Effects of minimal tillage and other operations on the soil

Eng. Agr. Marçal Elizandro Dornelles

Summary

1. **Effects of minimal tillage on the soil;**

2. **Influence of other implements on the soil;**

   Disk plow
   Moldboard
   Disks

1. Minimal tillage

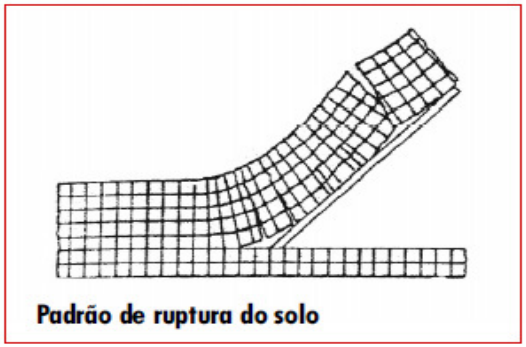
The chisel ploughing or minimal cultivation…

Allows disruption of compressed layers, reduction of soil density and mechanical resistance (Taylor & Beltrame,1980) and increasing of macropores (Abreu et al, 2004);

It promotes lower soil motion and reduced mulching incorporation than other tillages (Ortiz-Canavate, & Hernanz, 1989);

It doesn`t deep compressed layers besides the operation depth like happen with disking or traditional ploughing (Lanças, 2002);

It results in disruption of soil breaking lines and not in an unorganized cutting process like in disking or moldboard ploughing (Lanças, 2002);



Lanças, 2002

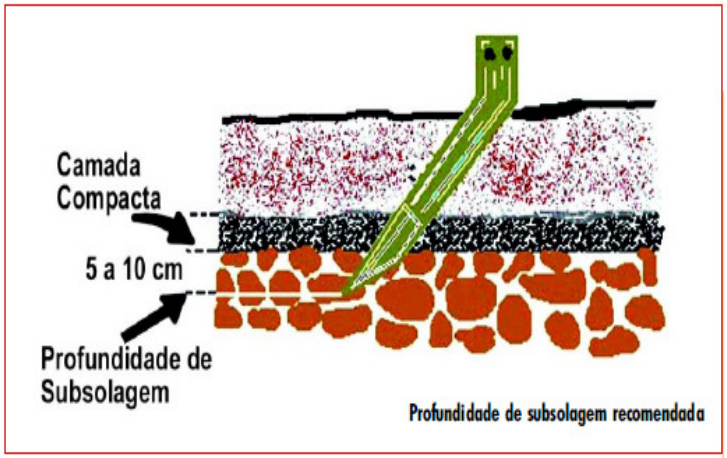
1. Minimal tillage

Subsoiler or chisel plough ?

	Subsoiler	Chisel plough
Operation depth (cm)	More than 40	Up to 35
Number of blades	Up to 7	Usually 5 or more blades
Width between rod (cm)	More than 50	Up to 50
Action on soil	Disruption of subsurfacing layers	Disruption of surfacing layers and soil motion

Subsoiling means operation for more than 40cm depth using implements up to 7 blades and resulting in lower ground motion than chisel ploughing.

Chisel plough more important to handle surfacing compressed layers.



