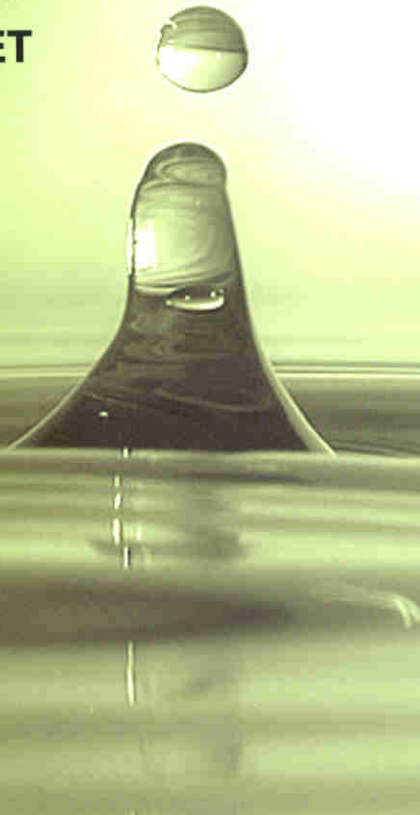




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NO-TILLAGE SYSTEMS FOR SUSTAINABLE DRYLAND AGRICULTURE IN MOROCCO

Dr. Rachid MRABET



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Preface

It is my privilege and honor to write a preface to Dr. Mrabet's book entitled, "No-Tillage Systems for Sustainable Dryland Agriculture in Morocco". This book contains valuable information that can lead to a more sustainable Moroccan dryland agriculture.

Problems with dryland agricultural sustainability were quite evident during my first trip to Morocco in 1983. Increasing population has greatly intensified the need for more production of grain crops and forages. Since irrigation potential is limited, this is bringing great pressure on dryland agriculture. Precipitation use efficiency is historically very low in Moroccan dryland agriculture because of the very intensive tillage practiced throughout the country. Intensive tillage has resulted in large losses of organic soil carbon, weaker soil structure, and a general debilitation of the soil. The weaker soil structure results in decreased water infiltration and this in turn has decreased precipitation use efficiency. Furthermore the loss in soil organic carbon decreases soil nitrogen mineralization rates, which results in more need for nitrogen fertilizer.

Greater food demand by the increasing population of Morocco also has increased the pressure to cultivate marginal land. These newly cultivated marginal lands are in regions of low rainfall, and are frequently highly susceptible to erosion by both wind and water. Use of traditional intensive tillage on these lands is even less sustainable than on the higher quality lands. If not managed judiciously, marginal lands will lose most of their productivity in a few decades.

No-tillage agriculture is a means of reversing the devastating effects of excessive intensive tillage and is a means of improving precipitation use efficiency in dryland agriculture. Dr. Mrabet's book is built on his own work and that of Dr. A. Bouzza who was the no-till pioneer in Morocco. The valuable information in this book is a result of their joint, tenacious pursuit to apply the principles of no-till agriculture to the drylands of Morocco. They have worked through all aspects of no-till ranging from herbicide choices to planting machines that work under Moroccan conditions.

Publication of this book is a landmark event for Morocco. Hopefully policy makers, scientists, and farmers are willing to learn from it and make the turn toward a more sustainable dryland agriculture for Morocco.

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EXECUTIVE SUMMARY

Over time, the interdependence between agriculture and environment is becoming both complex and obvious. Land mis-management through excessive or inappropriate tillage practices, over-grazing and biomass exportation for livestock feeding are harming and mining natural resources. In other words, there is a drastic large scale soil degradation where erosion, organic matter depletion and compaction processes are the most important environmental problems. The increasing Moroccan population, coupled with water and land scarcity, put increasing demands on agricultural scientists to increase crop yields in environments in which water deficits prevail.

The twentieth century saw the Moroccan economy relying heavily on agriculture and agricultural export. The overriding challenge facing Moroccan agriculture is the need to increase production of food enough to feed ever-growing population. Achievement of food security is of paramount importance. The question arises as to whether agriculture can in fact reasonably be expected to fulfill this required role. Several studies identified several soil degradation processes due to agricultural development as being major threats to the environment and to sustainable agriculture and hence to food security. The most disturbing aspect was not only the extent of soil degradation that exists in the country, but also the inability to identify and apply effective responses. Fortunately, Morocco has great agricultural potential and agricultural development should continue with strong relief to farmers affected by land degradation. Moroccan agriculture is characterized by the co-existence of both modern agriculture, and the traditional version. Both types of agriculture are under degradative processes due to mis-use of tillage implements, mis-management of crop residues and inappropriate links between grain and livestock productions.

