

AN INTRODUCTION TO AND ANALYSIS OF REGENERATIVE AGRICULTURE

Regenerative agriculture (regen ag) is a set of farming practices and a social movement that has been increasingly taken up by farmers in New Zealand over the last decade. Over the last four years it has now gained considerable national visibility and traction, such that MPI has launched a dedicated regen ag research fund in December 2020. The relative novelty of regen ag and diversity of influences means that its origins and exactly what it is about are unclear for many and some have expressed scepticism or even dismissed it. This article provides some background as to its origins and key components.

*Highly diverse fodder
crop including sunflowers.
All photos in this article
courtesy of Jono Frew*

What's in a name?

While many would like a clear and concise definition, currently this is not possible. First, the name 'regenerative agriculture' is one of a number of names used to describe the same general farming approach, including biological farming, holistic grazing, natural farming, humus/carbon farming, amongst others. In New Zealand, starting in the early 2000s, carbon farming morphed first into biological farming, which then morphed again into regen ag. This means that regen ag is therefore not just one thing.

The use of the term 'regenerative', however, is a very deliberate reaction against the term 'sustainable' because regen ag proponents consider that 'sustaining' (i.e. keeping the same) is not good enough and that it is also possible to sustain something in a sub-optimal (even degraded) state. Using the term 'regenerative' is therefore considered something of a line in the sand, in that regenerative farmers are by definition improving their farms and reducing their environmental impacts.

There are also a range of other farming practices and systems seen as being more distantly related to regen ag (such as organic agriculture, agroforestry, permaculture, no-till, cover cropping, agroecology etc). These can be

grouped together as the 'alternative agricultures' (alt-ag) because they are all alternatives to mainstream/intensive agriculture. There is a considerable cross-over of ideas and practices between the alt-ag.

Regen ag is still evolving globally, especially in New Zealand as the overseas versions of it are adapted to our farming conditions. Regen ag also has no governing body, only a set of associations and networks that often have no formal linkages with each other. So, unlike organics, which has a single international body in the International Federation of Organic Agricultural Movements (IFOAM) and formal definitions, principles and rules, regen ag is still quite fluid.

The origin of the term and concept of 'regenerative agriculture' is also not unambiguously known. It was first used in the academic literature in the late 1970s and early 1980s, but there are no clear linkages between those early uses of the term and current regen ag (i.e. it is likely the term and practices have been reinvented multiple times).

A major point of confusion is the term 'regenerative organic agriculture' coined by Robert (Bob) D. Rodale in 1983, the son of Jerome I. Rodale who founded the Rodale Institute in 1947, the leading organic agriculture research





Tillage radish

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organisation in the US. In 2017, this was formalised by the creation of 'Regenerative Organic Certified' (ROC). However, ROC is an extension to certified organic production with a focus on soil health, and animal and worker rights, and therefore is quite different to mainstream regen ag. For example, most regen ag farmers are not certified organic, so would be unable to obtain ROC, and organic farmers could not implement some aspects of regen ag (such as no-till which is currently difficult or impossible without systemic broad-spectrum herbicides that are prohibited under organic certification). ROC is therefore related to regen ag by name only.

As a formally agreed definition of regen ag does not currently exist, it is more helpful to look at its objectives and practices to understand it.

Key objectives and practices

In keeping with the fluid nature of regen ag and lack of agreed definition, there are also no formally or universally agreed set of regen ag objectives and practices. There are, however, a growing number of organisations dedicated to regen ag, most of which outline the key objectives and practices as they view them. Some of the main organisations/associations are:

- Terra Genesis International (terra-genesis.com and regenerativeagriculturedefinition.com)
- The Regenerative Agriculture Alliance (regenagalliance.org)
- Regeneration International (regenerationinternational.org)
- Regenerative Agriculture Foundation (regenerativeagriculturefoundation.org)
- The Carbon Underground (thecarbonunderground.org and thecarbonunderground.org/our-initiative/definition).

Most regen ag associations are based in and originate from North America, with Australia being second in the level of activity. The dominant regen ag farming systems in both regions are extensive livestock and lower intensity arable/row-cropping, and particularly mixed farming systems with both arable crops and livestock. These are often situated in lower rainfall areas represented by temperate grasslands, savannas and shrubland biomes.

