

# Can Science and Technology based Agriculture Feed the World in 2025?

Prof M S Swaminathan

## Abstract

1. By 2025 the global population will exceed 7 billion. Consequently the per capita availability of arable land and irrigation water will go down from year to year. At the same time there will be an expansion of biotic and abiotic stresses. The threats to sustainable food security are several. But the following are particularly important:

2. Threats to sustainable food security

**Ecology:** Among the ecological threats to food security, the immediate ones relate to land degradation and water famine and pollution, as well as biodiversity loss as a result of the destruction of forests, coral reefs and other important homes of biodiversity. In the medium and longer term, climate change induced by anthropogenic factors leading to adverse changes in temperature, precipitation and sea-level rise, is likely to cause harm to food and water security and quality of life. In all these cases the poor nations and the poor in all nations will be the worst sufferers.

**Economics:** There is increasing rich-poor divide in economic well-being. Unsustainable life style on the part of a billion members of the human family co-exists with unacceptable poverty on the part of over a two billion inhabitants of the planet whose per capita per day income is less than two US Dollars. This is likely to generate a great deal of resentment and violence. Ethnic wars are often due to a feeling of injustice and despair.

**Equity:** In terms of equity, the gender divide is unfortunately persisting. There is increasing feminization of hunger, poverty and HIV/AIDS. There is also increasing feminization of agriculture. Unfortunately women have little access to land, credit, technology and the other facilities essential for sustainable livelihoods. There is also inequity in access to technology. Thus, digital and genetic divides affect women more. Equity has to be considered in two time dimensions; the first in relation to the present generation, and the other relating to the generations yet to be born. The second form of inequity referred to as inter-generational inequity is caused by harm to life support systems such as land, water, forests, biodiversity, oceans and the atmosphere.

**Ethics:** Bio-ethics is basic to biosecurity. There are increasing threats to human security rising from diseases like HIV/AIDS, SARS, Mad Cow disease, H5N1 strain of poultry influenza etc., Care has to be taken in relation to the development of new biological weapons arising from the unethical use of recombinant DNA technology. New weapons of mass destruction can be developed by genetic modification. The other danger comes from drug addiction. UNESCO has already formulated a declaration on the human genome and human rights. Ethics will have to be integrated in all scientific endeavour. Bio-ethics alone can help to avoid bio-perils.

**Energy:** The excessive use of fossil fuel energy and coal and the destruction of forests (i.e. carbon sinks) lead to imbalances in carbon emission and absorption. Renewable energy sources like solar, wind, biomass, biogas and mini-hydel methods are important. Nuclear power is environmentally benign. There is however the problem of nuclear waste disposal. Every country will have to develop an integrated energy security system based on feasible combinations of renewable and non-renewable energy. Energy security is essential for food security

**Employment:** The world is increasingly witnessing job-less economic growth. In many developing countries, hunger today is more due to lack of purchasing power arising from inadequate non-farm livelihood opportunities. Where there is work, there is money. Where there is money, there is food. Therefore the hunger problem is best defined in million person years of jobs rather than in million tonnes of food grains. Job-less growth is joyless growth and is likely to result in a growing violence in the human heart. Globalisation therefore should not lead to job-less growth. Work for all is essential for achieving the goals of food and health for all.

**Education:** What every one of us is today is the product of interaction between our innate genetic make-up and the environment. The environment again relates to home, school and social environment. Education is essential for imparting rationality in thinking and originality in planning. It is unfortunate that today there is a growing intolerance of tolerance. Diversity and pluralism in terms of race, religion, language, colour, ethnicity or political belief, which are the strengths of human societies are not being appreciated or tolerated. We need teachers who are mentors and not indoctrinators.

3. Food Security is best defined as economic, physical and social access to balanced diet and safe drinking water. For achieving food security of this concept at the level of each individual child, women and man, it is essential to deal concurrently with issues relating to chronic under-nutrition caused by poverty and low-purchasing power, hidden-hunger caused by the deficiency of micro-nutrients in the diet and transient hunger resulting from natural or human induced disasters. Hence a holistic approach to nutritional and non-nutritional factors will be necessary to achieve success in the eradication of hunger.

4. Science and Technology can play a very important role in stimulating and sustaining an evergreen revolution leading to increases in productivity in perpetuity without associated ecological harm. Among frontier technologies, biotechnology, information and communication technology, space technology including GIS and remote sensing, nuclear tools and renewable energy technology are particularly important. Nano-technology is also likely to provide new opportunities. In view of the controversies relating to genetically modified foods, the following principle should be adopted to ensure consumer confidence in the products emerging from recombinant DNA technology.

**“The bottom line for any biotechnology regulatory policy should be the safety of the environment, the well being of farming families, the ecological and economic sustainability of farming systems, the health and nutrition security of consumers, safeguarding of home and external trade, and the biosecurity of the nation”.**

Transparent regulatory mechanisms should be in place if public, political, and professional confidence in GMO's is to be improved. At the same time, breeders and agronomists should work together to ensure concurrent attention to breeding and feeding crop plants for high yields.