

production. In addition to increasing the NUE, nanotechnology might be able to improve the performance of fertilizers in other ways. For example, owing to its photocatalytic property, nano TiO₂ has been incorporated into fertilizers as a bactericidal additive. Moreover, TiO₂ may also lead to improved crop yield through the photo-reduction of nitrogen gas. Furthermore, nanosilica particles absorbed by roots have been shown to form films at the cell walls, which can enhance the plant's resistance to stress and lead to improved yields. Clearly, there is an opportunity for nanotechnology to have a profound impact on energy, the economy and the environment, by improving fertilizer products.

1. Chen, H., and R. Yada (2011): Nanotechnologies in agriculture: New tools for sustainable development. *Trends in Food Science & Technology* 22, 585.
2. Ditta, A. (2012): How helpful is nanotechnology in agriculture? *Adv. Nat. Sci.: Nanosci. Nanotechnol.* 3, 1.
3. Joseph, T., and M. Morrison (2006): Nanotechnology in Agriculture and Food: A Nanoforum Report.,
4. Sharon, M., A. K. Choudhary, and R. Kumar (2010): Nanotechnology in agricultural diseases and food safety. *Journal of Phytology* 2, 83

Global Environmental Impacts of Agriculture: Requirement for sustainable agricultural practices to save the world

Professor Priyani A. Paranagama

Senior Professor of Chemistry (Chair), Department of Chemistry, University of Kelaniya

Introduction

World population is predicted to reach about nine billion in 2050 indicating an increase demand for agricultural produce and will continue to grow in the future. Increased population exerts further pressure on increased production of food, fiber, biofuel and other essential needs. Therefore, agriculture is an important sector that is directly related to the economic growth of a country. Although food, fiber, biofuel, drugs are produced in large quantities to sustain and enhance quality of human life, many environmental problems faced today are due to the activities of the agriculture which have been directly associated with the intensification of food production. If the agricultural practices which have been introduced in past two decades are continued without a change, the agriculture related environmental problems will remain as serious issues during the next decade. Although development of sustainable agriculture with increased food production of an ever-changing planet is a challenge, there is an urgent need for major changes of the global agriculture systems. It is evident that sustainability of agriculture depends on generation of environmentally friendly, economically viable and socially acceptable products and the balance of these three major factors is extremely important in order to maintain sustainability of the agriculture. It is similar to a 3-legged stool while sustainable agriculture is on the top of the stool. If one leg of the stool is broken, the stool is not stable and will

fall over indicating priority should be given to these three key factors which directly affect on the sustainable agriculture and it is clearly shown that agriculture today is largely a struggle against nature.

This paper reviews the presentation I made at the theme seminar of the annual sessions of the Institute of Chemistry Ceylon and discussed the effects of key activities related to the global agriculture that have contributed significantly to global environmental impacts.

Negative impacts of Green revolution

In this section I am highlighting the causes and effects of modern agriculture that was introduced after the green revolution. In 1960's the green revolution has been introduced by Nobel laureate, Norman Borlaug, who was called "Father of the Green Revolution". It was initiated with the intention to address the issues of malnutrition in the developing world, mainly targeted to increase the agricultural productivity. The technology of the Green Revolution involved generation of High Yielding Varieties (HYV) using selectively breed or genetically-engineered crops that work in combination with the use of chemical fertilizers, synthetic pesticides and high inputs of water to increase crop yields. The technology of green revolution was readily initiated in developed countries and later the developing countries (eg. Sri Lanka) were also following a similar trend to increase the food production. It was reported that fast growing dwarf