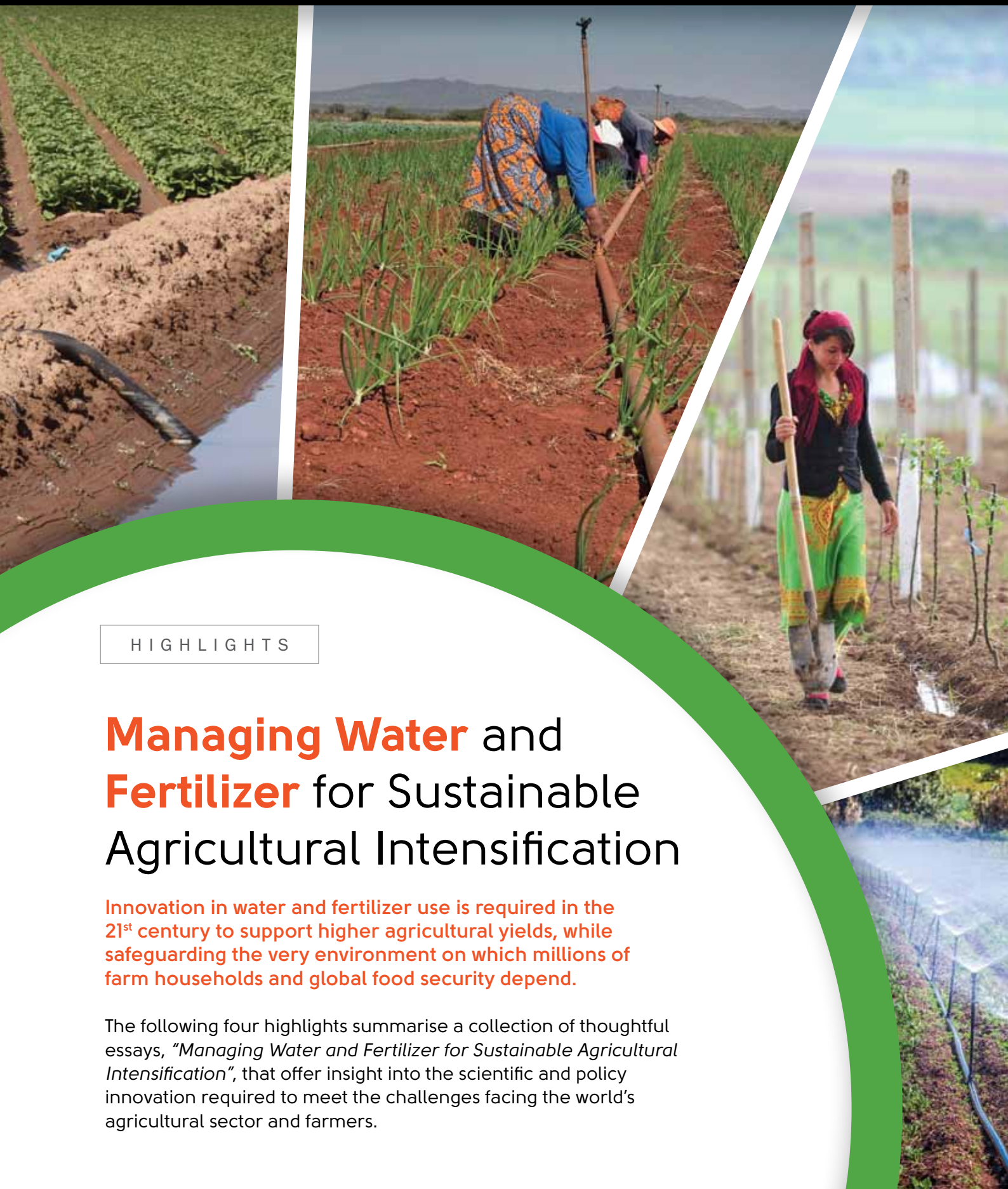
International Fertilizer Industry Association

IWMI International Water Management Institute

IPNI International Plant Nutrition Institute

International Potash Institute



HIGHLIGHTS

Managing Water and Fertilizer for Sustainable Agricultural Intensification

Innovation in water and fertilizer use is required in the 21st century to support higher agricultural yields, while safeguarding the very environment on which millions of farm households and global food security depend.

The following four highlights summarise a collection of thoughtful essays, *"Managing Water and Fertilizer for Sustainable Agricultural Intensification"*, that offer insight into the scientific and policy innovation required to meet the challenges facing the world's agricultural sector and farmers.

Managing Water and Fertilizer

Sustainable Development Goals

Two of the 17 proposed Sustainable Development Goals (SDGs) point to the importance of water and plant nutrients.

