No-Till Farming Systems

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“Calendario Agrícola Incaico – Agricultural Calendar of the Incas”

Drawing by Phelipe Guaman Poma de Ayala, Peru; early 17th century

By courtesy of Rolf Derpsch, Conservation Consultant, Asunción, Paraguay
NO-TILL FARMING SYSTEMS

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Cover photo credits: Front cover: Background: Close view of new pea field (Reduced Tillage Linkages). Insets: Indian farmers standing in wheat field (Suraj Bhan); Swiss tractor seeding into yellow rape (Wolfgang Sturny); Very close view of emerging sesame (Rolf Derpsch); White bullocks pulling seeder (Rolf Derpsch). Back cover: Background: Field view of flattened stubble with seed slot (Rolf Derpsch). Insets: Man holding manioc-cassava (Rolf Derpsch); Close-up of trowel and soil (Carlos Crovetto).

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“No one has ever advanced a scientific reason for plowing.”

“There is simply no need for plowing in the first instance. And most of the operations that customarily follow the plowing are entirely unnecessary, if the land has not been plowed.”

“There is nothing wrong with our soil, except our interference.”

“It can be said with considerable truth that the use of the plow has actually destroyed the productiveness of our soils.”

Edward Faulkner
From *Plowman’s Folly* (1943)
Welcome to a very unique book: A truly global collection of information presented by farmers, extension specialists, discipline professionals and research scientists. The World Association of Soil and Water Conservation (WASWC) had become aware of the range of no-till farming systems around the world, and realized the need to share this information as widely as possible.

The practice of no-tillage crop production has flourished during the last few decades. It has now been adopted in some form in most countries. Such a ubiquitous phenomenon has few precedents in modern times. The evolution of no-tillage and its adoption rate have not been linear. Progress accelerated as the breakthroughs in science and new technologies gradually accumulated.

The pioneers of no-till had a difficult time. Most were inquisitive farmers skilled in practical problem solving and mechanics, and motivated to continually initiate new avenues of exploration. They could see the rationale behind the practice and the potential benefits from its application. But equipment was limited and of inadequate design for the wide range of applications required. And their knowledge of the complex production ecology of no-till systems was very limited. However, their enthusiasm was infectious, and others increasingly joined in the quest to make no-till farming practical and profitable.

The early practitioners and researchers were challenged by weed problems and fertility management. They soon came to realize that no-till practices create a moving target. The soil’s biological, physical, and chemical properties all change over time, as does the composition of weed populations. It takes time for the soil and plant system to reach a new equilibrium. Long-term research was therefore required to unravel the puzzle. However, research grants were most often short term; hence the initial results and recommendations did not always coincide with longer-term field experience. Research scientists had problems trying to represent field conditions on small plots. And no single no-till suite of recommendations fitted all areas, so farmers had to conduct localized field trials to see what worked best in their region and for their particular cropping systems.
The continued evolution of no-till farming requires the sustained enthusiasm of all involved, including farmers, extensionists and scientists. New participants need to receive proper training and education in no-till farming techniques. Support at the national level is needed for no-till to continue to develop. Crop improvement trials need to be done under no-till conditions so that crop traits important to no-till are selected for. Likewise, fertility and agronomic practices need to be conducted on no-till managed land at the plot, field, and landscape scale to encounter the full range of production ecologies.

Research is venturing into new areas such as how innovative cropping systems and residue management can influence soil biological activity and nutrient cycling. Biological tillage is replacing mechanical tillage, and more attention is being given to cropping systems and agronomic practice to control weeds and replace the myopic view of ‘herbicides only’. It is the responsibility of all involved in no-till to ensure that such efforts continue into the future so that no-till can be adopted on a far greater scale across the agricultural systems of the globe.

This book aims to celebrate from where no-till has come, and to advance the concept by sharing the latest information and knowledge from around the world. New frontiers and the most recent developments are discussed. One of the most significant of these is the expanding interest in how carbon accumulation in agricultural systems can both enable greater adaptation to climate change and contribute to the mitigation of greenhouse gas emissions. The carbon markets are rapidly taking note of the vast potential for no-till systems to contribute to carbon offsets, thus opening up the opportunity for progressive farmers to gain additional income for their efforts to create more sustainable and productive no-till farming.

Dennis Garrity  
Director General  
World Agroforestry Centre  
Nairobi, Kenya
Preface

No-till farming systems have been developed and applied around the world over several decades. The technology is dynamic: it develops and changes as we overcome obstacles in soil opening, seed placement, fertilizer banding and more. Researchers and farmers continue to modify the systems and apply no-till to a wider range of agricultural production systems. Benefits of no-till have been found in production, economic and environmental aspects of farming. As farmers apply no-till, their agronomic system moves to a new equilibrium. New investments in research of soils and plants are helping no-till to develop further.

We are not aware of any text that reviews global trends in no-till. Some texts review aspects of no-till from a particular standpoint. Those texts are often written by scientists engaged in lab or plot research or from the experience of a particular country. In this text we have not constrained the reporting to a scientific plot based experience, nor have we constrained it geographically. We have encouraged those with experience and expertise in no-till to tell us their stories, which span a broad range of perspectives, including farmer experience and beliefs as well as plot research. This book is the result of the contributions of 78 authors from 20 countries or regions, describing at least 25 study areas of all habitable continents – several of them in more than one instance. These authors possess roughly one thousand person-years of no-till experience!

Bringing so many contributors together from so many countries and constraining them to a common language of English presents its challenges. Some of these papers have been translated from their original language. Some expressions do not translate well.

There may also be regional terms for the same implement or practice. One example of this is a ‘harvester’ or a ‘combine’—two names for the same implement that harvests crops. Another is whether we call placing the seed in the soil ‘planting’ or ‘seeding’. We are of course accustomed to many of these synonyms; others are new. For the simpler terms (planting or seeding) we have not enforced a consistent style. For less common terms, we have attempted to provide a description of the term where the meaning is not evident from the context.
We have encouraged all experts in no-till to contribute, whether they are scientists or field-orientated professionals. We have therefore not required the standards of refereed journal publications such as referencing every claim beyond the immediate work, inclusion of statistical tests, and the substantiation of claims with references or data. You may also see preliminary data from early field trials, and the use of some less ‘scientific’ terms (e.g. soil health, soil nutrition) in some areas. Through these allowances we hope we have allowed the chapters to retain some of the passion of the writers.

We are therefore very optimistic and feel this book is a useful compendium of the state of no-till from all corners of the world that contains not only an objective review of experimental research, but passion and field observations that may serve academics, professionals and farmers as their companion in motivating and guiding them to continue their work of discovery.

The Editors
October 2007
Acknowledgements

How did it all begin?

In August 2004, as the WASWC President, I was invited by the Asociación Argentina de Productores en Siembra Directa (AAPRESID – Argentine No-Till Farmers Association) to participate in its 12th Congress in Rosario, Argentina, from which I had gained first hand knowledge about no-tillage in agriculture. Mr. Jorge Romagnoli, the AAPRESID President and Mr. Roberto Peiretti, an active Board member as well as President of CAAPAS (Confederación de Asociaciones Americanas por una Agricultura Sustentable – American Confederation of Farmers Organizations for a Sustainable Agriculture), had helped in every way to facilitate my learning of no-till farming practices.

After the meeting I traveled to Brazil where John Landers, Director of the Associação de Plantio Direto no Cerrado (APDC – the No-Till Association of Brazil), took me to Brasilia and the vast agricultural region of Mato Grosso do Sul State where many farmers successfully practiced no-till agriculture. Mr. Landers introduced me to many EMBRAPA Cerrados staff in Brasilia, while Dr. Antonio Ramalho helped to liaise with his EMBRAPA Solos in Rio de Janeiro. Discussions with EMBRAPA personnel in both offices provided me with invaluable information on the reasons why or why not Brazilians adopted no-till practices. EMBRAPA is a large Brazilian government agency dealing with agricultural research and development, employing thousands of staff all over the country.

