



TECHNICAL GUIDE

POSITIVE OUTCOME AREAS



Cover crops and green manures

Cover crops and green manures are crops grown between or alongside cash crops to improve soil health, protect soil and support nutrient cycling. They are typically short-term crops but can also include longer-term fertility-building leys in organic systems.

They are used across arable, horticultural and mixed farms – not just in regenerative systems – to deliver multiple benefits within the rotation.

Depending on species and management, cover crops can:

- **Fix nitrogen:** legumes such as clover and vetch convert atmospheric nitrogen into plant-available forms
- **Capture nutrients:** deep-rooting species recover nutrients at risk of leaching
- **Build organic matter:** increasing soil carbon and improving structure
- **Protect soil:** reducing erosion, runoff, and compaction
- **Support integrated pest management (IPM):** by encouraging beneficial insects and disrupting pest cycles

Cover crops can be established after harvest or under-sown into standing crops and terminated using frost, grazing, cultivation, or herbicides (in non-organic systems).

Choosing the right mix and timing is key to achieving the desired outcome.

What the science says

Evidence shows that cover crops and green manures can deliver rapid and measurable improvements in soil and farm system performance. They can reduce soil erosion by up to 80% and significantly cut nutrient losses, helping retain nitrogen and other nutrients within the system. This is particularly important over winter, when bare soils are most vulnerable. Legume-based cover crops can contribute 20–100 kg N/ha to following crops, reducing the need for synthetic fertilisers.

Over time, cover crops increase soil organic matter, improving soil structure, infiltration, and water-holding capacity. This supports better crop performance in both dry and wet conditions. Diverse species mixes also improve biodiversity above and below ground, supporting beneficial insects and soil biology.

While results vary depending on system and management, the overall evidence is clear: cover crops are an effective tool for building soil health, reducing inputs, and improving resilience. In organic systems, they are essential for maintaining fertility and crop health without synthetic inputs.



Whole farm system

Cover crops are a flexible tool that can support multiple functions within a whole farm system. They can provide soil cover, build fertility, and integrate with livestock where grazing is possible.

Deep-rooting species such as chicory, plantain and radish help relieve compaction and improve soil structure, while also accessing nutrients deeper in the soil profile. Nutrient-scavenging species such as buckwheat reduce losses and recycle nutrients into the topsoil. Flowering species such as phacelia support pollinators and beneficial insects, contributing to

integrated pest management. Brassicas such as mustard can provide bio-fumigation effects when managed correctly.

In organic systems, longer-term green manures such as grass-clover leys play a key role in building fertility and soil organic matter. These can also provide valuable grazing for livestock.

Integrating cover crops into the rotation improves nutrient cycling, reduces external inputs and strengthens system resilience.

How do I make sure it will work for me?

Success with cover crops depends on matching species and management to your objectives and system.

Start by defining your main goal:

- **Nitrogen supply:** use legumes (clovers, vetch) – best in longer-term mixes
- **Weed suppression:** fast-growing species (mustard, oats, phacelia)
- **Soil structure:** deep-rooting species (radish, chicory, plantain)
- **Nutrient capture:** species like buckwheat and brassicas

Mixed species crops are often more effective than single species, as they deliver multiple benefits. However, avoid including species that may increase pest or disease risk in your rotation (e.g. brassicas before oilseed rape).

Timing is critical – early establishment improves biomass and effectiveness.

Be aware of risks:

- **Seed return:** some species can become weeds if not managed
- **Short-term legumes:** may not fix significant nitrogen
- **Rotation conflicts:** avoid overuse of certain plant families

Tailoring mixtures to your farm, rather than using standard mixes, will improve results.

In organic systems green manures can be a primary source of nitrogen and a key tool for weed and soil management.

Measuring and monitoring

Monitoring helps ensure cover crops are delivering benefits. The best approach is to focus on practical indicators such as:

- Track long-term improvements in soil organic matter
- Use visual evaluation (VESS) and soil pits to monitor soil structure changes over time
- Keep records of performance, yield and consistency for the following crops
- Make note of any weed and pest pressure changes across seasons

Recording simple observations – such as rooting depth, soil friability and earthworm activity – can provide valuable insights. While noting the establishment success, biomass and termination outcomes will help you refine the process for more effective future use.

Over time, improvements should be seen in soil workability, reduced input needs, and more consistent crop performance.

Timescales

Cover crops will deliver benefits at different timescales.