Source: Lanças, 2002

1. Minimal tillage

Evolution

Chisel plough to hitch by pull bar

of tractors

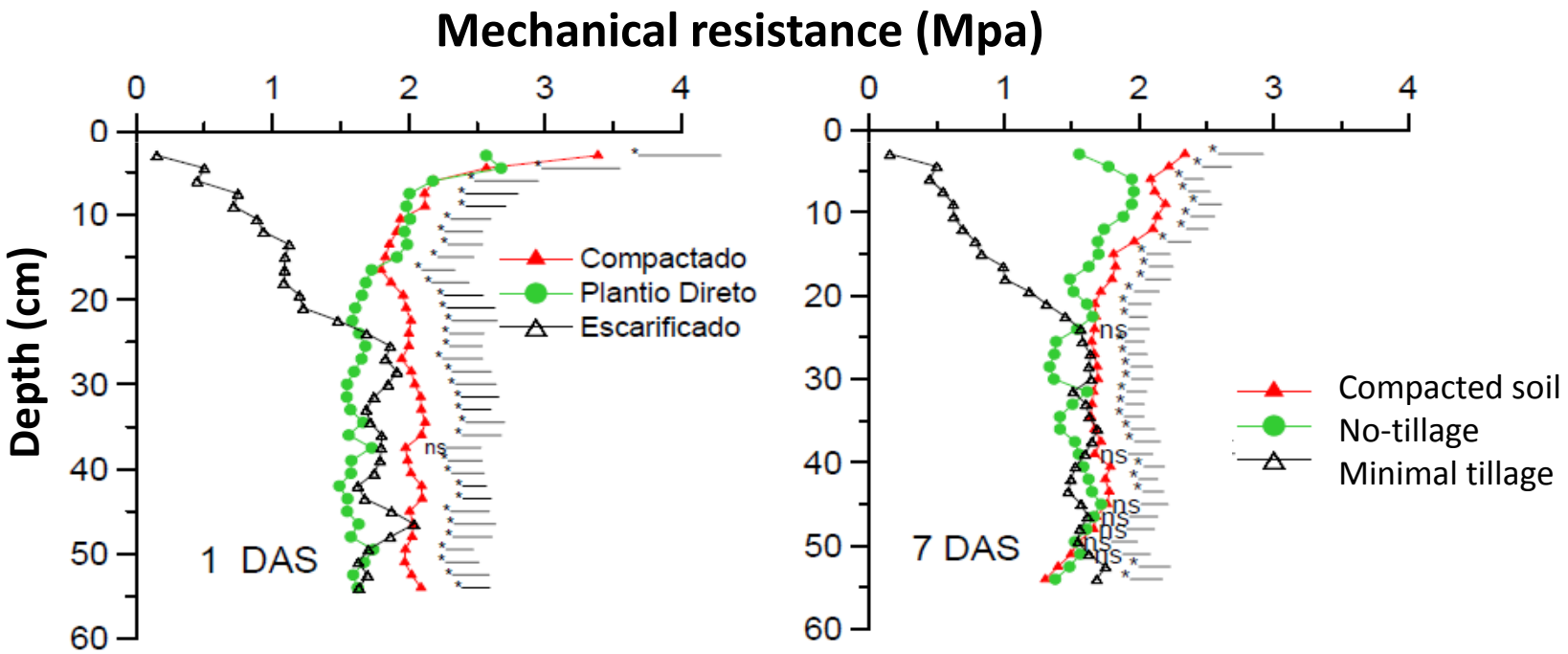
Chisel plough to hitch by 3 points of tractors

Subsoiler with

frame vibration

1. Minimal tillage

The minimal tillage have reduced the negatives effects of compaction reducing the mechanical resistance till 25 cm. (Kaiser et al., 2004).



DAS = Days after seeding

1. Minimal tillage

Interaction soil-implement

Implement features:

Operation depth; angle between the rod and soil and rod width (b);

Soil conditions

Density, friction internal angle and cohesion

Soil – implement interaction

Adhesion between soil and blade (and rod) and friction internal angle

Tabela 2. Área Mobilizada e Empolamento ocasionados pela haste escarificadora nos tratamentos estudados.

Tratamento	Área Mobilizada (cm^2)	Empolamento (cm^2)
Semeadura Direta	176,709	84,959
Compactação Adicional	117,879	38,505

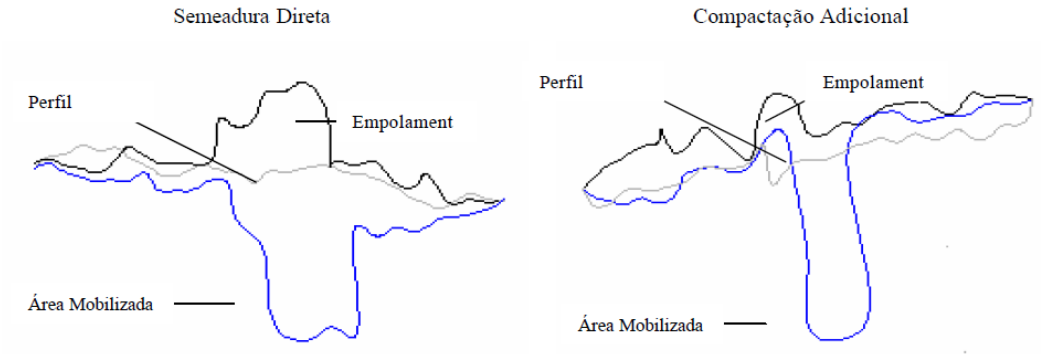
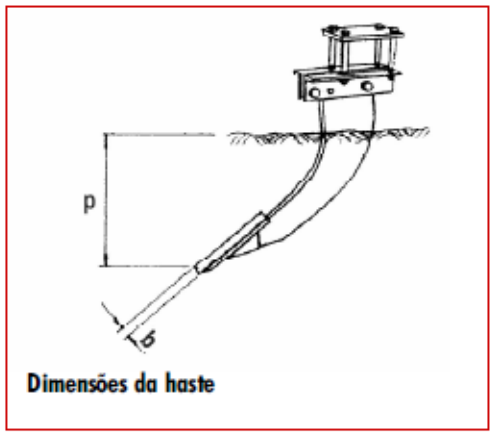


Figura 3. Detalhes da Área Mobilizada, Empolamento e Perfil Natural dos tratamentos estudados.