When the idea of no-tillage crystallized in 2005, the WASWC Council agreed to adopt the topic as the subject of its next Special Publication (SP number 3). The authors invited at that time were Rolf Derpsch, Don Reichosky, José Benites, John Landers and Carlos Crovetto, all ‘no-till gurus’ of the Western Hemisphere, where the success of no-till was already recognized. Tom Goddard, WASWC National Representative for Canada, agreed to help edit the 150-page volume, which was given the working title No-Till Farming Systems.

At the same time, private sector companies were contacted to ensure that WASWC would be able to publish and distribute the book globally to those who really need it. The following firms kindly agreed to support the
project: Syngenta AG, Basel, Switzerland; SEMEATO Farm Machinery Co., Passo Fundo, Brazil; Eijkelkamp Agrisearch Equipment, Giesbeek, The Netherlands; Donald Fryrear Custom Products and Consultants, Big Spring TX, U.S.A. and The No Tillage Development Center, Chequen Farm, Concepción, Chile. SonTek of San Diego also became involved at a later stage, the same as Mr John Burton of NJ, U.S.A.

Before the publication date, it was proposed that WASWC organization members should be invited to co-publish the book in order to enhance its dissemination through bulk purchases by these organizations, thereby lowering the book’s price. It became an unprecedented phenomenon: more than five dozen organizations embraced our offer and became co-publishers. At the same time a large proportion of them had offered to submit their papers, which made the book even more informative than before – something way beyond our anticipations. From a 5-paper book, our SP III had expanded to become a 544-page no-tillage compendium with 34 papers showcasing no-till experience from various territories of the world. Four additional editors (Michael Zoebisch, Yantai Gan, Wyn Ellis and Alex Watson) were invited to help to cope with the increased editing burden and very short deadlines.

For me personally, and for WASWC it is of course most gratifying to see such sustained commitment and willing cooperation to ensure the success of this publication. With initial sales through the co-publishing program already approaching 7,000 copies, we are certain our message will be well read worldwide by those interested in no-till farming systems, and we hope will also stimulate new ideas and initiatives to further refine and adapt the system to local conditions.

Our thanks and most sincere appreciation is extended to all who have offered helping hands to support this publication in various ways. Special thanks are due to the companies and individuals that have given their financial support, enabling us to produce this volume at an attractive price, accessible to a larger portion of the globe – thus fulfilling the global mandate of WASWC in managing and conserving the world’s important natural resources – soil and water.

Samran Sombatpanit
Immediate Past President and Editor
CONTENTS

Foreword xi
Preface xiii
Acknowledgements xv
Contents xvii
Contributors xx

PART 1. Opening
Introduction, by Lester Brown 3
No-Tillage and Conservation Agriculture: A Progress Report, by Rolf Derpsch 7

PART 2. No-Tillage and Soil Fertility
Carbon Sequestration and Environmental Benefits from No-Till Systems, by Donald C. Reicosky 43
Effect of No-Till on Conservation of the Soil and Soil Fertility, by José Benites 59
A Fresh Look at Life below the Surface, by Danny Blank 73
Organic No-Till, by Jeff Moyer 83
Assessing Soil Properties in No-Till and Traditional Tillage Systems in Switzerland, by C. Hauert and H.P. Liniger 91

PART 3. Impact, Adoption, Policy and Future Prospects
Environmental Impacts and Social Dimensions of Zero Tillage Conservation Agriculture in Tropical Brazil, by John N. Landers 103
No-Tillage in California: Historical Developments and Emerging Trends, by Jeff Mitchell, Stu Pettygrove, Dan Munk, Tom Barcellos, Andy Zylstra and Mike Crowell 135
Adoption of Conservation Tillage Systems in the Midwest of the United States, by Ted L. Napier 145
PART 4. Research, Development and Implementation

Adapting No-Tillage Agriculture to the Conditions of Smallholder Maize and Wheat Farmers in the Tropics and Sub-Tropics, by Olaf Erenstein, Ken Sayre, Patrick Wall, John Dixon and Jon Hellin

Roles of Annual Legumes in No-Till Farming Systems, by Yantai Gan and Tom Goddard

Infiltration Characteristics of No-Till vs. Conventional Tillage in Indiana and Illinois Farm Fields, by M.R. Savabi, M.H. Golabi, A.A. Abou-Arab and E.J. Kladivko

Experiences in No-Till Farming in Hungary, by M. Birkás, M. Jolánkai and A. Stingli

Environmental Aspects of Conventional and Conservation Tillage – Results of the SOWAP Project in Hungary, by A. Kertész, K. Bádonyi, B. Madarász and B. Csepinszky

No-Till and Minimum Tillage in Romania, by A. Canarache and E. Dumitru

A Review of Experiences and Developments towards Conservation Agriculture and Related Systems in Zimbabwe, by Isaiah Nyagumbo

Influence of No-Tillage on Soil Conservation, Carbon Sequestration and Yield of Intensive Rotation Maize-Cotton: Research on Sandy Alfisols of Cameroon and Mali, by Drissa Diallo, Zachée Boli and Eric Roose 383

No-Till Practices in Morocco, by Rachid Mrabet 393

The Current Status of Conservation Tillage in China, by Liu Hengxin, Li Hongwen, Fan Xuemin and Xu Liyu 413


No-Till Cropping Systems in Australia, by Ken Flower, Bill Crabtree and Greg Butler 457

‘Where the land is greener’ – Documenting and Evaluating No-Till Knowledge and Experiences, by H.P. Liniger, W. Critchley, M. Gurtner, G. Schwilch., R. Mekdaschi Studer and C. Hauert 469

PART 5. Closing

Critical Steps to No-Till Adoption, by Rolf Derpsch 479

Conclusion, by The Editors 497

ANNEXES


Annex III. The book, “Search for Sustainability for Dryland Agriculture”, by Bill Crabtree 511


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Introduction*

Lester R. Brown

In 1938, Walter Lowdermilk, a senior official in the Soil Conservation Service of the U.S. Department of Agriculture, traveled abroad to look at lands that had been cultivated for thousands of years, seeking to learn how these older civilizations had coped with soil erosion.

He found that some had managed their land well, maintaining its fertility over long stretches of history, and were thriving. Others had failed to do so and left only remnants of their illustrious pasts.

In a section of his report entitled “The Hundred Dead Cities,” he described a site in northern Syria, near Aleppo, where ancient buildings were still standing in stark isolated relief, but they were on bare rock. During the seventh century, the thriving region had been invaded, initially by a Persian army and later by nomads out of the Arabian Desert. In the process, soil and water conservation practices used for centuries were abandoned. Lowdermilk noted, “Here erosion had done its worst. ... If the soils had remained, even though the cities were destroyed and the populations dispersed, the area might be re-peopled again and the cities re-built, but now that the soils are gone, all is gone.”

Now fast forward to a trip in 2002 by a United Nations team to assess the food situation in Lesotho, a small country of 2 million people imbedded within South Africa. Their finding was straightforward: “Agriculture in Lesotho faces a catastrophic future; crop production is declining and could cease altogether over large tracts of the country if steps are not taken to reverse soil erosion, degradation, and the decline in soil fertility.”

Michael Grunwald reports in the Washington Post that nearly half of the children under five in Lesotho are stunted physically. “Many,” he says, “are too weak to walk to school.”

Whether the land is in northern Syria, Lesotho, or elsewhere, the health of the people living on it cannot be separated from the health of the land itself. A large share of the world’s 852 million hungry people live on land with soils worn thin by erosion.