Short-term:

- Reduced erosion and nutrient loss
- Improved weed suppression
- Better soil cover over winter

Medium-term:

- Increased soil organic matter
- Improved soil structure and infiltration
- Reduced input requirements

Long-term:

- Greater resilience to drought and extreme weather
- Improved biological activity and nutrient cycling

Consistency is key – the benefits build over time with repeated use.

Case study

At Tregooden Farm in Cornwall, Malcolm and Catherine Barrett have integrated cover crops and green manures as part of a wider transition to a lower-input, soil-focused farming system.

Cover crops are now a key part of the rotation, with a cover crop of Westerwold ryegrass broadcast onto an early established maize crop. It forms a vegetation understory that reduces soil erosion and adds more living roots to the soil thereby improving its condition. After the maize harvest, this cover crop provides a grazing platform as part of their cattle's out-wintering rotation. This approach helps maintain soil cover, recycle nutrients, and add organic matter back into the system.

After cereals, a 6 species mix (kale, stubble turnips, black oats, crimson clover, vetch, Westerwolds (rye grass) alongside 'volunteer cereals' is used, again providing a grazing opportunity with the grasses providing a second grazing round after Christmas.

The farm has seen clear improvements in soil structure and biological activity, with increased earthworm numbers and better soil porosity. These changes have improved drainage and workability, allowing more timely field operations.



By using cover crops and reduced cultivation, alongside the integration of grazing livestock has further strengthened the system – closing nutrient cycles and increasing overall resilience.

This whole-farm approach demonstrates how cover crops and green manures can support both soil health and profitability when well managed.

Reason for growing	Suitable species	Notes
Nitrogen Fixation	Clovers, Legumes	Not short-term mixes
Build Soil Organic matter	cocksfoot, chicory, yarrow, sweet clover, buckwheat (short term)	Longer term mixes, add legumes for nitrogen fixation as well
Recycle or scavenge nutrients	Longer term → buckwheat, plantains	Will add organic matter at depth
	Short term → mustard, forage rape, stubble turnips	
Protect soil	Rain cover = mustard, phacelia	Quick groundcover, clover and medic can be living mulch under taller crops
Repair soil	Compaction = sweet clover, plantains, daikon radish	
Pest control	Flowering plants like phacelia	
Bio-fumigation	caliente (Brown) mustard	Needs incorporation to be effective
Weed suppression	Annual mixes including black oats	Thick crop with range of rooting depths competes with weed species
	buckwheat - (allelopathic)	

Impact

Cover crops deliver multiple benefits across the system.

- **Soil:** improved structure, organic matter and biology
- **Water:** better infiltration and reduced runoff
- **Carbon:** increased soil carbon storage
- **Biodiversity:** more diverse habitats for soil life and insects

They also reduce reliance on fertilisers and pesticides, lowering costs and environmental impact.

In organic systems, they are essential for fertility building. In all systems, they provide a practical tool for improving resilience and sustainability.

Cover crops and green manures can reduce nitrogen fertiliser needs in the following crop, cutting input costs while improving soil fertility and resilience.

Costs, savings and improvements

Introducing cover crops and green manures will affect costs, workload, and management, particularly in the first few seasons. Establishment costs typically include seed, drilling, and in some cases additional passes for termination. Seed mixes can vary widely in price depending on species choice, with more diverse mixes generally costing more upfront.

There may also be indirect costs, such as soil moisture use ahead of spring crops in drier regions, or challenges with establishment in late harvest years. These risks need to be managed through careful species selection and timing.

However, these costs are often offset by a range of savings and system improvements. Cover crops reduce nutrient losses over winter, helping retain nitrogen and other nutrients for the following crop. Legume-based mixes can reduce nitrogen fertiliser requirements, while improved soil structure

can lower cultivation costs over time by reducing compaction and improving workability.

Weed suppression from well-established cover crops can also reduce herbicide use or the need for additional mechanical control. In mixed systems, grazing cover crops can provide a valuable source of forage, reducing purchased feed costs while recycling nutrients through manure.

Over time, improvements in soil organic matter and structure lead to better water infiltration and retention, supporting more consistent yields in both dry and wet conditions. This contributes to greater resilience and reduced financial risk.

From a whole-farm perspective, cover crops support a more stable system with lower reliance on external inputs. While short-term financial returns may vary, longer-term benefits typically include reduced input costs, improved soil performance, and more consistent crop yields.

For organic systems, these practices are essential for maintaining fertility and productivity. In all systems, they offer a practical route to improving both economic and environmental performance.



Contacts

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