Building Soil With Carbon Dioxide.

The soils of the world are degrading at an alarming rate. Even the most fertile crop growing areas, the topsoil is eroding at an unprecedented pace. It is estimated that for every ton of food produced, six to eight tons of topsoil is lost.

Overuse Of Fertilisers

All this is happening due to poor growing practices. The overuse of fertilisers, either inorganic that supply only basic nutrients, nitrogen, phosphorus and potash, or even organic that contain minerals and trace elements.

Neither supply the soil with humus building compounds, instead deplete it, destroying the structure. To make matters worse, mechanically turning the soil whether it's digging, ploughing or cultivating, increases the action of oxygen, literally burning off the rest of the humus.

This releases more carbon dioxide into an already oversupplied atmosphere, adding to the global warming problem.

It all leads to the natural adhesive qualities breaking down, allowing the mineral particles to fall apart and become susceptible to the actions of weather conditions. Without resistance to the sun, wind and rain, the topsoil erodes away until as in many parts of the world, only the bedrock is left.

Good Growing Practices

It all sounds a doom and gloom scenario. But it does not have to be. With proper practices the situation can be halted and put into reverse. Because small-scale holdings usually practice more traditional methods of growing, recycling all natural materials back into the land, they can be at the forefront of the carbon revolution.

With just a little adjustment to growing practices, great improvements can be made. Good soils becoming highly fertile, poor soils greatly improved in just a little time, degraded soils saved and gradually turned around, each year improving more and more.

Rebuild Soil Fast

Where in nature it takes thousands of years to build a few inches of soil, the humus gradually increasing in a natural but slow way. This can be vastly speeded up, reducing the time to a matter of decades. The structure can be rebuilt so rapidly that what would take five hundred years to achieve in natural conditions, can be created in less than eight years. Plus as the soil improves it also acts as a carbon sink. Absorbing atmospheric carbon dioxide, locking it up into the soil, creating rich self fertile soils while benefiting the whole of the environment

Cultivate soil And Decrease Atmospheric Carbon Dioxide

Everyone cultivating the soil can actually help decrease the carbon dioxide level in the atmosphere and vastly improve their own soil structure.

By making small changes to cultivating techniques and taking care which crops and crop varieties are grown, whether in the garden, smallholding or farm.

All can be self sufficient in soil improving compounds that lock up carbon dioxide. Growing each year a continuous supply of carbonaceous materials that will build a rich friable soil in a short number of years.

Absorption By Plants

As plants grow they absorb carbon dioxide to form carbohydrates. The carbohydrates are then utilised by plants for energy to grow, or to form sugars and starches that can then be stored in stems, roots or fruits.

Some of the carbohydrate is used in the production of varied types of cellulose. This is used to make strong cellular walls and giving strength to the structures of plants. As many plants mature they lay down an even stronger carbon compound called lignin. Lignin is a highly resilient material that is strong, flexible and resistant to breaking. It ranges in plants from just being very fibrous to dense heavy wood in its forms.

Lignin has a greater resistance to breaking down than cellulose. As a material it locks up carbon dioxide very efficiently, forming long lasting particles in soil.
These help to create an open structure capable of storing water and plant foods more efficiently. Black crumbly soils owe their colour to large quantities of lignins present in them.

Long Lasting Lignins

The breakdown of lignins for energy is the last resort for soil bacteria and fungi with its harder to utilise chemistry. It makes it a perfect material for carbon dioxide lockup.

Soil bacteria and fungi prefer the other more usable cellulose as energy rich compounds that are made available as plants rot down.

This high energy source allows the bacteria to take nitrogen from out of the atmosphere to create proteins that allow them to grow and breed. Gradually they build up the nitrogen content of the soil, which becomes available as they die releasing it from their body structures.

Free Fertility

This continuous free source of fertility is not the only benefit of feeding the soil carbon compounds. Bacteria and soil fungi or mycorrhiza, utilise carbon to release other organic compounds such as potassium, phosphorus, minerals and trace elements. These would otherwise be locked up in the soil structure, unable to be passed on through plants to animals and humans who need the vital chemicals to maintain and improve their health.

This locking up of nutrients is easily seen with soils fed inorganic fertilisers. Each year more and more phosphorus needs to be added to soils, Yet within most British soils it has been calculated that the majority contain three hundred years worth of phosphate even if no further was ever imported into them again.

