Conclusions from the 1st Symposium on Sustainability in Horticulture and a Declaration for the 21st Century

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Abstract

During the International Horticultural Congress (IHC) in Toronto, August 12 – 16, 2002, researchers from many different disciplines met to discuss the challenges of sustainability in horticultural systems. Pre-conference concerns that there would be little interest for such a cross-commodity and interdisciplinary subject proved fully unjustified. Economists, physiologists, agronomists, extension officers, directors, project leaders and many other disciplines, all contributed to the discussions with their presentations and comments.

During the last session of the symposium, James Anderson presented a summary and the conclusions from the meeting, prepared by the international scientific committee of this symposium. Based on these conclusions "*The Toronto 2002 sustainability declaration on research needs for a continuous development of sustainable horticultural systems for the 21st century*" was put forward. The declaration shall provide some guidance to further activities to support a sustainable horticulture in applied research. Horticulture should take the lead in the sustainability discussion in agricultural science for the sake of the well-being of human societies.

CONCLUSIONS

Sustainability is an emerging concept for all types of human endeavor, including food production, and refers to a dynamic balance of three aspects: ecology, economics, and social values (sometimes termed equity; Fig. 1).

Much has been written about sustainability over the past two decades. At the global scale, the Brundtland Report entitled 'Our Common Future' from 1987 has been widely accepted as a milestone in conceptualizing what sustainability means. The concept has been further refined, for example, using the "people-planet-profit" concept which was discussed at the symposium.

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The Research Contribution to Sustainability

Considerable progress has been made through research and education in addressing aspects of sustainable fruit, vegetable, and floriculture production systems, including integrated pest management, cover cropping, and soil health improvement. However, it was realized that it is still difficult to assess proposed and completed horticultural research activities in terms of their contribution to sustainability.

Lessons from Organic and Integrated Systems

In contrast to the global goal of a sustainable development, organic farming has evolved as a specifically defined production regime intended to increase sustainability including stringent rules that are not always compatible with integrated production but which refer to sustainability components (e.g. the build-up of natural capital by exclusion of synthetic not nature-identical inputs). It remains to be proven how successful this production concept will be in increasing sustainability. However, organic farming, particularly for tree fruits, has expanded dramatically in the past decade. Its development is increasingly supported by sound science-based studies. Climatic conditions greatly affect the challenges and success of organic tree fruit production, with semi-arid regions having a distinct advantage over more humid regions. A solid body of knowledge exists regarding the techniques of organic tree fruit production and its extent and distribution around the world.

Lessons learned from organic systems can be applied beneficially to other systems, and organic systems have benefited and continue to benefit from research on integrated and conventional systems.

In order to better engage with the trends of sustainability and organic farming, an ISHS working group on organic fruit production was proposed and recommended during the symposium. There is also considerable interest in developing a cross-commodity group which could focus on sustainability at a research methodological level, but no clear action has been taken in this respect yet. However, the fruit production group and others within ISHS may propose an ISHS commission on sustainable horticulture in the near future.

Systems Approach Needed

To move sustainable horticulture forward, more of a systems approach to research and implementation will be needed. Much of the development of organic and integrated production has relied on an input substitution approach rather than an ecological systems approach. Likewise, the integration of social factors will be important in shaping future research. The asset-based model of agricultural systems proposed by Pretty (Pretty 1999; see also Bertschinger 2004 on page XXX) may provide guidance for this by illustrating the various ways that system capital can be built up for horticultural systems.

Coordination of Systems and Component Research

Pretty's model describes the interactions between the different types of capital on which a production system is built.

Little scientific work has been done in this respect in horticulture so far. However, considerable progress has been made in conceptualizing and studying major system components, which are systems themselves. For example, Lewis et al. (Figure 2) have diagrammed how a systems approach can be applied to pest management to reduce inputs and negative impacts while improving renewable natural capital using such techniques as biological control and cover crops.

Some interesting examples for the progress in understanding very specific components of the system have been discussed at the symposium. For example, recent USDA research has shown the horticultural viability of cover crop-tomato systems. The vetch cover crop appears to induce expression of anti-senescence and pest resistant genes in the tomato. So, component research is now expanding from the field-based systems study to the molecular level to better understand and manage this important system impact.

New technology needs to be evaluated both at the component and systems level for its potential to enhance sustainability. For example, precision farming may hold promise for increasing sustainability in horticultural systems, but little research has been conducted to date.

The potential impact of global climate change on horticultural systems must be recognized as well as the potential impact of horticultural systems on global ecosystem properties. There is not much knowledge available in this respect so far.

Understanding System Boundaries - Social and Contextual Factors – a Future Challenge

Understanding systems boundaries and the different scales of systems will be increasingly important. Working to solve a disease problem on a specific crop must not lead to creation of another problem outside the farm scale (e.g. use of methyl bromide for disease control that also contributes to ozone depletion at the global level).

Sustainability in horticulture will also depend on the actions of individuals, be they growers, consumers, or researchers. Our current food system has been developed over decades with behavioral change at the level of the individual. A redirection towards sustainability will require the same process. The potential impact of local markets and reconnecting with consumers needs to be considered as a part of the future solution to current unsustainable practices.

