

Effects of destruction and burial dates of cover crops on runoff, erosion and phosphorus losses in a maize cropping system

Laloy Eric(1) and C.L. Biielders(2)

(1,2) Dept. of Environ. Sciences and Land Use Planning, Faculty of Bio-engineering, Agronomy and Environment, Université catholique de Louvain, Croix du Sud 2, boîte 2, B-1348 Louvain-la-Neuve, Belgium

charles.biielders@uclouvain.be

Planting Winter cover crops has been promoted in order to reduce soil losses. Although the reduction of soil losses during the winter period is well established, cover crops may possibly also improve soil structure after their burial, thereby reducing surface sealing, runoff and erosion, and consequently losses of sediment-bound and dissolved P during the subsequent Spring crop. The extent of this reduction in Winter will largely depend on the soil cover rate and the reduction during Spring on the amount of biomass produced by the cover crops and buried into the soil. The latter is affected by the dates of destruction of the cover crops. The objectives of this study were therefore to measure the impact of the date of destruction of winter cover crops on runoff, erosion and phosphorus losses in a maize cropping system.

Runoff, soil and P losses were measured by means of triplicate 90 m² runoff plots for 2 years during the winter period and the subsequent maize season on a loamy soil with an average 8 % slope (Nodebais) and on a sandy loam soil with an average 12 % slope (Bonlez). Two cover crop destruction dates (mid-march or mid-april) were evaluated and compared to control plots without winter cover crop. Bio-available P (P_{bio}) was estimated from the sum of labile (ammonium acetate-EDTA extractable) phosphorus and dissolved P.

During the 2004-2005 Winter period cover crops produced an average of 4.75 t biomass/ha, resulting in a significant reduction by more than 95 % of runoff, soil and P_{bio} loss compared to the control. In 2005-2006 cover crops produced 1.5 t/ha of biomass on average but runoff, erosion and P_{bio} losses were still reduced by 80 % on the sandy-loam site. Due to low intensity rainfall, the loamy site did not experience any runoff, erosion and P_{bio} losses during this period. There was no effect of cover crop management on runoff, soil and P_{bio} losses.

During the 2005 maize cropping season, previously covered plots of the loamy site showed up to 90 % reduction in runoff, soil loss and bio-available P compared to the control plots. The plots where cover crops had been destroyed in April showed a significant decrease of 50 % in runoff, erosion and P_{bio} losses compared to those where destruction took place in March, due to larger amounts of buried biomass (3 t/ha mid-March, 6.5 t/ha mid-April). This residual cover effect was not observed on the sandy loam site, in part because of less erosive rainfall at that site in 2005. In 2006, no residual cover effect was observed at any site. This may in part result from the lower biomass produced during the preceding winter.

Even at low rates of biomass and cover, cover crops are very effective at reducing losses of soil and bio-available P. When sufficient biomass is produced, a residual effect may in some cases be observed. This effect is larger as the amount of buried residue increases.