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LATEST NEWS

NUTRIENTS & WATER: Turning potential pollution into resource efficiencies



Nutrients & water is a topic confronting every farmer, regardless of their sector, geography or individual circumstances.

The total nutrient surplus generated by fertiliser and manure use on managed agricultural land in the UK remains high at 79kg/ha for nitrogen and 2.8kg/ha for phosphorus (Defra, 2022). There is scope for every farm business to be more efficient; the nitrogen (N) and phosphorus (P) surplus of each farm enterprise should be known. This can then be benchmarked against similar farms and measures implemented to reduce losses.

Below is a summary of the guide, created by the *Nuffield Farming Scholarship Trust** and supported by the *Royal Agricultural Society of England* and the *Elizabeth Creak Charitable Trust*, that

provides actionable insights for farmers to address nutrient and water management challenges and help them turn a potential problem into positives.

These practical recommendations are grouped into three categories:

- Actions that can be taken immediately (Do now).
- Actions that require some planning (Start planning).
- Long-term options to consider (Think ahead).

DO NOW

Nutrient Management: Work out your farm's N and P surplus

- ✓ Calculate nitrogen (N) and phosphorus (P) surplus to benchmark against similar farms and reduce losses.
- ✓ Use tools to quantify nutrient loss and adopt lean management principles to minimize waste.
- ✓ Choose contractors with more accurate fertiliser and manure application equipment for precise nutrient management.

Adopt catch and cover cropping



Image 1: Cover cropping in action: Bean and oat roots intertwined.

- ✓ Plant cover crops to improve soil health by feeding soil microbes, reducing compaction, and cycling nutrients.
- ✓ Focus on Functionality, Diversity, and Density (FDD) when growing cover crops, treating them with the same care as cash crops.
- ✓ Build resilience by integrating cover crops into broader farming systems. Farming layered and not naked is key.
- ✓ Always consider individual context as it varies between farms and fields.

Soil health and fertility in the uplands

- ✓ Conduct comprehensive soil assessments every five years to monitor trends and formulate a soil health plan.
- ✓ There is an urgent need for a renewed focus on lime application on hill and upland grasslands and a better appreciation of the calcium requirement of soils.

- ✓ Diversify grass species to reduce over-reliance on ryegrass at the expense of other species.

START PLANNING

Keeping nutrients out of water: Three key actions (by Tim Stephens, NSch 2017)

- ✓ Calculate N&P surplus for each enterprise.
- ✓ Improve nutrient use efficiency.
- ✓ Build soil carbon to retain nutrients and water.

It is also important to:

- ✓ Train staff in manure and fertiliser application best practices and leverage precision farming technology.
- ✓ Improve farm infrastructure, such as drains and manure storage, to prevent erosion and nutrient loss.
- ✓ Increase yields to produce more dry matter per hectare from the same inputs, will better utilize nitrogen and phosphorus. Double and companion cropping is another way of doing this.

Agroforestry:

Agroforestry can make the farm bigger and more productive if you choose to crop the extra dimension - above and below ground. It makes better temporal and spatial use of natural resources: *sun, air, soil, water*, than monoculture.

Modern agroforestry systems are compatible with present-day agricultural techniques and tree densities.

It can be as or more productive and profitable than monoculture systems; nutrient cycling and utilisation is more efficient in agroforestry systems and nitrogen losses can be reduced by 50% in agroforestry, with improved phosphate availability compared to monoculture.



Image 2 (© Stephen Briggs): Agroforestry is well established at France's INRA research organisation

The circular farm – reduce, reuse, recycle

- ✓ Design out waste, reuse materials, and regenerate natural systems to create sustainable farming models.

- ✓ Embrace diversity and complexity to mitigate risks and maximize synergies within farming systems.
- ✓ Collaborate with experts to build and support your knowledge and adopt system thinking to see interconnection, synthesis, and the whole rather than parts.

Anaerobic digestion (AD)

- ✓ Focus on waste-based products and co-location with secondary businesses which will profit from the heat, electricity, gas or CO₂ production.
- ✓ Invest in digestate treatment and nutrient recovery to reduce pollution risks and competition with others in a saturated marketplace.
- ✓ Design AD plants to maximize the full energy flows and co-digest with sewage sludge one of the few readily accessible ‘wastes’ that can be secured at a competitive price due to the diverse geographical distribution of treatment works.

THINK AHEAD

The soil carbon market (SCM)

- ✓ Approach soil carbon markets cautiously, focusing on climate change adaptation rather than mitigation.
- ✓ Mitigate risks by pursuing other private markets for non-offset based carbon outcomes, e.g. in setting within the supply chain, and other business models.
- ✓ Keep an eye on SCMs but keep expectations realistic, don’t allow it to delay decision making. The challenges are clear enough to proceed in a direction. The risks of delaying action are bigger than the benefits.

The soil carbon market (SCM) may not be the transformative panacea envisioned. It is uncertain whether the offset SCM will be a suitable instrument for driving genuine climate change mitigation, or agricultural transformation. It could have a role to play in future if the carbon price increases, even then its impact may be limited to small changes.

Lighthouse Farms as an insight into circular farming



Image 3: © Global Network of Lighthouse Farms

Wageningen University's 'circular farming lighthouse farm' project provides an insight into what is possible for circular farming. An example is the lighthouse farm, run by the Maj family in Belvadia, Latvia.

The family is milking 1,000 cows on 4,000ha. Milk is the offshoot of manure production, manure enters the farm's AD plant, producing enough electricity for 2,000 homes, the offshoot of the electricity is heat. The heat is used to warm water in which sturgeon and eels are raised. In two years, the sturgeon grows to 10kg and is then processed and sold. The fish is not the end of the story; caviar from the mature sturgeon is the farm's final product.

The farm has carefully examined its flows and mass balances of biomass and energy and created a model that makes every asset, be it land, stock, the anaerobic digester, or the fish farm, work to best use all mass and energy from each interlinked enterprise to maximise the flow of money.

Farming carbon-neutral insects for food and feed

In the UK, supermarkets and feed producers alike are exploring soy alternatives in livestock diets. However, insect meal is about ten times the cost of soya (at a comparable 50% protein level) – a key barrier.

Carbon-neutral insect farming is possible when waste unsuitable for animal consumption becomes insect food, instead of soya-based materials. Using livestock manure as insect food could be a strategic alternative, subject to careful risk assessment. Blending waste as a substrate for insects and integrating renewable energy can establish carbon-neutral insect farming as a viable option.

While the demand for costly and unfamiliar insect-based foods and feeds might be limited at present, overcoming challenges through ongoing research and innovation could position insect farming as a pivotal player.

Conclusion

This guide highlights practical actions and innovative approaches to advance sustainable farming practices. Farmers are encouraged to adopt system thinking, collaborate with experts, and embrace diversity to build resilient and efficient farming systems.

RASE/Nuffield are preparing a further 10 guides, aiming to achieve greater reach and penetration of information to farmers on key topics. For more information visit RASE website: <https://www.rase.org.uk/reports/>

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