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Keeping World Food
Security on the Agenda:
Implications for the
United Nations and
the CGIAR

Issues in Agriculture 11

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Issues in Agriculture is an evolving series of booklets on topics connected with agricultural research and development. The series is published by the Secretariat of the Consultative Group on International Agricultural Research (CGIAR) as a contribution to informed discussion on issues that affect agriculture. The opinions expressed in this series are those of the authors and do not necessarily reflect a consensus of views within the CGIAR system.

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About the CGIAR

The Consultative Group on International Agricultural Research (CGIAR) is an informal association of fifty-three public and private sector members that supports a network of sixteen international agricultural research centers. The Group was established in 1971.

The World Bank, the Food and Agriculture Organization of the United Nations (FAO), the United Nations Development Programme (UNDP), and the United Nations Environment Programme (UNEP) are cosponsors of the CGIAR. The Chairman of the Group is a senior official of the World Bank, which provides the CGIAR system with a Secretariat in Washington, DC. The CGIAR is assisted by a Technical Advisory Committee, with a Secretariat at FAO in Rome.

The mission of the CGIAR is to contribute, through its research, to promoting sustainable agriculture for food security in the developing countries. International centers supported by the CGIAR are part of a global agricultural research system. The CGIAR conducts strategic and applied research, with its products being international public goods, and focuses its research agenda on problem solving through interdisciplinary programs implemented by one or more of its international centers in collaboration with a full range of partners. Such programs concentrate on increasing productivity, protecting the environment, saving biodiversity, improving policies, and contributing to strengthening agricultural research in developing countries.

Food productivity in developing countries has increased through the combined efforts of CGIAR centers and their partners in developing countries. The same efforts have helped to bring about a range of other benefits, such as reduced prices of food, better nutrition, more rational policies, and stronger institutions. CGIAR centers have trained more than 50,000 agricultural scientists from developing countries over the past twenty-five years. Many of them form the nucleus of and provide leadership to national agricultural research systems in their own countries.

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Acronyms

CGIAR	Consultative Group on International Agricultural Research
FAO	Food and Agriculture Organization of the United Nations
GOA	Globally Oriented Agriculture
LOA	Locally Oriented Agriculture
NGO	Non-governmental Organization
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
WHO	World Health Organization
WMO	World Meteorological Organization



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Introduction

From November 13-17, 1996 the Food and Agriculture Organization of the United Nations conducted a World Food Summit. At that summit world leaders confirmed the need to both increase food production and strengthen the political will and commitment to reach food security and achieve access to food for all. That requires much of the world community.

This paper describes the changes needed to achieve these goals. It is not our intention to provide a blueprint for action. Rather, we wish to give an indication of what is needed and how technically feasible it is. Policy is, of course, the major influencing factor.

The general atmosphere of euphoria that surrounds the global economic growth in recent years, and the liberalization of markets in virtually all parts of the world, makes it easy to overlook the fact that food security can no longer be taken for granted. In addition, the superabundance of food in the industrial Western world and the highly improved food situation in many developing countries distort our view of the future. In fact, hundreds of millions of people are suffering from malnutrition, and in the absence of specific political and social attention, the situation will worsen.

The severity of the problem is illustrated by the rough estimate that over the next forty years as much additional food will need to be



produced as humankind has produced since agriculture began. The time has come to use the momentum generated by the World Food Summit, and by related meetings in the past year, to review how the international, intergovernmental, and non-governmental communities deal with the world food problem. This paper highlights selected issues and presents a set of proposals to strengthen international cooperation in the field. It is intended as a discussion paper for a wide audience and, therefore, does not include the usual references to the scientific literature.

Actual Performance in Food Production

As excellent reviews of the status of the world's food supply are widely available, we will not repeat their well-known messages here. Suffice it to say that the current situation does not provide reason for optimism. As an indication, global production of crops and livestock increased by only 1.8 percent in 1994 (with stagnation the previous year); in developed countries, there was little if any growth (0.3 percent in 1994, following a 3.8 percent decrease in 1993); and production in Central and Eastern Europe and the former Soviet Union continued to decline (16 percent since 1990). Although developing countries increased output by 2.8 percent, that increase, if expressed in growth per capita, is less than 1 percent, substantially less than their per capita output in the 1980s. In the Far East the rate of increase in food production is slowing down, but it remains ahead of population growth, particularly because of increases achieved by India and China in 1994, despite adverse weather conditions. Food production in South America is also increasing, but the increase is unevenly distributed; most of it occurs in Argentina and Brazil. In Sub-Saharan Africa the situation remains one of undiminished concern; the available food per capita has been falling since the 1970s, with the occasional annual and geographical exception; for example, Nigeria and Kenya.

