ENHANCING COMPETENCIES OF CENTRAL ASIAN UNIVERSITIES IN AGRICULTURAL POLICY FOCUSED ON ENVIRONMENTAL PROTECTION AND LAND MANAGEMENT

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LAND DEGRADATION: Water Management and Improvement

by

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Content:

- Four paradigmas of water content in soil and problems connected with decrease of soil water content in the country
- Most important causes of soil water content decrease
- Results of international research on increase of water infiltration into the soil and water holding capacity increase

Paradigme 1

→ **soil** is one of the most important water reservoir in nature

it means that

→ **soil water** is significant parameter of water regime of the land

Balances for Slovakia as „*rainfeed territory*“ is estimated as follows:

total rainfall: 33 billions of cubic meters per year

from that: 11 bill. infiltrated into the soil and kept by soil cover

11 bill. evaporated to air

11 bill. lost from territory (rivers,ground waters)

Paradigme 2

more soil and better soil quality

means

higher content of water collected in the country and opposite

Paradigme 3

***wat*er which is not infiltrated into the soil is**

threats of drought and/or floods !!!

Paradigme 4

fighting for water saving in soil is fundamental principle of water management theory and practice (EU Water Framework Directive,2000)

But problems are:

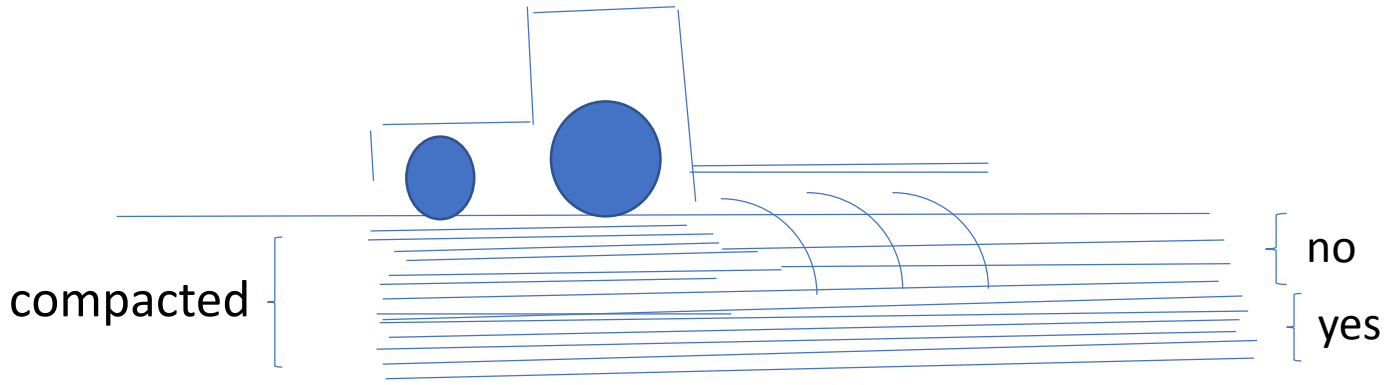
1. Decrease of total soil areas by soil sealing. Those areas are no able for water infiltration and water keeping inside of own soil body
2. No correct agricultural practices:
   - over drenage: in Slovakia almost 20 % of agricultural soils are drained, lower of soil water, decrease of soil organic matter on half level during 10-15 years (Novak-Zlatuskova,2000)
   - physical degradation of soil: decrease of humus content in soil
     soil structure degradation
     no correct plants rotation
     overgrazing

3. But soil compaction mostly

Soil compaction is the process of soil densification when air and water are displaced from the pores between the solid part of the soil and soil bulk densities are increased (over 1.5 g per 1 cubic centimeter of soil - Slovakian limit).

