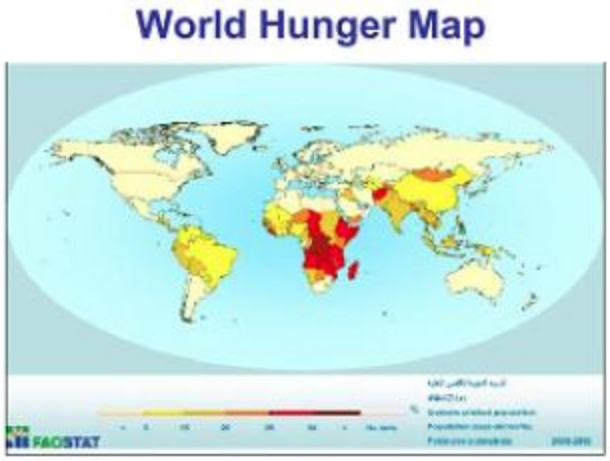
Food Biosecurity: Feeding the World in the 21st Century

Dr Philip O'Brien

25 members and guests braved the stormy weather to hear Dr Philip O'Brien, as outgoing RSWA President, deliver his Presidential Address. Philip began his presentation by outlining how in the "midst of plenty", the World Bank estimates that, globally, 1-2bn people are malnourished. This problem is not confined to developing countries, in the USA alone 35 million people are malnourished. Graded areas of hunger are shown on the World Hunger Map below.



Population growth is seen as the major cause (with human populations increasing from 5 million in 1800 to 6 billion today), and our ability to produce food has not kept pace with increased population growth. This is because the amount of arable land has declined. The constraints on food production are:

- soil degradation.
- pollution.
- salt degradation of land.
- use of land for human habitation.
- climate change
- pests, diseases and weeds, and
- agricultural land being used to grow crops for biofuels
- cities, where there are expanded use of land, and production of waste (megecities of > 15 million people are now common).

Currently 2 billion people live in the driest parts of the planet, and many cities are already facing water shortages. Crop production consumes most of the available water (87%). Climate change will also increase the occurrence of plant diseases, insects, and invasive weeds. Plant Diseases such as Late Blight (Phytophthora infestans) can destroy a potato crop within 3 weeks. Diseases, such as dieback (Phytophthora cinnamomi) occur in native ecosystems.

Insects cause an average loss of 30% of world crop production. For example, each year, there is some 30-70 % crop loss due to insects. Pests such as the Khapra Beetle affecting lucerne, almond, barley, bean, corn/maize, chickpea, cowpea, dried fruit peanuts, oats, pecans, rice, walnuts, wheat.

Invasive weeds such as rubbervine are destroying vegetation.

Invasive Weeds: A major Problem

Rubbervine, an invasive weed destroying native vegetation along the Burdekin river in Queensland. It is present in 20% of the state.

Food availability is a growing problem. Between 2005 and 2008 the price of wheat and corn tripled and the price of rice increased 5 fold sparking food riots in 2 dozen countries. This will get worse because for the past decade we have consumed more than we have produced, and stockpiles of food have dwindled.

What can be done?

Agroecology is one solution – utilizing natural resources for agricultural production. For example, the Millennium Project - a United Nations sponsored community-based low cost and integrated intervention has enabled impoverished rural areas to achieve sustainable outcome by, for example, using local plant varieties to increase biodiversity, rotating legumes with grain. In Malawi, for example, in 3 years, production has gone from 44% deficit to 53% surplus, with exports to Zimbabwe. For urban development, however, the Millennium Project will not produce the answer.

Philip went on to say how a revolution, similar to the green revolution of the 1960s, is needed in order to change farming practices. Soils need to be recognised as living entities. Changes need to include developing new crop varieties to overcome the constraints of salt, frost, disease, pests, and weeds; improved management of pests and diseases, better surveillance and detection, and improved responses, and new tilling procedures that do not destroy the soil.

New varieties of plants and improved management of pest are requited to overcome the constraints to food production.

The agronomic performance of Genetically Modified (GM) plants was discussed, and here Philip focused on the GM- insect resistant rice as an example. Transgenic rice plants with engineered insect resistance, for instance, have been found to give yield increases of 30%.

Weeds and their control are a major problem in plant production. Over $10bn is spent on herbicides and pesticides each year. After 10 years of growing insect resistant (IR) and herbicide tolerant (HT) Crops it has been found that farm income has increased substantially, the use of herbicides and pesticides has decreased, and the environmental footprint of crop production has decreased in every case.

The benefits of HT crops have been demonstrated to include:

- more flexible management options.
- less chemical damage to crop.
- facilitates the adoption of no till resulting in higher yields of crop, reduced soil erosion, reduced soil damage, and increased carbon sequestration.
- lower weed load reduces harvesting costs
- reduction in the amount of herbicide used
- reduced greenhouse gas emission.

Philip then went on to talk about the spread of exotic pathogens, and improved detection of disease organisms. While there has been a spread of Phytophthora infestans in the 19th century, the threat of exotic pathogen spread in the 21st Century has been exacerbated by globalisation of the world economy. In addition to Phytophthora cinnamom, a threatening pathogen in Australia is Eucalypt Rust (Puccinia psidii). Septoria is another threatening pathogen, causing premature defoliation), in Caragana, and Cottonwood. However, the good news is that there is improved detection of disease organisms, and advances in DNA detection technology has led to on site detection of pathogens in the field. Philip concluded his Address by saying that the food shortage being experienced globally is a long-term problem, which will get worse, and although there are a variety of hi-tech and low-tech solutions to the problem, there is no single answer. Different solutions are appropriate for different situations, and that we need to use every resource available to tackle the problem, and to continually develop new resources.