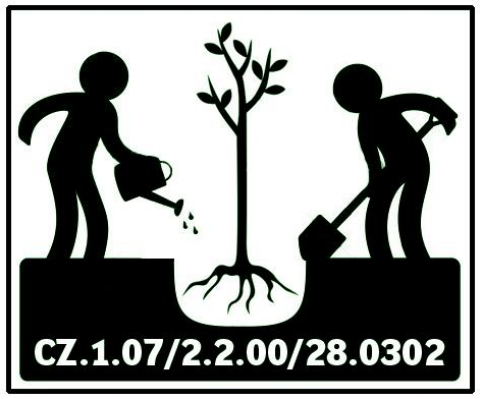
INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ



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Adaptable soil tillage

Mendel University in Brno

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Introduction

Crop production, soil tillage in Hungary
Szent István University, Faculty of Agricultural and Environmental Sciences

Adaptable soil tillage

- Importance of soil quality
- Adaptable soil tillage systems
- Climate scenarios – solutions by soil tillage

Total area: **9,303,000 ha**
Agricultural land: 6,400,000 ha
Cultivated land:
4,300,000 ha

Main crops:

Maize: 1,200,000 ha
W. wheat: 1,100,000 ha
Sunflower: 570-615,000
W. oilseed rape: 220-270,000 ha

Yields (t/ha):

Maize: 4.0-6.5
W. Wheat: 3.6-5.2
Sunflower: 2.0-2.7
W. o. rape: 2.1-2.7

Soil tillage:

Carbon and water conservation: 50 % of cultivated area
Partially conservation: 25-30 % of cultivated area
Conventional (sometimes soil deteriorating): 20-25 % of cultiv. area

Szent István University (SZIU), one of Hungary's most prominent institutions of higher education, consists of 7 different faculties for study and research hosting ~ 16,000 students

Szent István University

Within the seven faculties degree programs are offered in a wide variety of subjects ranging from natural sciences, engineering and veterinary medicine to business, economics, social sciences, health sciences and pedagogy. Programmes are available at every level from vocational training to PhD and beyond.
SZIU understands the importance of internationalization and promotes a variety of international activities.
Website: http://www.sziu.hu

Faculties

Faculty of Agriculture and Environmental Sciences (Gödöllő)
http://www.mkk.szie.hu/en
Faculty of Applied Arts and Pedagogy (Szarvas, Jászberény)
Faculty of Economics, Agriculture and Health Studies (Békéscsaba, Szarvas, Gyula)
Faculty of Mechanical Engineering (Gödöllő)
Faculty of Economics and Social Sciences (Gödöllő)
Faculty of Veterinary Science (Budapest)
Ybl Miklós Faculty of Architecture and Civil Engineering (Budapest)

Wonderful site

Faculty of Agricultural and Environmental Sciences

has been undertaken agricultural innovation, modernization, training many in each successive generation of farmers, researchers and environmental engineers to meet the current agricultural challenges with the most up-to-date technology and knowledge.

From 1996 new programs were started e.g. sustainability in modern agriculture, environment and wildlife management, aquaculture, ecological farming, environmental engineering, biotechnology, eco-toxicology, energy plant production, climate threat mitigation...

At present, there are **eight BSc, eleven MSc programs, and four PhD schools**, in addition to a variety of short courses and post-graduate specializations. Many of the courses are available in English language….students come to us from around the world to take part in academic exchange and full degree awarding programs at the BSc, MSc and PhD levels.

The **Faculty of Agricultural and Environmental Sciences**, Szent István University Gödöllő, with legal offices in **Gödöllő, Páter Károly utca 1**, represented by its Dean, Ass. Prof. Csaba Gyuricza, PhD.