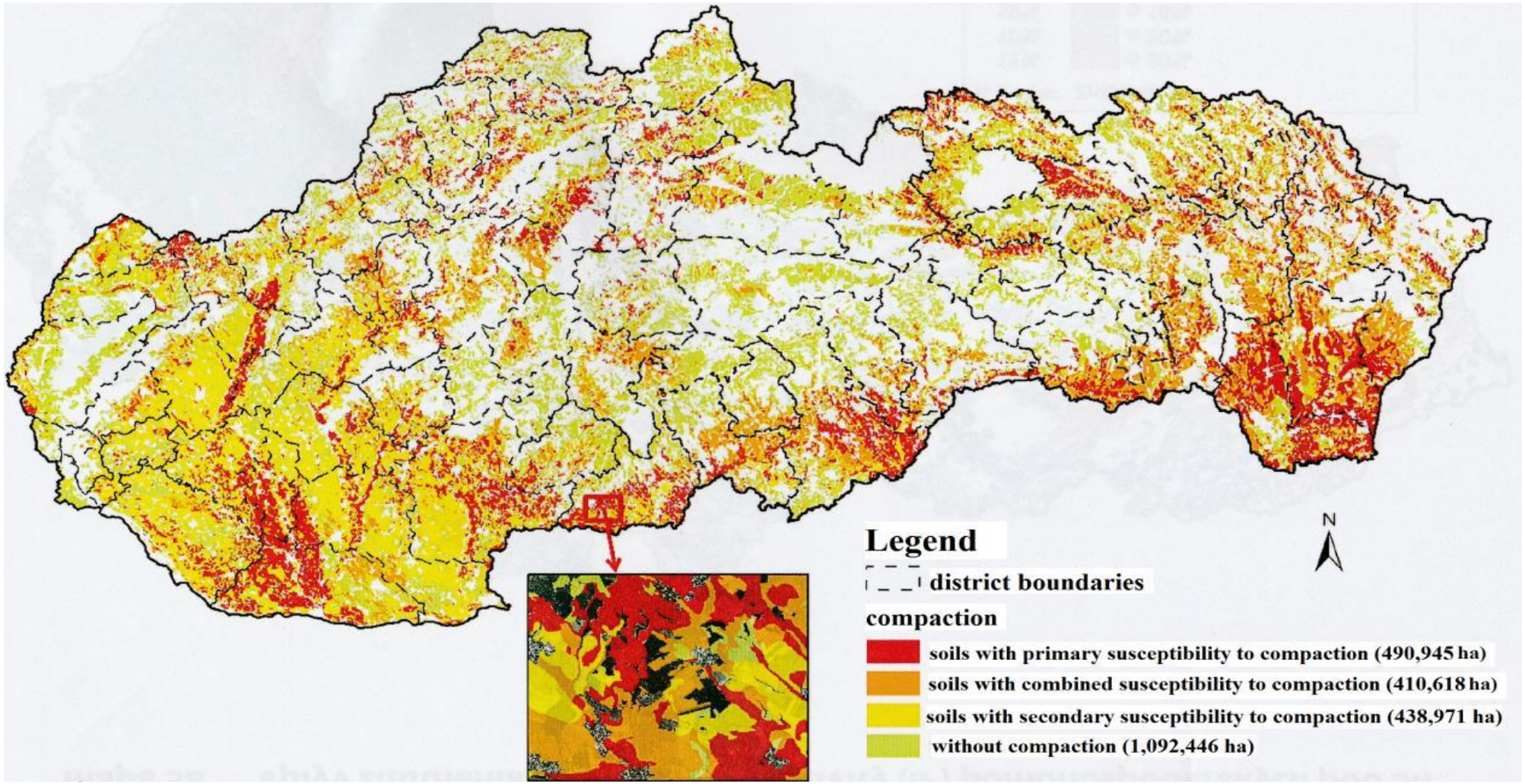
Soil compaction is results of heavy machine use mainly. Compacted is subsoil layer of soil usualy. Why is it?

Because of:

