

## Reducing nitrogen losses from winter grazed forage through crop selection and tillage practices.

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High producing winter grazed forage crops are often used during pasture renewal or as part of mixed-cropping rotations. The combination of wet winter conditions, high nitrogen (N) inputs from livestock excreta, low plant uptake of N and compaction increases the risk of N losses. Previous work has shown benefits of establishing a forage crop with no-tillage compared to cultivation to reduce N losses from grazing during winter on a poorly draining soil. However, such benefits have not been quantified for freely draining soils. Furthermore, while a range of crops are grazed during winter, there is a limited information on the best crops to grow to minimise the risk of N losses.

We established a field experiment near Lincoln, Canterbury on a freely-draining Templeton soil to quantify how tillage, different crops, and grazing affect N losses from winter grazing. Rape, Italian ryegrass, and an Italian ryegrass/oats mix were established using no-tillage and intensive tillage in March 2015. Grazing was simulated in July; crops were harvested and treading and urine was applied to split plots. Rape plots remained fallow for 64 days until re-sown with Italian ryegrass using minimum tillage. Dry matter production, soil inorganic N and soil moisture were measured from until February 2016.

Before grazing, the rape and Italian ryegrass/oats plots yielded more than Italian ryegrass ( $p=0.008$ ). However, after grazing yields were higher in Italian ryegrass plots than rape and Italian ryegrass/oats ( $p<0.001$ ). This was similarly reflected in the N removed in biomass. Yield and N removal was affected by tillage and grazing interactions ( $p=0.009$  and  $p=0.005$  respectively). Preliminary interpretation indicates that post-grazing amounts of soil N remained elevated in rape plots longer than in Italian ryegrass plots. Further results on the fate of soil inorganic N and mitigation strategies will be discussed.