It is suggested that the objectives and farming practices of RA have been shaped by the biophysical constraints of these biomes, in a similar way to how organic agriculture has been shaped by the climate, soils and farming systems of Northern Europe (UK, Germany, Denmark etc) where

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it originated. From the above sources and scientific publications key regen ag 'practices' have been distilled:

- Minimising or eliminating tillage (i.e. no-till)
- Avoiding bare soil/keeping the soil covered at all times with living plants or residues – 'soil armour'
- Increasing plant biodiversity (both pasture and crops)
- Integrating livestock and cropping (mixed/rotational farming).

Then there are further practices that are listed by three or less sources:

- Maintaining living plants and their roots year round
- Increasing soil fertility through biological means.

In the New Zealand regen ag group 'Quorum Sense' (QS) – named after 'quorum sensing' which is the ability of microbes to detect and respond to cell population density by gene regulation – there is also a keen interest in reducing the amounts of soluble/mineral fertilisers.

There is a strong belief that nitrogen fertilisers, in particular, are detrimental and the aim is to replace them as much as possible with biologically-fixed nitrogen via legumes and free-living diazotrophs.

Some in QS also express the view that they have been over-fertilising with phosphorus and other nutrients and are aiming to utilise existing soil P by increasing the biological activity of the soil, especially via mycorrhizal fungi. There is also considerable interest in the base-cation saturation ratio (BCSR) soil nutrient testing approach, also called the Albrecht-Kinsey system, even though mainstream soil scientists widely consider the approach to be unsubstantiated at best.

Likewise for the pesticides (herbicides, fungicides and insecticides), there is a view among QS that they have negative effects, particularly on soil biology, and should therefore be avoided. As many of the QS farmers have been using agrichemicals extensively for many years (even decades) before their move to regen ag, they have good knowledge of the different types of chemicals and rate them as to how bad their negative effects are. Some are considered particularly harmful such as neonicotinoids ('neonics'), and are completely avoided, while others are considered less harmful and/or they are difficult to substitute (e.g. glyphosate) so are used sparingly. This view is not unique to QS. Gabe Brown (brownsranch.us) in his first principle of soil health states, 'Synthetic fertilizers, herbicides, pesticides, and fungicides all have negative impacts on life in the soil as well.'

The same as for on-farm practices, the 'objectives' of regen ag have also not been systematically agreed as different sources have different perspectives. However, like the practices, there are common themes that have been distilled from multiple sources.

Improving soil health is considered to be the core objective and focus of regen ag. Soil health is viewed holistically (e.g. it includes biodiversity but the main aim is building soil carbon/organic matter and thus improving soil biology). The next objective is considered to be mitigating climate heating through sequestering atmospheric CO₂ as soil organic matter, which is synergistically linked to the core objective of soil health (an example of a win-win scenario for climate heating). Adapting to climate heating as the next objective is clearly linked to the mitigation objective, as the solution to both is rooted in building soil organic matter because that makes soil more resilient and better able to deal with climate extremes (such as floods and drought).

Further building on the climate heating adaptation there are objectives around improving ecosystem services, although these are rarely couched using the term ecosystem services, rather more practical outcomes (e.g. not polluting waterways with soil, nitrogen and phosphorous). There are also multiple objectives around improving the health and vitality of farming communities, a clear difference with farming systems such as no-till and Conservation Agriculture (CO), which are purely focused on technical in-field issues.

The objectives therefore stretch from the highly specific (e.g. building soil organic matter) to the high level (e.g. the vitality of farming communities) within a holistic approach/view. So, while regen ag can be viewed as 'just' a collection of existing on-farm techniques, it has become something larger. Some regen ag advocates are claiming that it has moved into higher levels, such as system redesign and reconceptualisation of the farm, viewing the farmer as an actor in their farm environment, and regen ag being as much about a change in mindset as changing on-farm practices (e.g. some see it as a framework for self-assessment and collective aspiration). Regen ag should therefore not just be viewed as a set of practices and objectives, but rather as a fundamental re-evaluation of the farmer's relationship with the farm. Also, how their farming impacts on the quality (healthfulness) of the food they produce, the effect this has on the health of their customers who consume that food, and finally on the health of the wider biosphere and planetary systems.

