Prevention of soil compaction is best achieved through the implementation of the four key principles and practices of conservation agriculture:

- **Reduced or zero tillage**
- **Controlled traffic**
- **Permanent soil cover**
- **Rotations and cover crops**

**Permanent soil cover and rotations and cover crops**

These two principles of conservation agriculture reduce compaction levels by:

- enhancing biological activity;
- increasing organic matter levels: this maximizes the aggregation of soil particles and consequently increases soil stability. Organic matter content is essential for optimized soil architecture.

In addition, rotation crops provide a variety of root types and patterns in the soil that break up compacted layers and create a network of root channels.

The power of the system comes from the **SYNERGY** of the above four principles of conservation agriculture. However, the system is not prescriptive and there is no one recipe to suit all conditions. It is important that individuals find a system that works for them on their land using available equipment and expertise.

**Conservation agriculture optimizes soil structure for reduced-cost, sustainable cropping systems that maximize the use of rainfall and irrigation water for improved and more guaranteed productivity. The overall outcome is the more productive soil system that obtains the best from even a ‘poor’ soil because of the enhanced soil water store and deep rooting system in an uncompacted, biologically diverse and organic-matter-rich soil.**

For more information:

- **Land and Plant Nutrition Management Service**
  Food and Agriculture Organization of the United Nations
  Viale delle Terme di Caracalla - 00100 Rome, Italy
  http://www.fao.org/landandwater

- **Dipartimento di Scienze degli Alimenti**
  Università degli Studi di Teramo
  Via Spagna, 1 - 64023 Mosciano S. Angelo (Teramo), Italy
  http://www.unite.it

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Soil structure degradation – often called soil compaction – is regarded, with soil erosion, as the costliest and the most serious environmental problem caused by conventional agriculture. The immediate consequences of soil compaction are:

- decreased water and fertilizer efficiencies
- increased soil erosion

This type of land degradation causes major negative impacts at many levels from subsistence farmers to large-scale farms. It increases the risk of crop failure under reduced water supply and it increases farming costs (higher input requirements and investments to alleviate the problem).

Soil consists of more than the solid parts. The network of pore spaces is particularly important. The number, size and connectivity of pores are related directly to the chemical and biological processes that are found in natural ecosystems. In agro-ecosystems, an adequate network of pore spaces supports and enhances yields because of:

- Increased water infiltration and crop water availability
- Reduced runoff
- Improved environment for root development
- Facilitated seed germination

Soil porosity is affected considerably by soil management practices. Appropriate soil management reduces excessive and inappropriate physical inputs (in-field traffic and tillage) and protects the biological activity that improves soil structure, porosity and quality for crop production.

Soil compaction is a human-induced problem. It can be prevented through better soil practices that do not disrupt the natural soil architecture.

Compaction is a subsurface phenomenon that requires soil excavation in order to view and describe it. Crop performance is not an efficient indicator because compaction effects are minimal under adequate rainfall patterns.

The two most common visible forms of soil compaction are:
- Massiveness: soil aggregates are compressed into large and dense blocks that equate to reduced air space and increased soil strength.
- Platiness: the soil forms plate-like structures, horizontal to the soil surface. These structures are a strong barrier to plant root proliferation and water movement into subsoils.

Once compaction is recognized and the cause (or causes) of its formation resolved, farming systems can be designed to repair and then ensure future prevention of the problem.

A compacted soil can be repaired using a workable combination of break and rotation crops that provide:
- natural crop-induced wetting and drying cycles to crack the soil;
- root penetration to break up massive and platy soil structure;
- increased organic matter to enrich and strengthen the soil.

This is called ‘biological ripping’, achieved through the break and rotation crops that grow through and break up the compacted soil, increase organic matter levels, improve water penetration and facilitate the return of earthworms – the best ‘soil cultivators’.