Because of modern growing techniques the phosphate remains unavailable as so little carbon foods for the flora and fauna to proliferate on is ever applied. So the need for

soluble phosphates goes on, with the inevitable run off of the excess to pollute rivers and lakes.

Traditional Methods

The traditional methods of growing applying carbon compounds in the forms of rotted manures, allowed residual carbons to accumulate within the soil. This maintained a reasonable good soil profile, But it was dependant on low inputs and over deep cultivation of the soil.

The accumulated carbons were rapidly used up, leaving only small quantities behind. This was enough to maintain a good soil structure, but not enough to make a big impact on actual soil building.

Growing The Right Crops

The key to harvesting carbon to build soil is to grow the right crops and take advantage of their Carbon dioxide absorbing qualities. Fast single season crops brought to their ultimate maturity that create fibrous Carbon rich straws, are some of the quickest methods of absorbing Carbon.

With crops such as wheat, barley, oats and maize, the best forms are the traditional varieties, the long straw or long stemmed varieties. Modern varieties have been bred for short straw enabling them to overcome 'lodging'.

Lodging occurs to the traditional long stemmed varieties if they are subjected to the over-rich Nitrogen diet from high fertiliser inputs of modern farming.

High dose Nitrogen fertiliser does not allow the slightly longer maturing traditional grain varieties to lay enough Carbon in their stems to stand upright under its own weight.

Seen As Waste

Modern systems see straw as a waste product, a nuisance to have to get rid of. Unlike a Carbon harvesting system, where fertility is provided by the previous years Carbon harvesting that supplies much of the Nitrogen needed naturally. Plus an abundant excess of Carbon compounds that accumulate to building of soil and ever deepening structure each year.

Using Straw

Straw used as bedding then composted when mixed with manure or compost straw with other Nitrogen rich materials from plant wastes, allow it to break down evenly. Straw laid down directly on the soil as a weed suppressing mulch and moisture retainer. Any of these methods will create a rich carbon soil.

Holdings And Farms

The right percentage of crops grown on a holding of any size needs to be balanced to enable it to create it's own soil. The estimates that are put forward are reliant on intensive growing methods that make full use of the space allocated for growing.

These methods include deep beds, close cropping and mixed cropping companion planting. Using any of these methods of growing, the area can be divided into various percentages for differing crop types.

10% of the growing land is needed for vegetable growing. These are crops that are heavily rich in vitamins and minerals needed for good health. 30% of the land is used for calorie crops such as potatoes, rice etc. The remaining 60% of growing area is set aside for grain crops, wheat, barley, oats and maize.

Garden Growing

The above system is fine where the holding is large enough to grow Carbon crops at these percentages without utilising too much of the overall growing area. But in the garden, the growing area is needed totally for growing vegetable and food growing, none can be spared for Carbon crops.

Other ways of supplying the Carbon needs to be found. Tree and shrub crops can be utilised within the garden easily being substituted for grain stems.

Pruning fruit or ornamental shrubs , fast growing trees by coppicing or pollarding their stems and branches. After shredding and composting, a high Carbon compost for building the soil is easily obtained. Other Carbon suppliers include: sunflower stems, dried bracken, end of season stinging nettles, ground bark and leaves.

Importing Carbon

Importing Carbon in the form of bedding for animals increases the speed of rapid soil building to begin with. Straw is an obvious source. If some farmers cannot see the benefits of it as yet to help impoverished soil, at least if can be used to lock up Carbon and build soil elsewhere by importing it.

Other Carbon rich sources that can be used as bedding is sawdust, wood shavings and paper. All need careful composting with a good balance of manure or other Nitrogen to break down some of the Carbon compounds into usable forms that will not rob the soil of it's Nitrogen when the compost is used.

Most sawdust and shavings composts are safe after two years of composting, but if any wood chips are present it can take longer for the breakdown to occur. An indication that it is ready is when everything looks very dark brown and when rubbed between thumb and finger, it breaks up easily.

If in doubt about the readiness of the compost, don't dig it in, use it as a surface mulch where it will safely break down and still enrich the soil.

Paper used by itself can mat into a hard to compost mass. It is better to mix it with an open material such as straw. It will then break down into a good Carbon rich soil builder.

Growing the older grain varieties with their tall straws to ultimate maturity and utilising Carbon compounds within fast growing trees and shrubs whilst using Carbon rich beddings, will build deeper richer soils that will improve in leaps and bounds.

Meanwhile so much of the ever increasing Carbon in the atmosphere will be locked up into the environment where it will be doing greater good than harm.

Neil Jordan