Market gardening and catching carbon

By HUGH LOVEL

AFTER DRIVING ALL NIGHT from my North Georgia market gardens I arrived just before seven in the morning at the Indianapolis hotel where the ACRES USA Convention was to be held.

As fate would have it, as I joined the queue the people in front of me were Gary Zimmer, president of Midwestern Bio-Ag from Wisconsin and Roelf Havinga, Dutch environmental consultant. We struck up conversation and all took a table together in the packed restaurant. I ventured that I believed the single highest priority we had as ecological farmers was to maximise the carbon we took out of the atmosphere and stored in the soil. After all, we, and all the things we grew on our farms, were carbon based life forms.

Roelf echoed my sentiments with: "You sure have got that right. When we store carbon in our soil we build life into our farms. I am all the time telling people this."

The irrepressible Gary, who can say more in less time than all three Marx brothers

talking at once, then regaled us with details of the whats, whys, hows, whos, whens and the importance of catching carbon. "You can't build soil without carbon, and the crazy thing about it is carbon is free. It's the single most important thing a farmer can do. It's a pity we cow farmers are demonised for releasing methane when growing grass and grazing it puts more carbon in the soil than anything else you can do."

I had to agree with Gary that savvy graziers caught carbon more easily than any other type of farmer. The single biggest riddle I'd had to solve in self-sufficient biodynamic market gardening was how to build carbon into the soil while cultivation returned so much to the atmosphere. I'd discovered I had to maintain a grass and legume sod on all my traffic paths as well as growing robust mixes of the most productive grasses, legumes and forbs I could find for my rotations.

For those veggies like cukes, potatoes, capsicums, tomatoes, squash and ginger, mulch was the answer; but I had to keep the soil as fully covered as much of the time as I could, and I had to find ways of cultivation that minimised compaction and soil structure destruction.

After a delicious breakfast and lively discussion we got on with our day, each agreeing that being a good farmer meant catching carbon, first, foremost and always.

It should be no secret that excessive cultivation ranks right up there with mono-cropping and use of chemical nitrogen for driving carbon out of the soil and killing it; and yet, cultivation is what even the best organic and biodynamic market gardeners do. The trick is to not be excessive.

Here is a picture of the method of

cultivation I worked out. By cultivating metre-wide beds between my tractor tyres and growing a mix of grass, clover and forbs on my driving strips I created heaps of edges (much-loved by observant permaculturists) while my paths were my biological reservoirs. There was never any spot in the field more than half a metre away from a rich diversity of plants and animals, small and not so small.

Maize or sweet corn, interplanted with soybeans, was my favourite way of catching carbon in summer. In winter it was cereal rye interplanted with a winter annual clover such as crimson clover, though I'm told arrowleaf clover or fenugreek are well suited to Australian conditions. In this mix I would also plant turnips, mustard greens, Chinese winter radishes, rape and corn salad, an annual valerian that solubilises phosphorous and is known in German lore as rapunzel. The turnips, radishes and greens I harvested for market, as – like most folks – I needed a payday. The corn salad is a much-loved and medicinal spring salad greens, and the grain can be cut for mulch at milk stage in the spring when it boots. Once the soil becomes crumbly and full of life, tomatoes, capsicums or cucurbits can be planted directly into the stubble with a spade but don't ever walk on the beds!

As for maize, the growing season is fairly long and earthworm populations would decline without mowing the paths for earthworm tucker about midway through the maize cycle.

Earthworm populations need to be kept high in order to digest the thick stalks and soybean vines over winter after the rye is planted. Only the maize or sweet corn ears are picked, following the rule that if you want to build carbon you never export more than 8% of your biomass production.

The spader used has a beautiful tossing action that keeps the organic matter in the top five or six centimetres with just enough soil on top to plant the rye and clover mix into. The mass of maize stalks and soy vines need to be finely mowed before spading or the spader can't chew them, but what a wealth of carbon is incorporated into the topsoil for moist, aerobic, fungal digestion. Fungal breakdown produces glomalin, which builds structural carbon into the soil.

Nitrogen management is another key. Loose, salty nitrogen burns carbon. It is the waste product of nitrogen fixing microbes, and when the soil is awash in it nitrogen fixers tend to feel like they are drowning in a dysfunctional septic tank. They say; "That's it. We're out of here."

What sets them on a nitrogen fixing jag is sugars. Then they tie up carbon in stable proteins in the soil reserve on healthy soils that could easily be 3-4000 parts per million as stable protein nitrogen. Dumping something like raw chicken manure on the soil makes these beneficials give up the ghost and a protein breakdown cascade sets in. Then your soil loses carbon at a scary rate. Some estimate that 100 parts of carbon can be lost for every part of salt nitrogen added.

Something else occurs – weeds. Unlike big seeds such as maize, beans and cereals, weed seeds generally are quite tiny. They depend on the soil being awash with soluble NPK and other nutrients. Their role in nature is to sop this up and conserve it. When it's there they take off and outpace large seeded crops. Thus savvy farmers do not want much soluble nitrogen in the soil when they plant. They want nitrogen fixers to come running when large seeds start sprouting and excrete their carbs into the soil. Then there will be abundant amino acid nitrogen – all within a centimetre or so of the roots of the crop plants – while next to none will be available to the weeds even if they sprout.

Close inspection shows plenty of weeds which can't get beyond the cotyledon stage because they don't have any carbs to feed the nitrogen fixers, and they don't have enough free nitrogen in the soil. This is an example of good nitrogen management in a vibrantly healthy living soil with plenty of nitrogen fixers living in it. And good nitrogen management is how to catch carbon and build it into the soil – even in a market garden.

To summarise, building soil carbon – the foremost imperative of every ecological grower – requires minimal, non-destructive cultivation. It also requires maximum diversity so the ecology is robust. It also needs good nitrogen management, which means keeping soluble nitrogen to a minimum and keeping plenty of nitrogen fixers alive in cultivated areas. This in turn means minimising areas and times the soil is left bare. This also requires not tilling in green matter which will decay and release soluble nitrogen.

And lest we forget, you want aerobic, fungal breakdown if you mix dry matter, like corn stalks, into the soil. This means you never incorporate organic matter deeply – even if it is dry – because you want fungi breakdown to make glomalin, build stable carbon and create superb soil structure.

Maize with soybeans at 21 days after planting.

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