The stagnating productivity in Africa goes hand in hand with a decrease in soil fertility as a result of overuse of fragile and poor soils. The need for sufficient external inputs is not met by the ability to

buy these inputs. Kenya and Nigeria are exceptions because of their willingness and ability to invest in agriculture.

Despite the relatively limited growth of the agricultural sector as a whole, the growth in world food production is expected to be higher in the 1990s than in the 1980s, with a significant rise in exports.

Long-Term Food Requirements

To obtain a realistic picture of future food requirements, we also must examine the reasons for the increase in demand for food and agricultural products and the possibilities of meeting that demand.

Demographic analyses indicate that the most dramatic population increases will occur in South and East Asia and in Sub-Saharan Africa. Feeding the populations expected in these regions over the next three decades may require a doubling or tripling of their food supply. This population-dominated need for additional food is exacerbated by the expected changes in diet that may result from the predicted economic growth over the same period.

The relationship between economic welfare and consumption of animal proteins is very strong. The higher the income the greater the consumption. As the production of 1 kilogram of chicken meat requires at least 3 kilograms of grain equivalents, 1 kilogram of pork requires 5 kilograms of grain equivalents, and 1 kilogram of beef requires at least 8 kilograms of grain equivalents, change from a nearly complete vegetarian diet to a more carnivorous diet has a dramatic effect on required food production. It is for this reason, and not the population increase, that the expected changes in diet cause the tremendous increase in the demand for food. Many of the byproducts of human consumption and rangeland are and can be more intensively used for animal production.

Depending on the assumptions used to estimate population growth and predict future dietary patterns, annual world food demand will be between 7.3 billion metric tons and 18.8 billion met-

ric tons of grain equivalents; roughly half of that demand will be from South, East, and Southeast Asia. As mentioned previously, estimates indicate that the additional quantity of food that will need to be produced over the next forty years will equal the total quantity of food produced since agriculture began. To produce this amount will require us to double or triple production per hectare.

Effects of Agricultural Practices

The amount of land suitable for agriculture is limited, and most of it is already in use. Therefore, the enormous production increase of the future will necessitate a spectacular rise in productivity per unit area. Attaining this goal is made even more difficult by the awareness that during the last two decades, the increasing use of fertile land for urbanization and the subsequent expansion of agriculture into more fragile land has already caused tremendous environmental problems. Because of population pressure and stagnating productivity increases in the better-endowed lands, the overuse of fragile lands continues to increase. As a result, many current agricultural practices are creating what we can call an "unsustainability spiral." Some of the negative side effects of agricultural practices are summarized in Table 1 [see pages 6-7]. The implication of these ecological side effects of agricultural practices is clear, however: future food production will need to incorporate innovative and imaginative measures to improve sustainability.

Potential Production

There is often a large gap between what is possible in terms of agricultural production and what is achieved. A detailed study of the relationship between the biophysical potentials of different regions and the socioeconomic objectives and constraints showed that the difference between what *can* be produced and what *is* produced is considerable.¹ For the world as a whole, current food production

¹ Netherlands Scientific Council for Government Policy. 1994. *Sustained Risks: A Lasting Phenomenon*. Reports to the Government No. 44. The Hague. 208 pp.

may be sufficient to feed many more people than are present today—1 to 4.4 billion additional people, depending on production technology, land use, and use of external inputs.

However, there are considerable differences among the various areas of the world. The Americas may feed their inhabitants without much difficulty; the same is true for Europe. However, in South Asia and East Asia the situation is worse. There, the difference between actual production and potential productivity is considerably smaller.

Land Shortage and Multifunctional Land Use

Although, in theory, there is certainly enough land area—approximately 1.8 billion hectares of good agricultural land and a total of 3.6 billion hectares of all suitable land²—to meet even the highest projected demand for food, the competition among agriculture and other land uses is an increasing source of concern. More and more demands are being placed on the world's land surface now being used for arable cropping and grazing. Land is needed for cities, roads and railroads, irrigation channels, waste deposits, recreation, and nature conservation. The less land required for food production, the greater the area that can be retained to serve other desirable functions, such as maintaining biodiversity.