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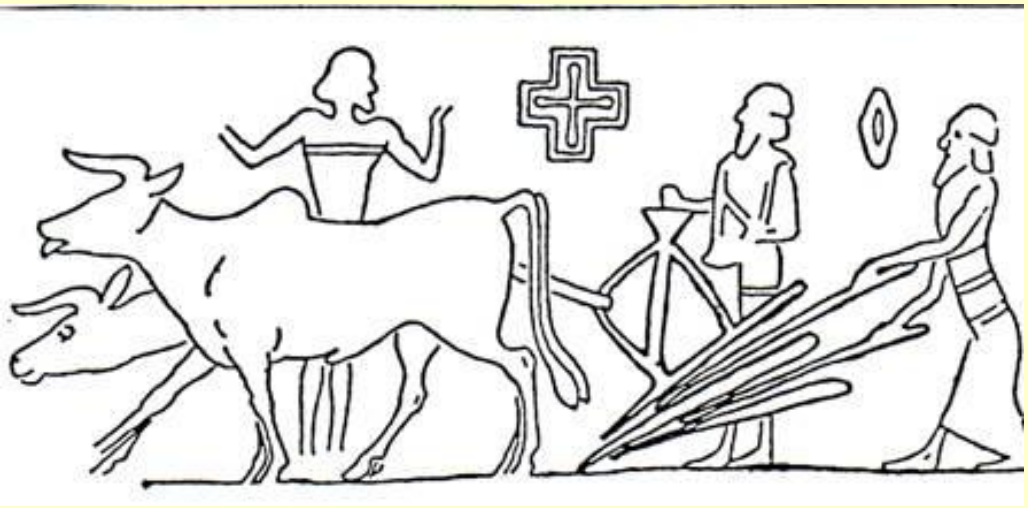
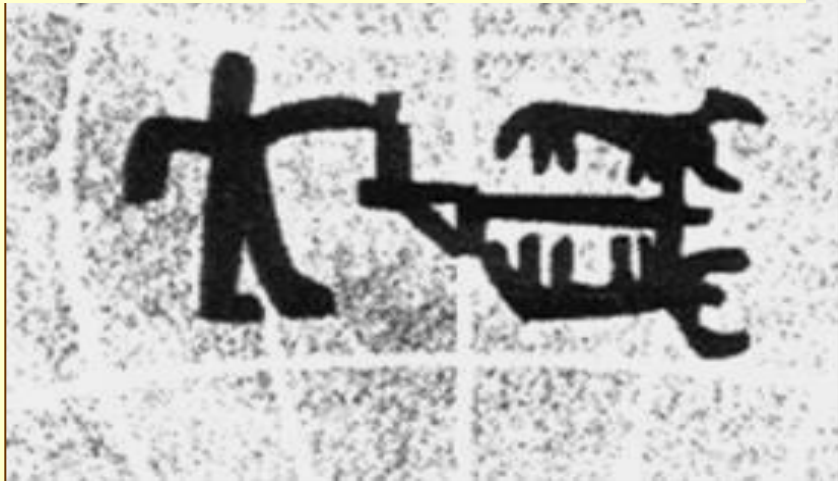
First ploughs were really loosening tools

Ploughing, sowing (Egypt, B.C. ~1300)



Plough-Planter from Babylon
(1300, B.C.)

Plough figure from Bohuslän (1000, B.C.) (logo for International Soil Tillage Research Organization)



Legendary sayings

“Nothing causes as much damage as does neglected arable land (…) Nothing is less expensive than the best possible tillage” PLINIUS Secundus, 23-79 A.D.

„the ploughman should frequently check the field not only by taking a look, which may mislead him as earth crumbles on hidden compacted shelves, but also (…) by poking a measuring stick through ploughed soil (…) and when the stick hits a harder pan it shows that the fallow has not been broken (…) For if you cultivate land in patches you will not be able to make do with it throughout the year and that land will not be good for sowing”
COLUMELLA, 1st Century A.D.

Aims of soil tillage

Crop demand

= *plant-focused* tillage (to ~1975)

Soil quality improvement

= *soil-focused* tillage (1975-2000)

Reduce climate threats

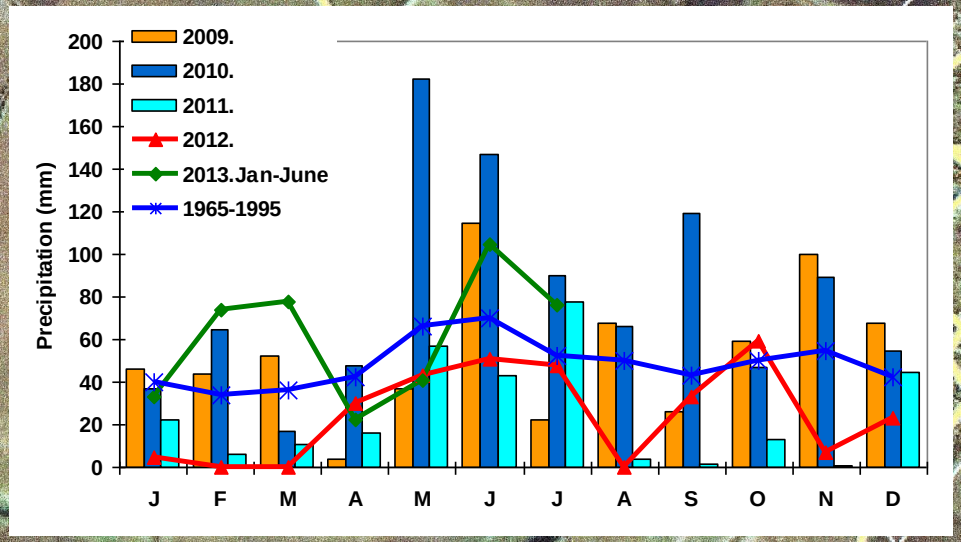
= *climate-focused* tillage (2000-)

Background: research results

(33 exp. variants, 39 years,
~ 1000 site monitoring
(H, HR, SK, SLO, SRB)

Nowadays growing
need for adopting a *climate-focused* tillage,
since losses caused by climate can be alleviated **by conserving / improving the quality of the soil**

Places of experiments and soil monitoring (Hatvan-Józsefmajor)