The thin layer of topsoil that covers the planet’s land surface is the foundation of civilization. This soil, measured in inches over much of the earth, was formed over long stretches of geological time as new soil formation exceeded the natural rate of erosion. As soil accumulated over the eons, it provided a medium in which plants could grow. In turn, plants protect the soil from erosion. Human activity is disrupting this relationship.
Sometime within the last century, soil erosion began to exceed new soil formation in large areas. Perhaps a third or more of all cropland is losing topsoil faster than new soil is forming, thereby reducing the land’s inherent productivity. Today the foundation of civilization is crumbling. The seeds of collapse of some early civilizations, such as the Mayans, may have originated in soil erosion that undermined the food supply.

The accelerating soil erosion over the last century can be seen in the dust bowls that form as vegetation is destroyed and wind erosion soars out of control. Among those that stand out are the Dust Bowl in the U.S. Great Plains during the 1930s, the dust bowls in the Soviet Virgin Lands in the 1960s, the huge one that is forming today in northwest China, and the one taking shape in the Sahelian region of Africa.

Each of these is associated with a familiar pattern of overgrazing, deforestation, and agricultural expansion onto marginal land, followed by retrenchment as the soil begins to disappear.

Twentieth-century population growth pushed agriculture onto highly vulnerable land in many countries. The overplowing of the U.S. Great Plains during the late nineteenth and early twentieth centuries, for example, led to the 1930s Dust Bowl. This was a tragic era in U.S. history, one that forced hundreds of thousands of farm families to leave the Great Plains. Many migrated to California in search of a new life, a move immortalized in John Steinbeck’s “The Grapes of Wrath”.

Three decades later, history repeated itself in the Soviet Union. The Virgin Lands Project between 1954 and 1960 centered on plowing an area of grassland for wheat that was larger than the wheatland in Canada and Australia combined. Initially this resulted in an impressive expansion in Soviet grain production, but the success was short-lived as a dust bowl developed there as well.

Dust storms originating in the new dust bowls are now faithfully recorded in satellite images. In early January 2005, the National Aeronautics and Space Administration (NASA) released images of a vast dust storm moving westward out of central Africa. This vast cloud of tan-colored dust stretched over some 5,300 kilometers (roughly 3,300 miles). NASA noted that if the storm were relocated to the United States, it would cover the country and extend into the oceans on both coasts.

Andrew Goudie, Professor of Geography at Oxford University, reports that Saharan dust storms—once rare—are now commonplace. He estimates they have increased 10-fold during the last half-century. Among the countries in the region most affected by topsoil loss from wind erosion are Niger, Chad, Mauritania, northern Nigeria, and Burkino Faso. In Mauritania, in Africa’s far west, the number of dust storms jumped from 2 a year in the early 1960s to 80 a year today. The Bodélé Depression in Chad is the source of an estimated 1.3 billion tons of wind-borne soil a year, up 10-fold from 1947 when measurements began. The 2 to 3 billion tons of fine soil particles that leave Africa each year in dust storms are
slowly draining the continent of its fertility and, hence, its biological productivity. In addition, dust storms leaving Africa travel westward across the Atlantic, depositing so much dust in the Caribbean that they cloud the water and damage coral reefs there.

In China, plowing excesses became common in several provinces as agriculture pushed northward and westward into the pastoral zone between 1987 and 1996. In Inner Mongolia (Nei Mongol), for example, the cultivated area increased by 1.1 million hectares, or 22 percent, during this period. Other provinces that expanded their cultivated area by 3 percent or more during this nine-year span include Heilongjiang, Hunan, Tibet (Xizang), Qinghai, and Xinjiang.

Severe wind erosion of soil on this newly plowed land made it clear that its only sustainable use was controlled grazing. As a result, Chinese agriculture is now engaged in a strategic withdrawal in these provinces, pulling back to land that can sustain crop production.

Water erosion also takes a toll on soils. This can be seen in the silting of reservoirs and in muddy, silt-laden rivers flowing into the sea. Pakistan’s two large reservoirs, Mangla and Tarbela, which store Indus River water for the country’s vast irrigation network, are losing roughly 1 percent of their storage capacity each year as they fill with silt from deforested watersheds.

Ethiopia, a mountainous country with highly erodible soils on steeply sloping land, is losing an estimated 1 billion tons of topsoil a year, washed away by rain. This is one reason Ethiopia always seems to be on the verge of famine, never able to accumulate enough grain reserves to provide a meaningful measure of food security.

Fortunately there are ways to conserve and rebuild soils. In reviewing the literature on soil erosion, references to the “loss of protective vegetation” occur again and again. Over the last half-century, we have removed so much of that protective cover by clearcutting, overgrazing, and overplowing that we are fast losing soil accumulated over long stretches of geological time. Eliminating these excesses and the resultant decline in the earth’s biological productivity depends on a worldwide effort to restore the earth’s vegetative cover.

The secret of avoiding soil erosion is to never allow the soil to be bare and unprotected, but to ensure that the soil surface is always covered with growing plants or the dead mulch from these same plants. To achieve this in modern agriculture, all types of tillage and soil loosening should be avoided. The no-till technology described in detail later in this book has shown to be one of the most efficient methods of protecting the soil from being eroded by wind and water. This system is very similar to a permanent pasture. In addition to reducing erosion, this practice helps retain water, raises soil carbon content, and reduces the energy needed for crop cultivation. Instead of plowing land, disk ing or harrowing it to prepare the seedbed, and then using a mechanical cultivator to control weeds, farmers simply drill seeds directly through crop residues into undisturbed soil...
(with special machines), controlling weeds with herbicides. The only soil disturbance is the narrow slit in the soil surface where the seeds are inserted, leaving the remainder of the soil undisturbed, covered by crop residues and thus resistant to both water and wind erosion. Small farmers can no-till seed their crops using a stick or a manual hand planter.

Now widely used in the production of corn and soybeans in the United States, no-till has spread rapidly in the Western Hemisphere, covering 25 million hectares in the U.S.A., 24 million hectares in Brazil, 18 million hectares in Argentina, and 13 million hectares in Canada. Australia, with 9 million hectares, rounds out the five leading no-till countries. Worldwide, the no-tillage technology was applied on 45 million hectares in 1999 and has expanded to about 95 million hectares in 2005. It now exceeds the 100 million hectares mark. Farmers worldwide are increasingly recognizing the environmental benefits of this technology: No-till protects the soil from wind and water erosion, reduces fossil fuel consumption, reduces CO₂ emissions while also providing CO₂ sequestration, and increases soil fertility and productivity. Overall, it helps reduce farm expenses and increase the quality of life for farmers.

The Author:
Lester Brown is founder and president of the Earth Policy Institute, Washington, D.C., U.S.A. (epi@earth-policy.org, www.earth-policy.org)

You have just read Chapter 1, Introduction, by Les Brown.

Chapters 2-34, with details about no-till research, development, policy, etc. in 20 countries, are available in the 544-page book.

The price of the book - with a CD and including delivery:

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Contact Samran Sombatpanit at sombatpanit@yahoo.com for more details and to order copy/ies or see in the next pages if you want to buy the book locally and pay in local currency.
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ANNEX I

New Book

No-Tillage Seeding in Conservation Agriculture

Authors: Baker, Saxton, Ritchie, Chamen, Reicosky, Ribeiro, Justice and Hobbs
Editors: C.J. Baker and K.E. Saxton (baker@crossslot.com)

A Summary

This 326-page book is an expanded second edition of No-Tillage Seeding: Science and Practice (Baker, Saxton and Ritchie), first published in 1996. The second edition was commissioned by FAO (United Nations) and published jointly in 2006 by FAO and CABI, England.

FAO explained why it commissioned the book in a Foreword penned jointly by Shivaji Pandey and Theodor Friedrich. The preface is contributed by the editors and outlines why the book was written and how the reported science has already dictated the design of Cross Slot® no-tillage technologies.

