

Compacted soil and aeration

Soil compaction occurs when soil particles are pressed together, reducing pore space between them. Heavily compacted soils contain few large pores, less total pore volume and, consequently, a greater density.

A compacted soil has a reduced rate of both water infiltration and drainage. This happens because large pores more effectively move water downward through the soil than smaller pores.

In addition, the exchange of gasses slows down in compacted soils, causing an increase in the likelihood of aeration-related problems. Finally, while soil compaction increases soil strength – the ability of soil to resist being moved by an applied force – a compacted soil also means roots must exert greater force to penetrate the compacted layer.



The most common signs of compacted soil are:

- Puddling of water in low areas of your lawn.
- Water runs quickly away from high areas of your lawn.
- Trees with shallow roots.
- Thin, patchy areas of grass.
- Bare dirt areas where not even weeds will grow.
- Heavy clay soil.
- Soil so hard a shovel can't pierce it.

Minimal crop rotation contributes to soil compaction in two ways:

1. Limiting different rooting systems and their beneficial effects on breaking subsoil compaction.
2. Increased potential for compaction early in the cropping season, due to more tillage activity and field traffic.

How soil compaction affects plant growth:

- In dry weather soil compaction can speed up germination and water retention up to an optimum level, after which it can lead to decreased root growth and reduced yields.
- In wet weather soil compaction decreases yields and root diseases are more of a concern.

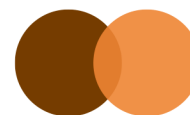
A **broadfork** is a tool of choice for regenerative no-till farms and gardens.



Globally, soil compaction and erosion contribute to over

15%

reduced crop yield.



Videos & More:

<https://www.globalvillagefarms.org/compaction/>



Support from:



A well-aggregated soil

- Under the influence of microbial activity, soil particles bind into generally stable units called aggregates. Heavy equipment and tillage implements can damage these and reduce soil structure.
- Structure is an important defense against soil compaction. Without good structure, individual soil particles are more susceptible to compaction from external pressure. This increases bulk density and decreases pore space.



Well aggregated soil: crumbly soil with visible root pieces on a hand

Impact of deep tillage

Large tractor deep tillage destroys soil structure, and though this temporarily aerates the soil and lowers the bulk density, it can reduce seed-to-soil and root-to-soil contact and easily re-compact after tillage, resulting in slower germination and growth.



Moisture has been retained longer in the compacted wheel track on the right

Regenerative Soil Aeration Methods:

- Plug Aerator (core aerator): good for large areas, usually behind tractor or lawn mower
- Spike Aerator: Other types of aerators push solid spikes or tines into the soil without removing a plug (spiking). These are not as effective because they can contribute to compaction.

Hand Tools for Soil Preparation:

- Hand tools can thoroughly prepare a small amount of land for planting. Spades and digging forks are designed to thrust vertically into the soil rather than at an angle. They are preferable to a shovel because the blade of a shovel is often shorter than the blade of a spade; in addition, the curve of a shovel blade makes it difficult to deeply penetrate the soil. Short-handled spades and forks with a D- or T-shaped handle allow for more efficient use of energy when digging deeply and when moving soil. After the soil has been forked or spaded, a garden rake can be used to break up larger clods and remove residues and stones that, left alone, could interfere with planting, cultivation, and overall plant health.
- Rakes can also be used to level abed and open furrows for seeding.
- They can be used with the head facing either up or down and by using a push-pull motion. The handle of a rake can also be held parallel to the body so that the head can be used to lightly tamp down the soil after seeding. A seedbed rake is designed with longer tines that can be covered with tubing to mark out spacing rows for planting.
- **Broadfork**, or U-bar (see image on reverse), is a 2 to 3-foot-wide spading fork used for deep tillage. It consists of two handles, one on each side of the fork, and teeth that are spaced about four inches apart.

How far away should aeration holes be? Aeration holes are typically 1-6 inches deep and 2-6 inches apart.



A digging fork (above) with a T-handle and a spade with a D-handle

