

5.1. Physical Manure Treatment (Solids Separation)



Summary:

Slurry separation separates the dry and liquid portions of the slurry. Separating is of great benefit because the nutrient content of the separated dry matter and liquid is different. Thus, they can be better targeted for field fertilization. e.g. the separated dry fraction can be targeted to phosphorus poor fields or exported off the farm to relieve the pressure from high phosphorus soils.

Operation and maintenance:

Operating costs consist mainly of electricity with maintenance costs being small. The period use of separation equipment can vary as needed, usually some hours per week.

Efficiency: Separating has proven to be a useful way to handle sludge. It offers new uses for sludge. Sludge problems are reduced or even eliminated. Extra space in the tank and cost savings over the long term are significant.

Efficiency and functionality   Cost of the Practice  Ease of Operation  Potential for nutrient recovery  

Overarching Issue:

Over half of Northern Ireland's agricultural grasslands may currently be above the agronomic optimum phosphorus (P) index of 2+ (21-25 mg Olsen P L⁻¹), primarily in intensive dairy production areas. High P index soils pose a significant threat to water quality, with increased soil P levels linked to increased P loss from overland flow and sub-surface drainage systems.

A strategy to minimise damaging effects of surplus P is to reduce the amount in slurries and manures prior to land application.

Introduction:

- Dairy cattle slurry and digestate are valuable sources of nitrogen (N), phosphate (P₂O₅) and potash (K₂O). Making efficient use of these 'organic' nutrients can appreciably lower the need for expensive 'chemical' fertiliser and thus improve farm profitability.
- Furthermore, because chemical fertilisers are produced using fossil fuel energy, minimising the amount brought onto farms will also reduce the 'carbon footprint' of farm enterprises.
- However, many dairy farms have large (P) surpluses (> 20 kg P/ha),
- Some of this excess soil and manure-P is being washed into streams and rivers thereby hindering N. Ireland from meeting chemical water quality standards under the EU Nitrates and Water Framework Directives.

A key to managing water quality in N.Ireland:

- The need for enhanced nutrient management on-farm could be critical to prevent soil P levels increasing and to reduce the risk of P loss to water. For example, the ability to partition the P in slurry and digestate to a liquid and a solid fraction using mechanical separation, would be of considerable benefit.
- The liquid fraction has a lower concentration of P than the solids fraction, and contains valuable N and potash (K₂O) which can be spread as organic fertiliser to more precisely match crop nutrient requirements without exacerbating the P over-supply problem.
- The separated solid fraction may be further processed (dried, composted or granulated) to produce a saleable, stable, low moisture product that could then be exported off-farm to facilitate P-balance lower run-off risk.

Goals:

- To separate and isolate nutrient from both the solid and liquid fractions of separated digestate and slurry
- To produce "cleaner" separated waste waters (i.e. lower NPK) to enable low risk, year-round land spreading
- To reduce the requirement for storage and tankering of slurries and digestates.

Methodologies of Slurry and Digestate Separation



Decanting Centrifuge Separator

- ◆ Decanting centrifuges particularly effective at separating the majority of the P into the solid fraction
- ◆ Capital (>£100k) and running costs (3 – 5 kWh/m³) are much higher
- ◆ Efficiency of P separation into the solid phase is > 60% even without coagulants

Screw Press Separator

- ◆ Low capital costs (£25k approximately) and running costs (0.4 – 0.5 kWh/m³)
- ◆ Efficiency of P separation into the solid phase is 25-40%

Benefits

- ◆ Export concentrated nutrient to where it was required and would pose reduced environmental risk
- ◆ Provide improved methods for NPK nutrient recycling and lower risk of water pollution and eutrophication
- ◆ Reduce the quantity of slurries and digestates stored and tankered across the country at great cost to the farmer / AD operator.
- ◆ All these outcomes have significant commercial value and contribute to the Circular Economy
- ◆ To explore & develop better management strategies for nutrients from slurries and digestate
- ◆ As P is a costly and scarce resource, costing around 2-3 EUR/kg, while N costs around 1 EUR/kg, livestock manure separation can save money. These figures vary, however, as the separation efficiency depends greatly on the technology used.
- ◆ This technique is well suited for nutrient recovery and after separation, the recovered nutrients are also easily dispersible in the desired locations.

Slurry and digestate separation: a KEY to managing surplus P₂O₅

- ◆ A strategy to minimise environmentally damaging effects of surplus P is to reduce the amount in slurries and manures prior to land application. The need for enhanced nutrient management on-farm could be critical to prevent soil P levels increasing and to reduce the risk of P loss to water.
- ◆ For example, the ability to partition the P in slurry and digestate to a liquid and a solid fraction using mechanical separation, would be of considerable benefit.
- ◆ The liquid fraction has a lower concentration of P than the solids fraction, and contains valuable N and potassium (K₂O) which can be spread as organic fertiliser to more precisely match crop nutrient requirements without exacerbating the P over-supply problem.
- ◆ The separated solid fraction may be further processed (dried, composted or granulated) to produce a saleable, stable, low moisture product that could then be exported off-farm to facilitate P-balance reduction and lower run-off risk.

MORE INFORMATION

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