Being aware of these contextual facts as a new set of parameters in our scientific activity becomes increasingly important. Successful development of sustainable systems may rely not on the development of a single system but on a diversity of concepts, each with boundaries as a necessary part of contextual human behaviour.

Moving between these boundaries and scales is an will be a major challenge. Only working across these boundaries will contribute to the generation of equity and well-being.

THE TORONTO 2002 SUSTAINABILITY DECLARATION

Research Needs for a Sustainable Horticultural Development in the 21st Century

- Horticultural research needs to embody more interdisciplinary and holistic approaches in addition to the traditional reductionist approaches to problem solving.
- Horticultural research should involve new players from outside the traditional disciplinary area, including more international scope and inclusion of social and cultural expertise.
- Research regarding sustainability should not end at the farm gate. A dynamic systems approach is needed for planning and conducting research that is more systems-oriented.
- Practical methods are required to bring the concept of sustainability to bear on the horticultural research agenda and to connect with the farm level.
- We need simple methods for assessing sustainability, both qualitative and quantitative.
- The choice of research methods for a project needs to be carefully evaluated to maximize sustainability. On-farm, participatory, and transdisciplinary methods may be useful and can involve various stakeholders (e.g. farmer, consumer). Small farmers and extension workers should not be overlooked and be included in this new research approach.
- Research should address the natural, social, human and physical capital and finance (according to Pretty's model). If addressing the renewable, natural capital in horticultural systems, research should contribute to its build-up. For this purpose, the following topics deserve specific attention:
  - Continuous development of new technologies and knowledge for disease and pest management that support sustainability.
  - Holistic approach for following fixed nitrogen through the farm system and ecosystem (e.g. effect on ground water, NOx emissions).

- Development of new disease and pest resistant germplasm that also meets market requirements.
- Enhance soil quality and natural resource management in all horticultural systems (e.g. replant diseases, water quality).

Literature Cited

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Figures

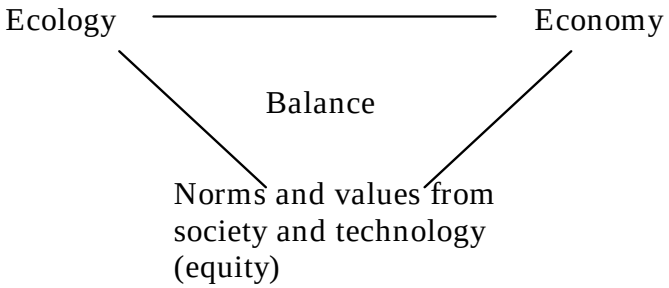

Fig. 1. The tripartite concept of sustainability, based on the Brundtland report of 1987, describing a dynamic balance.

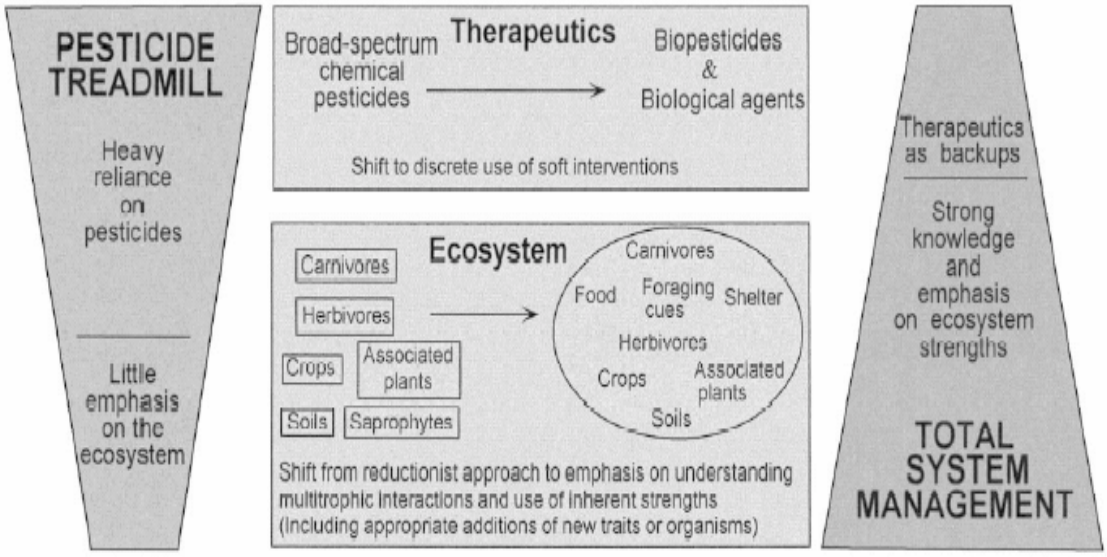

Fig. 2. An example from system component research addressing the component of pest management: Illustration of a shift to a total system approach to pest management through a greater use of inherent strength based on a good understanding of interactions within an ecosystem while using therapeutics as backups. The upside-down pyramid to the left reflects the unstable conditions under heavy reliance on pesticides, and the upright pyramid to the right reflects sustainable qualities of a total system strategy (Lewis et al., 1997).