One of the early proponents of the concept of No-Tillage goes back to Edwards Faulkner in 1943 in the USA and since then the system continues to dissipate in all five continents, reaching around 100 millions hectares. No-tillage cropping systems are multi-functional within landscapes and economies. They not only produce food and other goods for farm families and markets, but also contribute to a range of valued public goods, such as clean water, wildlife, carbon sequestration in soils, flood protection, groundwater recharge, and landscape amenity value.

From the research conducted over the last three decades in the semiarid regions of Morocco, the vast majority of beneficial tillage effects are very transient. Conversely, the harmful effects of conventional tillage systems are long-lasting, if not permanent. Technological change in agriculture is a necessary condition for achieving sustained increases in food production. The present book aims at evaluating the potential of no-tillage practices in the management of soils in semi-arid areas of Morocco. Hence, the present work

is intended to describe major achievements in no-tillage research conducted in semiarid Morocco and to present important ways to implement these achievements within the Moroccan rural society.

A free economy and trade environment, should normally favor the most efficient utilization of agro-ecosystem's resources. In other words, No-tillage systems are found and recognized to revert several degradation processes and enhance productivity of most cropping systems. These systems have revolutionized cropping worldwide and in semiarid Morocco localities, resulting in reduced soil erosion, greater soil water conservation, improved soil quality, environment protection and stable and higher crop yields. The straw over the soil decreases soil water evaporation, while each tillage operation increases it and hence the No-till crops are less vulnerable to drought. No-tillage systems, associated with appropriate crop rotations, are important drought management and mitigation strategies for dryland agriculture. Changes in crop production practices due to shifting to no-tillage systems and retention of crop residue at or near the surface produce progressive qualitative and quantitative variations in soil organic matter. These changes resulted in physical and chemical differentiation, mainly at the seed zone. These effects benefited both farmers and society in terms of higher yields, returns and efficiencies.

Under no-tillage systems, benefits from improved agriculture's environmental performance must be added to remunerations of reducing costs of production, increasing production and improving well-being of farmers. Ecologically integrated weed and pest management is required for best yielding and stable productivity under no-tillage systems. In fact, the transitional period from conventional to no-tillage systems required a prudent control of weed and disease infestation. It is found from on-going research that there is a tendency to weed speciation and disease/insect infestation under no-tillage systems, if not appropriately managed. From fragmentary available research on erosion and sedimentation processes, it was validated the worldwide recognition of positive impacts of no-tillage residue covers on runoff and sediment yield control and prevention.

Even though, many agronomic and environmental benefits accrue from no-tillage and increasing crop diversity; lack of incentives from the government and social factors often encourage the continued use of intensive tillage and specialized crop production. Hence, it is convenient to ascribe the slow adoption of no-tillage systems in Morocco to a lack of knowledge available to most researchers, developers and their advisers. This book will partially fulfill this information gap.

There is a need for the results of such research to be disseminated quickly to national and local government, the general public and - above all - the farming community. No-tillage cropping systems will developed and continue to change in response to economic and social pressures while concern for the state of wildlife and the quality of soil and water has led to further pressures on the way that crops are farmed. There should be an ongoing debate about the future of both no-tillage and conventional farming – not only in Morocco but also in North Africa and global dryland context.



Dr. Rachid Mrabet, Born in 1964, is native of Oujda, Morocco. He received his PhD from Colorado State University in Agronomy. Dr. Mrabet was hired by INRA in 1990 where he is acting as a research director and head of regional agricultural research center of Tangiers. He published 12 book chapters, 20 peer-reviewed papers and more than 30 communications. He is a member of the CNRST and WASWC. He advised more than 20 graduate students and served as expert for several projects and organisations.

The book presents the state of the research on no-tillage agriculture in Morocco. For semiarid Morocco, no-tillage system contributes to agro-ecosystem durability through its positive influence on environmental quality, agronomic sustainability and socio-economic viability. Pertinent results are improved crop performances vis à vis changing weather, enhanced water conservation and accumulation, increased soil carbon capture and sequestration, and ameliorated soil chemical and physical attributes under conservation agriculture. Nevertheless, more studies are needed to understand hydrological and biochemical processes in the soils and socio-economic implications after shifting to no-tillage systems. It was also concluded that more efforts should be encouraged for promoting the adoption and adaptation of these systems by farmer's communities.