Improving soil tilth using Weed Badger®

Get answers to the frequently asked questions below.

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What benefits do I get using Weed Badger® to aerate soil?

When you aerate the soil, you accelerate nutrient delivery. Soil is full of life. You could say that soil breathes. Microbial life is vital to healthy soil. Aeration by tilling the soil gives it the ability to convert decaying materials into life sustaining nutrients. Weed Badger® actually turns weeds into fertilizer. Proper aeration gives the fertilizers you use the opportunity to do the most good. Aerating the soil also allows improved water penetration or percolation. Weed Badger's® unique horizontal, rotary action is the easiest way to aerate the in-row strip.

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How will Weed Badger® improve water penetration or percolation?

Soil crusting is a classic symptom indicating low organic matter in the soil and you need to fix the problem. Perhaps you've seen water from your irrigation emitters trickle off the strip, or under-canopy area in the row, toward the middle. Your irrigation dollars are literally going up in thin air or running down the river. No matter what your soil type you can use Weed Badger® equipment to incorporate soil amendments to build and improve your soil grain.

Organic matter is the "sponge" in the soil. Soils that have an abundance of coarser grains mixed with organic debris also have a large volume of pore space. The pore space permits a large amount of rainwater to infiltrate into the soil before it begins to run off at the surface. Not only does organic matter grab and hold water for later drought periods, it also keeps nutrients where they belong.

A low amount of runoff lessens the likelihood of erosion on these coarser soils. Along with the water go the nutrients downstream and into wetlands. Any soil, tilled or untilled, continually looses organic matter over the years if plant materials, compost, green manure crops, or other soil amendments are not added back into the soil in some manner. (Nature has continual renewing of organic matter because surface litter is allowed to accumulate for years and is constantly decomposing at the subsurface layers.) Chemical fertilizers do nothing to improve this critical requirement of good soil structure and there is no substitute.

Broadcasting well-composted materials and working it into the top 1-2 inches of topsoil using a Weed Badger® is an easy way to quickly fix the water percolation and runoff problem. (See *"How can I incorporate soil amendments with my Weed Badger®?"*) Other ways to improve soil structure and address the water penetration problem are to apply light mulches during the heat of the summer growing season. Then work them into the soil surface with the Weed Badger® during fall cleanup. "Green manure" plantings and annual cover crops are other options to quickly add vital nutrients and organic matter, improve soil structure, and retain water. Weed Badger® is the easiest method to incorporate the cover crop into the in-row soil and get an instant improvement in the water retention capacity of the soil.
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What are mycorrhizae and how does Weed Badger® in-row tillage work with it?

Weed Badger's unique shallow tillage works with nature…not against it. Weed Badger® is different from other brands of in-row tillage equipment because it gives positive depth control. Keep the tillage near the surface and out of the root zone. Kill the weeds…not your plant's roots.

Mycorrhizae are naturally occurring fungi (mushroom-related organisms). Myco means fungus and rhiza means root. Root structures are enhanced when specific fungi invade plant roots. This is a mutually beneficial relationship. Mycorrhizae provide a critical bi-directional link between the plant and the soil. These fungi are found all over the planet and benefit approximately 80% of known plant species. There are hundreds of kinds of mycorrhizae found in North America. Mushrooms, truffles, puffballs, are examples of the above ground "blossom" of mycorrhizae. Many are found in healthy established forest and woodlot settings.

Mycorrhizal fungi live off a starch provided by your crop producing plant roots and pull nutrients and moisture from the soil back into the plant roots. Some kinds of mycorrhizae grow around the feeder roots. Others grow literally into the root cells. Both kinds extend the plant root system vastly and help the plant explore for nutrients and moisture. In poor soils nutrients taken up by the mycorrhizal fungi can lead to improved plant growth and reproduction. Mycorrhizae also form the "glue" in your soil structure that fastens soil grains together. It is what creates the large, crumbly, erosion-resistant particles you see in humus soils. As a result plants that have such an established relationship are better able to tolerate environmental stress and disease than plants that do not. Dormant mycorrhizae (inactive state for storage) can be purchased and applied to your trees, vines, or plants, whether newly planted or well established. You can inoculate bare-root stock of plants just before lining them out. A probe can be used to inoculate existing blocks of plants.

