Horticulture: soil management to build organic matter and diversity

Fact File: Oxton Organics

Date	February 2025
Location	Worcestershire
Enterprise	Vegetables, fruit, sheep
Size	5 hectares (1 ha market garden, with access to 5 hectares of trust grazing)
Actions Taken	Compost, green manures, soil biology, rotational grazing
Impact on Business	Building healthy, productive and resilient soils. A system that works well, produces healthy crops, and an interesting farm. A thirst for knowledge and culture of experimentation.
Impact on Carbon Footprint	Sequestration in hedges, soil and perennials. No artificial fertiliser. Electric van. Low diesel inputs. Biological system.

Tags: horticulture, sequestration, soil biology, cover crops, sheep, experimentation

Introduction to the farm

Jayne Arnold and Julian Eldridge have been on the farm for 38 years. Julian retired from farming so it is now run by Jayne It's a 12 acre organic farm, of which 2 acres is market

garden with 6 tunnels, a glasshouse, 1 acre of orchard, and the rest pasture. The business runs a veg box scheme, and sells a little to other organic businesses.

The soil is predominantly a Sandy Clay Loam, situated on a second river terrace. The water table can be high (as little as 50cm below the surface in winter), and a risk of flooding in extreme rainfall events. The soil pH in the market garden is 7.4 - 7.8.

Vegetables and fruit are produced, and there is a flock of sheep to manage the pasture and green manures.

Actions

Cropland

There is a great diversity of vegetable crops, and the rotation has transitioned to more of a polyculture. Aiming for lots of diversity, the market garden is bordered by lines of willow and poplar (a third of which are coppiced every year), and within the growing area are a huge range of cover crops. "*The more diversity in green manures, the less you need to worry about rotation.*" says Jayne.

Until 2017 the market garden was run in a more 'conventional organic' approach, ploughing mixed species leys and rotation. But the plough hasn't been in use for years, and the only cultivation is now done by power harrow.

Soil management is at quite an advanced stage, and has changed substantially over recent years. Read more about that in the Soil section below.

Fertility management for cropping is based on cover crops and compost. See more about compost production below.

Living pathways between the cropping beds provide a source of diversity and mulch to go under crops. When the pathways are mown (unless leafy salads are growing in the bed) a side discharging lawn mower blows the clippings onto the bed. This provides a regular food source for soil biology, lush green material feeds mainly bacteria whilst lignified stalky material provides food for fungi. Long term crop health has improved where this system is working well.

Shumei principles are being trialled in some areas where the crop is grown in the same place year after year, seed is saved from the crop and replanted . This way

of growing is more akin to natural systems, microbial associations between crop and soil build up leading to healthier, more resilient crops and soils.

In contrast to a cultivated system where there is a big input of food for the soil, then very little, the aim is to provide a constant supply of food for the soil ecosystem.

Jadam type bio-fertilizers and ferments are made to increase soil fertility.

Jayne expresses a desire to incorporate some arable approaches on a market garden scale:

"I'd love to do strip tillage - on a small scale, in horticulture. It could be great for increasing diversity, we just need the tools."

Grassland

The grassland has changed in management over the years, from regular moves every few weeks to a more adaptive approach - mostly daily moves, part of the pasture left the whole growing season to flower and set seed, whilst grazing other areas more than ideal. Mixing the grazing up rather than sticking to a set pattern. The flock ranges from 10 to 30 occasionally up to 40 if raising breeding stock.

"Observing the plants growing in the pasture and not grazing before the broadleaved plants have recovered has made the biggest difference to diversity in the sword. Grasses will regrow quickly, but if the sheep graze before the broadleaved

herbs have had a chance to recover it is easy to overgraze these all important plants" says Jayne

15 years ago the pastures were seeded with a diverse mix, using cultivations and a ring roller. Until quite recently the ridges of the ring roller could still be felt, and during dry weather pushing the electric fence posts in the ground could be really difficult! High calcium soils with lack of biology can be very tight.

Now the sward is becoming thicker and more diverse, soil biology is increasing and the soil is relaxing. As plant diversity increases so do the insect pollinators and the number of birds feeding in the sky above.

Orchard

One acre of apple trees, comprised of standards, but trained horizontally at 1.5m for ease of picking, mostly desert apples. These are sold through the box scheme and also to other box schemes. They would like to do more apples, and do more with them.

Discovery is probably the most reliable variety, but Jayne has noticed how the ripening season has changed. "*The season is getting earlier - the first ones used to be ready around August 14th, but last season was the end of July*."

The orchard is grazed by sheep in winter and spring, and is a good place for lambing.

There are some plum trees, though they're not very productive as the land is vulnerable to late frosts. Some pear trees exist with variable crops. Nut trees crop well, but the squirrels take most of the crop!

Compost

Compost is one of the main fertility sources on the farm, and something that is now a core focus for the Oxton team. Woodchip from a local tree surgeon is composted on the farm, and the only compost now used in the Market Garden.