The book’s 19 chapters draw on research conducted at New Zealand’s Massey University and U.S.A.’s Washington State University that helped identify and eliminate many of the causes of previous biological failures in no-till systems. Other research is reported from the U.S. Department of Agriculture; 4Ceasons Agriculture and Environment, U.K.; Instituto Agronômico do Paraná, Brazil; National Agriculture and Environment Forum, Nepal; and Cornell University, USA.

The book sets the scene by outlining the fundamental principles of no-tillage. The first chapter reports the benefits of no-tillage, many of which are due to maintaining or increasing soil carbon levels. These benefits are given some perspective in a chapter on risks (biological, physical, chemical and economic) associated with no-tillage systems. The authors argue that the risks of crop failure (or even partial
failure) are increased when the levels of technology and/or management are decreased, i.e. cheap no-tillage solutions greatly heighten the risk of failure.

The authors illustrate how technical differences between a range of no-tillage machines can be traced back to how their openers operate in the soil. In this respect, the authors dissect opener functions in greater detail than has hitherto been reported elsewhere. For example, the authors examine an extensive range of opener designs that exist, in terms of how they create seed slots and how (or whether) they cover these slots. They even quantify the value of different forms of slot covering material, distinguishing between loose soil and mulch as well as combinations of the two.

Then, in separate chapters, the authors detail the biological responses of various basic opener designs in dry soils, wet soils, and a wide range of surface residues. The authors highlight the unique value of vapor-phase soil water in no-tillage, since the very act of performing conventional tillage virtually eliminates vapor-phase water from performing any significant role in tilled soils. Similarly, the authors explore the role of soil aeration, infiltration and earthworms in wet soils and how all of these factors can be influenced (or more importantly, harnessed) by good no-tillage opener designs.

The importance of, and opener-design-options for, controlling seeding depth in varying soil conditions are examined, together with the desirability of “double shooting” (delivering separately) seed and fertilizer under no-tillage. Its effects on crop yield (compared with broadcast fertilizers) are examined together with the pros and cons of a range of design options for banding fertilizer separately from seed during no-tillage.

Since true no-tillage has much to do with minimizing surface residue disturbance, a separate chapter is devoted to comparing minimum and maximum residue disturbance options in terms of both crop responses and technology design options and a further chapter examines the mechanisms and problems of residue handling by openers.

There is a special chapter on no-tillage for forage cropping that supports the view that all competing vegetation does not necessarily need to be removed prior to seeding when crops are to be fed to animals. The chapter on management of no-tillage systems places emphasis on planning and even gives an example of typical time-line decision-making.

Having outlined the major factors influencing the biological success or failure of no-tillage machines and systems, the book moves logically into an analytical discussion of critical engineering aspects of machine design as they relate to both small-scale and large-scale machines. The book acknowledges that some of the more desirable design features of large-scale machines are impractical and uneconomic to reproduce on small-scale machines that are constrained by limited budg-
ets; the effects of the resulting design compromises on biological risk are also documented.

Because no-tillage is one part of a complex food production system that involves repeated exploitation of the thin and fragile layer of croppable top soil that covers only 4% of the world’s surface, other related soil sciences are also integrated into the book. In particular, the importance of soil carbon is dealt with in detail, both in relation to how no-tillage minimizes losses of soil carbon during seeding (compared with conventional tillage) and how it sequesters soil carbon that feeds soil fauna. In turn, soil fauna have much to do with creating soil structure that is essential for maximizing crop yields and minimizing soil erosion. Since compaction from vehicle wheel traffic is almost always detrimental to soil health, the complementary practice of controlled traffic is examined as it has the capability to limit wheel compaction to designated traffic areas and leave productive soils unaffected.

Finally, a book on no-tillage would not be complete without some examples of economic comparisons, which almost invariably come out in favor of no-tillage over tillage. A separate chapter is also devoted to the experimental techniques and procedures used to improve our understanding of the differences between methods of no-tillage. Some of these techniques are unique since some of the authors themselves pioneered aspects of agricultural research that had not previously been examined in detail or under controlled conditions.

The book therefore provides a useful reference for students and scientists alike, but is also designed to appeal to practitioners. Anyone who has attempted or been associated with no-tillage in any context should find this book enlightening. In many cases it will help show why otherwise-unexplained crop failures have occurred when inappropriate equipment, methods, and/or management practices have been applied.

Some 300 quoted references attest to the depth of information sourced for this easy-to-read but information-filled book. A review of this book by T. Francis Shaxson can be read from the BOOK REVIEWS page of WASWC website at http://waswc.soil.gd.cn.


The Editors: John Baker, CEO, Baker No-Tillage Ltd and President NZ No-Tillage Association (Inc.), New Zealand (baker@crossslot.com, www.CrossSlot.com); K.E. Saxton, formerly of USDA, ARS, U.S.A.
New Book

NO TILLAGE
The relationship between no tillage, crop residues, plants and soil nutrition

Carlos C. Crovetto

Ten years have elapsed since Carlos Crovetto published his book “Stubble Over the Soil: an introduction to no tillage”. His work has already been edited five times, has been published in four languages and is considered a pioneer work of a farmer for farmers all over the world. The author is now offering his book “No Tillage”, which approaches readers to this new system of soil management.

The author has given lectures in 20 countries, having been 40 times in Argentina, a country where in 15 years traditional agriculture was revolutionized by “direct sowing”. Today, over 17 million ha and 70 manufacturers of machinery for direct sowing have displaced traditional farming practices and tillage implements.

In United States of America he has had a strong influence in forming more conservation-minded farm producers in California, North Carolina, Georgia, Pennsylvania, Delaware, Maryland, Illinois, Ohio, Kansas, North Dakota, and Washington. His agricultural extension work has been recognized by institutions like the Soil and Water Conservation Society, granting him three awards, the last being the “Hugh H. Bennett” Award, the highest distinction, presented to him in August 2001. In the same month and year, the American Society of Agricultural Editors, conferred to him the “Distinguished Services Award” for exceptional and meritorious service to American agriculture.
Intellectually formed under the guidance of important conservationists like W.C. Lowdermilk, E.H. Faulkner, M. Fukuoka, A. Primavesi, J. Molina, and others, Crovetto has been able to stop the erosive processes and recover the productivity of his Chequen farm, with generous devotion and love for his soil.

In this new work, Carlos Crovetto shows us something unique and unpublished. Most of the scientific research and results he shows have been obtained in his farm. He has attracted the interest of Chilean and Foreign Universities, proudly showing Chequen soils after 49 years of profound changes.

During the official release of Carlos’ book “Stubble Over the Soil” the former President of the American Society of Agronomy (ASA, 1996) Jerry Nelson stated: “This is the first time that our society (ASA) has published a text about agronomy that has been translated from a foreign language into English, as well as it is the first time we have edited a book written by a farmer. This marks of profound change in our scientific behavior, by accepting farmer experiences materialized with a scientific rigor.”

Profound changes proposed by the author and strengthened by his close relationship to the soil will surely help the reader to better understand his most important resource: the soil. At the same time, the agronomic community shall find a remarkable example of a vicious and complex circle of agricultural sustainability.

From the back cover of the book by Edmundo Acevedo H., Eng. Agr. PhD, Faculty of Agronomic Sciences, University of Chile, Santiago, Chile

NO TILLAGE: The relationship between no tillage, crop residues, plants and soil nutrition.
ISBN: 956-310-178-6, published in Chile by the author in 2006. 216 pp. Contact Carlos Crovetto at crovetto@entelchile.net for information how to obtain a copy. In U.S.A. you may order from www.conservationinformation.org
ANNEX III

New Book

Search for Sustainability for Dryland Agriculture

by Bill Crabtree

One of Australia’s most recognized authorities on no-tillage is “No-Till Bill”. Now, after 22 years of research, observations and interaction with no-till innovators he shares his views on the quest to help make the most arid country in the world a sustainable agricultural continent. Bill is an alternative thinker. He is constantly exploring new ways to improve agriculture, and his unconventional determined style has made him a unique character.