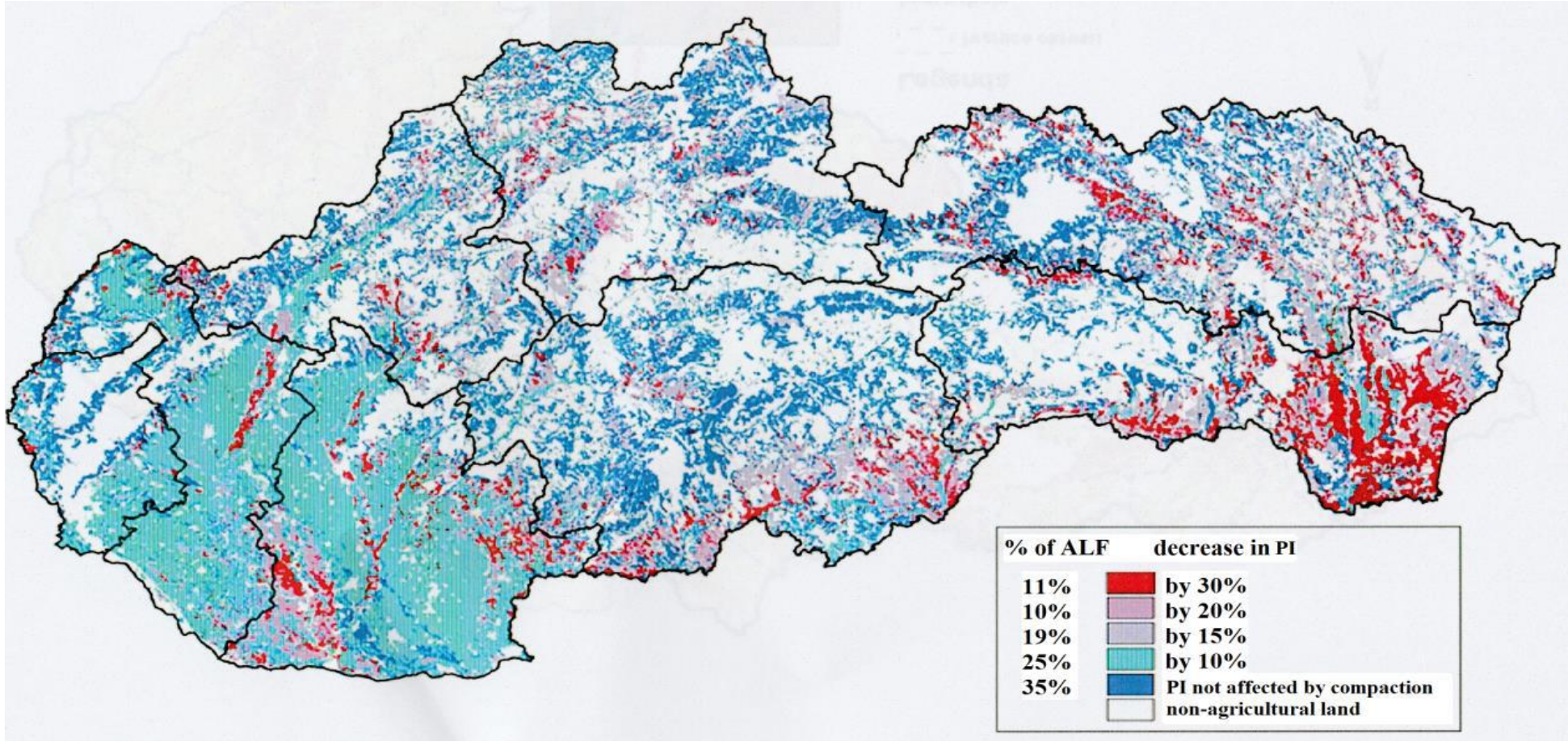


Potentials of pedocompaction in agricultural soils of Slovakia

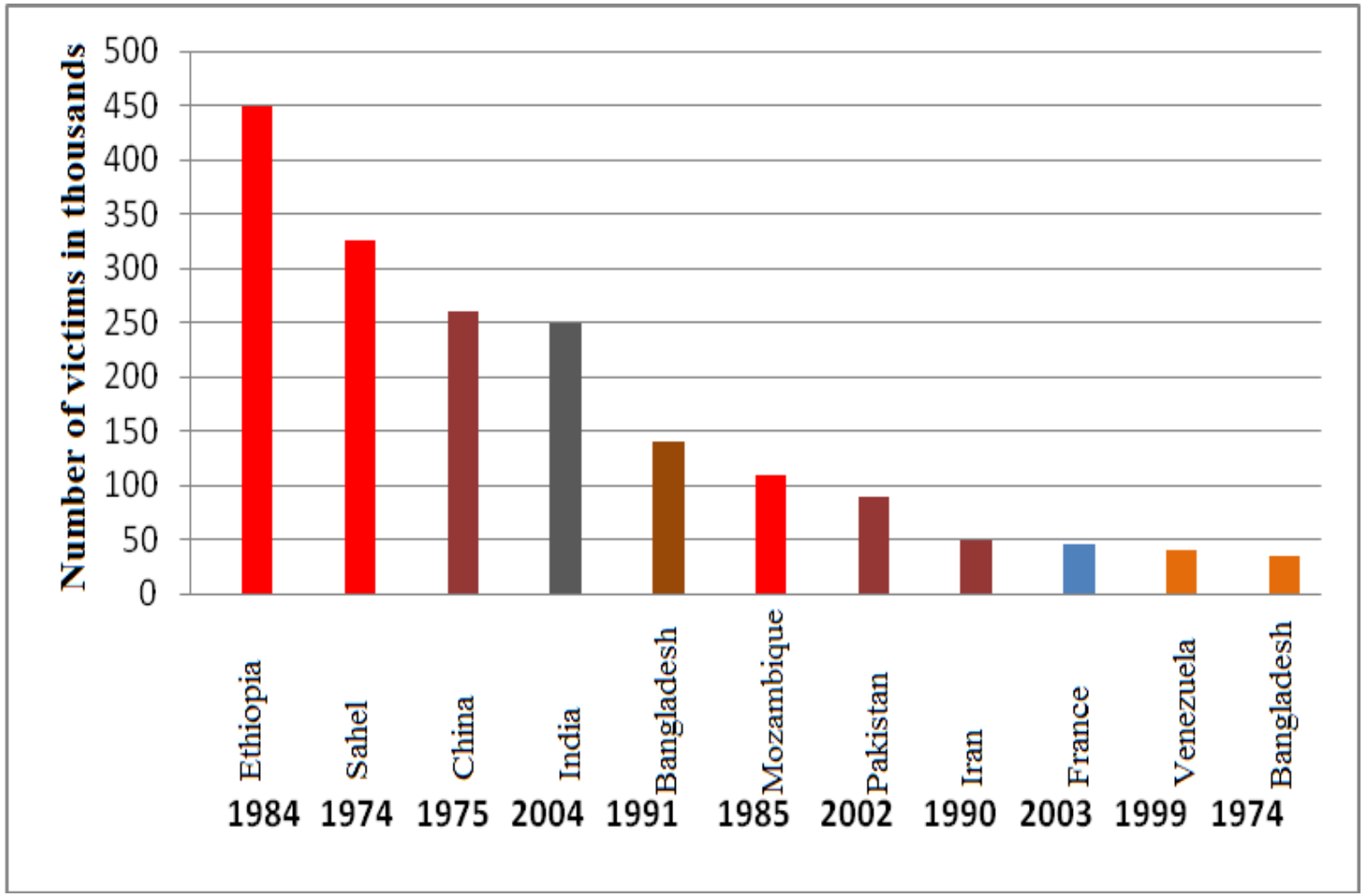
About 1.3 mill. ha are potentialy compacted, but aproved are 800 th.ha - it lead to total decrease of water retention capacity of Slovakian land for about 100 mill. cubic meters of water



Impact of soil compaction on production potential expressed by the production index



Top 11 worst natural disasters in the world during of period 1974-2004



Source: United Nations, 2008

Drought, earthquake, tsunami, cyclone, heat waves, floods

5 disasters are drought and floods and about 5 mill. people death

What to do against it?

we can not affect intensities of rainfall

but

capacities for water saving we are capable to increase

How to do it?

1. Water reservoirs (artificial lakes) built up (not sufficient enough and expensive)
2. Implementation of higher water infiltration and water saving measures by agricultural practices - good measures because of its possibility for large scale use (e.g. reduced tillage,no-till,deeper-till,mulch-till,strip-till,ridge-till,organic farming,subsoiling)

Results of field experiments

To receive concrete results, during of 2013-2015 field experiments have been set up in Slovakia, Czech Republic, Slovenia and Poland

where have been verified several tillage practices to understand

how it influence

on water infiltration and water holding capacity of soil.

It was carried out under international research project supported by Global Water Partnership (Stockholm).

Reference:

Bielek,P.(SK)-Hladík,J.(CZ)-Mihelič,R.(SI)-Kedziora,A.(PL). Drought management by agricultural practices and measures increasing soil water holding capacity. GWP Stockholm,2015,43pp. (internal project document of GWP)

