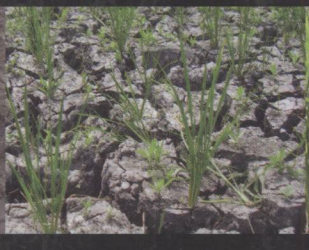

FOOD AND WATER SECURITY

U. ASWATHANARAYANA
EDITOR

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Food and Water Security

Editor
U. Aswathanarayana
Mahadevan International Centre for Water Resources Management
Hyderabad, India

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Cover Illustration:
Indonesian farmer holding two rice plants of same variety and maturity, the one on left grown with SRI practices and the one on right grown with conventional practices. (Picture courtesy of Shuichi Sato, Nippon Koei, Jakarta, Indonesia, quoted by Norman Uphoff, in this volume)

Preface

Food security is a fundamental human right. US AID defines food security as follows: "When all people at all times have both physical and economic access to sufficient food to meet their dietary needs in order to lead a productive and healthy life". While there are indeed undernourished people in the industrialized countries, it can be safely stated that virtually all the undernourished people in the world are in developing countries. Economically-viable, ecologically-sustainable and people-participatory technologies are indeed available to realize hunger-free developing countries. The difficult part is for the developing countries to integrate combinations of technologies with policy interventions, economic instruments, and managerial systems consistent with the agroclimatic, socioeconomic situations and food preferences in a country, or in some cases, parts of a country. The purpose of this volume is to place on the present selection of techno-socio-economic options, from among which the developing countries could choose combinations to suit their particular needs.

What the great Chinese philosopher, Confucius, said 2500 years ago with profound prescience, "Despite the many accomplishments of mankind, we owe our existence to the thin layer of top soil, and the fact that it rains", is as valid as ever. Food security is critically dependent upon optimizing the use of soil and water. Food security and water security are inseparable, as food cannot be grown without water. We must find ways of growing more crop per drop, and getting more meat and milk per drop, and more fish per drop. What constitutes food security changes, as food habits of people change. Food availability is a necessary but not a sufficient condition for food security. It can happen that food security at the aggregate level may not translate into food security at family level – for instance, China is not only self-sufficient in food grains, but is an exporter of food grains, but still, according to UN sources, about 142 million Chinese are food-insecure, though this number has been coming down rapidly.

The chapters in the volume are based on the presentations made in the Panel Discussion on the Biophysical and Socioeconomic dimensions of Food Security in the developing countries, organized by the editor on Jan. 6, 2006 in

the ANGR Agricultural University, Hyderabad, as a part of the Event, "Science and the UN Millennium Development Goals", plus some solicited papers. The key challenge of growing more food with less water has both science-based and people-based dimensions. Regrettably, there has not been adequate interaction between the practitioners of the two sets of dimensions. This volume deals with ways and means of management of food and water security in various agroclimatic environments through the integration of research and development, training, people participation, agronomic practices, economic instruments, and administrative policies, etc.

The problems of food security in India, and the attempts that are being made to address them, are relevant to the developing countries generally. India has 100 million farming families, i.e. ten times the number in all the OECD countries, including USA, who incidentally get a support of USD one billion a day.

Because of the advantage of repetitive coverage and capability of synoptic overview, satellite remote sensing has emerged as a powerful and cost effective tool covering all aspects of soil, water and crop management, wasteland reclamation, etc. Advances in data assimilation methodologies have made it possible to customize synoptic remote sensing data to farmer-specific use. Through the instrumentality of the Village Knowledge Centres (*Gyan Chaupals*), Information and Communication Technology (ICT) is playing a crucial multipurpose development role in regard to food and water security, health, sanitation, habitation, etc. in the villages. Young, *practicing* farmers who are trained in the measurement of soil and water quality parameters, agronomic practices (e.g. SRI), use of fertilizers and pesticides, etc. have proved effective in promoting science-based, productive agriculture.

In this book three basic key issues are treated:

Soil: Preparation of soil health cards, to enable the farmer to manage the fertility of the soil in his farm, with particular reference to micro-nutrients, such as zinc, boron and sulphur, which have a marked effect on the productivity of dryland agriculture.
Water: Rainwater harvesting, aquifer recharge, conjunctive use of surface and groundwater, monitoring and management of soil moisture, sprinkler and drip irrigation. Preparation of hydroclimatic calendar for use in crop planning. Reuse of waste water.
Agronomic practices: System of Rice Intensification (SRI), and Aerobic rice which yield more rice with less water, development of salt-tolerant and drought-resistant seed varieties, through the use recombinant DNA technology and methods of transferring salt-tolerant genes (e.g. from mangroves) into important food crops, such as rice.