The farm's coppiced willow is chipped and used to make Johnson Su compost - an IBC cage lined with rat proof mesh is filled with a mix of fairly high carbon organic material. Worms are added after a couple of weeks when the temperature is below 25c. You can use whatever is available aiming for 25-1 carbon to nitrogen material. At Oxton the recipe includes rock dust, seaweed, cow manure, sheep manure, ramial woodchip, nettles, veg waste, hay, molasses and leaves. If available rumen is added for further microbial diversity.

Composting takes 12-18 months, and it is better the more mature it is. In that time it is occasionally fed and watered. Keeping it moist is really important, at Oxton

the cage is lined with old fleece for insulation and moisture retention. Once it is matured, it is used in one of two ways:

Seed and transplant inoculant:

One spade of Johnson Su with water to a thick slurry. Beat this for 2 minutes (Oxton's use a plaster mixer on a drill), pour through a sieve and add 1% seaweed, a teaspoon of molasses. If available, nettle or seed ferment is also added. This makes 30 litres of inoculant that transplants are soaked in before planting. This makes for noticeably better transplants and onward growth.

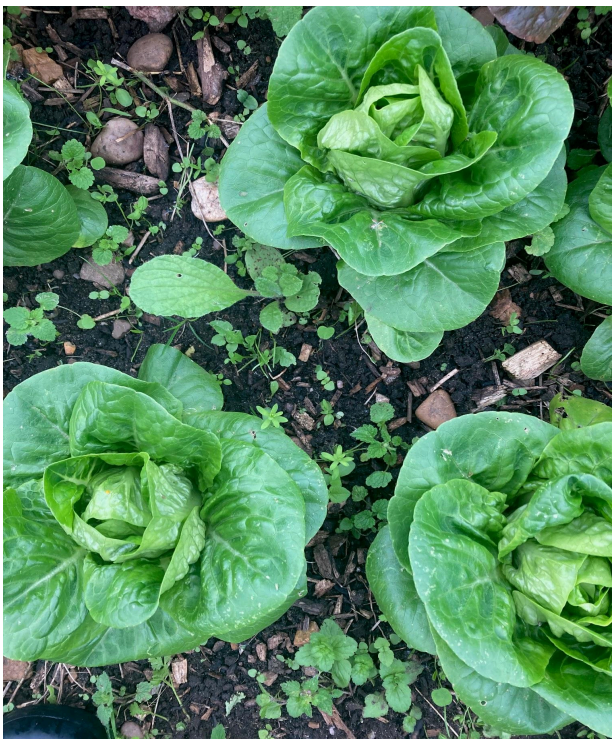
The same mixture can be used as an inoculant on soil by watering on to the beds. Dry Johnson Su might be trialled immediately before power harrowing. Jayne comments "*when damaging soil biology, like when cultivating, I try to put soil biology back on to repair the damage.*"

Seed compost:

Refusing to use peat composts and at times experiencing problems with peat free compost, for the past three years the farm has experimented with making their own growing medium. Their homemade mix has generally worked well, though there were some variability between batches and crops - such as brassicas and beets, didn't like it so much.

The mix has evolved, the present recipe all species seem to be growing well. The recipe at present is 10 litres of home made compost, 10 litres of leaf mould compost, 20 litres of woodchip compost, 1 cup of hoof and horn, 1 cup of rock dust, 5 litres of vermiculite.

"*More than putting microbes in, it's putting signals in to the soil to wake up microbes*" Jayne sums up the benefit of applying composts.



Soil

Soil management is focussed on trying to rebuild the diversity of microorganisms in the soil, rather than nitrogen inputs. In addition to the compost applications (described above), the green manures are diverse and omnipresent. From late summer onwards nearly all crops are undersown with cover crops. Pathways between the beds are living, including species like trefoil, ribwort, cowslips, and burnet. Inevitably grass creeps in, but if there's too much grass then the bed

gets power harrowed and they start again.

As the soil improves, overwintering green manures improve - despite some winter flooding. Green manure mixes are tweaked all the time, especially trying to get more perennials in. Soil quality is better in the market garden than the pasture, because a lot more organic matter has been added.

Jayne is cautious about the amount of legumes going in to cover crops, *"because you won't build a fungal dominant soil with legumes. Plants will reject mycorrhizal associations if there's too much Nitrogen in the system. You need to build bacteria that naturally fix Nitrogen and be more balanced. You don't see many legumes in the hedgerow - yet that's all green."*

They aim to get more into microscopes, and other soil measurement devices, so that more can be learnt about the processes and microbiology in the soil.

Impacts

Cropland

In 2017-2018 the Market Garden reduced in size and transitioned to no dig. The approach was to apply compost, and then apply a tarp to kill off weeds. As they started to introduce cover crops into the system it became apparent that tarping after a cover crop was leading to reduced soil aggregation. So to observe differences, an adjacent bed was green manured and power harrowed (twice).

The tarped bed showed much faster initial crop establishment, although the soil was less aggregated and felt tight. Soil can be quite hard after tarping over winter - perhaps it is suffocating the soil and the initial boom of microbial life when mowing and tarping is followed by bust as the microbes run out of plant material to break down.

