

# Can Crop Farmers Benefit from Substituting a portion of Mineral Fertiliser with Organic sources of N, P, K and S?

Ashekuzzaman S.M.<sup>1,\*</sup>, Redmond C.<sup>1</sup>, Murphy J.<sup>1</sup>, Plunkett, M.<sup>1</sup>, Fenton O.<sup>1</sup>, Bourke M.<sup>2</sup>, Forrestal P.J.<sup>1,\*</sup>

- <sup>1</sup> Teagasc, Environment Research Centre, Johnstown Castle, Co. Wexford, Ireland
- <sup>2</sup> Teagasc, Tillage Advisory, Tinahely, Co. Wicklow, Ireland
- \* Corresponding E-mail: sm.ashekuzzaman@teagasc.ie; patrick.forrestal@teagasc.ie

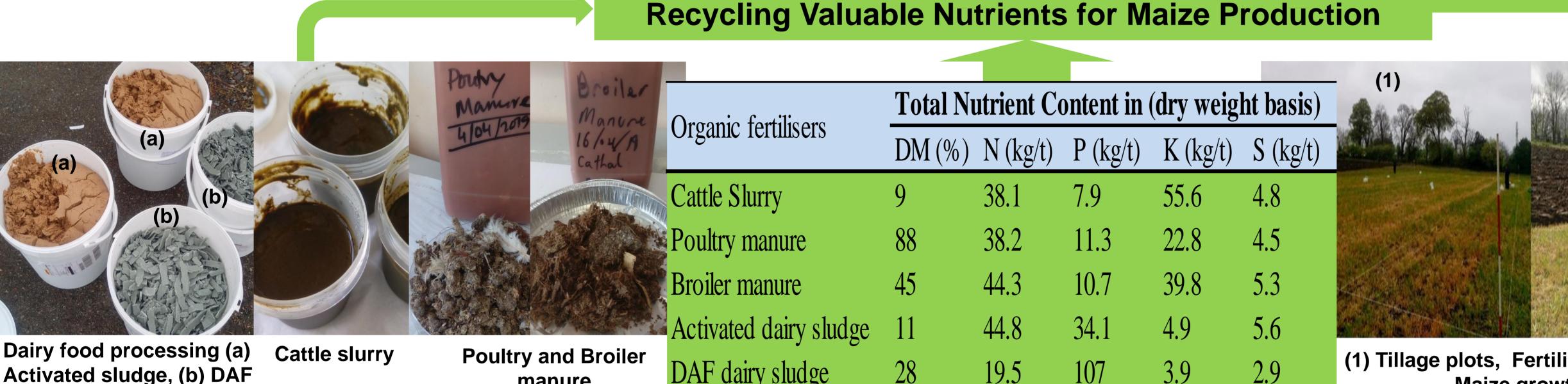


# Introduction and Rationale

- □ Cropping systems provide the grains which underpin the nutritional requirements of many animal production systems. These grains carry nutrients from the croplands, concentrating them on animal farms. Commonly, by-products from dairy and poultry supply chains are nutrient-rich cattle slurry, dairy food processing sludge, poultry and broiler manure, used as organic fertiliser.
- □ To close nutrients (N, P, K, S) cycling it is important to return these nutrients to the croplands. Balanced use of organic-inorganic fertilization showed the potential for higher crop yield, reducing chemical based fertiliser usage, and improving soil quality [1, 2].
- □ Farmers need to know an appropriate application rate of organic fertilisers with combination of chemical fertilisers. Limited study is available in the Irish condition to assess the impact of balanced organic and chemical fertiliser application on the crop yield and soil quality considering closing the C, N and P loop in agro-ecosystem.
- ☐ The objective of this study was to assess agronomic benefits of using cattle slurry, dairy sludge and chicken manure in conjunction with chemical fertilisers on spring maize production in order to facilitate farmers' understanding to use these options and to replace chemical fertilisers.