Market-linked farming systems to improve the income of the farmers. ICT empowers poor, rural women to get self-employed by producing various

food-based goods and services. Food fortification (methods of processing foods to improve their nutritional value) whereby (say) the same quantity of cereals could provide nutritious diet to more people.

I thank Dr. Malin Falkenmark, the doyen of water scientists in the world, for her perceptive Foreword. *Gangamai* (Mother Ganga) is the goddess of water. In Sanskrit, Ganga refers not only to River Ganga, but also to all surface and groundwater in India. I have a fanciful notion that the great fervour with which Malin Falkenmark pursued water issues all her life, could be attributed to her being a devotee of *gangamai* in her previous birth!

The care of my wife, Vijayalakshmi, and my physician friends, Drs. Bhaskar Reddy and Surya Prakash, kept me in good health. I am grateful to them.

This broad-spectrum volume would be useful to university students and public officials concerned with water, soil and crop sciences, remote sensing, agrometerology, food processing, food distribution, technology transfer, sociology, economics, etc.

U. Aswathanarayana
Editor
September, 2007

Foreword

The global food security issue is gathering increasing interest, especially in view of the recent IPCC report's projections on future water scarcity outlooks. The challenge is particularly large in irrigation dependent regions of the South, where river basins are in a state of closure, and hunger and poverty still common.

The dilemma is that food demand tends to grow more rapidly than population, driven by socio-economic changes, new food preferences, and altered food composition for nutritional reasons. One particular dilemma is of course that animal protein, which demands one order of magnitude more water than grain to produce, is fundamental for both growing children and breast-feeding mothers.

While food water requirements rapidly increase, the availability of irrigation water is moving in the opposite direction. One reason is that irrigation has added a consumptive use element into the water availability, altering it with time. This has contributed to the fact that, today, one basin after the other is suffering from streamflow depletion, entering a state of river basin closure.

In the mean time, with surface water heavily exploited, farmers have been turning more and more to groundwater, securing more immediate access to irrigation water when and where needed. This approach is sustainable as long as only the amount of groundwater recharged is being withdrawn and consumptively used. But as soon as the aquifer is being overused, water table continuously drops. At present, the scale of water overuse is already dramatic – it has even been suggested that the groundwater withdrawals in S Asia would have to be reduced by as much as 70 percent to move back towards a sustainable situation.

Indian authorities now indicate the need to double food production in ten years only – a major step in terms of agricultural approaches. Adding up all these dramatic challenges – population growth, changing food preferences towards more water-consuming food items, closing river basins, and severe groundwater overdraft – we arrive at a situation where the expression by Will Steffen, earlier Executive Director of the IGBP, is in fact highly pertinent, when

he rightly refers to humanity's environmental challenge as the era of Great Acceleration.

What will be needed is an almost completely new mode of management of the whole food chain from production to consumption. In this process, many of the components discussed in this publication will have to be included. First of all, there are in the food chain huge losses of both water and food, that can be minimised by resolute agronomic efforts, reduction of post-harvest losses, and an effective enough food security-oriented governance.

Secondly, even if water is at the core of food production growth, it is fortunately NOT necessarily more irrigation water that is the critical issue. It is rather to find various ways to secure enough soil moisture/green water in the root zone, that is the crucial task. First of all the huge water losses in current agriculture will have to be minimised. Only when deficient, the green water resource may be complemented by additional water from locally harvested rain or runoff, or from blue water withdrawn from rivers or aquifers, to increase the water available to the roots. Wise upgrading of rainfed agriculture will indeed have to be a core component of the new production mode.

This publication is therefore extremely timely with its discussion of a whole set of steps possible to take. On the one hand to reduce the large yield gap, still characterising Indian agriculture; better use of remote sensing, biotechnology and GMO's; new approaches to improved crop varieties including aerobic rice; to soil microorganisms and geochemistry; to rainfed agriculture and green water conservation; and to expanded irrigation based on wastewater reuse, a source that in fact grows with increasing urbanisation. And on the other hand reduction of post harvest losses in the various segments of the food chain, including household waste.

A strategy that considers what benefits can be reached though improvement of both food production and consumption could result in a win-win-win solution where both water, environmental and public health can all benefit.

Malin Falkenmark
Professor
Stockholm International Water Institute (SIWI)
& Stockholm Resilience Centre
Stockholm, April 12th, 2007

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