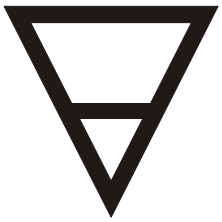
1

Land Resources and Land Use Options – Challenges for Food Security to Climate Change

Dr. Manfred Kern

Bayer CropScience AG, Sustainable Development, D-40789 Monheim, Germany
Fax: +49 69 30 51 75 55, E-mail: manfred.kern@bayercropscience.com

"**Quae sint in quoque agro serenda ac facienda, quo terra maximos perpetuo reddat fructus" Varro, M. T., *Rerum rusticarum (First Century BC)*.**



Alchemistic Symbol
for the Earth

When he wrote these words, *Marcus Terentius Varro*, a Roman landowner of the first century BC, was eighty years old and had recently remarried. *Rerum rusticarum*, one of a number of Latin treatises on agriculture to survive to the present day, was written for his wife as a handbook of advice on how to run the estate he had purchased for her. In this passage he defines, for the first time, the concept of sustainability.

He says: "**Agriculture is a science which teaches us what crops are to be planted in each kind of soil, and what operations are to be carried out in order to that the land may produce the highest yields in perpetuity**".

Or 'sustainability' in other words: "**As for the future, your task is not to foresee, but to enable it**" *(The Wisdom of the Sands, Saint-Exupéry, 1948).*

Agriculture is a new global mega-trend in the coming decades, and will be triggered by sustainable food and feed, fiber and energy production! Globalization and climate change will shape the whole of agriculture!

Food security has top priority in future. There is no discussion about the fact that everybody must eat. Nevertheless, this fundamental need was globally addressed by the United Nations in the Universal Declaration of Human Rights in 1948, Article 25: *"Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family,*

including food, clothing, housing and medical care and necessary services..." At the beginning of the 3rd millennium, we all know that this human right is not being realized worldwide.

Four questions are of key importance: "How can we feed the future world population in a sustainable way and in keeping with human dignity?" *(Kern, M., 1998),* "Who will be fed in the 21st century?" *(Wiebe, K. et al., IFPRI, 2001),* "What do we eat in the 21st century?" *(Kern, M., 2001),* and "What can or must be done by whom to react to changes in time?" *(Kern, M., 2002).*

Within the next 30 years, world food requirements will more than double as a result of population growth and dramatically changing consumption patterns, which means we will have to produce more food worldwide during this period than over the last 10,000 years put together.

To reduce hunger and improve livelihood worldwide, it is important not only that food is available but also that people have the necessary purchasing power and that global food prices are moderate.

The key challenge for the mankind is land use and the need to resolve the conflicting claims of food production, energy supplies, urban habitats and ecosystem services. Increasing dependence on declining resources such as land, water, energy will shape agriculture worldwide in future. The central topic for agriculture of the future will be resource efficiency and effectiveness of production.

SOIL IS A KEY RESOURCE OF HUMAN MANKIND

Let me quote Dick Arnold, USA, 2006 (International Union of Soil Science):

"You and I know that soils are not human, but we still like to give them some anthropogenic characteristics from time to time.

"*Hello there, folks. Do you know who or what I am? I am the geomembrane of the Earth. I am your protective filter, your buffer, your mediator of energy, water, and biogeochemical compounds. I am your sustainer of production of life, your ultimate source of elements, and the habitat for most biota. I am the foundation that supports you, the cradle of your myths, and the dust to which you will return. I am a soil.*"

Soils are so common and taken-for-granted that we are seldom aware of many of their attributes that affect our daily lives.

"Soil – is more valuable than gold!" "We must recognize that soil has a value higher than gold. Unfortunately, the world does not yet appreciate this vital fact. For those who are farmers, soil is the source of our food, the very future of humanity. But for the urbanized world, soil is just dirt, mud and no-one has a proper understanding of it. I see that the UNCCD 10-years strategy foresees an important new UNCCD commitment to public information and communication. My recommendation is that the UNCCD starts a million-dollar press and media campaign as soon as possible to create awareness. Soil doesn't look like a particularly exciting subject, but unless ordinary people come to appreciate its meaning and value and the need for conserving it, they will ignore any strategy on soil created by politicians." *(Kern, M., 2008, Desertification – Coping with Today's Global Challenges, UNCCD, 2008).*

Desertification, land degradation and drought already affect one third of the Earth's surface and have forced an estimated 24 million people to migrate to new areas.

About 2 billion ha of the world's agricultural land have been degraded because of deforestation, industrialization, urbanization and inappropriate agricultural practices. *(Pinstrup-Andersen and Pandya-Lorch, 1998).*

At the beginning of the 3rd millennium, several countries did start to buy or lease millions of hectares of the world's most fertile land in other countries to guarantee food security for their own population. This is a clear new trend focusing on availability of fertile soil.