Posi-Depth Plate shown below rotor

- keeps tillage depth to 2 inches and less
- protects plant roots
- preserves soil structure and mycorrhizal root links

Herbicides, fungicides, and granular fertilizers (especially high rates of soluble phosphate fertilizer) have been shown to affect mycorrhizae, suppress, and even destroy colonies. The key is to keep herbicide residue out of your soil and work to maximize beneficial soil organisms. Mycorrhizae perform best with low to moderate rates of organic fertilizers and good soil aeration. Weed Badger® allows you to break the chemical dependence cycle and incorporate organic soil amendments into the topsoil. Deep tillage destroys not just soil structure and plant root structure but also breaks these beneficial root-fungi links. Weed Badger® gives you positive shallow weed control, 2 inches and under, maximizes topsoil aeration, and sanitation, yet maintains critical beneficial structures and links in the root zone.

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How does Weed Badger® tillage affect earthworm activity?

Contrary to popular belief, **shallow tillage** can be very beneficial to earthworm populations. Use Weed Badger® to cultivate earthworm activity and work with natural soil processes. Check it out. You won't find a lot of earthworms in fields after years of granular fertilizer, herbicide, and fungicide applications. The soil eventually becomes cement-like. However, look where organic matter has regularly been tilled into the soil surface, such as a garden and you will find healthy populations of earthworms. **Low earthworm populations are a strong indicator of low organic matter** and not due to shallow tillage**.**

Use your Weed Badger® with the optional **Rotor Shroud Attachment** to till weeds or incorporate broadcast organic matter, such as compost, into the top 1 to 2 inches of the soil so the worms can do their work. If you prefer light mulches, occasionally Weed Badger® them into the surface to sanitize the topsoil and feed the worms, then reapply a light layer of fresh mulch. Organic matter is absolutely essential for healthy, living soil. Deeply tilled sterile soils with low organic content are very hostile to earthworm populations. Likewise, avoid thick heavy mulches that accumulate, year after year as they can create stale, saturated, compacted soil with little organic matter or air actually in the subsoil. Feed the worms and they thrive. Get the food to where they can access it and populations flourish.

Earthworms enhance soil a number of ways. Plants roots cannot efficiently access and utilize the nutrients in organic matter lying on the soil surface. Organic materials need to decompose further before the plants can fully utilize all the nutrients. Organic materials are the earthworm's food source. **Earthworms ingest the organic matter, accelerating the decomposition process.** Technically speaking, they ingest the organic matter and select the microbes as the nutrient source. The earthworm castings (earthworm manure) and slime secretions left behind are nutrient rich with plant-usable elements. Sticky slime also helps to hold soil particles together to form aggregates.

Earthworms are superb at mixing and moving organic matter throughout the soil and deeper into subsoil layers. It is estimated that the worms in one acre of soil can turn 18 to 20 tons of soil every four or five years. This mixing action is especially useful for potassium, phosphorus, and other minerals that are not water-soluble. Many nutrients do not move downward through soil layers as easily as nitrogen. Orchards, blueberries, vineyards, and many other crops remain in place for decades and cannot have fragile root systems disturbed. Shallow root systems are extremely vulnerable to drought, soilborne insect pests, and the elements – and not desirable. **Cultivate a robust earthworm population and you will cultivate an extensive, healthy, deep root system.** Let the worms do the work of transporting surface applied organic amendments and mix the nutrients deeper into the subsoil layers. Roots seek out nutrients, moisture, and aerated soil layers.

