A major issue in sustaining vegetable production is maintaining high soil quality in the face of common practices that work against it. Vegetable growing often involves intensive tillage, cultivation, exposure of almost-bare soil to the sun and rain for long periods, and heavy traffic from people and equipment. All of these practices tend to destroy soil organic matter and soil structure while increasing soil compaction. This reduces yield over the long run because it creates a poor environment for root growth and function; also the soil biological community is adversely affected. Soils with poor quality cannot retain sufficient nutrients and moisture. Fruit trees also grow better when organic matter in the soil is increased, both from mulch as well as compost mixed into the soil.

A great solution to the soil building problem is utilizing the vast amount of wood chips available in urban areas from tree trimming companies. Wood chip sheet-composting conserves water, controls weeds and builds long-term soil fertility. When it comes to building soil, nature relies heavily on trees — fallen limbs, leaves, cones, seeds and, eventually, the massive trunks. Adapting this natural process to urban agriculture by using free wood mulch from local tree trimming companies as soil-building material is a cost-effective and efficient strategy that promises huge, long-term returns.

When properly managed, an army of fungi, molds, and microorganisms feed on chipped wood mulches and dramatically increase levels of organic matter and beneficial biota in soil, vastly improving fertility, tilth, and productivity. This is beneficial on urban sites that require high -- sustainable -- returns due to land values and other inputs and costs that are generally much higher for urban agriculture operations. This method also addresses issues on some sites that have residual elements in the soil that may be toxic.

Field studies dating back to the 1950s — and as recent as this year — suggest that a high-fiber diet of woody materials is exactly what many soils need. Rotted bits of wood persist as organic matter for a long time, enhancing the soil's ability to retain nutrients and moisture, which results in bigger and better crops. These materials also attract a community of beneficial organisms that turn the soil into a network of life forms that benefit plants and result in extremely healthy plants. This approach shifts the focus from feeding plants to feeding soil – resulting in a vibrant topsoil profile that increases each year at levels unimaginable in rural farming situations.

Some will point out that woody materials are high in carbon and cellulose, and that they need nitrogen and time in order to decompose. There is also concern that woody amendments acidify the soil. Only in the early stages of decomposition is there a fast flush of acids, when cellulose fibers begin to degrade. Long-term studies of the effects of wood chips and sawdust in soil actually show a slight rise in soil pH, which is good news for most crops. The lower the pH; the more acidic the soil.

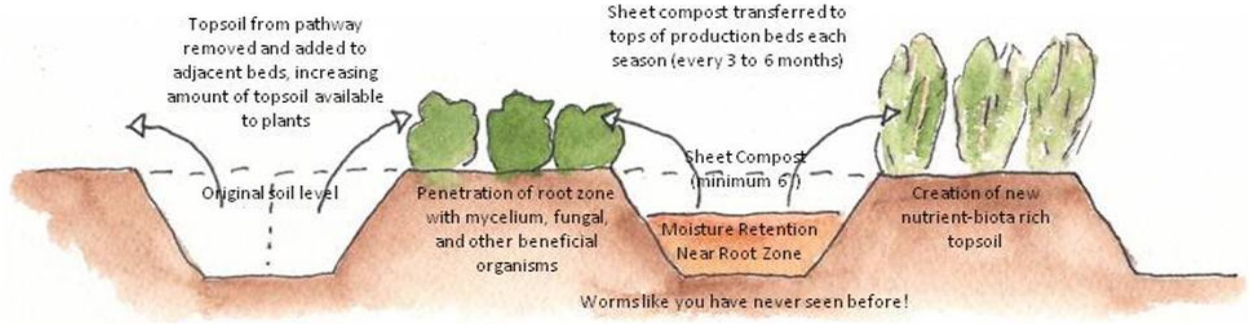
Fears that directly applying these nutrient rich materials into the soil profile will acidify the soil or bind up the soil's nitrogen and rob plants of needed nutrients can be easily addressed through an urban agriculture methodology I refer to as the Modified Raised Bed System.

Raised bed agriculture, in which the soil is formed in wide beds (generally several feet across), can be of any length. In the modified raised bed system, the soil in the production beds is about a foot or so above the surrounding soil or pathway. The top soil in the pathway is dug out (one shovel head deep -- approximately one foot) and the soil is tossed onto the garden bed – thereby doubling the amount of topsoil available to the plants.

Once the pathway is cleared of topsoil, it is covered 6 inches to 1 foot deep in mulch (available free from tree trimming companies). This depth is more than mulching; it is "sheet-composting" and has a powerful effect on transforming the soil profile. Once the beds are planted, the beds are can be mulched as well depending on the type of crop—up to 6 inches deep, tapering down around the crowns or central stems of the plants.

To favor the multiplication of beneficial organisms, including many members of the phyla Basidiomycota, sheet-compost humidity must be maintained. The most conspicuous and familiar Basidiomycota are those that produce mushrooms, but Basidiomycota also include jelly fungi, smut fungi, rusts, yeasts, etc., among many 30,000 species in the phyla. Basidiomycota have a huge impact on human affairs and ecosystem functioning. Many Basidiomycota obtain nutrition via decaying dead organic matter, including wood and leaf litter. Thus, Basidiomycota play a significant role in the carbon cycle.