Consequently, preserving fertile arable land, implementing sustainable land management practices, enabling access to water and combating desertification will become more and more important in the future. To safeguard and increase yields over the same area of land is a necessity for sustainable agriculture. Research and innovation will be the key to mastering these challenges.

Climate change mitigation and adaptation are further key challenges at the beginning of the 3rd millennium.

Many people tend to think of climate change as something that will impact the future, but warming over the past 20 years has already had real effects on global crop supplies. Between 1981 and 2002 higher temperatures have reduced the combined production of wheat, corn, and barley by 40 million tons per year. Global warming is creating a drag on production of the world's leading food and feed crops, as well as of raw materials for biofuels. Agriculture is the industry whose fate is most closely linked to climate.

Nevertheless, land use change has to be avoided as much as we can, because the expansion of land area under cultivation presents a serious threat of increasing greenhouse gas emissions. Consequently, the maintenance or increase of crop yields is necessary in any strategy for climate change mitigation and sustainable agriculture.

Plants and plant crops have always been, and will continue to be, of vital importance for humankind.

Conservation of biodiversity and sustainable use are key factors. Plants and crops are an essential source of food, feed, fiber, fuel, fun, freedom, raw materials, and energy.

Improvements in the adaptability, physiological fitness, and photosynthetic capacity of crops are key factors for combating climate change and protecting productivity both now and in the future. All people working to improve seed quality have to rethink and refocus their breeding targets. A great deal of work is in progress in that direction in order to overcome abiotic stress factors using state-of-the-art technologies - hopefully in time.

Drought-, flood-, and salt-tolerant plants must be developed. Conservation tillage farming must be implemented in order to reduce soil erosion and to retain soil moisture, as well as to reduce carbon emissions from the soil.

Key questions at the beginning of the 3rd millennium are:

"*How can we improve the value creation in plant production? How can we improve biomass/crop energy production in agriculture? How can we develop a more efficient and effective use of land, energy and material, or: how can we establish a superior 'industrial ecology'?*"

Fortunately, the World Bank claimed in their *World Development Report 2008*: "After 25 years, agriculture has top priority – again!"

In the 21st century, agriculture continues to be a fundamental instrument for sustainable development and poverty reduction. Managing interrelationships between agriculture, natural resource conservation, and the environment must be an integral element in the use of agriculture for development. In many regions, agriculture will have to shift to high-value agriculture. The focus is definitively the right one.

Factor Fn: **F**uture **F**arming, **F**ood, **F**eed, **F**itness, **F**uel, **F**iber, **F**reshwater, **F**ishery, **F**orestry, **F**lora, **F**auna, **F**un, **F**reedom are milestones on a roadmap for tackling the challenges of the 21st century.

Sustainable production of food, feed, fiber, fuel, freshwater and industrial products in the future will depend for its success on a future-oriented, knowledge-based and added-value agriculture – that, finally, will enable freedom and safeguard global peace.

Last, but not least, let us not forget the following warning from a piece of wisdom put into words 3500 years ago:

"Upon this handful of soil our survival depends. Husband it and it will grow our food, our fuel, and our shelter and surround us with beauty. Abuse it and the soil will collapse and die, taking humanity with it." *(From Vedas Sanskrit Scripture - 1500 BC).*

REFERENCES

Kern, M. (1998): Feeding the World: A Wider Perspective, Future - The Hoechst Magazine 1/98, 24-28.
Kern, M. (2000): Future of Agriculture. Monograph published by Aventis CropScience AG, pp. 68.

Kern, M. (2001): What Can We Expect from Agrotechnologies in the Future? In: Villages for the Future – Crops, Jobs and Livelihood, (Eds.) Virchow, D. and von Braun, J., Springer, Berlin, Heidelberg, New York, p. 281-293.

Kern, M. (2002): Food, Feed, Fibre, Fuel and Industrial Products of the Future: Challenges and Opportunities. Understanding the Strategic Potential of Plant Genetic Engineering. J. Agronomy & Crop Science 188, 291- 305.

Kern, M. (2008): UNCCD High-Level Policy Dialogue, Desertification – Coping with Today's Global Challenges, 27 May 2008, Bonn, Germany.

Pinstrup-Andersen, P. and Pandya-Lorch, R. (1998): Food Security and Sustainable Use of Natural Resources: a 2020 Vision, IPPRI, Washington.

Wiebe, K., Ballender, N., and Pinstrup-Andersen, P. (2001): Who will be fed in the 21st Century? Hopkins University Press, USA.

World Bank (2007): World Development Report 2008: Agriculture for Development, New York.