects of synthetic agrochemicals mankind enjoyed the benefits of it. The realization of the agrochemicals create adverse effects on ecosystems was surfaced by the recovery of pests, development of resistance, contamination of soil, water and air, destruction of predators, parasites and other non-target organisms, including wildlife. It is through direct run off, leaching, careless disposal of empty containers, washing of equipments etc that pesticides reach aquatic environment [4]. By the misuse of pesticides, tremendous economic losses and hazards to human health is found. This human exposure to pesticides is usually estimated by measuring its levels in the environment like soil, water and food [5].

#### 1.1. Benefits and risks of pesticide application

About one third of the agricultural products are produced by using pesticides, that is why pesticides are so essential in agricultural production [6]. By using pesticides, crop loss from pest's decline to 35% to 42%. At the same time using pesticides are serious as well. Most of them are highly toxic to humans and the environment and they are not spontaneously generated. Pesticides and their degraded products threaten human health and the environment as they flow into atmosphere, soils and rivers. In India even in earlier years the residues of DDT, Lindane and Dieldrin in fish, eggs and vegetables have been beyond safe range and the DDT content in human body was the highest in the world [7].

#### 1.2 Global use of pesticides

One fifth of all pesticides are consumed in India which has increased in developing countries. In major categories of pesticides, herbicides ranked the first during the period of 2007-2008. The second place came to fungicides which increased rapidly. Now the largest consumer in the world is Europe which was followed by Asia, China, the United States, France, Brazil and Japan.

#### 1.3 Pesticide use in India

In the manufacturer of pesticides India ranks the second after China, and twelfth in the sector globally [8]. The pesticide pollution problem is serious in India, though the average consumption is far lower than many others. Among the few remaining countries still producing and using some of the chlorinated pesticides such as DDT and Lindane, India is one among [9].

#### **1.4 Soil contamination**

The persistent soil contaminants are the chemicals used in pesticides whose impact endure for decades and mainly affect soil conservation. Pesticides enter the soil through spray drift, wash off from treated foliage and from treated seeds in soil. To control pests and plant diseases in soil, some pesticides like soil fumigants and nematicides are applied directly into the soil. The degradation of pesticides in soil depends on physical, chemical and biological properties. These factors affect degradation, runoff and leaching of pesticides.

#### **1.5. Water contamination**

Water contamination depends mainly on nature of pesticides. Pesticides can be applied directly into water surface. By heavy rainfall rapid transport to groundwater may be caused. Recent studies also reported the presence of pesticides in surface water close to agricultural lands. The present study seeks to apply suitable measures to reduce pesticide pollution. A survey was also conducted in the vegetable tracks of Pathanamthitta district to assess pesticide management protocols.

### **II. Study Area**

Pathanamthitta is a small town that situate in central Travancore region in the state of Kerala, South India. It spreads over an area of 23.50 sq.km. The latitude and longitude of Pathanamthitta are 9.2647° N, and 76.7872° E. The town has a population of 1,197,412 (Census 2011). Pathanamthitta is a district with Kottayam and Idukki districts in the north, Alappuzha district in the west, Kollam district in the south and Tamil Nadu state in the east. About 75% of the annual rainfall is received during south-west monsoon. About 75% people depend on agricultural sector in the region. Rubber is the most important crop. Vegetables such as snake gourd, brinjal, tomato, cucumber, bitter gourd, pea and plantain are widely cultivated. Pampa river (176 km long), the third longest river in Kerala, flowing through the study area, forms the major water source. Though farmers use farm chemicals, quite a good majority still depend on synthetic pesticides for pest management. The locations such as Naranamuzhy, Vechoochira and Ranni panchayath in Pathanamthitta district were taken as experimental sites for investigation

### **III. Methodology**

A detailed questionnaire survey was conducted among farmers to assess the types of pesticides used, frequency of application and quantity of pesticides used in the vegetable tracks of Pathanamthitta district. Fifty selected farmers were interviewed and their responses were used to create a data base on pesticide use pattern in the vegetable tracks.

