



ARAB FUND FOR
ECONOMIC
& SOCIAL DEVELOPMENT

PROJECT

Sustainability and Operationalization of Established Regional Agricultural Research Centers in Five Arab Countries

Activity

**IMPROVEMENT OF WATER PRODUCTIVITY AND ADAPTATION TO CLIMATE CHANGE THROUGH THE DEVELOPMENT OF INTEGRATED INPUTS (WATER AND NITROGEN) MANAGEMENT OPTIONS.
BUS 200190, 2017.**

SUB-ACTIVITY :

RESPONSE OF BREAD WHEAT GENOTYPES TO NO TILLAGE: NO TILLAGE TREATMENT EFFECTS ON SOIL PHYSICAL HEALTH.

by CLAUDIO ZUCCA, PhD

Progress report 2017

Deliverable N. 1-2017.

“Outline of the literature review on no tillage treatment effects on soil physical health”

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SUGGESTED CITATION:

Zucca C., Nangia V., Montanaro G., Belabhir A. (2017). Outline of the literature review on no tillage treatment effects on soil physical health. Technical report. “Sustainability and Operationalization of Established Regional Agricultural Research Centers in Five Arab Countries” Project. International Center for Agricultural Research in Dry Areas (ICARDA). Rabat, Morocco.

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¹ International Center for Agricultural Research in Dry Areas (ICARDA). Rabat, Morocco.

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Foreword

The research Activity “Improvement of water productivity and adaptation to climate change through the development of integrated inputs (water and nitrogen) management options” was launched in 2015, and implemented by ICARDA in Morocco, in the frame of the Project titled “Sustainability and Operationalization of Established Regional Agricultural Research Centers in Five Arab Countries”, which was granted by the Arab Fund for Economic & Social Development (AFESD).

Under this research Activity an experiment was started in 2016/2017 at Merchouch station (Morocco), addressing the response of different genotypes of Bread Wheat to no tillage.

This study, titled “Response of bread wheat genotypes to no tillage: no tillage treatment effects on soil physical health”, is linked to that experiment. The study is aimed at exploring methods to assess tillage impact on soil physics by means of a literature review and of targeted field tests. This report summarizes the results of the literature review.

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1. Introduction

During the last decades Conservation Agriculture (CA) has been the subject of a huge body of research. The effects of conservative practices such as no tillage (NT) on the soil have been investigated and compared to conventional tillage (CT) under various conditions. NT systems are known to result in significant changes in soil properties, especially in the topsoil layers, favorably affecting physical soil properties. However, most of the research has been conducted under temperate and humid climatic conditions, and in Western countries. Relatively few studies have been performed in dryland. Here, further and more specific research is needed to understand the potential of NT practices under dry climatic conditions and on peculiar soils such as the Vertisols. The experiments launched by IWLM at the Merchouch research station, on a semi-arid Vertisol, constitute an opportunity for targeted research on the subject.

The impact of CA practices on soil physical properties has already been the subject of several review articles and metadata analyses. However, it is recognized that the understanding of CA effects on some soil properties still escape univocal interpretation, as shown by the contrasting patterns sometimes reported by different articles, or by the different conclusions achieved by different metadata analyses. This is partly due to the wide range of conditions (notably climate, soil, and tillage practices considered) under which the CA research is conducted in the world. Not always this diversity is duly considered and used to interpret the results obtained. Furthermore, these conditions are not always described and documented by the individual articles, making it impossible to properly contextualize the results obtained, to compare them with those obtained in other sites.

In our review we tried to overcome the limitations mentioned above, by stratifying our search by geographic region and climate, and by specific soil type (discarding articles that don't provide such information) and by targeting crops and farming systems that are of greater relevance to the ICARDA mandated regions. We also took the previous review articles into consideration to achieve greater completeness.

1. Schematic outline of the review topics

The review considered the following soil physical properties:

- Bulk Density
- Resistance to penetration
- Wet or dry aggregate stability
- Surface roughness
- Infiltration
- Water retention and porosity

- Macroporosity
- Soil water content
- Saturated hydraulic conductivity (Ks)

Finally, to support interpretation of results, the following chemical and biologic properties were noted and considered when reported by the articles:




- Soil organic carbon
- Total Nitrogen
- Nutrient stratification
- N&C mineralization
- Root length density

Typically, research articles only target some or few of the above properties, with some of them being more frequent and more uniformly treated (e.g., BD), and other being less frequent, or measured through a variety of methods.

2. Selected references

The peer reviewed international journal articles selected for our literature review are listed below.

Review and metadata analysis articles

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