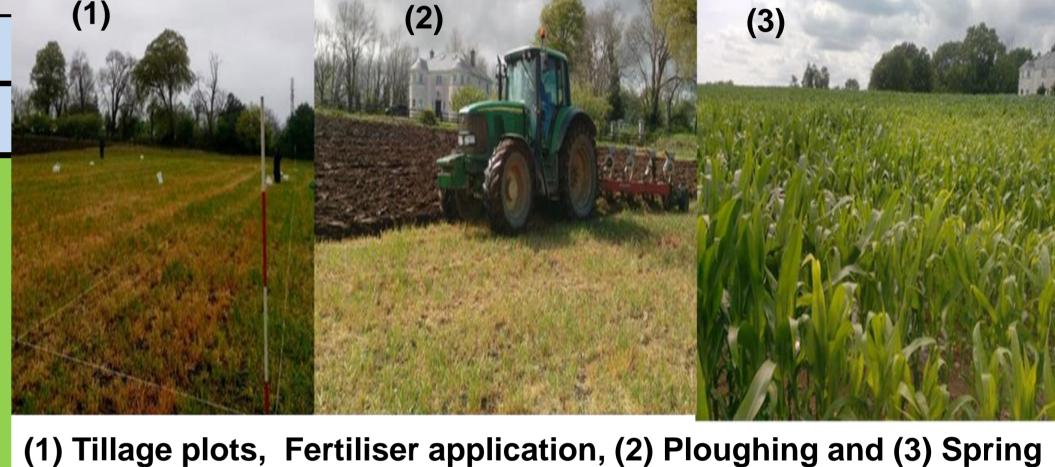
# Organic Fertilisers and Spring Maize Trial

Results



DAF dairy sludge

manure



Maize growth in 2019 at Arklow, Co. Wicklow

Activated sludge, (b) DAF

sludge

✓ Collected maize samples in sheaves of ten – Maize plants from fertilized plots were significantly taller with more cobs than unfertilized plots

- Fertiliser Application (kg fresh weight / ha)
  - Yield is significantly higher in fertilized plots compared to unfertilized plots
  - The fertiliser programmes incorporationg organic manures yielded as well as the mineral fertiliser programmes.

Treatments	Fertiliser Programme (kg/ha)	N availability (%)	Cost (€/ha
Chemical fertiliser (CF)	180N, 40P, 190K, 20S from CF	100	453
Poultry manure (PM)	4020 PM + CF (95N, 0P, 109K, 4S)	63	285
Broiler manure (BM)	8329 BM + CF (97N, 0P, 41K, 0S)	50	336
Catlle slurry (CS)	33052 CS + CF (146N, 16.5P, 25K, 6S)	30	312
DAF sludge (DS)	1335 DS + CF (178N, 0P, 189K, 19S)	31	349
Activated sludge (AS)	10653 AS + CF (174N, 0P, 184K, 13S)	11	334
Cost analysis based on – CAN €274/t. Superphosphate €397/t. MOP €386/t. SOP €573/t (Chemical Fertiliser price			

November 2019 from CSO) [3], Poultry/broiler manure €25/t [4]; Cattle slurry €3/t [5]; Dairy processing DAF/Activated sludge €0/t (delivered and followed on with NMP by dairy companies). N availability source – [6,7,8]

✓ Using 100% Chemical fertiliser costs significantly more than using a combination of organic and chemical fertiliser options while no yield difference found between them

## Conclusions

- Significant savings (23–37%) can be made when using organic fertilisers in conjunction with chemical fertilisers farmers can save up to €168/ha when using poultry manure as part of their fertiliser programme for Spring Maize production.
- Although nutrient content of different organic fertiliser options varies, an appropriate balanced fertiliser programme using organic and chemical fertilisers can give similar yield and more sustainable profit if the nutrient content and requirement is known.
- Future studies in this trial will look into crop nutrient uptake and benefits on soil quality for nutrient distribution, carbon and organic matter build up.

## References

[1] Geng et al. (2019) PLoS ONE 14, e0219512; [2] Zhao et al. (2016) Appl Soil Ecol 99:1–12; [3] CS0 (Central Statistics Office), 2019; [4] AgriLand (2016) Should more tillage farmers use poultry manure as a fertiliser?; [5] AgriLand (2017) What is the going price for slurry spreading?; [6] Forrestal et al. (2017) Proc. of the 17th Int RAMIRAN conference; [7] Ashekuzzaman et al. (2019) Proc. of the IPSAM conference; [8] Teagasc Greenbook (2016) Teagasc Environment Research Centre.

### Acknowledgements

Thanks to Mr Sylvester Bourke for facilitating experimental plots in his Tillage land. This work has received funding from the Horizon 2020 Framework Programme of the European Union Grant agreement no 773682.



Funded by the Horizon 2020 Framework Programme of the European Union