Earthworms are subterranean earthmovers and tunnel borers. Some species of earthworms specialize in horizontal topsoil tunneling. Other species of earthworms are especially good at creating vertical tunnels deep into subsoil layers, even through hardpan layers, carrying air and nutrients downward. These "vertical highways" also open avenues for beneficial microorganisms to establish, as they are dependant on well-aerated soil. The tunnels serve as water reservoirs during downpours to trap and hold excess precipitation. Earthworm tunnels are conduits for root penetration allowing access to moisture and nutrients normally beyond reach, trapped below compacted layers. Deep subsurface soil structure

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improves and compaction reduces when earthworm activity is increased. Use your Weed Badger® to maximize this activity. What you do in the top two inches greatly influences soil health and structure down deep.

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How can I incorporate soil amendments with my Weed Badger®?

Build your soil using Weed Badger® by adding organic matter and soil amendments. Soil with low organic matter is not just sterile, lifeless soil. It cannot sustain beneficial microorganisms. It erodes much easier. You can't keep taking money from the "soil bank" without putting some back in. Weed Badger® enables you to feed your plants and soil. Organic matter is money in the bank.

Soil amendments and compost need incorporation into the topsoil for optimum release to the plants. If simply broadcast on top of the ground, surface air, sunlight, and changing weather conditions can cause such products to loose a great deal of effectiveness. Roots cannot reach it. Earthworms cannot reach it. Materials left on the surface exposed to the elements, provide only a fraction of the performance you paid for.

Use of the **Rotor Shroud** will outfit your Weed Badger® for incorporating materials into the soil. Since the belting material completely encloses the rotor and tines it is easy to contain soil while tilling, so you can incorporate materials in one pass. Growers will sometimes open the front of the belting on their Rotor Shroud with a utility knife. This will allow for entry of a line of material, previously laid down, in the clean strip along the tree, vine, or bush row.

Rotor Shroud

With a little ingenuity, growers equip their tractor to perform this valuable procedure in one pass. A hopper or dispensing bin can be custom mounted on the front of the tractor. A release mechanism and flexible tube can be directed to gravity-feed materials directly in the path of the Weed Badger® rotor head. As the Weed Badger®, with Rotor Shroud installed, passes over the line or row of materials, the exclusive action of the tillage head incorporates it into the soil.

Some operators will cut vertical strips on the rear side of the rotor shroud belting to allow the mixed, incorporated materials and soil to exhaust. Incorporation works best after breakout or regular maintenance type weed control. It is also best to incorporate it while driving in a straight line along the strip or border, without retracting and extending.

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How can I use my Weed Badger®
to manage cover crops or "living mulch"?

Cover crops can be very beneficial to improve soil tilth, control erosion and weeds, provide slow release of nutrients, and build organic matter. They can also be used to provide a firm base for seasonal fieldwork or access in the field during wet periods. However, managing the cover crop is essential. The ideal scenario is to use your Weed Badger® to prevent the cover crop from competing with the main crop or becoming weedy over time, and yet continue to provide consistent benefits.

Perennial or biennial ground cover crops can be established between alternating rows and tilled in every other year. Each year alternating row middles are cultivated or disked leaving every other row for tractor or vehicle access during rainy seasons. The permanent cover eventually creeps into the in-row strip under tree or vine rows each season. Incorporate the cover crop as a soil amendment with your Weed Badger® in the spring. Select a low profile cover to minimize middle mowing and crop competition. A low profile cover crop tills in well each spring using your Weed Badger® with the **Rotor Shroud Assembly** installed.

Winter annual cover crops, such as annual rye grass, can be seeded early each fall. In cold climates annual rye grass winterkills and is easily incorporated into the in-row strip by using your Weed Badger® with the Rotor Shroud Assembly. Summer annuals may be used in warmer regions with sufficient rainfall and cultivated in after harvest as "living mulch" or "green manure". The **Cyclone Spade Attachment** is especially effective for incorporating taller cover crops common to regions with milder winter seasons.
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