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Regen ag and science

Most of the practices listed above (e.g. no-till, cover cropping) are not unique to regen ag, with many of them being part and parcel of other alt-ag. For example, the aims of minimising/eliminating tillage and keeping soil covered are 'borrowed' directly from minimum/no-till and CA, respectively, and some farmers have come to regen ag through previously practising these farming systems. Therefore, while regen ag as a whole is novel, it mostly consists of well-proven practices (e.g. residue retention)

and farm systems (e.g. no-till).

The main novel regen ag practice is considered to be the focus on highly diverse multi-plant species rather than monocultures or simple mixtures of a few species. There is considerable scientific supporting evidence from ecological studies that it both increases yield and also improves other ecosystem services, for example, from Tamburini and colleagues in 2020 (see <https://advances.sciencemag.org/content/advances/6/45/eaba1715.full.pdf> DOI:10.1126/sciadv.aba1715).

Break feeding diverse pasture mixture



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Therefore, the charge that regen ag lacks scientific validity and evidence is contrary to a large amount of scientific evidence on its component parts. Where there is a lack of research is on regen ag as a whole system. This is partly due to it being relatively new, so there hasn't been sufficient time to undertake research, especially as regen ag is a whole of system approach so it requires farm systems research, which needs considerable resources and time. In addition, regen ag has been almost entirely developed by farmers (not scientists) so there has been little communication between the two camps.

The lack of research into regen ag as a system cannot be blamed on the farmers, as they are farmers (not scientists) so lack the resources and expertise to undertake it. Also, farmers undertake 'informal' and 'natural' experiments all the time: they modify and adapt their practices and note the results, and keenly observe the effects of changes outside of their control (such as the weather). While these 'experiments' do not meet the scientific gold standard of random, replicated experiments, they are also not worthless. Agriculture has existed for some 10,000 years and agricultural science some two to three hundred, so farmers have developed agriculture, including the domestication of all farmed species, without the benefit of science. The reliability of farmers' experiments is therefore sufficient for their needs and to answer their questions. Therefore, if scientific evidence is desired it is up to scientists to undertake it, not farmers.

Regen ag as a social movement for change

Regen ag farmers are wanting to change their farming systems to address local to global issues (such as climate heating, biodiversity loss, nitrogen and phosphorus pollution, food quality, rural life etc), which means they are actively trying to address some of the biggest social and environmental issues of our times. This is perhaps the most important aspect of regen ag that is being lost in academic arguments about the pros and cons of particular farm practices and the level of scientific 'proof' (i.e. that regen ag farmers are actively engaged in solving the massive global challenges that humanity faces).

In New Zealand, and many other countries, the farming sector (or at least its political organisations) have long argued that issues like climate heating do not exist. Then when such positions have become

untenable, they have argued against agriculture's role in the issue and the need for change. It should therefore be warmly welcomed by wider society that regen ag farmers are actively engaged in these issues, acknowledge that farming is responsible, and that they are changing their farming practices to try to address the issues.

Conclusions

Regen ag is not straightforward to understand as it is a complex and whole of system approach. There is general agreement among proponents as to what practices and objectives are core to regen ag or are not. The practices that appear to be universal are the minimisation or elimination of tillage (soil disturbance), having a high diversity of plant species (both pasture and crops), avoiding bare soil, and the integration of livestock and cropping (mixed farming). The objectives are improving soil health, especially increasing/maximising soil organic matter (soil carbon) and soil biology, particularly microbiology.

However, regen ag is also much bigger than a mere collection of farm practices, as it is also a social movement, a value system and a philosophy, with the objectives to change the industrial/intensive farming paradigm, and to repair the damage done to planetary systems by mainstream agriculture on the farm, at the planetary level, and in the social sphere.

Finally, considering the intransigence of the agricultural sectors over several decades (both in New Zealand and globally) to engage with wider society and politics to address the multitude of global and environmental issues that face civilisation, it should be warmly welcomed that a network of farmers is actively acknowledging that agriculture is part of these problems. They are changing their farm systems, to the best of their abilities and knowledge, based on science and within economic constraints to mitigate and adapt to these issues, and are therefore worthy of support.

Further reading

This article is based on a more detailed report published by the BHU Future Farming Centre. See: www.bhu.org.nz/future-farming-centre/ffc/information/misc/an-analysis-and-overview-of-regenerative-agriculture-2019-ffc-merfield.pdf

Dr Charles N. Merfield is Head of the BHU Future Farming Centre based at Lincoln University in Canterbury. Email: charles.merfield@bhu.org.nz 