Australia is a fascinating country with limited rainfall and some of the most infertile soils. It is a large country, with farms to match. Australian farmers have some of the lowest level of agricultural subsidy of any country. These factors have combined and resulted in a large number of innovations that have led to many new agricultural inventions that have originated in Australia.

This book covers more than just no-tillage, it discusses the land, climate, soils, machinery, agronomy, some animal production and the challenges of fixing problems. It explains situations where tillage may need to be adopted for specific problems, but warns of the risks and exhorts farmers to continue with no-tillage regimes because of the vast range of benefits that result from its sustained use. The book explains at length the weed control and moisture retention benefits that exist in the winter wet and summer dry climates of southern Australia. There is also discussion of sheep, pasture and cover crops and their role in crop rotation, and discussion on the possible future of sustainable agriculture in Australia. The book contains many photos and some graphs and is available for purchase at www.no-till.com.au.
Note: Bill Crabtree (bill.crabtree@wn.com.au) is affectionately known as "No-Till Bill" for the courageous stand he took in promoting no-tillage against popular opinion, in the early 1990s. It was partly this stand for what was right, that won him respect throughout the Australian farming community. He was thanked for this work with two awards. In 1996 he was Landcarer of the Year for Western Australia, and in 2006 he won the prodigious "Seed of Light Award" for excellence in communication.

Bill has an active agronomic consulting business and manages three diverse and important companies in WA. He obtained his B.Ag.Sci and M.Sci from the University of Western Australia and is currently the state Manager for Seed Hawk seeders and AgGuide gps steering systems. He is also the CEO of Green Blueprint International Ltd, who is working on developing a frost resistant wheat. Bill travels widely and speaks on no-tillage, GM technology and sustainable agriculture. He employs three full time staff and is based in Perth, Western Australia. Bill has recently returned to farming on a 9,000 acres property.

**Book contents**

1. The search for sustainable agriculture
2. Background to Australian agriculture
3. Definitions - what is no-till?
4. Adoption of no-till in WA and Australia
5. Overview of benefits of no-till
6. Weed control is superior with no-till
7. Time of sowing
8. Better plant water relations
9. Greater biological activity
10. Increased macro soil biology
11. Type of openers
12. Seeder set-up for stubble management
13. Press wheels and harrows
14. Fertiliser systems and issues
15. Rotations and cover crops
16. Some challenges with no-till
17. The herbicide resistance issue
18. When might full tillage be unavoidable?
19. Salinity in Western Australia
20. Stock and their fit with no-tillage
21. Economics of no-tillage
22. Where to next?
23. Impact of Australia rejecting GM canola
24. How did I get into no-tillage?
25. History of no-tillage agriculture
26. References and no-till experts
27. Crabtree publications
The name BLUE AGRICULTURE was coined by the Italian Association for an Agronomical and Conservative Land Management (AIGACoS). Blue refers to water and the environmental benefits of Conservation Agriculture (CA). The four main principles of CA are: maintaining soil cover with plant residues, reducing mechanical soil disturbance (tillage), restricting in-field traffic to permanent wheel tracks, and the use of rotation and cover crops. Adoption of CA in Italy is still low in comparison with other countries; nevertheless, minimum tillage is more common than no-tillage.

This book draws on the expertise and practical experience of experts at Italy’s leading research institutes and universities. The book describes their collaborative efforts to investigate, develop and teach practices to (a) increase the productivity of rainfed agriculture in drylands, (b) make a significant contribution to meet basic food needs, and (c) encourage adoption of farm practices that retain water
for increased productivity and improved land quality. Soil moisture utilization for enhanced crop production can be improved through maximizing the capture, infiltration and storage of rainfall water into the soil. An absorptive, organic matter-rich and biologically diverse soil can be achieved through the application of the four principles of Conservation Agriculture as described above.

This 257-page book represents the first Italian publication describing these principles, technologies and methodologies. It uses clear terminology, and provides numerous practical examples of the use of CA to reduce soil erosion and increase productivity in both annual and perennial crops. The book has three sections. The first section deals with the agronomic and environmental concepts and principles of CA as an integrated production system for water and soil management and conservation. There is also a general overview of CA experience in Italy, Europe and worldwide. The Visual Soil Assessment (VSA) method is also described as a practical tool for soil quality monitoring.

The second section describes integrated management systems in CA (annual cropping systems, crop rotation techniques, and guidelines for transition from conventional to conservation agriculture). This is followed by strategies for the adoption of CA in Italy for several annual crops such as durum and winter wheat, corn, soybean, sunflower, canola, vegetables, field horticulture and fruit crops, as well as long-term crops such as olives and viticulture. Suggestions are given to help farmers make the transition from conventional to conservativ agriculture.

The third section describes in one chapter developments in the mechanical tools and equipment for CA. In particular it reports on new technologies for machinery such as no-tillage, and shallow and deep methods of minimum tillage. The next chapter provides an economic analysis of costs and profitability of CA. The concluding chapter highlights the energetic-economic comparative advantages of CA, based on a study conducted in Italy for annual crops (corn, wheat and soybean).

The book provides an in-depth discussion of the most important issues in soil erosion phenomena that to a large degree are responsible for the landscape we see today in Italy. Erosion accounts for the formation of plains, valleys and plateaux, the levelling of mountains, and the accumulation of the material that has been eroded from them. Despite the importance of erosion in creating the very areas of our country now used for modern agriculture, accelerated erosion, in which soil erosion outpaces land formation, can have detrimental, even disastrous conse-
quences for agriculture, the environment, and the biodiversity that inhabit fragile ecosystems.

The shift from conventional to CA requires the implementation of several aspects: (a) exposure of farmers to different CA practices, particularly through participatory activity and on-farm demonstrations to show the benefits and practicality of new techniques, tools, equipment, and cropping techniques; (b) training in the practical use of new technologies, combined with flexible funding mechanisms and incentives, particularly during the period of transition; (c) fostering cooperation and dialogue between scientists, suppliers and farmers, and between government and educational institutes; (d) development and use of farmer-friendly tools to measure soil physical health and water-use efficiency; and (e) achieving and publicizing improvements in land productivity, reduction in farming costs, and environmental benefits (e.g. carbon sequestration) resulting from the application of new CA practices, within the BLUE AGRICULTURE integrated management system.

Both our future food security and conservation of the global environment will in large measure depend on advances in the science and technologies of sustainable agriculture, particularly CA. Achieving such advances is indeed possible, but meeting these challenges will require major increases in investment in specific research areas, both in Italy and at a global level. The ever-present challenge in agriculture is to optimize farm productivity in a sustainable fashion, while maintaining the quality of farmers’ livelihoods, and minimizing impacts and degradation of the broader landscape. This is particularly true for drylands, where productivity is already low, options are limited and where many rural people live in poverty.

The book has over 250 figures, including several pictures and tables explaining and demonstrating the diverse range of applications of CA and the experimental results from Italy and international studies. Key references and internet resources are reported at the end of each chapter.
This impressive book, published recently in 2002, offers a collection of papers by 13 distinguished authors, presented at the 5th Brazilian National Zero Tillage Meeting at Goiânia, Goiás State of Brazil in 1996. The book was first published in Portuguese, then later translated to English. The following extract has been taken from the book’s Foreword.

Taking advantage of the highly positive results of the 5th Brazilian National Zero Tillage Meeting in 1996, this book was edited in Portuguese in order to better inform both the farming community and environmentalists, ecologists, politicians, opinion formers, and the general public of the benefits of this new technology, Zero Tillage, which establishes a strong link between the concerns of soil conservation and obligations to the environment. The English edition, translated and published with the support of FAO, brings an international dimension to Brazil’s pioneering efforts.

