Effects of row-injected cattle slurry on yields of silage maize

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Keywords: slurry; injection; maize; yield; phosphorus.

Abstract

A new phosphorus (P) regulation in Denmark means that the maximal annual total P input in mineral and organic fertilisers to agricultural land must not exceed 30 kg P ha^{-1} on normal farms (farms with up to 170 kg manure nitrogen ha^{-1}) and 35 kg P ha^{-1} on dairy derogation farms (farms with up to 230 kg manure nitrogen ha^{-1}). Therefore, many dairy farmers have no longer the ability to apply mineral starter P to silage maize. Improved slurry application technology is therefore requested to improve P utilisation of the slurry applied to maize. To meet this challenge, a row-injection development project was developed in collaboration between Aarhus University, the machine manufacturer Samson Agro, the Danish contractor association, and SEGES.

Row-injection implies that slurry is injected in bands distanced 0.75 m apart. The localization of the slurry bands is registered by GPS. The maize is a couple of days later seeded GPS controlled right above the injected slurry bands. The development is focusing on optimal design of injection tines and injection depth regarding optimal crop yield, application capacity and draught requirement. The aim of the project is to develop a commercial slurry application technology enabling row-injection of cattle slurry to maize to ensure better utilisation of animal slurry and its nutrient content.

An important part of the project has been to study how different designs of injection tines and depth influence P uptake and crop yield. Field studies were carried out in 2018 to 2020 to study maize P uptake and yield in response to cattle slurry applied in different depth and by different design of row-injection technologies. The studies took place in both strip-till and ploughed cultivation systems on sandy loam. Each year more than 12 different slurry application systems were compared. Each treatment took place in 24 x 3m experimental plots replicated four times. Traditional slurry application with and without addition of mineral starter P was included for comparison.

It was shown by the field studies that silage maize yields and P utilisation of applied cattle slurry can be improved by row-injection of slurry, and that row-injected cattle slurry can replace the crop yield

effect of 15 kg starter P ha^{-1} (Pedersen et al., 2020). However, the studies have also shown that the design of the injection tines is very important. In particular, the lateral distribution of the slurry in the soil and the injection depth have major impact on P uptake and crop yield. Highest yield was found by 0.05 m vertical distance between seed and slurry. Higher distance (0.10 m) and lower distance (0.03 m) between seed and slurry reduced crop yield.

Row-injection of slurry in silage maize cropping has the potential to improve the utilisation of P in cattle slurry and hence maintain high final yields. However, considerable attention should be put on optimal injection depth and design of injection tines.

References

Pedersen I.F., Rubæk G.H., Nyord T., Sørensen P. 2020. Row-injected cattle slurry can replace mineral P starter fertiliser and reduce P surpluses without comprimising final yield of silage maize. European Journal of Agronomy, 116:, 126057.