Rosa et al., 2008.



Lanças, 2002

1. Minimal tillage

Water availability and infiltration

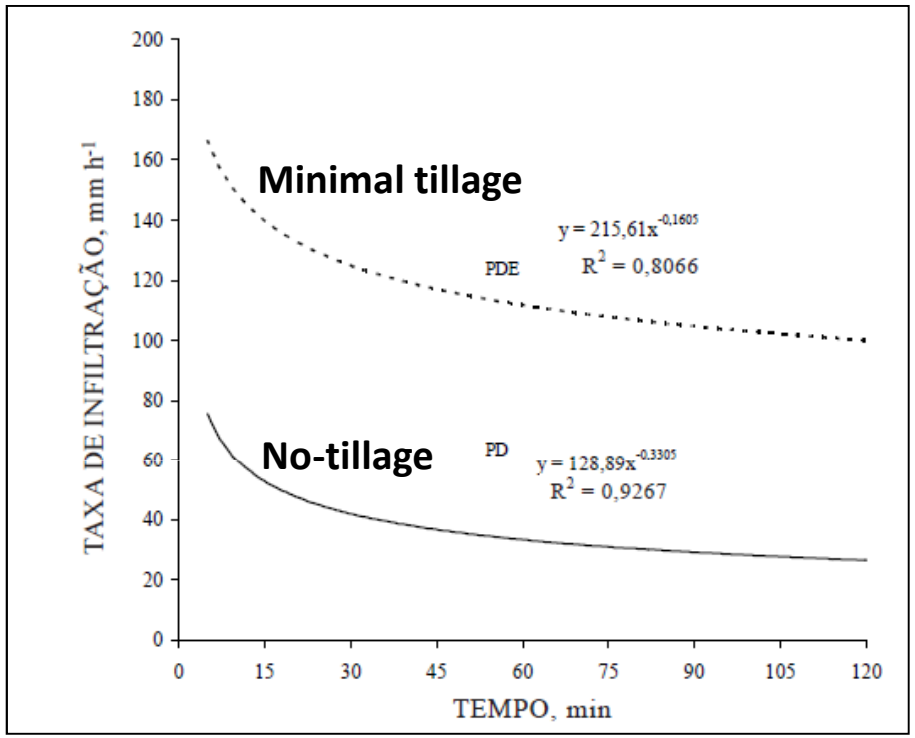


Figure: Infiltration rate 12 months after tillage.
Source: Camara & Klein, 2005

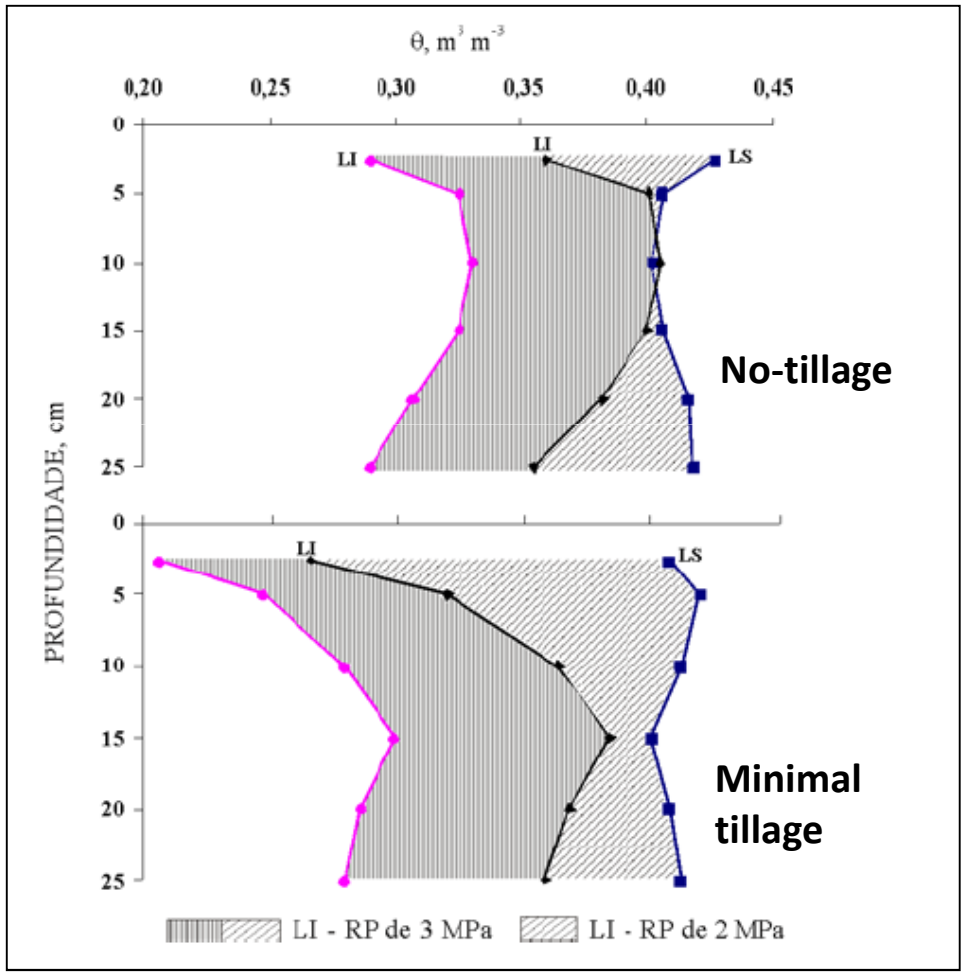


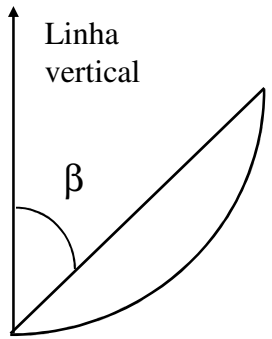
Figure: IHO distribution through soil depth
Source: Klein & Camara, 2007

2. Other operations and implements

Disk plow

For hard surface or dry soil conditions is recommended a smaller vertical angle (~15) (Pinto, 2011);

Vertical angle



Vertical angle determines operation depth

Source: Tatu & Marchesan

2. Other operations and implements

Moldboards

Used to incorporation of crop residues, snow…

This kind of implement design doesn`t respect breaking lines of soil

Using of moldboards results in a bigger operation depth than disk plows;

Source: Tatu & Marchesan

2. Other operations and implements

Desintegration of the soil

Disks

- Leveeling / coverage of seeds
  Weight up to 50kg/disk

- Leveling / desintegration of soil
  Weight up to 50kg/disk

Source: Baldan

- Harrow disks
  Weight over to 50kg/disk

Source: Tatu & Marchesan

Obrigado

References

ABREU, I.N.; PORTO, A.L.M., MARSAIOLI, A.J.; MAZZAFERA, P. 2004. Distribution of bioactive substances from *Hypericum brasiliense* during plant growth. Plant Science, 167: 949-954.

