

## **Topic: Chemical Leasing and Nano-materials in Agriculture Sector**

### **Introduction**

The benefits of agrochemicals include the increase of the plant growth and, the yield and quality of crops. While these benefits are substantial, the intensive use of agrochemicals over the year has caused serious environmental problems, such as contamination of surface water, soil and ground water. Examples of such environmental issues arisen in Sri Lanka include Kalpitiya and Jaffna etc. Usually, the amount of fertilizers applied to the soil is not fully utilized by plants. About 50% of fertilizers applied to crops are left behind as residues. When pesticides are applied to protect crops from pests and diseases, only around 15% of the preparation hits the target while the rest is distributed in the soil, water and air. Soil is the main matrix for agrochemicals deposition. However, the bulk of agrochemicals in soil are generally confined to the upper layer of the soil. Agrochemicals in soil can move from the surface when they dissolve in run off water, or when they percolate down through the soil. The agrochemicals that have infiltrated the soil will eventually reach aquifers and ground water systems. The run off of agrochemicals flow into streams, lakes and other surface waters can cause an increased productivity of those at aquatic eco systems, a problem known as eutrophication. The use of some agrochemicals is also risky for humans. About one million pesticide poisonings occur globally every year, resulting in 20,000 fatalities. About one-half of the human poisonings occur in poorer, less-developed countries, even though these places account for only 20% of the world's use of pesticides. Though some agrochemicals are not directly toxic to humans, they have been found to damage the existing ecological balance.

Traditionally, farmers become the owners of the agrochemicals and therefore responsible for its use and disposal. Agrochemical manufacturers have a clear economical interest in increasing the amount of agrochemicals sold, and this may result in releasing large amounts of agrochemicals to the environment. In solving this problem, the application of Chemical Leasing (ChL) has gained a great interest during the last couple of years, since it is much more service-oriented. In ChL, chemical manufacturers try to optimize the use of the chemicals, improve the quality of products in order to reduce the amount consumed and thereby reduce the environmental pollution. In this business model the customer pays for the benefits obtained from the chemicals not for the substance itself. Consequently, the economic success of the manufacturers is not linked with product turnover. When applying ChL in agrochemical sector the manufacturer provides not only the agrochemicals but also the know-how on how to reduce the consumption of agrochemicals optimizing the conditions of use.

In the recent years, there is a great interest in enhancing the efficiency and quality of fertilizers by applying nanotechnology. It is expected that nanofertilizers enhances the ability of plants to absorb nutrients and reduce the amount of fertilizers used. In addition to that Nanotechnology has the potential to revolutionize the agricultural industry with new tools for the molecular treatment of diseases, rapid disease detection, enhancing the ability of plants to absorb nutrients etc. .

Therefore, the proposed chemical leasing and nano-materials approach will reduce the input of chemicals into ecosystem in agricultural practices. The main goal of the project is to develop a suitable model for ecologically sustainable farming system that would ensure food security and reduce environment pollution without inhibiting the progress of the industries associated with agriculture.

### **Objectives:**

- Understand the flow of Chemicals in various formats in the Sri Lankan agriculture sector
- To improve the efficiency of Agro chemicals use with minimum risk to the environment
- Promote the sustainable management of Agrochemicals, to boost economic performance
- To enhance interaction between farmers and Agrochemicals producers/suppliers that results in reduced Agrochemicals use, reduced emission to environment, reduced pollution of water resources and eliminate any health risk to farmers and consumers of agricultural products.

- Minimize toxic chemical residues in food and environment.
- Reduce risk from Agrochemicals by improvement of farming technology to minimize surface runoff
- Through use of nano-materials achieve process optimization to enhance the ability of plants to absorb nutrients.
- Promote the sustainable management of agrochemicals, to increase the economic performance – the potential of classical chemical leasing applied analysis for the Sri Lankan agro sector
- To enhance interaction between farmers and agrochemical producers/suppliers that results in reduced agrochemical use, reduced emission to environment reduced pollution of water resources and reduce any health risk to farmers and consumers of agricultural products
- Understanding the implications of the developments in nanotechnology in agriculture coupled with the concept of chemical leasing

**Methodology:**

- Literature survey on
  - a. Identification of environmental impacts that are influenced by agriculture and use of Agrochemicals
  - b. Identification of impact of different soil conditions for agriculture and use of Agrochemicals
  - c. Study on absorption of Agrochemicals for selected plants
- Lab scale testing to measure the absorption efficiency of Agrochemicals in selected plant species.
- Estimation of optimization potential for the use of Agrochemicals
- Calculation of added value of optimal use of Agrochemicals in a selected crop variety
- Develop a result oriented new unit of payment for Agrochemical use.

**Research Period:** Two year

**Estimated Budget:** USD 4500