When, in 1995, I had the opportunity to show the Nobel laureate research scientist Norman Borlaug what was being achieved in Brazil in reclaiming the infertile, acid soils of the “Cerrado” (Tropical Savannah) and Amazon regions, we sought to show him that we had at our disposal technologies for sustainable agriculture in the new frontiers of Brazil.

Referring to what he had seen, Dr Borlaug declared in lectures given in Belo Horizonte and São Paulo:

“It is agronomic management – such as planting at the right time, including Zero Tillage, which I admire because it reduces both erosion and costs – which allows expression of the genetic potential of the new varieties” (April 1995).

“In 1995, I had the pleasure to visit various parts of the Cerrado region. I saw many large-scale mechanized operations, in which not only was liming employed but fertilizers were used to very good effect. Also, Conservation Agriculture was practiced, for instance with Zero Tillage and Minimum Tillage, which leave the crop residues on the soil surface in order to increase soil organic matter and reduce erosion. In the central savannahs visited I saw little erosion.” (May 1996).

These conclusions complement the declaration of the speakers at the 5th Bra-
zilian National Zero Tillage Meeting, where the papers presented expressed the authors’ convictions on the subject of Zero Tillage (ZT). This meeting counted on the illustrious presence of Alberto Duque Portugal, President of the Brazilian National Research Corporation – Embrapa; Paulo Alfonso Romano, the (National) Secretary of Water Resources of Brazil’s Environment Ministry as well as the representative of José Roberto Marinho, President of Radio Globo and Chairman of the Board of Directors of WWF-Brazil and Garo Batmanian, CEO of WWF-Brazil.

In the words of the President of Embrapa, we note the auspicious development of Zero Tillage, giving credit to those who merit it:

“We researchers started late in this question (Zero Tillage), in which the farmer took the lead. I would like to underline the initiative of the farmers of Central Brazil who pressured research to get involved with Zero Tillage. As a means of improving the identification of research demands, we have learned that we should pay great attention to what the farmer is saying, because he knows what he’s talking about”.

With the involvement of the government research institutions alongside the efforts of the farm input suppliers in divulging this technology both pressured by the farmer in his untiring quest for progress, creative and ever-willing to try new practices, we are progressing surely in the direction of greater and greater adoption of Zero Tillage. The annual area covered by protective crop residues is growing every year, already covering 4.5 million hectares in 1995/6 and extending to over 14 million hectares by 1999/2000 (figures for the summer-planted main crop area plus winter small grains).

In describing this picture, it is our duty to recognize the apostolates of three untiring companions in the dissemination and promotion of Zero Tillage, all motivated by their ideals: Manoel Henrique Pereira and Herbert Bartz of Brazilian origin and John N. Landers, an Englishman adopted by Brazil. They merit recognition from both farmers and technicians, all peers in the promulgation and stimulation of sustainable agriculture, practiced throughout the country.

Fernando Penteado Cardoso
Agrolida Ltda., São Paulo-SP, Brazil


Cover photos show that crop rotation and good biomass generation are fundamental to sustainability.

Copies of the book may be obtained from:
• APDC. SCLRN 712 Bloco C Loja 18 – Brasilia – DF – Brazil – Cep 70760-533; Phone: 55 (61) 272-3191/273-2154; Fax: 55 (61) 274-7245; apdc-DF@terra.com.br or john.landers@uol.com.br
• FAO, Viale delle Terme di Caracalla, 00100 Rome, Italy. Ask Theodor Friedrich at theodor.friedrich@fao.org.
Introduction to the Earth’s Hope Project

The Environmental Education Media Project for China (EEMPC) has documented the rehabilitation of China’s Loess Plateau since 1995 at the request of the World Bank. The findings and images have been presented to over 100 audiences in China, the UK, France, Singapore, Rwanda, Tanzania, Ethiopia, South Africa and the USA.

Loess Plateau: The Geography

The Loess Plateau is approximately the size of France. It’s named for the powdery loess soil that is its primary feature. These mineral-rich wind-borne sedimentary loess deposits accumulated over geologic time and can be hundreds of meters thick.

The Loess Plateau stretches over parts of seven Chinese provinces: Qinghai, Gansu, Ningxia, Inner Mongolia, Shaanxi, Shanxi and Henan.

Humans and their ancestors have lived in the Loess Plateau for more than 1.5 million years. Settled agriculture first emerged between 9,500 and 10,000 years ago. This is the place where the Han, Qin, Tang and several other Chinese dynasties flourished.

Since the advent of settled agriculture, the fine, powdery loess soil has eroded continuously, and in ever increasing amounts, until the Plateau became the most eroded places on earth.

Chinese history is well documented and we know that the Yellow River has flooded more than 1,500 times in recorded history.
Cycle of Poverty and Ecological Destruction

Research shows that in the Loess Plateau, a pristine nurturing ecosystem was fundamentally altered by human impact, leading to almost total ecological devastation over a vast area.

Cutting the forests and preparing the earth to plant crops exposed the fragile loess soil to wind and rain, causing the erosion that created massive gullies and a cycle of flooding, drought and famine. Removing the vegetation cover also disrupted the decaying plant litter and devastated the microbiological layer near the soil surface, destroying the cycle of natural fertility and disrupting the ability of water to be absorbed into the soil during rainfall.

Gradually wild plants and animals disappeared. People planted crops on steeper and steeper sides of the gullies and took their sheep and goats further to eat grasses and bushes hoping to eke out a living. However, with their own activities further degrading the natural systems, the people became mired in poverty.

Rehabilitation

It takes an overarching and ambitious vision to believe that what was destroyed over 10,000 years can be restored; yet a little over a decade ago this is what the Chinese began to do.

1. Planning:

Chinese and international planners worked together with experts in hydrology, soil dynamics, forestry, agriculture and economics to design a workable project plan. The team divided their work into two areas: economic and social well-being of the people, and ecologic health of the environment.

2. Policy:

From the planning process, four main policy decisions emerged.

i. Ban on tree cutting — following the devastating floods of 1998.

ii. Ban on planting on steep slopes — reversing centuries of unsustainable agricultural practice.

iii. Ban on free-range grazing of livestock — protecting plants and soils.

iv. Land tenure — clear policies on land tenure were established.

3. Participation:

It was critical to engage the local people to understand and participate in the rehabilitation efforts, and to convince them of the value of rehabilitation work.
4. **Engineering:**

The Loess Plateau had been so fundamentally altered that restoring economic productivity and ecologic health required basic engineering.

Sustainable water management – it is critical a watershed does not depend on water diverted from other watersheds or from finite underground supplies.

Terracing – flat fields created on the sides of gullies and hills and well-maintained, will reduce erosion while providing economically viable fields.

Sediment Control Dams.

5. **Vegetation Cover:**

Dune stabilization – to halt the movement of sand dunes afflicting the most fundamentally damaged areas.

Grasses and bushes – indigenous or well-suited varieties are planted.

Trees – through an integrated approach of afforestation and policy change, returning trees to the region is a chance to correct the damage that was done over thousands of years.

Perennial crops (orchards) – an excellent way to stabilize the soil cover, while raising incomes and diversifying the economies of small farming communities.

**Outcome**

Over the past decade as we have documented the Loess Plateau an astounding transformation has taken place, proving it is possible to rehabilitate large-scale damaged ecosystems.

We have filmed as once denuded hillsides came alive with grasses, bushes, trees, birds and insects. Humidity is changing as the hydrological cycle is restored. The entire dynamic of the plateau has changed.

The seemingly hopeless cycle of poverty and ecologic destruction has been broken.