Over the season the cultivated land was better. Seeing the difference in soil health and increasingly growing cover crops that are hard to kill by tarping has led to the change to shallow power harrowing before planting crops in spring. *"The plant material settles into a mulch on the surface keeping the soil covered, and later in the season mowing the pathways and blowing the clippings onto the bed is looking very promising - I'm keen to see how that works out." says Jayne*

There have been substantial benefits to soil health, organic matter and soil biology. See the Soil section below to read more.

Grassland

The pasture is so much thicker now. SOM is building, and the soil feels more spongy. There are some micronutrient deficiencies, where ideally an inoculant will be added. The sheep seem healthier now and the whole system is going in the right direction. Wormer hasn't been used for several years, and fly strike is so much less, neem being sprayed onto the sheep every month throughout the summer and autumn - Jayne believes much of this is due to an increase in minerals and nutrition.

When the pasture was last re-seeded using cultivations and a roller, compaction likely occurred. Before that the field was 'absolutely hammered', where a light rain shower would cap the soil. It has now changed beyond all recognition. Even fields that are now only grazed twice a year before were far worse.

Jayne has observed how the species composition has changed over the years. *"In the years after sowing the pasture it was predominantly grasses, white clover, and yarrow, with a little ribwort, burnet and yellow trefoil. Now there is much more diversity there are flowers throughout summer and autumn, dandelions, wild carrot, yarrow, knapweed, oxeye daisy, ladies bedstraw, sainfoin, mallow, hedge sage, black medic, red clover, sorrel, cowslips, stitchwort, prunella, lucerne, hogweed, cow parsley, yellow trefoil, burnet and ribwort are increasing.*

A few bee orchids and pyramidal orchid appeared four years ago and returned every year since. We had never seen orchids on the farm before! Butterflies and other pollinating insects are also more abundant."

Wildlife

Tall hedges around the fields provide great habitat for insects and birds. Flowering species throughout the farm also provide really valuable habitat, particularly for insects.

The soil ecosystem is actively encouraged throughout the farm, and the soil is teeming with life. "*There are so many worms in the soil, it's hard to avoid them when transplanting crops!*" Jayne says.

For the first time in 30 years, the pasture now has pyramid and bee orchids, which have not been sown or planted. This is a reaction to a change in management.

Soil

Changes to management in the market garden have led to a *"beautiful structure in the top 5-10cm of the soil profile, here aggregation is fantastic, the soil dark and smells of woodland. Below this level the paler subsoil is increasingly marbled with black streaks. This is carbon formed by worm activity and the dead bodies of the microbes that were feeding around the roots of the diverse cover crops. It goes 30-40 cm down, hopefully in the future the soil will be as well aggregated and dark throughout the top 40cm "* comments Jayne.

Soil Organic Matter levels in the top 5-10 cm are at 7-8% below this level organic matter is 3 to 6%.

Perennials with deep roots help to aerate the soil and build carbon deeper in the soil, whilst also helping drainage, so it is the aim to incorporate more perennials in the cover crops. Chicory and ribwort plantain seem to be working out, they will try to introduce more perennials in the future.

"It's a journey and soil dictates the pace, but we're moving faster now" says Jayne.

Weather

When looking back at weather patterns, it can be hard to remember accurately what happened. Jayne remembers many extremes over the years. Whilst there have been no terrible events recently, she says *"what has changed is the frequency of heavy rain events".*

"The up and downness of the weather has changed a lot. Had we still been ploughing now, we would've had two or three terrible seasons and lots of soil damage. The way I farm now has softened that blow. I wouldn't want to be cultivating the land like we used to."

Carbon footprint

The farm uses an electric van for transporting veg boxes.

Soil Organic Matter levels are rising all the time, and will be re-emeasured again soon. They hope to see carbon sequestration occurring due to increasing Soil Organic Matter levels.

Hedges around the site are sequestering carbon in biomass and soil, as is the orchard.

Three questions

1. **What's the most difficult thing about making changes?**

   "Not to get over excited in winter and make a lot of plans, that you have nowhere near enough time to implement in the summer!"

2. **What setbacks have you had, and how have you dealt with them?**

"When you're determined to get a winter cover crop, but when the crop is not allowing it, and it hasn't worked. Sometimes I have resown three times. Note to self: be more relaxed about having less diversity - put in rye if necessary; don't be a perfectionist."

3. **What are the best things in the changes you've made?**

"Increased flowers in the pasture and watching the swallows flying over the market garden and pasture feasting". Smell of the soil and seeing all the worm casts. It can be the best and worst because you're cutting a worm in half every time we put a trowel in the soil when planting! Seeing tiny little insects in the soil that I've never seen before is very positive. The next thing is to learn what they all are! All this helps build the soil food chain."

Links

Website:

https://www.oxtonorganics.co.uk/

Organic Grower podcast episode
https://open.spotify.com/episode/1xFiss79NPMD9CQMg9qlcU

Organic Growers Gathering
https://organicgrowersgathering.org/videos-1/v/nlecx29aabcjjcs2mw3mskgy8rbwd9

Instagram:

https://www.instagram.com/oxton.organics/