We contend that our primary effort should be to design production systems that optimize the efficiency of input use and minimize emissions—for example, of fertilizers, pesticides, sediments, and water—to the environment. This design will have positive effects on the quality of both the agricultural land and adjacent, nonagricultural land. Moreover, such efficiency will result in higher yields and, therefore, will allow considerable “land savings,” as described in the following paragraphs. Also, because the efficiency with which fertilizers and pesticides are used generally rises at higher levels of produc-

² *Ibid.*

Table 1. Agricultural Practices and Their Negative Side Effects

AGRICULTURAL PRACTICE	NEGATIVE SIDE EFFECT
<i>Use of Soil and Water Resources</i>	
<ul style="list-style-type: none"> • Increase in the area of land under cultivation 	<ul style="list-style-type: none"> • Expanding agriculture to fragile soils increases the risk of physical soil degradation (e.g., crusting, sealing, wind and water erosion). • Cultivation on unsuitable soils and steep slopes increases the susceptibility of crops to soil-borne pathogens. • Clearing natural vegetation can reduce habitat complexity, which may in turn negatively affect the natural enemies of insect pests.
<i>Genetic Improvements</i>	
<ul style="list-style-type: none"> • Replacement of heterogeneous plant varieties with genetically uniform varieties 	<ul style="list-style-type: none"> • Decrease in crop genetic diversity increases the development of new virulent strains or biotypes of pests.
<ul style="list-style-type: none"> • Introduction of high-yielding varieties and breeding resistant varieties 	<ul style="list-style-type: none"> • Lack of resistance to pests for varieties that were not bred for resistance is particularly acute at high fertilizer levels. • There is increased risk of crop genetic susceptibility and sensitivity to endemic pests that previously were in the natural vegetation or were controlled by the natural resistance of local crop varieties. • New virulent pest strains or biotypes may emerge. • There is increased risk of introducing new pests with exotic germplasm.
<ul style="list-style-type: none"> • Introduction of nonnative crops into new biotic communities and climatic regions 	<ul style="list-style-type: none"> • New crops lack resistance to indigenous pest species. • New climatic conditions may favor population increase of common pest species whose populations are limited in climatic regions less favorable to these pests. • The new crop may act as an alternative host plant for pest species, enhancing pest development over time.
<i>Cropping Practices</i>	
<ul style="list-style-type: none"> • Replacement of mixed cropping by large-scale monocultures 	<ul style="list-style-type: none"> • Decreases in spatial and temporal diversity may disturb the endemic status of pests and subject crops to large-scale outbreaks.
<ul style="list-style-type: none"> • Shortened fallow periods and narrow rotations 	<ul style="list-style-type: none"> • Soil and nutrient depletion leads to decreased yields. • Crops are continuously available; thus, pest populations can increase to much greater densities. • Loss of soil nutrients may result in greater crop stress and thus increased susceptibility to attacks by pests.
<ul style="list-style-type: none"> • Continuous cropping by using earlier maturing varieties and irrigation 	<ul style="list-style-type: none"> • Pest populations increase throughout the year because crops are available throughout the year, which can result in higher pest pressures. • Soil and nutrient depletion leads to decreased yields.

Table 1. *continued*

AGRICULTURAL PRACTICE	NEGATIVE SIDE EFFECT
<i>Use of External Inputs</i>	
• Fertilizer	<ul style="list-style-type: none"> • Soil acidification results from fertilizer use. • Overuse of fertilizers promotes development of pests.
• Pesticides	<ul style="list-style-type: none"> • Pesticide use reduces natural microbial activity in the soil. • Repeated application of nonselective pesticides kills natural enemies of pests, causing pest resurgence and infestations by formerly innocuous secondary pest species. • Pests develop resistance to intensively used pesticides.
• Irrigation	<ul style="list-style-type: none"> • Inadequate drainage can cause secondary salinization. • Inadequate drainage can cause waterlogging. • Irrigation water can transport weed seeds, fungal spores, and bacteria. • Irrigation by overhead sprinkling increases air humidity and leaf wetness, which enhances development of many foliar diseases.
<i>Use of Animal Husbandry</i>	
• Overgrazing	• Too much grazing on marginal rangeland.
• Too little grassland management	• Deforestation.
• Inadequate use of manure	• Overuse of chemical fertilizers at a few places.

tion (i.e., more kilograms per hectare), there will be further environmental gains, in particular, lower emissions.

