Phosphorus fertilization of maize seedlings using side-band injected animal slurry

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The third *Action plan for the aquatic environment* passed by the Danish parliament in 2004, stipulates a 50% reduction of the P-surplus in 2015. Maize is typically fertilized with animal manure in amounts, which fully covers the P requirements. On top of that, mineral P fertilizer is placed close to the seeds at sowing to overcome potential P deficiency in the early growth stages. Maize is typically grown on the same field with high frequency. Therefore maize cropping often cause unintended accumulation of P in the soil. Our aim is to examine the possibilities for replacing mineral starter P fertilization by placement of animal manures as P source for maize seedlings, and this poster will show our preliminary results:

Field experiment: In spring 2008, 108 miniplots (1 m row of maize, 10 plants) were sown at Jyndevad experimental station (54° 54´N 9° 08´E) in a coarse sand soil with low P status. Compared with mineral P references, two types of animal slurry labelled with ^{15}N were side-band injected 5 cm next to the seed row at the time of sowing. Three replicates of each treatment were harvest weekly at six dates from 7th May to 12th June. Plant dry matter was analysed for N, ^{15}N, P, K, S, Ca, Mg, B, Na, Mn, Fe, Cu, Zn, Cd and Al.

The concentrations of $^{15}N$and K in plants were increased 2-4 weeks after emergence synchronous to a decrease in the Ca and Mg concentration irrespective of slurry type. Placement of mineral P fertilizer affected the plant P concentration 2-4 weeks after emergence. In contrast, animal slurry P did not affect the plant P concentration, which was comparable with the mineral reference without P. Placement of a reduced rate of mineral P fertilizer within the seed row increased the plant P concentration 1-3 weeks after emergence, but also cause a 2-4 days delayed germination and a tendency to reduced plant density.

The roots of maize were able to take up N and K from the animal slurry, but P uptake seems unaffected. This illustrates that specific, yet undefined, barriers, may restrict P uptake in maize seedlings from the slurry.

Growth chamber experiments: The field experiment raised the questions of how to identify and eliminate the barriers limiting P availability in manure applied at sowing. Processing of animal manures may be a way to go. In April 2010 a pot experiment was initiated with the aim to study the interaction between side-banded P-sources and temperature. We side-band injected cattle slurry treated in three different ways (raw slurry, acidified slurry and raw slurry spiked with mineral P) side-banded to the maize seeds. The reference treatments were side-banded N and NP. Maize was grown at 7, 10 and 13°C (increasing +0.1°C/day, ±4°C during 24h for a day/night of 16/8h). Plants are sampled at one of 9 dates during the first 6 weeks of growth, in total 270 pots (5 treatments×3 chambers×9 samplings×2 replicates). We will analyse the dry matter growth and off-take of P and other elements.