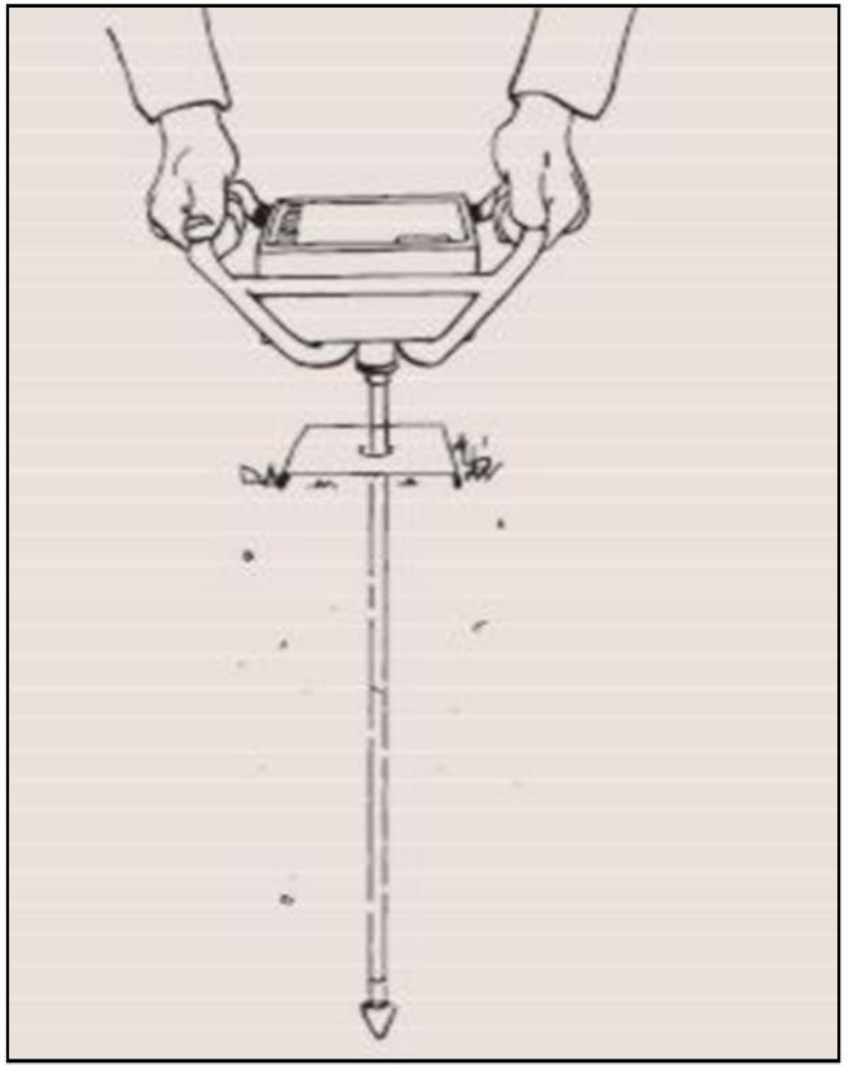
Examples of machines use in experiments

Machine for subsoiling

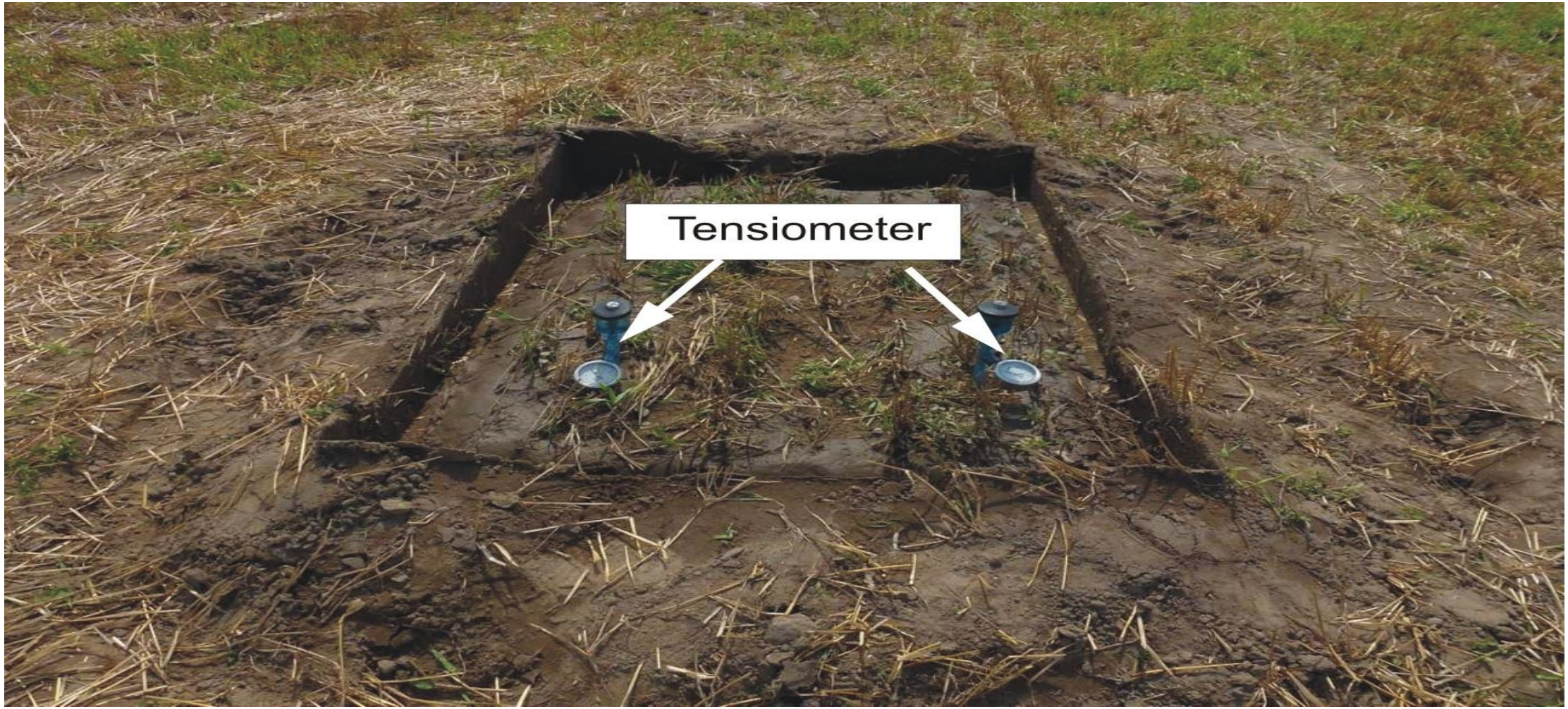
A key machine for the
Composting tillage

