Guidelines for Abstracts

After acceptation and revision by the scientific committee, two page abstracts will be published in the 21st international ISTRO conference proceedings. No full paper will be requested for the conference. A special issue of Soil and Tillage Research will be edited after the conference with full papers issued form the conference.

The abstract should clearly indicate the objective, results and conclusion of the study. The text should not exceed TWO pages. One figure (and/or one table) could be inserted. A caption is necessary for each figure or table. Three main references could be added at the end of the text. Each reference must be cited in the text. Text, tables and figure must be typed all in black.

The abstract will be sent in a word format

Typing

A Times new Roman 12 font size must be used (except for the title), and margins should be set at 2,5 cm in all sides. Single spacing (or 14 point line spacing) must be used.

Title

Type the exact title of the study in upper and lower case with **Times new Roman 14 bold font style**. The title should be brief and NOT longer than two title lines.

Names of authors

Type the name(s) of authors (in the order of first, middle and last name) putting an asterisk (*) in front of the corresponding author's name. Underline the name of the presenting author. Do not use titles (i.e., Prof., Ph.D., Mr., etc.). E-mail address of the corresponding author must be given for correspondence with the scientific committee.

Affiliations

The affiliation of author(s) (including city and country) should be given below the list of authors. Please use Times new Roman 12 italic font style for the affiliation(s).

Text

The text will be organized following a classical outline: introduction, material and methods, results and discussion, conclusion.

References

References (maximum three) should be listed at the end of the paper in alphabetical order of the last names of the first authors and referred in the text by the last name and the year of publications as (Choi, 1989). Style the reference list according to the following examples. Use abbreviates on journal titles according to standard forms. Please use Times new Roman 10 font style for the references.

Journal articles:
Choi, C.K. and Kim, S.H., 1989. Int. J. Num. Meth. Eng., 28(4), 1909-1928.

Books:
Salvadori, M.G. and Baron, M.L. (Eds), 1961. Numerical Methods in Engineering, Prentice-Hall, Englewood Cliffs, NJ.

Modeling Cropping Effects on Changes with Time in the Tilled Layer Structure of Cultivated Fields in Northern France.

J. Roger-Estrade[1*], H. Boizard[2], G. Richard[3]

[1] *AgroParisTech, UMR Agronomie, AgroParisTech, INRA, Université Paris-Saclay, 78850 Thiverval-Grignon, France*

[2] *INRA, UR Science du Sol, 45166 Olivet, France*

[3] *INRA, US Agro-Impact, 80203 Péronne, France*

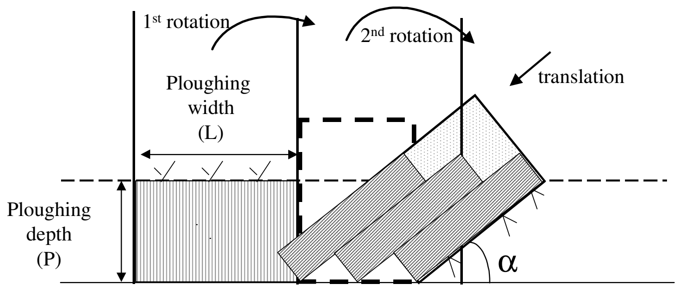
* corresponding author: jean.roger-estrade@agroparistech.fr

Introduction

An indicator of the soil structure has been proposed by Manichon (1987) to assess the effect of cropping systems on the changes in the tilled layer structure. This indicator, called **Δ**, is the percentage of zones with a massive structure and no visible macropores in the tilled layer. These **Δ** zones are either compacted zones located under the wheel tracks or clods created when these zones are fragmented during tillage or by climate action. The proportion of **Δ** volumes increases when compaction occurs, decreases by fragmentation and changes also with soil displacement (during plowing) when **Δ** clods coming from different parts of the profile are mixed. Those modifications depend, for a given texture (i) on the soil conditions (structure and moisture content) at the time of tillage, (ii) on the characteristics of the equipment used (axle load, tire characteristics, working width, speed…) and (iii) on the location of the compacted volumes in the soil profile (Richard et al., 1999). This paper presents a new approach of soil structure modeling, based on the simulation at the field scale of the time course changes of the proportion of **Δ** volumes within the tilled layer, in mechanized cropping systems, where the main factors responsible of this evolution are anthropic.

