ADVANCES IN SOIL AND WATER MANAGEMENT FOR SUSTAINABLE CROP PRODUCTION IN SOUTHERN AFRICA

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INTRODUCTION

During the 12th Congress of the SSSSA held in Bloemfontein 4 – 6 July 1984, thus 25 years ago, a one-day workshop on "the utilization of soil in high drought risk areas" were held in which all the delegates participated. The delegates were divided into four groups, each with a specific assignment to formulate recommendations and define goals for lowering drought risk through: i) effective water conservation practices, ii) the contribution of different types of underlying materials, iii) fertilization practices and iv) irrigation. A report of the discussions and recommendations were published and distributed among all the participants. Many, now respected, scientists used these recommendations from this high profile document to plan and obtain funding for their research programs.

RESULTS AND DISCUSSION

Several of the recommendations from the report will be reviewed in terms of the forthcoming advances during the past 25 years. The research addressing different aspects of drought risk reduction became more inter-disciplinary. High drought risk soils were converted from crop production to pasture production. Longer fallow conservation tillage crop production systems are now commonly used. Increasing the length of the fallow period before planting increases the amount of pre-plant stored water in the soil, thereby reducing the risk of drought damage to crops resulting also in an average of 30% higher yields. The soil classification system was amended to accommodate more types of diagnostic C-materials. The depth of soil classification was increased from 1.2 to 1.5 m and procedures were developed for determining the water storage capacity of soils. Several computer models were developed for simulating the component of the soil water balance and crop growth. Farmers are now better equipped to manage the impacts of droughts. Vast improvements in irrigation practices were achieved. Low risk fertilization practices are in place.

CONCLUSIONS

Significant progress have been made during the past 25 years in developing management guidelines for soil fertility and fertilization, soil tillage, rain water utilization and irrigation, production potential of soil-crop-climate ecotopes, maintaining soil health and the prevention of soil and environmental degradation. Maybe it is now time to again take stock and formulate recommendations that will require attention in the near future.

Keywords: soil classification, fallowing, drought risk

THE IMPORTANCE AND FUTURE OF WEED SCIENCE

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Worldwide, weeds cause massive losses in agricultural production of food, fiber, and crops cultivated for other needs. Furthermore, invasive weeds have devastated natural ecosystems in many parts of the world. In developed countries, weed management costs are very high. The rapid and enthusiastic adoption of transgenic, herbicide-resistant crops (HRCs) in these countries, despite the high cost of the seed plus the herbicides, supports this view. The vast majority of transgenic crops (GMOs to non-scientists) are HRCs. In developing countries, extensive hand weeding by women and children has limited the weeders' opportunities for educational and other more beneficial experiences. Even with this human cost, weeds, especially parasitic weeds, limit crop production significantly. In some countries weeds clearly cause starvation. The financial and human toll of weeds is enormous. Yet, compared to other pest management scientific disciplines, weed science has been a neglected discipline, perhaps because it is hard to convince those who control research resources that weeds are as destructive as insects and pathogens that can occasionally devastate a crop rapidly.

Since nature abhors a vacuum, any technology for weed management decreases in effectiveness with time. For example, many farmers who found glyphosate-resistant crops to solve most of their weed problems are now having to spray higher rates of glyphosate, to spray glyphosate more often, and to spray herbicides other than glyphosate due to evolution of glyphosate-resistant weeds and to filling of ecological niches by naturally resistant weed species (weed shifts). Invasive weed species are a growing problem in most places. The number of herbicide tools for battling weeds is being dramatically reduced in many developed countries, especially in Europe. Thus, our weed problems will increase in coming years if new technologies and strategies are not discovered and developed to confront these emerging problems. Weed scientists have a formidable challenge ahead.

Although, new HRCs will be introduced in the next decade, they will not solve many of the problems that we now have and will be only introduces for a few crops. The likelihood of economical, powerful, new herbicides being introduced does not appear to be great. Thus, sophisticated weed management systems, utilizing old and new technologies must be developed for specific crops in specific environments. This will require considerable research and the training of a cadre of weed management specialists who can effectively adapt these tools to the needs of their clientele.

MORE SUGAR WITH LESS WATER IN THE AUSTRALIAN SUGAR INDUSTRY

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Water is probably the most contentious issue in Australia because of its scarcity and skewed distribution, with under-use of catchments in the north and over committed water supplies in the south particularly in the Murray-Darling catchments. Research in agriculture is funded largely by federal and state governments who require answers for an electorate highly critical of the use of tax payers' money. Researchers are required to demonstrate impact on paddock management or policy often within the life of short term projects. This paper illustrates attempts by a research team to balance the requirements for science to address immediate concerns about the use of water for irrigation in the Australian sugar industry and at the same time to meet the long term goals to enrich knowledge about the physiology of sucrose accumulation by sugarcane. Examples are given where a range of skills and approaches were engaged to achieve impact on the reduction of water use for irrigation. We found that the engagement of farmers and extension officers throughout the planning and execution of projects was essential for impact at the paddock level. Simulation models were also essential for the delivery of information for irrigation management. End users of research into sucrose accumulation were breeders and molecular biologists rather than farmers and these people also needed to be involved in planning and execution of projects on sucrose accumulation for there to be any impact on their areas of research. We found that conceptual or working mathematical models were also essential for the integration of detailed knowledge on sucrose accumulation across various levels of plant organisation.

OPPORTUNITIES FOR HORTICULTURE AND HORTICULTURAL SCIENCE IN A GLOBAL CONTEXT

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It seems that the new model '*Cradle to Cradle*' (C2C) of the US Designer, William McDonough, and German Chemist, Michael Braungart, is quickly conquering our world of horticulture and horticultural science (1). The growing knowledge of the living earth, its opportunities and chances, its limitations and restrictions are inviting our professional sector and research community to re-invent the human industry of horticulture. The challenge for scientists and stakeholders in horticulture and horticultural science in the coming decade will be to again 'upload' the word horticulture, a word with content probably as old as mankind.

Our colleagues of the year 2012 '*Floriade*' exhibition in The Netherlands have recently simplified the C2C model into five themes, addressing horticulture as Relax and Heal (Well-being), Green Engine for Economy (Sustainability), Education and Innovation (Future), Environment (Quality of Life) and World Show Stage (Cultural BioDiversity).

This article will give a glimpse of the issues that horticulture and horticultural science are facing in view of the above themes. Secondly, a number of topics in relation to the growing importance of horticulture will be discussed. And finally, comments on the positions and answers of the various stakeholders, including the reshaping of the International Society for Horticultural Science in this global context will be presented.

The application to horticulture of the C2C paradigm by the '*Floriade*' provides a clear illustration of the potential of horticulture to contribute to the future sustainability and prosperity of humankind.

References

(1) Cradle to Cradle – Remaking the Way we make things by William Mc.Donough & Michael Braungart, Nort Point Press, 2002.