Infiltrometers

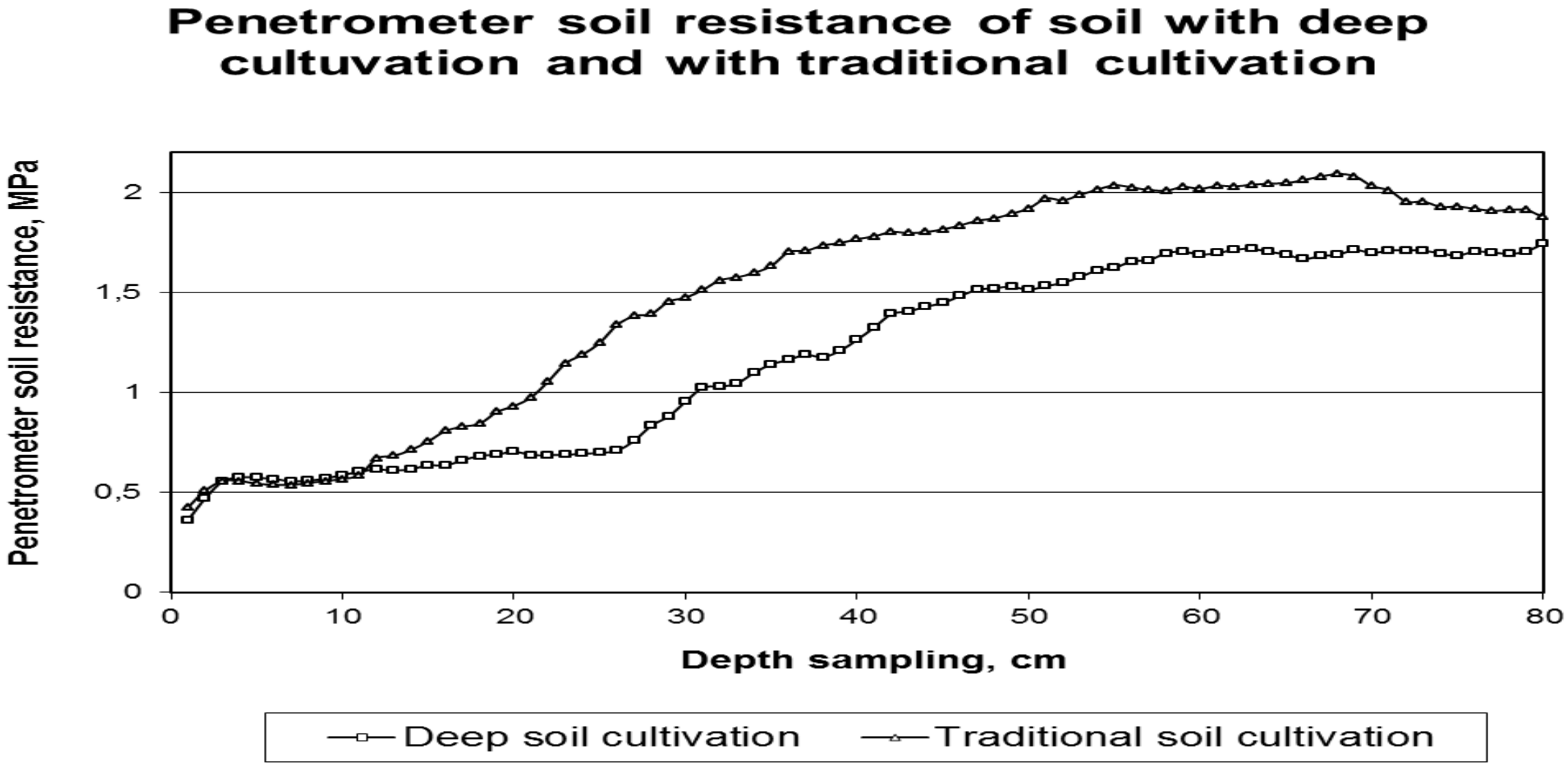
Methods of soil density observations - penetrometric study