SDG 2 calls for ending hunger, achieving food security and improving nutrition, while promoting sustainable agriculture.

SDG 6 calls for ensuring the availability and sustainable management of water and sanitation for all.

While food security depends on sustainable agriculture, sustainable agriculture in turn depends on sustainable water and nutrient management.

Climate change has already brought greater risks and uncertainties for agriculture. Our food production systems need to become more resilient and there is a need to reassess both water management and crop nutrition.

Global agricultural output must increase to keep pace with population growth and changing diets, but water and nutrients must be better managed to prevent the depletion of aquifers and reduce nutrient losses to the environment.

Integration of efforts to increase both water and nutrient use efficiency will be an important step for meeting the proposed Sustainable Development Goals.

Sustainable Production Systems

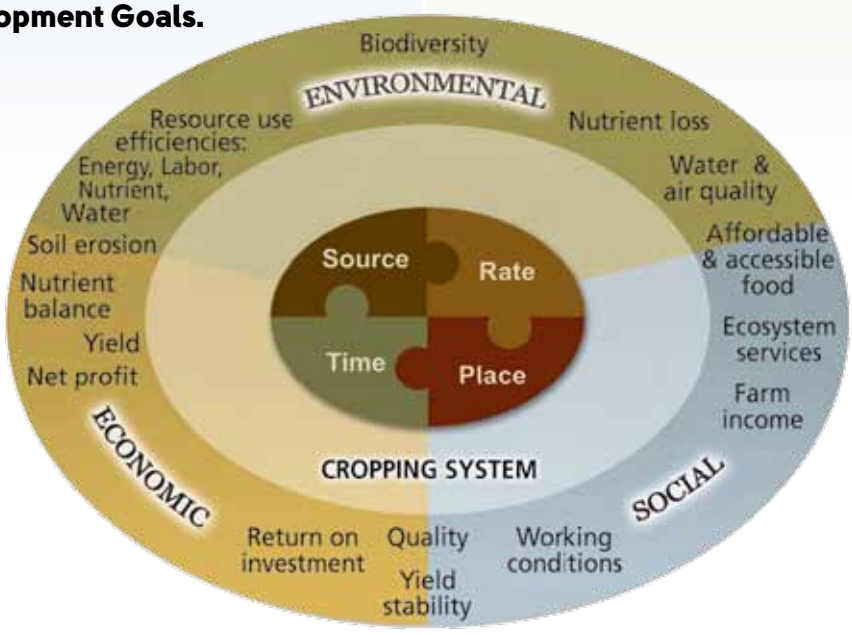
Much of the extraordinary growth in agricultural productivity achieved during the previous 50 years has been powered by applications of nitrogen and other plant nutrients, and increasing irrigation withdrawals from surface water and groundwater sources.

Currently, agriculture accounts for about 70 per cent of all water withdrawals from aquifers, streams and lakes. Due to competing uses and climate change, water scarcity is becoming an increasing concern for agriculture and food security.

About 180 million tonnes of fertilizers (on a nutrient basis) are applied annually to crops. Income and population growth will stimulate future fertilizer demand, but anticipated gains in fertilizer use efficiency are expected to smooth the trend.

Water and fertilizers/nutrients are essential inputs for agricultural production. By optimizing their balanced use and management, farmers can achieve high yields and good returns, while mitigating possible negative environmental impacts of their activity.

Innovations in the way we apply, manage, reuse and recycle water and plant nutrients, along with policy reforms and incentives, are critical.



Global Framework for 4R Nutrient Stewardship (i.e., applying the Right nutrient source, at the Right rate, at the Right time, and in the Right place). The concept is centered on the interlocking 4Rs, which influence the cropping system's contribution to the three dimensions of sustainability.

Indicators reflect the social, economic and environmental aspects of the performance of the cropping system. Their selection and priority depends on stakeholder values.

Water and Nutrient Use **Efficiency**

Fertilizer best management practices can enhance water productivity, just as an adequate water supply is a requirement for improved nutrient use efficiency.

Often, water and nutrient management are addressed separately, although they are intimately linked. Improvements in nutrient use efficiency should not be viewed only as a fertilizer management issue. The same is true for water.

Water stress hinders the transport of nutrients from the soil to the crop's roots, as well as the chemical and biological processes in the soils, required for optimal nutrient uptake by plants.

Nutrient deficiencies, in turn, reduce root development and therefore, the ability of crops to use water efficiently.

Improvements in agronomic practices are essential for increasing agricultural output per unit of land, water and nutrients (sustainable intensification).