### **IV. Discussion**

Increasing crop loss due to pests is a major constraint in sustaining agricultural production and productivity. The cropping pattern in India is fast changing particularly towards export oriented, value added crops mainly major spices, fruits, vegetables and industrial crops. Pesticide is an ally in the farmer's struggle to protect their crops. It was experienced that without pesticide use, loss throughout the production system remains high [10]. However consumption has never been uniform in the country and it varies with the intensity of pests and diseases, cropping pattern and agro-ecological regions. Pesticide use is high in the regions with good irrigation facilities and in areas where commercial and economically important crops are grown. In addition agricultural exports were rejected due to the presence of high pesticide residues[11]. In order to minimize crop loss, farmers aggressively adopt self-defeating practices of plant protection measures such as either increasing dosage or frequency of pesticide application, regardless of its effects on environment, health and socio-economic conditions of the community

#### **4.1. Development of a Database on Pesticide Use Pattern in Pathanamthitta District**

The major pests include thrips, root grub and for their timely management farmers were adopted plant protection measures with conventional insecticides. A purposive sampling survey was conducted in different vegetable tracks; five each in Naranamuzhy, Vechoochira and Ranni Panchayats adopting varying methods of pest control practices to assess the types of pesticides used, frequency of application and the amount of pesticides used. Farmers shared their experiences about the cultivation and plant protection practices. The respondents in the hot spots were concerned about increasing crop loss due to pests and diseases. In order to protect the crop from biotic disturbances, farmers followed strict plant protection measures at an interval of 15 to 20 days by spraying various plant protection chemicals in rotation. Majority of them practiced their own schedule of pesticide application regarding the dosage and type of chemical to be used.

The farm labourers as well as cultivators followed application of chemicals without taking any safety measures while handling and spraying. Most of the farmers were unaware about the active ingredients and the toxic effects of the insecticides and were not concerned about the environmental pollution caused due to the misuse of these xenobiotics.

**Table. 1.** Major Pests and Diseases

Major Pests	Major Diseases
Thrips	Azhukal
Root Grubs	Clumprot or Rhizome Rot
Hairy Caterpillars, White fly, Nematode	Leaf Blotch Disease

The conventional organo phosphorus insecticides were widely used by the farmers and it included phorate, chlorpyrifos, quinalphos, profenophos and methyl parathion. The progressive farmers among the respondents were more concerned about the quality of the ecosystem and adopted the new generation insecticides as a component in plant protection. Synthetic insecticides controlled the pests effectively during the early green revolution period. However, the indiscriminate use of these chemicals resulted in the elimination of the natural enemies of pests, leading to increased outbreak and resurgence of insect pests [11]. Pesticide application accounted for a major share of the cost of cultivation. However, they were of the opinion that the prescribed dose of pesticides in the package was ineffective for the control of pests and diseases. The indiscriminate use of broad spectrum synthetic pesticides resulted in reduction of biodiversity, outbreak of secondary pests, development of pesticide resistance, pesticide-induced resurgence and contamination of food and the ecosystem [12]. Chlorpyrifos and phorate were mainly applied as soil insecticides.

#### 4.1. Physico-Chemical Properties of soil and water

The physico-chemical properties of samples from the three locations were analysed and it was observed that the soil of Naranamuzhy, Vechoochira and Ranni were very rich in organic carbon content and contains higher percentage of organic matter also. The nutrient status of the soils revealed that they were high in nitrogen and potassium. More than 44% water holding capacity is observed in all the soils. Water samples were analysed it was found that the pH was slightly acidic

#### 4.2. Monitoring of pesticides in soil

The impact of pesticides in soil was carried out using modified QuEChERS method [13]. The recovery studies in this method showed that extraction using acetonitrile gives maximum percentage of recovery and hence adopted as solvent for detection of various pesticides in soil. The results of soil sample analysis showed that the samples collected from surface soil at 0-15 cm depth showed traces of residues when compared with that of 15-30 cm deep soil. When water samples were analyzed for the presence of pesticides it was found that none of the samples were contaminated with pesticides

#### 4.3. Monitoring of pesticides in vegetables

Fresh edible portions of vegetables like pea, snake gourd, bitter melon and brinjal were collected from selected vegetable tracks and analysed for the presence of pesticides and the results showed that none of the samples were contaminated with pesticides.