F-14

X

F-13

Józsefmajor

X

X

F-11

X

F-12

F-10

X: fields of stubble trials

Multiyear ave: 580 mm
2010: 962 mm
2011: 297 mm
2012: 294 mm
2013: 1-6: 388 mm
1-12: 572 mm

Soil quality factors improving tillage

Tillage's direct impacts on soil state

1. looseness of the root zone
2. duration of looseness (!)
3. depth of the loosened layer
4. occurrence of compacted layer
5. thickness of compacted layer
6. agronomical structure
7. surface form
8. surface cover

Tillage's indirect impacts on soil state

1. Water transport (intake, storing, loss)
2. CO_2 release (flux) from disturbed soil
3. C loss from soil
4. biological state
5. mellowing
6. decomposition
7. earthworm activity

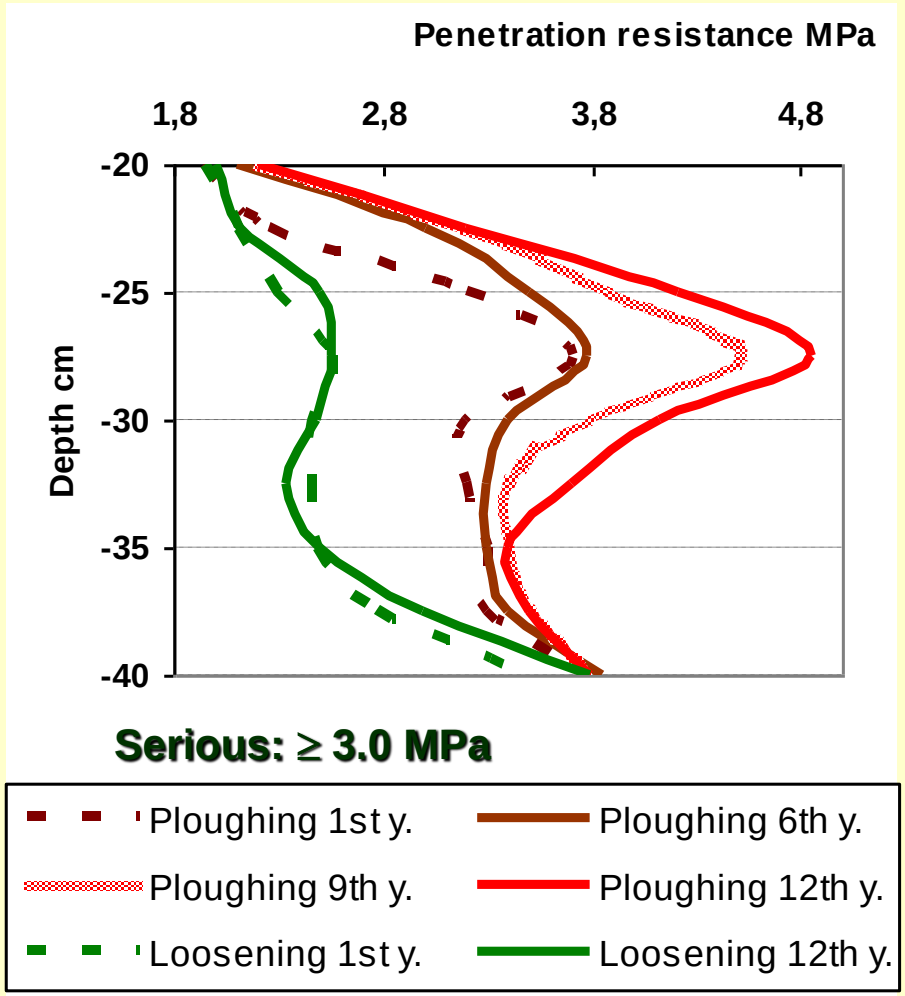
Soil quality factors affecting tillage

Directly	Measurable parameter/state	Indirectly
Looseness	Bulk density (t m^{-3}), total porosity %, penetration resistance (MPa)	CO_2 flux, C/OM developing or loss, aerobe/anaerobe biological processes, Stubble residue decomposition
Compaction in root zone		
Extension of compacted layer	Thickness (mm)	
Depth of loosened layer	Depth of rooting (mm), root formation / deformation	Water intake capacity
(chance of water infiltration)	w/w %, v/v %, g g^{-1}	Water content, Water balance (ratio of retention/conservation and loss)
Agronomical structure	Ratio of crumb (0.25-10 mm), dust (<0.25 mm), and clod (> 10 mm)	Biological mellowing
Surface form	Difference from optimal, % ±	Even/smooth, rough, wavy etc.
Surface cover	Cover (%), mass (t/ha)	Earthworm number and activity

Tillage's direct impacts on the soil

looseness of the root zone

describing by bulk density, pore volume, penetration resistance…



Influencing factors: a) tillage depth, b) depth of tillage earlier, c) tool effect, d) soil water content, e) soil characters

Pan-compaction extension