Research and extension organizations should be encouraged to examine these topics in a more integrated way.

Innovation and **Adoption**

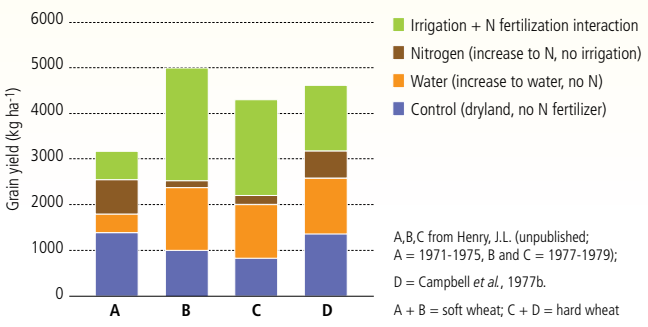
Innovation offers great opportunities to improve simultaneously water productivity and nutrient use efficiency, and could lead to significant increases in agricultural output.

Improving upon existing techniques and developing innovative products and technologies in the fields of both water and nutrient management in agriculture require an integration of these objectives.

Technologies such as fertigation, precision farming and conservation agriculture offer increasing yields with a more efficient use of inputs, and more balanced crop nutrition, including the use of micronutrients.

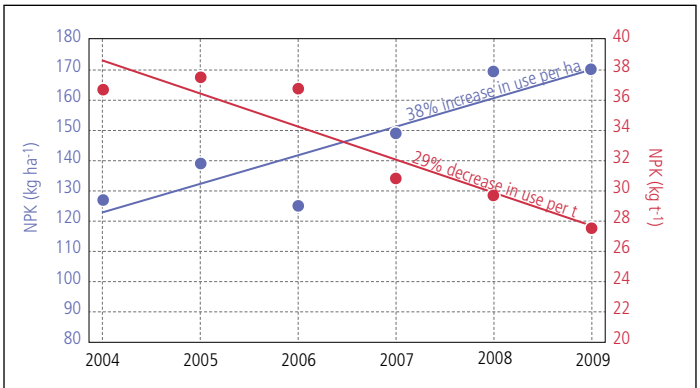
Fertigation maximizes economic yield and minimizes risks of over-fertilization and nutrient losses. Precision farming places the right types and quantities of nutrients at the right time and in the right place. Conservation agriculture improves the productivity of land, increases available water and helps prevent soil degradation.

Transferring knowledge and triggering adoption of best management practices by farmers requires a major and coordinated effort from all the stakeholders advising farmers.



The influence of fertilizer on yield depends on available water and there is often a positive interaction between these two components, and their relative importance varies depending on the degree of stress imposed by each factor.

The graph above illustrates the effect of water and nitrogen fertilizer, and their interaction on grain yield of wheat in Saskatchewan, Canada (adapted from Henry *et al.*, 1986).



Annual record keeping that compares input (fertilizer) versus output (yield) is a relatively simple process that can provide valuable information to a farmer on nutrient use efficiency.

The graph above shows trends in fertilizer use per ha and per ton of grain for a farm in Brazil. In this case, fertilizer use per ha increased, but the amount used per ton of crop yield decreased due to the accompanying yield increase.

Excerpt from the foreword to

"Managing Water and Fertilizer for Sustainable Agricultural Intensification"

This book is a timely contribution as it cuts across the water and fertilizer sectors and summarizes the state-of-the-art knowledge on plant nutrition and water management and the challenges we face in achieving the food security component of the Sustainable Development Goals.

The authors describe our current understanding of plant nutrient and water interactions, while looking ahead to the best management practices and innovations that will propel crop production to higher levels. The authors also address the issue of sustainability, as only those options that achieve food security and livelihood goals, while also protecting ecosystem services, will be acceptable in the 21st century.

We have come a long way since the remarkable insights and innovation provided by research pioneers in the 19th and 20th centuries. The fundamental principles of agronomy, plant science, and hydrology are well established and timeless. Yet, with increases in population and advances in economic growth, we face new challenges in each century, with regard to food security, livelihoods, and the environment.

We can meet the challenges ahead, provided we continue to innovate and integrate our research programmes and transfer new knowledge effectively to farmers and other agriculturists seeking to optimize the interactions between plant nutrients, water, and other agricultural inputs in a sustainable manner. The same integration of efforts is required for those working on sustainable agricultural development at different scales. This book will inform and inspire those engaged in this pursuit.

Frank Rijsberman
CEO, CGIAR Consortium

Download the Book:

http://www.fertilizer.org/imis20/images/Library_Downloads/2015_ifa_ipni_iwmi_ipi.pdf