The Modified Raised Bed System



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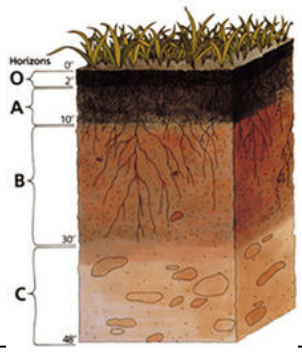
The plants are planted in such a manner as to maximize the benefit of a continuous canopy…allowing the outer perimeter of each plant canopy to meet up with other plant's canopies, optimizing the amount of soil surface in the shade. The spacing of plants is such that when the plants are fully grown, the plant's leaves just barely touch each other, creating a microclimate in which moisture is conserved and weed growth suppressed. The close plant spacing and the extensive use of mulch generally results in significantly higher yields, enabling intensive crop production to be sustained over time, and for plants to grow at optimal rates, generally uninhibited by weeds.

The beds are disturbed as little as possible, allowing the natural soil system to establish itself. The farmer avoids walking on the raised beds as much as possible, and thusly the soil is not compacted and the roots have an easier time growing. The sheet compost / mulch is replenished seasonally, continuously building the soil profile.

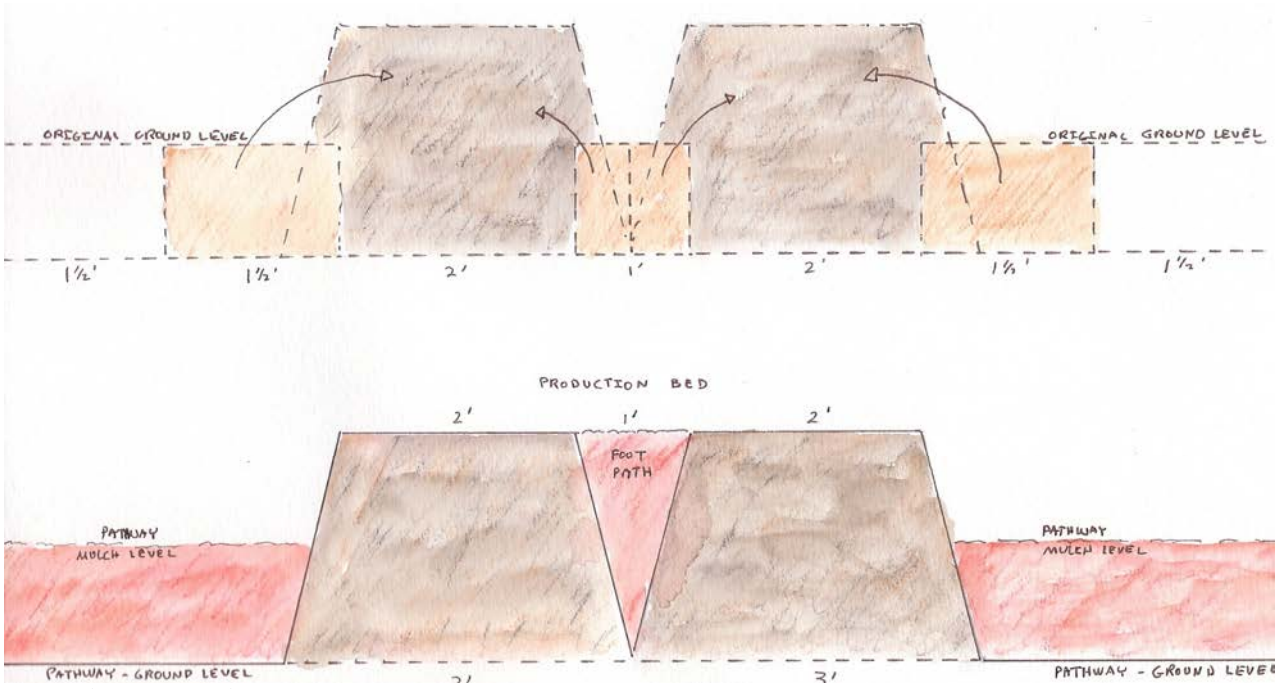
This "modified raised bed" system lends itself to the creation of a rich layer of hummus and to establishing a complex and healthy soil system that builds upon many of the principles and methods of organic agriculture and Permaculture. The method can be used effectively to control erosion and recycle and conserve water and nutrients by capturing the maximum level of moisture, irrigation water and precipitation. The method works in small or large areas and can be accomplished with hand tools or with the help of commonly available roto-tillers or tractor-drawn implements.



Humus has a characteristic black or dark brown color due to an accumulation of organic carbon

Construction of Raised Beds

Production beds can be designed for various crops and settings. The following diagram shows one configuration for a five foot wide bed with a strip of wood chips down the center of the bed to facilitate access and retain moisture and fertility.