### V. Strategies For Reducing Pesticide Pollution

Pesticides provide the best opportunity to those who entertain with the risk-benefit equations. In developing countries the economic impact of pesticides in non-target species (including humans) has been estimated at approximately \$8 billion annually. Between developed and developing countries the total cost-benefit picture from pesticide use differs largely. It is essential to use pesticides for developing countries as no one would prefer famine and communicable diseases like malaria. We should be sensible on our approach to use pesticides. All activities concerning pesticides should be based on scientific judgment and not on commercial considerations. Some of the measures to minimize pesticide pollution are discussed below.

- Reduce pesticide dispersion in the environment: Adapt the use of crop protection product to environment conditions. Crop protection is the science and practice of managing pests, plant diseases, weeds that damage agricultural crops. It includes cover crops, bird netting, plant breeding, genetic modification etc.
- Crop rotation prevents the carryover of pest, pathogens and weed population.
- Intercropping and use of variety mixtures limits the spread of pests and diseases and provides food and shelter for natural enemies of pests.
- Timely shallow tillage reduces weed population and at the same time improves nutrient supply of the crop.
- Appropriate timing of sowing or planting and of intercultural operations reduces pest pressure
- Reduce loss of applications: Improve the properties of active substance preparations. We can reduce the runoff and volatilization by improving the properties of preparation by adjusting inert substances or adjuvant. By replacing traditional nozzles of sprayer by air injection nozzles, we can reduce quantities of droplets and thus drift.

- Do not apply pesticides during very windy conditions, at very dry conditions, at very low or very high temperatures or when rain is forecast. Spray only when conditions are favorable.
- Reduce transfers within and out of the field. Grow grass between rows of perennial crops. Leave crop residues on the soil if the field is not ploughed. Apply organic matter.
- Choose the right product to reduce environment risks.
- Reduce pesticide use: Promote non chemical pest control method by using natural pesticides. The following are some methods
  - a. Neem oil reduces proliferation of insect and pests.
  - b. Pyrethrum, an extract of *Chrysanthemum* species decomposes rapidly in the environment.
  - c. Copper is widely used to control fungal diseases.
  - d. Sulphur and soap are used to control mites and other pests.
  - e. Pheromone dispensers can be used to control mating of pests.
  - f. Traps like sticky coloured boards, pheromones traps and light traps to catch insect pests.

- **Integrated Pest Management**

Integrated Pest management defines as a careful consideration of all available pest control techniques and subsequent integration of appropriate measures that discourage the development of pest population and reduce or minimize risks to human health and environment. For better understanding of the problem the data on environmental cum health risk assessment studies can be used. Occurrence of pesticide-related illnesses among defined populations in developing countries is minimum. By examining the end product of human exposure in the form of residue levels in body fluids valuable information can be collected. A major vehicle to ensure a safe use of pesticides can be done by educating the workers.

A quick, easy, and inexpensive solution for controlling weeds and insect pests in urban landscapes are the pesticides. Almost every part of our environment have been contaminated by pesticides. Environment and non-target organisms ranging from beneficial soil microorganisms, to insects, plants, fish, and birds poses significant risks.. Even herbicides can cause harm to the environment. If weed killers are used they will cause problems. If we use safer, non-chemical pest control methods, the pesticide contamination can be reduced.

## **VI. Conclusion**

In this study, a detailed analysis was carried out on the impact of pesticides and heavy metals in soil, water and vegetables samples at Naranamuzhy, Vechoochira and Ranni,Panchayaths..The physico chemical properties of soil samples from the locations were analysed and it was observed that the samples were very rich in organic carbon content and organic matter. Since the soil samples were found slightly acidic it may be recommended that the soil need be treated with quicklime for optimum yield. The results showed that the concentration of pesticides and heavy metals in soil was below quantification level set by WHO. The water bodies were not contaminated with pesticides and heavy metals. The reason may be due to leaching and runoff. The study revealed that though the concentration was below quantification level, the situation may become hazardous, if there is excessive use of pesticides.

To sum up, based on our limited knowledge of direct and inferential information, the domain of pesticides illustrates a certain ambiguity in situations in which people are undergoing life-long exposure. There is thus every reason to develop health education packages based on knowledge, aptitude and practices and to disseminate them within the community in order to minimize human exposure to pesticides.

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