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# Center for Smart Agriculture

## Organic Farming



**Module 2: Soil cultivation and tillage operation**

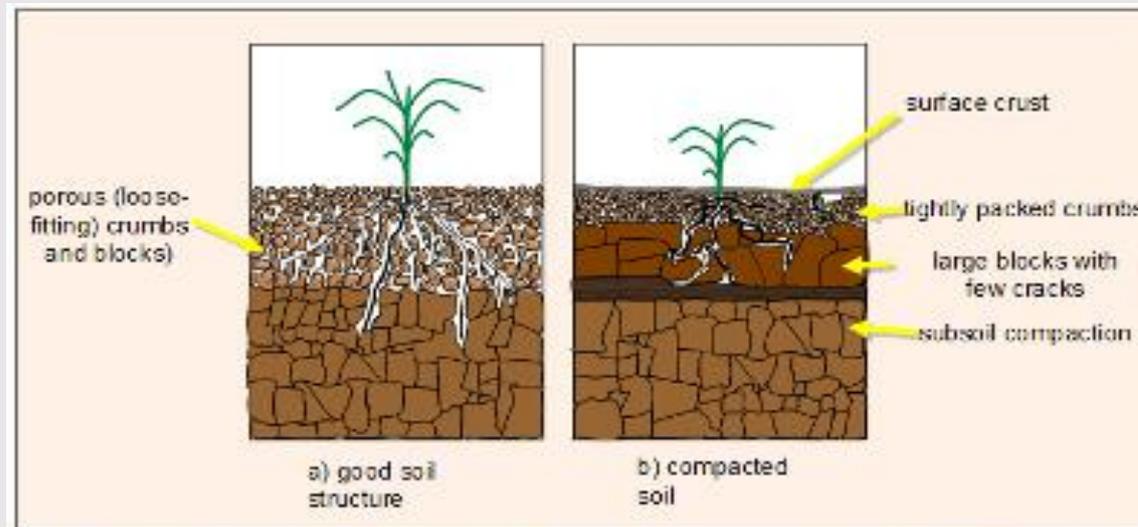
**Session 2: Soil compaction**



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**Soil compaction:** If soils are cultivated in wet conditions or burdened with heavy machinery, there is a risk of soil compaction which results in suppressed root growth, Reduced aeration and water logging

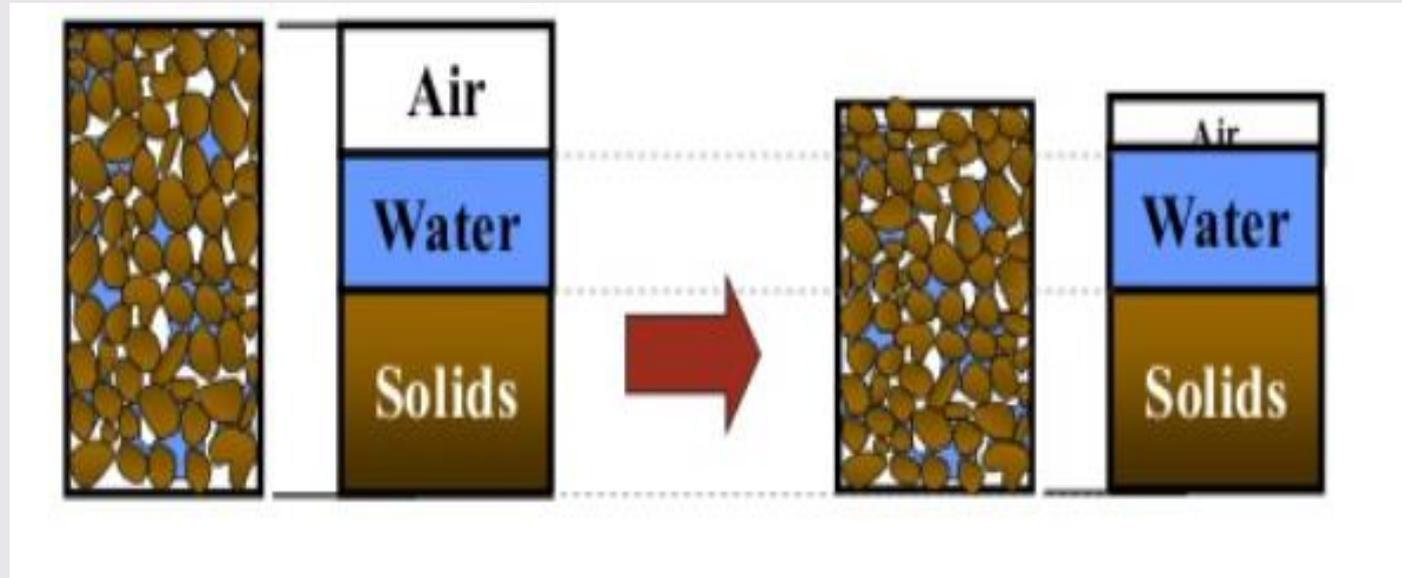




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Soil compaction occurs when soil particles are pressed together, reducing pore space between them.



Loose Soil

Compacted Soil



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## CAUSES OF SOIL COMPACTION

- Soil compaction can occur naturally by the drying and wetting process called soil consolidation or when external pressure is applied to the soil.
- The most relevant human-induced causes of soil compaction in agriculture are the use of heavy machineries, tillage practice itself, inappropriate choice of tillage systems, as well as livestock trampling.
- Use of large and heavy machineries for agriculture often causes not only topsoil but subsoil compaction.
- Inflation pressure of wheels and tyres also plays an important role for the degree of soil compaction.



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- Whether heavy machinery is in use or not, tillage practice itself can cause soil compaction.
- The tillage activity could reduce topsoil compaction compared to no tillage activity in the long term.
- Significant livestock trampling resulting from livestock farming on meadows and agricultural land is also viewed major cause of soil compaction.



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# EFFECT OF COMPACTION

## Roots impeded

Soil compaction results in root growth being restricted and affects mechanical resistance to root development in two ways:

1. Compaction decreases the number and size of large pores, macropores. As a result, there are fewer pores with diameter larger than roots in which the roots can grow freely, without mechanical resistance
2. Compaction increases the mechanical resistance of the soil through pressing soil particles more closely together



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## **Water transport restricted**

1. Soil compaction also restricts the movement of water down through the soil. This causes water saturation in the upper layers, which leads to oxygen deficiency for the roots.

2. In addition, soil aeration status affects the availability of various plant nutrients, e.g. nitrogen and manganese. Under anaerobic conditions, denitrification can lead to severe loss of nitrogen in the form of nitrogen oxide or nitrogen gas to the atmosphere. Soil compaction can thereby decrease nitrogen availability in the soil.



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## POSSIBLE REMEDIAL MEASURES

- To avoid soil compaction, it is important to employ remedial measures that can contribute to better soil structure in the long term.
- Such measures include drainage, structure liming, keeping the soil covered with vegetation and supplying external organic material.
- Cropping system and soil tillage are also critical for soil compaction. The most important consideration is to avoid tillage when the soil is too wet.
- Having a large contact area with the help of broad tyres or dual wheels results in a lower wheel load.



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**Where soil compaction is a potential problem, farmers should be aware of the following aspects:**

- The risk of soil compaction is highest when the soil structure is disturbed in wet conditions.
- Do not drive vehicles on your land soon after rains
- Ploughing of wet soils can lead to a smearing of the plough sole
- Soils rich in sand are less prone to soil compaction than soils rich in clay
- High content of soil organic matter reduce the risk of soil compaction
- It is very difficult to restore a good soil structure once soil compaction took place



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**THANK YOU**