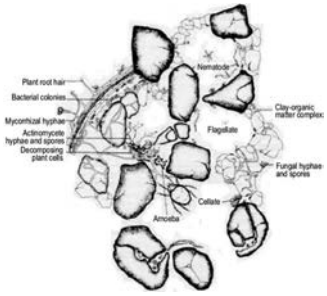


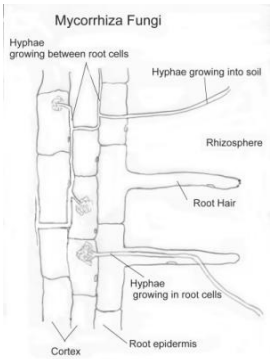
Mycelium Running

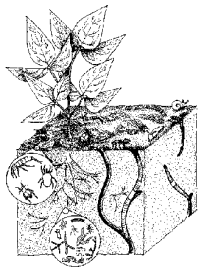
My own observations over the years are confirmed by contemporary research that the wood chip plots became permeated with white mycelium, which is the vegetative form of many fruiting fungi and is commonly known as white rot. The work of Paul Stamets and his book "Mycelium Running" illuminate the powerful impacts of these organisms. More mushrooms mean less pollution and toxins in the soil: growing more mushrooms are among the best thing we can do to save the environment and build our soils.

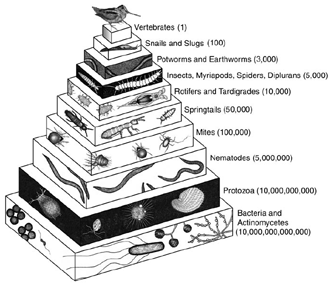
Microscopic cells called "mycelium"—the fruit of which are mushrooms —recycle carbon, nitrogen, and other essential elements as they break down plant and animal debris in the creation of rich new soil. What fungi expert Paul Stamets has discovered is that mycelium also breaks down hydrocarbons —the base structure in many pollutants. So, for instance, when soil contaminated with diesel oil is inoculated with strains of oyster mushroom mycelia, the soil loses its toxicity in just eight weeks. In his acclaimed book, Mycelium Running, Stamets discusses revolutionary uses of mushroom cultivation and provides tips for choosing the appropriate species of fungi for various environmental purposes.

The development of these fungi in the wood mulch increases the character of organic matter in the soil, as well as helps the soil's ability to retain moisture. A large community of beneficial macro and micro organisms are invited to take up residence, including the group of fungi known collectively as Basidiomycetes, a core player in wood chip decomposition. Where moist wood chips and soil unite, these fungi use enzymes to access nutrients in the wood, which is their energy source for the growth of threadlike, white hyphae. The hyphae knit themselves together into mycelium, which is easy to see. This knitted mat acts like a blanket to hold in moisture and nutrients. In addition to fungi, several specialized types of bacteria are able to degrade high-cellulose materials such as wood chips, while others digest failing fungi.









This system taps into the capacity of wood chips to serve as islands of life that support several levels of activity that promote soil fertility: the fibrous organic matter of the chips themselves, the biological mass of filamentous fungi that grows on them, and beneficial bacteria that come and go in waves as the natural process of decomposition occurs.

Two decades of experiments with wood chips in both forestry and agriculture in Québec, Africa, Europe and the Caribbean have demonstrated:

- Better soil conservation due to the water retention capacity of humus content (up to 20 times its weight) and the capacity of water accumulation and management by soil organisms;
- An increase in pH from 0.4 to 1.2 or, under tropical conditions, in alkaline soils, a decrease in the range of 2.0.
- A yield increase up to 1000% for tomatoes, and 300% on strawberries
- A noticeable increase in frost and drought resistance
- More developed root systems highly integrated with mycorrhiza

- Fewer and less diversified weeds
- A decrease or complete elimination of pests (including control of root nematodes)
- Enhanced flavor in fruit production
- Higher dry matter, phosphorus, potassium and magnesium content
- A soil turning from pale to deep brown in the same season

Starter colonies of these microorganisms are usually present on the bark of chipped branches and fungi present on wood chips start growing quickly after the wood has been cut or chipped.
In dryer climates it is necessary to irrigate the sheet-compost to kick-start the process in order to speed and enhance the soil creation process. These fungus spread, increasing soil depth and attracting beneficial organisms, such as armies of amazing, fat and happy earthworms.

Wood chips are byproducts of other activities, so finding good-quality and local tree companies is essential. Recent studies with wood chips have focused on ramial wood chips, which are what you get when you put live, tree branches through a chipper. A number of references and studies on ramial wood chips follow at the conclusion of this article.

It is possible to acquire an unlimited supply of wood chips for free by establishing relationships with tree-trimming crews working in most urban areas. Unobstructed easy access is essential – whenever they need to "dump" their chips. Often you can identify tree-trimming companies while on the freeway – when you see large trucks on the way to landfills (where the waste is often used for "daily cover"). Recycling wood chips to grow soil and food is beneficial to the environment, converting the material directly into topsoil and sequestering countless tons of carbon into the soil.

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Volunteers at Full Circle Farm implement the Modified Raised Bed System