In view of the tremendous overuse and inefficient use of fertilizers, an emphasis on sustainable land use will likely slow the growth of fertilizer and pesticide use in many places, less than proportional to the growth of production, at least in parts of South and East Asia. The potential for increases in the efficiency of nitrogen and water use is considerable when appropriate measures are used. Counterintuitively, higher productivity per hectare can help to increase the efficiency of each of the external inputs. That synergism holds in the majority of the world's agricultural areas. In Africa, however, the decrease in soil fertility requires an increase in the use of inputs to repair the degradation of soils over the last decades.

This new concern with land as a scarce commodity has two important implications: (1) if we want other land functions to be served and want to minimize the area used for agriculture, then we must strive toward the highest possible average yield per unit area; and (2) we must develop instruments to assess the long-term effects of multiple land use on nature and the environment. Taken together, these implications point out the need to develop an entirely new approach to land use planning.

We believe that the overall policy must be to concentrate agricultural production, as far as possible, in areas with high yield potential. Exceptions can be made, however, for areas where governments are willing and able to reward farmers for maintaining agricultural and biological diversity; in other words, in areas where agriculture can serve more goals than the classical goal of food production. However, such areas are limited in size and in their potential contribution to food production.

A New Ecological Basis for Food Production

Food production requires agroecosystems that are devised and manipulated on the basis of production ecology insights and exper-

tise. Production ecology is the interdisciplinary science that integrates the knowledge of basic physical, chemical, physiological, and ecological processes in agroecosystems and uses that to understand their functioning.

Ecological basis implies, then, food production systems designed to minimize both losses to the environment and the destruction and degradation of the land resource basis while optimizing the amount of land destined to be used for maintaining natural habitats, thus leaving room for other uses, including maintenance of biodiversity and desirable landscapes. If land is used on such a basis, various strategies can be pursued to obtain an optimum result for food production. Efforts can be made to close nutrient and water cycles, as much as possible, at the district or provincial levels—or at another suitable landscape unit—to bring environment losses under local control. In some rare cases cycles could be closed at the farm level. Another strategy is to close the cycles at the continental or global level, with a view toward maximizing the efficiency of the system and, hence, minimizing overall losses. The agricultural system can be organized in many different ways within each of these approaches.

We consider two different agricultural systems to present the extreme estimates for production potential without violating the principles of sustainable production. These are globally oriented agriculture and locally oriented agriculture.

GOA seeks to achieve sustainability by maximizing the efficiency of agriculture at the global level. This is based on the notion that the environment is best served by the *lowest possible loss of inputs per unit of output*, making it acceptable to have comparatively high local leakages to the environment with a view toward reducing the overall global burden on the environment. By using efficiently produced fertilizer and transporting it to places where these nutrients can be converted as efficiently as possible into agricultural products, an attempt is made to limit the total losses as far as possible.

To guarantee sustainability, LOA aims as far as possible at closing regional or local cycles. This is based on the underlying premise that the quality of the environment is best served by the *lowest possible loss of inputs per hectare*. This principle results in the use of techniques that avoid, wherever possible, the use of external substances such as artificial nitrogen fertilizers and pesticides. Efficiency, therefore, is defined on a totally different scale.

Both GOA and LOA aim at maximum efficiency, within their own limiting conditions, with a view toward the sustainable functioning of the entire system. Under GOA, agricultural output is ultimately limited by the available agricultural land and the local availability of water. Under LOA, output is limited not only by the local availability of land and water but also by the amount of nitrogen that can be fixed from the atmosphere by natural means. In addition, other physical conditions, such as the quality of the soil, play a role in determining the land's production potential. Computations have been made on the assumption that other aspects, such as energy, minerals, investments, and labor, do not impose constraints on production. Therefore, demands for energy or investments can be met in both the GOA and the LOA systems. However, the total land area used for agriculture and food production is more than twice as large in the LOA system, which conflicts with the aims of biodiversity and natural resources management. Relative to the present situation, this situation represents a substantial expansion of agricultural area at the cost of natural ecosystems.

In many regions of the world there are distinct limitations on food production attributable to a lack of resources and manpower; for example, the necessary quantities of water, fertilizer, or energy are not universally available. Furthermore, the necessary infrastructure is lacking in many places; for example, even if sufficient funding were available within development projects to buy fertilizer, it is not certain that the fertilizer could be applied in the right place and in the right way.

