

## O.01 - Global challenges: what the near future holds for world agriculture and what it means for research on crop protection

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### Abstract

During the last decades there were a few megatrends that dominated world agricultural development. Productivity rise per hectare, per man hour, per animal and, unexpectedly, also per kilogramme of external input were visible worldwide with the exception of sub-Saharan Africa. The nature of agriculture is changing from skill to a more industrial nature. Primary production is becoming more and more a part of food systems including processing, distribution, logistics and retail. Chains are more and more common. More objectives than just production count. These megatrends are found everywhere and require appropriate policy and research agendas. Agriculture is back to become a priority in the world after many years of neglect. That creates chances and opportunities. More and more crop protection may be seen as an important component in that broad spectrum of research and interventions.

During the last decades, a few megatrends dominated the global agricultural developments. The global food security increased as result of a substantial inncrease in agricultural productivity per ha, per man hour, per animal and –counterintuitively– per unit of external input. That productivity rise was most spectacular in the developed countries, but also present in the developing world<sup>1</sup>.

Unexpectedly the food availability per capita in the 20<sup>th</sup> century increased. The agricultural production increased 7-fold, whereas the world population showed a 6-fold increase<sup>2</sup>. Hunger should have been eliminated but due to poor allocation and dramatic poor increase in productivity per capita in parts of South Asia and Sub Sahara Africa hunger is still very high in these parts of the world. Hunger in the world even increased last year from some 800 million (less than 1500 kcal per day) to more than 900 million, mainly in SS Africa and South Asia<sup>3</sup>. The absence of food shortage in most parts of the world is for a small part due to the expansion of agricultural area, but for the greater part due to increased productivity per ha.

In the future, an even higher productivity is needed since we face a doubling in food demand in the coming decades for two reasons. The first reason is the increase of the world population: in the low scenario to some 7 billion people in 2050, in the UN middle scenario to some 9 billion and in the high scenario to some 11 billion world human inhabitants<sup>4</sup>. The second reason is that more people will eat a much more animal protein diet (meat, dairy, eggs). Therefore a doubling of global agricultural production is demanded<sup>5</sup>. That is not impossible but requires a step forward on the five megatrends in global and more specific European agriculture in the coming decades. These megatrends are:

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<sup>1</sup> Bindraban, P.S., H. Löffler and R. Rabbinge (2008). How to close the ever widening gap of Africa's agriculture. International Journal of Technology and Globalisation 2008 - Vol. 4, No.3 pp. 276 - 295

<sup>2</sup> FAO (1996). Food for all. World Food Summit, November 1996. Rome.

<sup>3</sup> FAO (2008) Briefing Paper: Hunger on the Rise.

<sup>4</sup> Census (2009). <http://www.census.gov/ipc/www/idb/worldpopinfo.html>

<sup>5</sup> FAO (2007). The state of Food and Agriculture.

A further increase in agricultural productivity per ha, per man hour, per animal and per kg of external input be it water, energy or fertilizer.

A shifting character of agricultural towards more science based and sophisticated approaches aiming at best technical and best ecological means.

An increase in objectives for agricultural produce and production systems. Environmental aims, landscape and social aims count. That requires more sophisticated agricultural systems and better choices in land use. The best agricultural systems at the best land will diminish pesticide use, nitrogen pollution and costs for agriculture with some 30-80%. That looks like utopia but well verified and scientifically completely sound scenario studies demonstrated these possibilities<sup>6</sup>.

An increasing role for tracing and tracking and chain management. From plough to plate or from seed to shelf are the buzz words for these developments where the four components of food systems are fully integrated. Production in the farmer fields, processing in factories where increasingly consumers eat processed food; distribution and logistics and finally retail and consumers. The integration of these components will require the coming years a lot of intervention and also appropriate studies and research.

A growing awareness of the important interactions between food, nutrition and health. The objective to have a long and sound life in good health requires diets that are fine tuned to the specific needs. The presence of rapid growth of nutrigenomics, proteomics and metabolics enables such a combination of prevention making use of specific gene-environment combination fine tuned to the well analyzed needs.

The megatrends are present at global level and everywhere visible, although the advancement may be different at different places.

In summary, the challenge for global agriculture is to become more productive, cleaner with minimal environmental side effects, less land demanding, less depending on external inputs like water, less labor demanding and creating more space for biodiversity and nature. To reach this situation, crop protection has a pivotal role to play. According to the agro-ecological principles, yield is suboptimal because of limiting factors on the one hand, and reducing factors on the other<sup>7</sup>. Reducing factors are mainly pests and diseases, and thus belong to the realm of plant-pathologists. Besides decreasing yield, pests and diseases sometimes destroy a large part of the produce *after* harvest. These post-harvest losses are an important reason for food-shortage in many regions. It therefore is a challenge and a duty for scientists to fight yield losses and minimize reducing factors. That will require a much more integrated crop protection. Crop protection is more and more integrated, more and more science based, more and more specific for the various production systems and based on ecological literacy at all levels like farmers, extensionists, the private sector and policy makers. It is possible to turn such utopia into reality when at all levels the right choices are made. The role of crop protection in the global development is modest but crucial. With appropriate agricultural systems and crop protection the world wide accepted Millennium Development Goals one and seven can be attained. It is a privilege and a dear obligation of the crop protection scientist to fulfill that role.

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<sup>6</sup> Rabbinge, R., C.A. van Diepen, J. van Dijksebloem, G.J.H. de Koning, H.C. van Latesteijn, E. Woltje and J. van Zijl (1994). Ground for choices: a scenario study on perspectives for rural areas in the European Community.

<sup>7</sup> Rabbinge, R., S.W. Kazibwe and M.S. Swaminathan (chairs) (2004). Realizing the promise and potential of African agriculture. InterAcademy Council