6. **Active and Passive Measures:**

Active measures generate income from economically viable cropland. An important finding is that when sustainable water and land use are in place, passive rehabilitation methods that let nature restore itself may be more effective than active ones for ecological rehabilitation.

*Envisioning a Future without Poverty in a World with Intact Ecosystems*
Implications

The lessons of the Loess Plateau have profound implications for the local people, the Yellow River basin and global ecology.

- Ecosystem functions – demonstration of the possibility of restoring fundamental systems that were disrupted by humans, such as the natural fertility of the soil and the hydrological cycle over a huge scale.
- Yellow River Basin – rehabilitation is reducing the levels of eroded loess that led to the dangerous cycle of flooding, drought and famine.
- Sandstorms – restoring vegetation cover reduces the risk of sandstorms originating in the Plateau.
- Climate change – increased vegetation cover and soil organic matter over this huge area is offsetting CO₂ emissions worldwide that are exacerbating climate change.
- Model – the restoration of the Loess Plateau can serve as a model for other regions.

Paradigm Shift in Human Consciousness

The lessons of the Loess Plateau are fundamental to humanity overcoming the massive environmental challenges we face.

Protecting ecologically sensitive land results in massive long-term benefits to soil, biodiversity and climate; whereas trying to exploit these areas for economic benefit only causes more degradation and does not lead to significant financial returns.

In the Loess Plateau we are witnessing a paradigm shift in human consciousness that is addressing mistakes of the past. These lessons could be applied to other damaged ecosystems and could help guide humanity towards a sustainable future.

www.EarthsHope.org

Envisioning a Future without Poverty
in a World with Intact Ecosystems
WASWC: Its History, Operations and Publications

By

Bill Moldenhauer and David Sanders (2003)
Updated by Samran Sombatpanit (2007)

WASWC was established in 1983 with the help and support of the Soil and Water Conservation Society (SWCS) of the U.S.A. The original purpose was to support international activities of both SWCS and the International Soil Conservation Organization (ISCO). The world was divided into nine regions with at least one Vice President from each region. Since there was little contact among ISCO participants from one biennial conference to the next, our first priority was to publish a quarterly newsletter with meeting announcements, international conservation news, book reviews, member news, etc. From the beginning, we tried to give recognition to, and a forum for, workers in the international field who had published mainly in the “gray literature” (company, Government (GO) and non-governmental (NGO) agency and organization reports that had had very small circulation).

This continues to be one of our most vital functions. By 1986 there was great interest in the Food and Agriculture Organization (FAO) of the United Nations and many GOs and NGOs in just how effective their international programs were in solving problems in developing countries. WASWC and SWCS organized a workshop in Puerto Rico with the help of several donor organizations and invited speakers to address the success (or failure) of donor sponsored soil and water conservation and land husbandry programs in developing countries worldwide.

This was a very successful conference and resulted in two publications published by SWCS, Conservation Farming on Steep Lands and Land Husbandry: A Framework for Soil and Water Conservation. Since our Puerto Rico workshop we have held a workshop in Taiwan in 1989, one in Solo, Central Java, Indonesia, in 1991, and one in Tanzania and Kenya in 1993. These have all been published and were circulated by SWCS.

Our Vice President for Europe, Dr. Martin Haigh, has initiated a series of meetings on Environmental Regeneration in Headwaters in various parts of the globe. Our Vice President for the Pacific Region, Dr. Samir El-Swaify, has initiated a series on “Multiple Objective Decision Making for Land, Water and Environmental Management.” Four of our members—Samran Sombatpanit, Michael Zoebisch, David W. Sanders, and Maurice Cook have edited a book titled, Soil Conservation Extension: From Concepts to Adoption. David Sanders, Paul Huszar, Samran Sombatpanit and Thomas Enters have edited a book titled, Incen-
atives in Soil Conservation: From Theory to Practice. Lately, Samran Sombatpanit has edited a voluminous book, Response to Land Degradation, with five other editors in 2001 and Ground and Water Bioengineering for Erosion Control and Slope Stabilization, with four other editors in 2004. Besides the above publications, past WASWC President Hans Hurni initiated a long-term program, “World Overview of Conservation Approaches and Technologies (WOCAT),” based in Berne, Switzerland in 1992 and had a landmark WOCAT Global Overview book “where the land is greener” published in 2006. WASWC has supported Jim Cheatle’s “Organic Matter Management Network” based in Nairobi, Kenya. WASWC is also closely allied with Reseau Erosion, a project of Vice President Eric Roose, based in Montpellier, France, and operating mainly in Africa. WASWC is closely allied to ISCO and cooperates fully with planning and conducting its biennial conferences. WASWC is requested and very willing to co-sponsor conferences, symposia and workshops it feels will further its philosophy and objectives.

The WASWC Philosophy: WASWC philosophy is that the conservation and enhancement of the quality of soil and water are a common concern of all humanity. We strive to promote policies, approaches and technologies that will improve the care of soil and water resources and eliminate unsustainable land use practices.

WASWC Vision: A world in which all soil and water resources are used in a productive, sustainable and ecologically sound manner.

WASWC Mission: To promote worldwide the application of wise soil and water management practices that will improve and safeguard the quality of land and water resources so that they continue to meet the needs of agriculture, society and nature.

WASWC Slogan: Conserving soil and water worldwide – join WASWC

The Objectives of WASWC: The basic objective of WASWC is to promote the wise use of our soil and water resources. In doing so WASWC aims to:

• Facilitate interaction, cooperation and links among its members.
• Provide a forum for the discussion and dissemination of good soil and water conservation practices.
• Convene and hold conferences and meetings and conduct field studies connected with the development of better soil and water conservation.
• Assist in developing the objectives and themes for ISCO conferences and collaborate in their running.
• Produce, publish and distribute policies, guidelines, books, papers and other information that promote better soil and water conservation.
• Encourage and develop awareness, discussion and consideration of good conservation practices among associated organizations.

• Liaise, consult and work in conjunction with environmental organizations on the development and promulgation of global environmental and conservation policies, strategies and standards.

**Recent Developments:** The WASWC has had to face some serious problems in recent years and, as a result, some important changes have taken place. The cost of running WASWC has increased over the years and, at the same time, membership numbers dropped to below 400. The drop in numbers was partly because a membership fee of even US$10 per year is a considerable amount of money for many members from developing countries. Added to this, is the problem of paying in dollars and transferring relatively small sums of money internationally. To overcome these problems, a number of important steps have been taken. *First*, a concerted effort has been made to recruit new members. As part of this campaign, an effort has been made to improve the services provided to members. This has included improving the quality and length of the quarterly newsletter and distributing it by e-mail. *Second*, a flexible system of membership fees has been introduced which means that members can join for as little as US$5 and US$10 per year for respectively developing and developed countries. *Third*, a program of decentralization has also been launched with the appointment of several more Vice Presidents and the establishment of National Representatives, now covering approximately 100 countries. This program is not only bringing our association closer to members but has also provided other advantages including a system whereby it is now possible for local organizations to collect membership fees in local currencies and to pay the secretariat in bulk. *Fourth*, the WASWC council has become more actively involved in encouraging regional and local meetings, conferences and other useful activities. *Fifth*, the WASWC council offers 1-year Guest membership to persons who have participated at any technical meeting worldwide, if they wish so. As a result of these measures, membership has risen to several thousands in 2007.