Opinions on sustainable food production differ not only in relation to the potential agricultural techniques to be used, but

also with regard to the food that the average world citizen will consume in the future. The combination of production technology (GOA or LOA) and diet determine the number of people who can be fed when the appropriate techniques are used at the right place. This may vary from region to region. This explorative study demonstrates what possibilities there are. For example, Latin America has considerable possibilities, whereas those for South Asia are limited, but still more than sufficient when globally oriented production techniques are used, biocides and artificial fertilizers are not completely excluded, and not more than very moderate meat consumption is allowed. Ecotechnological insight is needed to enable the introduction of these sophisticated production technologies and the appropriate land use. That may result in high productivity and very efficient and effective use of external inputs.

Food Security and International Cooperation

The broadening of aims and the interactions among various objectives, such as productivity, emission reduction, or control of erosion, require stronger institutional integration of the organizations with a world mandate for these aims. Such integration requires an institutional rearrangement.

The United Nations institutions and, increasingly, non-governmental organizations, play a vital role in the development of agriculture and food production. They set the stage for future possibilities and determine the activities of the different organizations.

The major organization in this respect is FAO, which was founded just over fifty years ago in Quebec, on October 16, 1945, when representatives from forty-four countries signed the FAO charter. Although there had already been concern before the war about the global imbalance in food distribution, the motivation for forming FAO so soon after World War II was clear: the general conviction that world food security has to be guaranteed was widely accepted, and that multilateral organizations should be instrumental in

reaching that goal. The CGIAR's more recent key role in conducting and coordinating research has since been acknowledged.

The work of the United Nations Development Programme, the Consultative Group on International Agricultural Research, and the United Nations Environment Programme is well known. Food security remains the central concern of the CGIAR and the United Nations, but it is increasingly linked to other less clearly defined objectives, such as participation by the local population, especially women. In particular, sustainability and environmental goals are promoted by the integrated control of diseases, pests, and weeds, and the prevention of soil degradation.

These wider goals have brought into focus new questions that involve other agencies as well. Our main concern is the lack of a coherent, comprehensive view of the combined problems of multiple land use, including food production and environmental protection. The most important observation in this regard is that the long-term objective of "sufficient food for future generations" can no longer be simply translated into short-term productivity goals or into "more of the same"—more bulk, more inputs. On the contrary, there are ample opportunities for sustainable intensification of agriculture and for increased productivity and efficiency of use of external inputs, minimizing the negative side effects on the environment. Using the appropriate agricultural practices at the right place is the first condition to be fulfilled to minimize negative side effects.

In other words, decisionmaking at the global and continental levels is required to decide how the world can optimize the use of scarce land resources. If, as a world community, we decide to preserve tropical forests, this limits the availability of land at the country and regional levels. Within countries, better assessments need to be made of the potential for food production without detrimental effects on the environment. At the farming system and cropping system levels, the opportunities to increase efficiency are becoming more and more available. Ecological insight and expertise have demonstrated that

“smart” farming can lead to more efficient use of water, nitrogen, and *biological control measures*. In that way, discontinuities in productivity rise per hectare may be followed by discontinuities in water use efficiency, nitrogen use efficiency, and reduced emission of pesticides per unit product.

Discontinuities as those seen during the green revolution comprise a sudden increase in rates of change. For example, the yearly rate of increase in wheat production per hectare in the industrial world went from 4 to 10 kilograms per hectare per year before 1950, to 80 to 150 kilograms per hectare per year after 1950. A similar phenomenon occurred in India, China, and other Asian countries in the early 1970s. For the external inputs such as nitrogen and water and for labor similar patterns may be achieved as the potentials are there.

Institutional Adjustments

The need for a continuing rise in food production and wider land use objectives calls for institutional adjustments. UN provision of direct technical assistance to implement large projects and programs may be less important than the role that UN and CGIAR institutions play as moderators of new policies and new technology developments. Implementation of these policies and developments must be increasingly left to the countries, including NGOs. This would allow FAO to concentrate on international tasks such as managing international databases and convening expert consultations on technical problems.