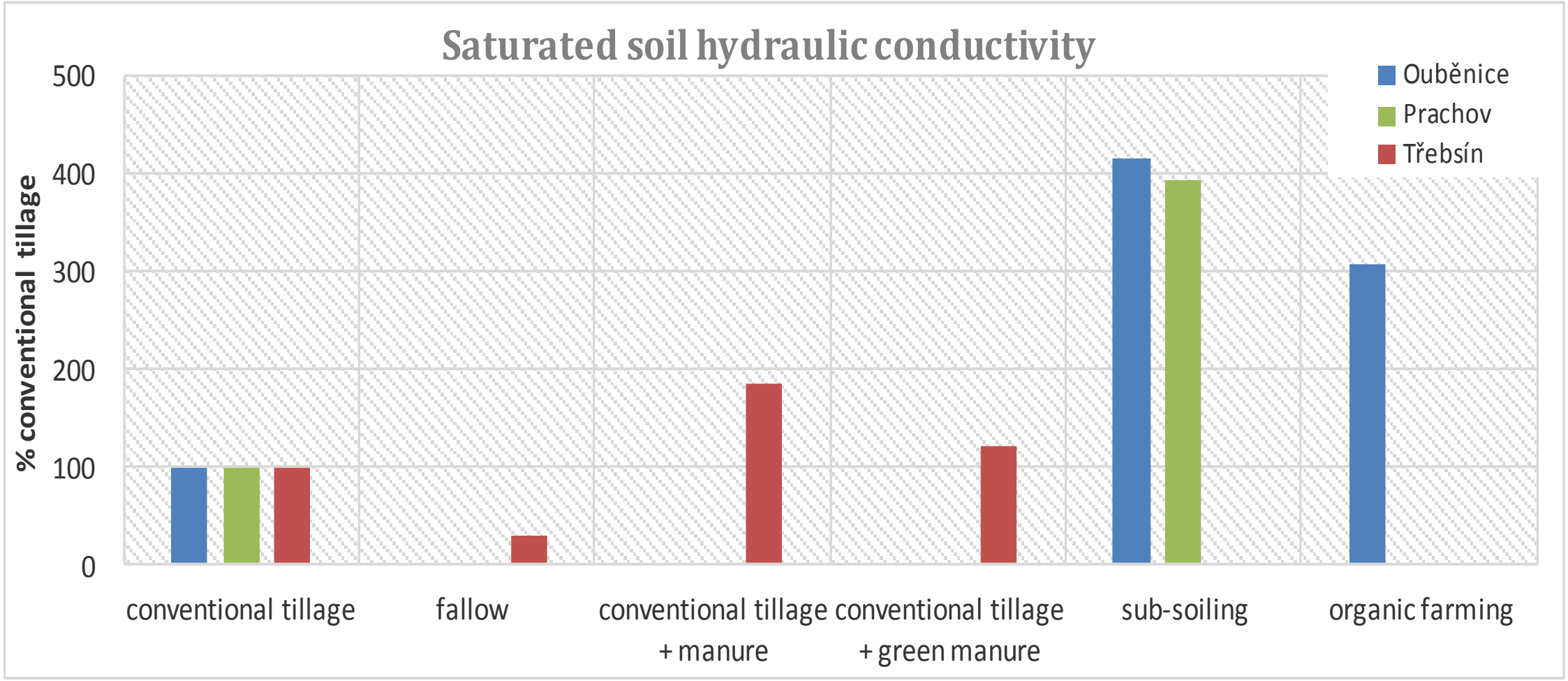
Tensiometric study (permanent water content study)