Another major change has been the move of the WASWC secretariat from the SWCS in the U.S.A. to Beijing in China, on April 1, 2003. It is now hosted by the Ministry of Water Resources. The WASWC appreciates the generous help that it received from the SWCS over the 20 years that the SWCS ran its secretariat and intends to maintain a close association with it in the future. However, the Council believes that this move will have a number of advantages. Our Chinese hosts have offered very generous terms for the running of the secretariat; we will have the opportunity to work in a country where running costs are relatively low and where there is considerable technical expertise available and of interest to many of our members. The most recent development is the establishment of our main website at the Guangdong Institute of Eco-Environmental and Soil Sciences in Guangzhou, in the southern part of China, to offer services to our members along with the other one in Tokyo, Japan, supported by ERECON.
WASWC Council  
(For the period up to December 2007)

President: Miodrag Zlatic, Serbia  
Deputy President: Machito Mihara, Japan  
Treasurer: John Laflen, U.S.A.  
Executive Secretary: Jiao Juren, China  
Imm. Past President: Samran Sombatpanit, Thailand (& Membership Coordinator)  
Councilor for Africa: Mohamed Sabir, Morocco  
Councilor for America (Latin): Eduardo Rienzi, Argentina  
Councilor for America (North): Ted Napier, U.S.A.  
Councilor for Australasia: Ian Hannam, Australia  
The next council will operate from January 2008 for a period of 3 years.  
Contact Samran Sombatpanit (sombatpanit@yahoo.com) for further information.

Past Presidents

1986-1988: Norman W. Hudson, UK  
1992-1997: Hans Hurni, Switzerland  
1997-2001: David W. Sanders, UK  
2002-2004: Samran Sombatpanit, Thailand  
January-March 2005: Martin Haigh, UK  
April 2005-June 2006: Samran Sombatpanit, Thailand (Acting)

WASWC Secretariat and Websites: See p. viii, this volume
WASWC Publications
– Published in association with other institutions or publishers –

1988
• Conservation Farming on Steep Lands. Edited by W.C. Moldenhauer and N.W. Hudson, ISBN 0935734198

1989

1990
• Soil Erosion on Agricultural Land. Edited by J. Boardman, I.D.L. Foster and J.A. Dearing, ISBN 0471906027 (From a meeting co-sponsored by WASWC)

1991

1992
• Erosion, Conservation and Small-Scale Farming. Edited by H. Hurni and K. Tato, ISBN 3906290700
• Environmental Regeneration in Headwaters. Edited by J. Krecek and M.J. Haigh

1993
• Working with Farmers for Better Land Husbandry. Edited by N. Hudson and R.J. Cheatle, ISBN 1853391220

1995

1996
• Hydrological Problems and Environmental Management in Highlands and Headwaters. Edited by J. Krecek, G.S. Rajwar and M.J. Haigh, ISBN 8120410483
1997
• Soil Conservation Extension: From Concepts to Adoption. Edited by S. Sombatpanit, M. Zoebisch, D. Sanders and M.G. Cook, ISBN 8120411897

1999
• Incentives in Soil Conservation: From Theory to Practice. Edited by D.W. Sanders, P. Huszar, S. Sombatpanit and T. Enters, ISBN 1-57808-061-4

2000

2001

2004

2007

Special Publications, published by WASWC


The Editors

Mr. Tom Goddard has worked with no-till development over the last three decades from research plot scale to farm-field scales while working as a summer student, an agricultural extension agent and a soils specialist. His varied experience ranges across agricultural extension, environmental consulting and applied research. Research activities have covered precision farming applications, site-specific management, landscape science, soil quality monitoring, erosion processes and greenhouse gas emissions. He is currently on a secondment to the policy secretariat from his position as head of soils and climate change section for Alberta Agriculture and Food. He resides in Edmonton, Canada with Elizabeth and their three teenaged children.

Dr. Michael Zoebisch is a soil and water engineer and agronomist with more than 25 years of experience in Asia, Africa and the Middle East. He specializes in land and water management and the conservation of natural resources. Michael is chartered engineer and chartered environmentalist. He has worked for the International Center for Agricultural Research in the Dry Lands (ICARDA) and as Visiting Professor at the universities of Kumasi (Ghana), Nairobi (Kenya) and for the Asian Institute of Technology - AIT in Thailand. Michael has initiated and managed substantial research projects in Kenya, Syria and Thailand. He is currently senior advisor for the university reform program in Ethiopia responsible for curriculum development.

Dr. Yantai Gan, a Research Scientist with Agriculture and Agri-Food Canada, the Canadian Federal Department of Agriculture, has been focusing his research on the development of diverse no-till cropping systems in the past 15 years. His research achievement is reflected in some 80 papers published in refereed journals and over 200 technical articles. Currently, Dr. Gan is the Director of North America Pulse Improvement Association and the Director of Canadian Society of Agronomy. He is active in training graduates, being Adjunct Professor at four universities: the University of Saskatchewan in Canada; China Agricultural University in Beijing; Lanzhou University in Lanzhou, China; and Gansu Agricultural University in Gansu, China. He is also serving Associate Editor for Canadian Journal of Plant Science.
Mr. Wyn Ellis is a Senior Adviser with the GTZ Thai-German Programme for Enterprise Competitiveness, based in Bangkok. With 29 years of consultancy experience covering crop protection, biosafety, organic farming, innovation management, and sustainable development, he has advised on major rural development programs in Africa and Asia, and has lived in Asia for the past 22 years. He holds degrees from the Universities of Oxford and Reading in UK.

Mr. Alex Watson has worked as a researcher in New Zealand for the past 25 years. He has over that time been engaged in investigations involving catchment hydrology and associated land use change issues, plantation and forest water use, tree and tree root anchorage and their relationships to slope and wind stability, and erosion process studies. His previous editorial responsibilities have included co-editing *Ground and Water Bioengineering for Erosion Control and Slope Stabilisation* in 2004. He is currently employed by Landcare Research New Zealand Ltd.

Words of Appreciation

WASWC sincerely appreciates cooperation from the following businesses and individuals for giving financial help from the start of the project, to enable its implementation and to make the book available to worldwide readers at an affordable price.

Syngenta AG, Basel, Switzerland

SEMEATO Farm Machinery Co., Passo Fundo, Brazil www.semeato.com.br

Eijkelkamp Agrisearch Equipment, Giesbeek, The Netherlands www.eijkelkamp.com

SonTek Company, San Diego, U.S.A. www.sontek.com

Donald Fryrear Custom Products and Consultants, Big Spring TX, U.S.A. www.csrl.ars.usda.gov/wewc/bfryrear.htm

Carlos Crovetto, No Tillage Development Center, Chequen Farm, Concepción, Chile crovetto@entelchile.net

John Burton, Washington, NJ, U.S.A. jjjburton@verizon.net

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for dust particle size determinations.

(Left) Wind erosion and (right) Bill Fryrear with a special chrome-plated BSNE Sampler, which he invented, given to him at his retirement from USDA-ARS

Contact Donald W. (Bill) Fryrear at
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Root Auger
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Wet sieving apparatus
The aggregate stability of a soil is the resistance of soil structure against mechanical or physico-chemical destructive forces. Soil structure is one of the main factors controlling plant growth by its influence on root penetration, soil temperature and gas diffusion, water transport and seedling emergence and therefore it is an important soil characteristic for farmers. The wet sieving apparatus is used to determine the above mentioned aggregate stability. The wet aggregate stability is determined on the principle that unstable aggregates will break down more easily than stable aggregates when immersed into water. The testing procedure results in an index for aggregate stability.

E info@eijkelkamp.com
I www.eijkelkamp.com
Penetrologger

The resistance to penetration is a means of determining the ground load-bearing capacity, and the ease with which roots will grow through the ground. The resistance to penetration is a mechanical characteristic that, given a certain texture, depends on changing parameters such as degree of humidity, density and the strength of the connection between mineral particles.

Measuring the resistance to penetration of the soil in a great number of measurements is best executed applying an electronic penetrometer together with a datalogger, allowing for immediate storage and processing of the data in the datalogger. To this purpose Eijkelkamp developed the penetrogger: An electronic penetrometer with a built-in datalogger for storage and processing of a great number of measuring-data (1500 measurements). The penetrogger is a versatile instrument for in situ measurement of the resistance to penetration of the soil.

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