Material and method

The system modeled corresponds to a two-dimensional soil profile, the depth of which is that of the moldboard plowing. The profile width is defined by the user. The soil profile is represented in the model as a set of 1 cm x 1 cm pixels, regularly located on a square grid (1 cm). Each pixel is defined by its co-ordinates and a specific structure, **Δ** or non-**Δ**. The pixel co-ordinates are modified during plowing, for which the model calculates the lateral and vertical displacement of the soil. The structure of any individual pixel can be changed, depending on the soil condition and the kind of operation. The number of **Δ** pixels is computed by the program after each operation. As each pixel represents an area of 1 cm², the total number of **Δ** pixels corresponds exactly to the total area with a **Δ** structure in the modeled profile. The percentage of **Δ** areas is calculated as the ratio of the **Δ** pixels to the total number of pixels in that part of the plowed layer beneath the superficial tilled layer. The representation of the movement of the furrow during plowing shown in Figure 1 was used to model soil cutting and displacement. The furrow slice cut by the moldboard plow moves in a plane perpendicular to the direction of plowing as shown in Figure 1. This movement comprises two successive rotations of the furrow slice and ceases when the angle of inclination between the furrow slice and the plow pan is such that its sine is the ratio of depth to width of the tillage. The furrow slice in fact breaks during this movement. This was modeled by separating the furrow slice into smaller slices which slide downwards until they reach the plow pan. This representation allowed us to calculate the final



vertical and horizontal co-ordinates of any pixel as a function of its initial co-ordinates, the plowing depth and the plowing width.

Figure 1: Furrow movement during plowing.

A model of soil compaction (SOILFLEX) was used for predicting the width and depth of the Δ zones as a function of machinery characteristics and soil conditions at the time of traffic. The depth of the weathering process was computed from the soil moisture content evolution.

Results and discussion

The general trend of the change in the percentage of **Δ** areas with time was correctly simulated by the program and the model accurately predicted the order of magnitude of the percentages of **Δ** areas measured on a long term field trial. This model is based on a morphological description of soil structure, as it was proposed by Manichon (1987). This morphological approach has proven to be useful for studying the effect of cropping systems on soil structure and could be complementary of other approaches based on the evaluation of indicators linked only to the compaction process. The combination of this approach and image analysis has allowed us to quantify soil structure. The percentages of **Δ** areas in experimental plots showed a marked difference in soil structure dynamics, and the higher percentages were found in the plots where the risks of compaction caused by the cropping system were at a maximum. This percentage is thus sensitive to experimental treatment, which is essential for modeling changes with time in soil structure. Compaction does not, however, provide a complete interpretation of the changes in the indicator: the percentage of **Δ** areas at a given moment is the result of a balance between creation and loss of **Δ** volumes. Displacement during plowing also plays a role, bringing **Δ** clods from the bottom of the plow layer nearer to the soil surface. Concerning the action of a moldboard plow, there have been few studies on soil displacement due to this tool. We took a two-dimensional geometrical approach, although we know that there is also forward displacement during plowing.

Conclusion

The simulations agreed well with the observed trends in the changes in the percentage of **Δ** areas with time. The model we have developed can be used to study variation in structure of a loamy soil at the field scale. It can be used to compare different technical choices (e.g. occasional omission of plowing, changes in the scheduling of field operations) under the soil and weather on which it was tested.

References

Boizard H., Yoon S.W., Léonard J., Lheureux S., Cousin I., Roger-Estrade J., Richard G., 2013. *Soil Till. Res., 127, 34–44*. Doi : 10.1016/j.still.2012.04.007.

Manichon, H., 1987. Observation morphologique de l'état structural et mise en évidence d'effets de compactage des horizons travaillés. In: Monnier, G., Goss, M.J. (Eds.), *Soil Compaction and Regeneration*. Balkema, Rotterdam, pp. 39-52.

Richard G., Boizard H., Roger-Estrade J., Boiffin J., Guérif J., 1999. *Soil Till. Res.*, 51, 151-160.