CAMARA, R.K. & KLEIN, V.A. Escarificação em plantio direto como técnica de conservação do solo e da água. ***R. Bras. Ci. Solo***, 29:789-796, 2005.

KAISER, D.R.; COLLARES, G.L.; REINERT, D.J.; REICHERT, J.M.; SANTI, G.R.; KUNZ, M. Impacto do tráfego de máquinas e da escarificação nas propriedades físicas do solo em plantio direto de feijoeiro. Anais...XV Reunião Brasileira de Manejo e Conservação de Solo e Água. Santa Maria, 2004.

KLEIN, V.A. & CAMARA, R.K. Rendimento da soja e intervalo hídrico ótimo em latossolo vermelho sob plantio direto escarificado. ***R. Bras. Ci. Solo****,* 31:221-227, 2007.

LANÇAS, K.P. Subsolagem ou escarificação. ***Cultivar Maquinas****, set/out*., p.34-37. 2002.

ORTIZ-CAÑAVATE, J. & HERNANZ, J.L. **Técnica de la mecanización agrária. Madrid, Ediciones Mundi-Prensa, 1989, 643p.**

PINTO, F. de A.C. Cultivo mecânico. Diapositivo color. CD-Rom.

ROSA, D.P. da. Comportamento dinâmico e mecânico do solo sob níveis diferenciados de escarificação e compactação. Dissertação de Mestrado (Programa de Pós-graduação de Engenharia Agrícola). Santa Maria, 2007. 122f.

TAYLOR, J.C.; BELTRAME, L.F.S. Por que, quando e como utilizar a subsolagem. Lavoura Arrozeira, Porto Alegre, v.33, n.320, p.34-44, maio/junho 1980.