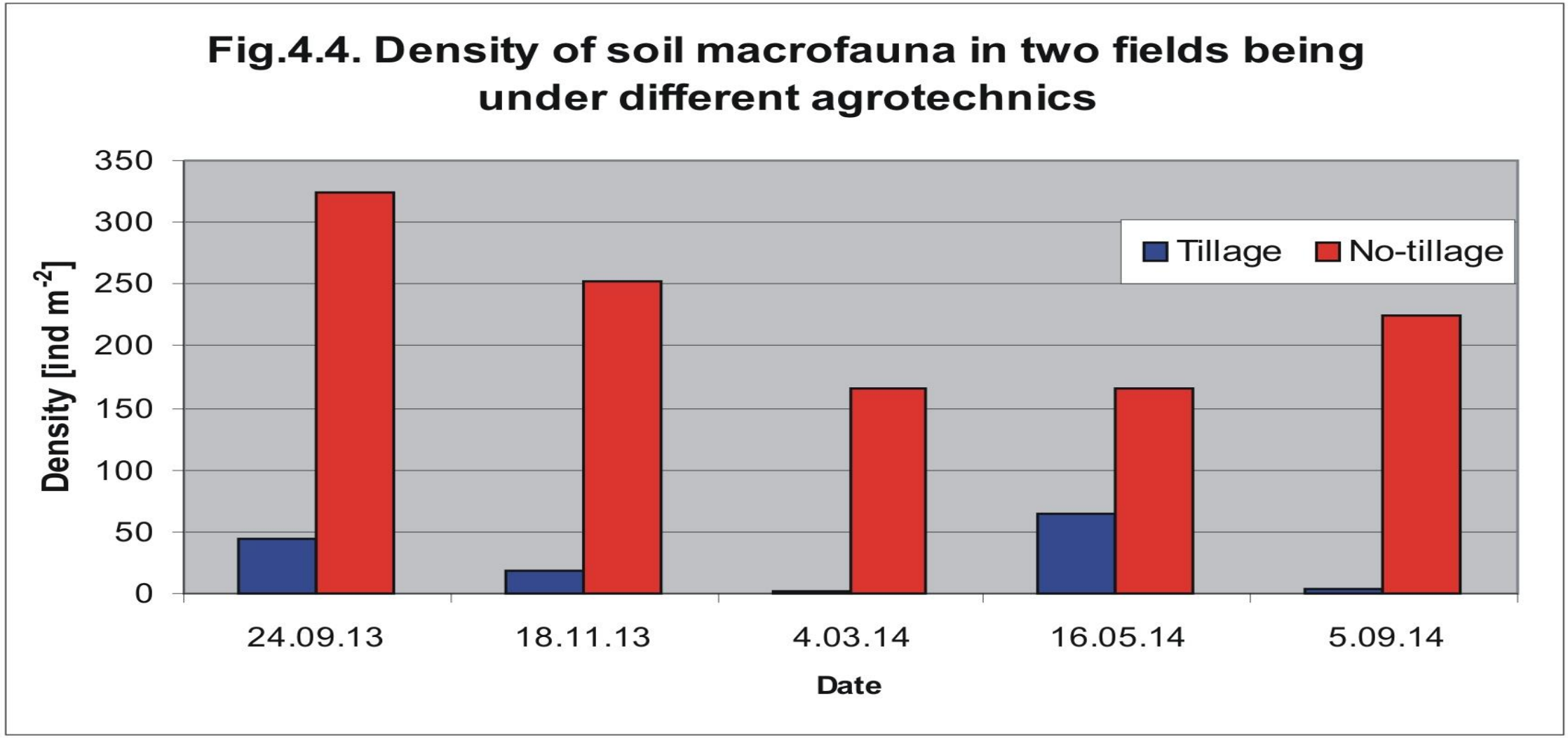
Example of penetrometric results (SK)



SHC differencies as water infiltration potentials (CZ)



Specific macrofauna research (individuals per m^2) (PL)



Yields (Maize) diferences between no-subsoiled and subsoiled soils (SK) (green plants in August,2014), Luvisols, Kolíňany

no-subsoiled (8.28 t grain/ha,finaly)

subsoiled (9.25 t grain/ha,finaly)

Main conclussions to the theme

- Subsoiling and deep tillage decreased resistance of soil profile against root and water penetration into the soil profile (penetrometric study)
- Water infiltration into the soil and water holding capacities of soil profile have been increased in follow order (infiltration experiments):

subsoiling > manure and green manure applications >

mulch tillage > no till farming

Farming methods increasing of water infiltration into the soil and water holding capacity of soil - can be recomended as protection against drought, against floods, for higher yields, against land degradation and as important measures for water management improvement of land.

Measures focused on soil water holding capacity increase as advanced agricultural technologies are still not using or not sufficiently using, because lack of knowledge and low support by agricultural policies mainly.

If you do what you always did,

you will get what you always got.

Henry Ford

Thank you for your attention!

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