The extension of FAO's goals also raises the wider ranging question of how the specialized UN agencies have divided up the topics of agriculture, environment, and nature. FAO already operates extensively in the field of its sister organization, UNEP, which has resulted in a large *interagency consultative structure*. UNEP, established in 1972, has a current budget equal to less than one-seventh that of FAO and is in many respects the poor relation of the United Nations, in that *environmental issues* also are addressed by other agencies,

including: the World Health Organization, which is concerned with clean drinking water; the World Meteorological Organization, which is actively involved in international climate consultations; and UNDP, which conducts numerous environmental projects. Similarly, the Environment Fund that UNEP is required to manage has not gotten off the ground properly.

There is a growing realization among relative outsiders like ourselves, and also within UN agencies, that environmental goals deserve a more prominent place on the international agenda. These environmental concerns demand a reappraisal of the roles of the CGIAR, FAO, and UNEP. Global cohesion and prevention of conflicts between nations are the major aims of the United Nations bodies. During the Bretton Woods negotiations, security and appropriate monetary and trade relations were seen as the major instruments to achieve these goals. The United Nations Security Council, the International Monetary Fund, and the recently created World Trade Organization are now the major instruments. Security and economic relations are, thus, the first and second pillars in international relations between countries and groups. The environment is the third pillar; and, in our opinion, food production and environmental integrity are the fourth pillar.

Apart from these substantive shifts, the efficiency of FAO is affected by another important aspect. FAO has a highly complex intergovernmental structure, which makes it extremely difficult to change priorities, activities, and modes of operation. Also, UNEP has too few resources and continually runs the risk that its work will be performed elsewhere or will be put on the back burner. We believe that the time has come to make radical changes in the organization, financing, and executive structure of these two organizations, changes that would enable us not only to meet the widened objectives of increased food production, but also to achieve environmental goals.

There are two models for such a reorganization: (1) creation of a separate and strong Global Environmental Organization, as pro-

posed in some academic circles in the United States; or (2) integration of UNEP into other agencies, especially FAO (and in part into WHO and WMO). Given the present reluctance of donor countries, especially the United States, to discuss various options for institutional adjustment, the outlook for establishing a new agency is not optimistic. It is more likely that UNEP will be subdivided and then merged with FAO. The objectives of the two organizations overlap considerably, and such a merger would eliminate competition between them for competence, activities, and responsibilities, and would provide an opportunity to streamline the bureaucracy and reorganize the institutional structure. This restructuring has direct implications for the CGIAR as well, because of its role as an institution for technology development and training. The shift toward an ecological basis for agriculture cannot be attained without considerable effort; it requires ecological knowledge by policymakers, environmentalists, farmers, and their advisors. Highly efficient, effective, and productive agricultural production systems require continual upgrading of that knowledge.

More than ever, the scale and complexity of worldwide food and environmental problems demand a more effective and efficient worldwide organization. If the CGIAR centers and the UN's specialized agencies are to continue their success, they must redefine their collaboration to meet these new challenges.

About the Authors

Louise O. Fresco is a professor of plant production systems with an emphasis on the (sub)tropics at the Wageningen Agricultural University in the Netherlands. She is former Chair of the Department of Agronomy, and a founding member of the newly created Graduate School of Production Ecology. In 1996 she became Chair of the Advisory Council for Research on Nature and Environment (RMNO), a body responsible to five Government Ministries. Previously, she held positions at the Food and Agriculture Organization of the United Nations. She is a former Board Member of the West African Rice Development Association (WARDA) and Chair of its Program Committee. She is author and co-author of over 40 international scientific publications.

Rudy Rabbinge is a professor at the Wageningen Agricultural University in the Netherlands. Since 1979 he has been Chairman and head of the Department of Theoretical Production Ecology. He has extensive experience as a teacher and researcher in crop and production ecology, and is an expert on the population dynamics of pests and diseases, and the integration of biological, socioeconomic, and environmental sciences. He is an advisor to the Minister of Housing, Environment, and Planning, the Minister of Environmental Sciences, and the Minister of Agriculture, Nature, and Fisheries in the Netherlands, and a member of the Prime Minister's Scientific Council for Government Policy. Professor Rabbinge has served as a member of the Advisory Council of the Government of the Netherlands on Science Policy in Developing Countries, the Government Committee on Evaluation of Scientific Research in Developing Countries, and the Dutch Committee on Applied Entomology, for which he was Chairman. He is Chair of the International Rice Research Institute (IRRI) and a former Board Member of the International Center for Agricultural Research in the Dry Areas (ICARDA). He has led various missions and agricultural projects in developing countries, served as editor of several international journals, and published more than 150 scientific publications, five textbooks, and over 200 other publications.