Constructed wetlands for agricultural drainwater

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INTRODUCTION

In the Netherlands agricultural practices have led to a number of environmental problems such as eutrophication, pollution and drought. Although agricultural drainwater is low in nutrients compared to other anthropogenic sources like effluent from communal waste water plants, it is still too high to meet the ecological quality goals for surface waters from the EU-WFD. Constructed wetlands may serve as sanitation units, at the same time offering opportunities for multiple goals, like water storage and biodiversity. However, the purification efficiency for N or P is insufficiently known for policy making and planning purpuses. Integration of constructed wetlands with agricultural practices on different scales is recommended. Several systems are being compared since 2005.

METHODS

Four field scale purification systems for agricultural drainage water have been installed on an experimental farm in 2005 and one wetland.was constructed parallel to a stream (**Tab. 1**). for purification of the discharge from an agricultural subcatchment. Input and output to the systems is sampled discharge proportionally for the determination of N and P loads, and –retention. Vegetation is measured yearly for dry matter production, N and P.

Table 1. The five different types of agricultural drainage purification

Year	Type	Principal nutrient	Vegetation	Length (m)	Surface (m^2)
2006	surface flow system	P	Reed	290	1305
2005	surface flow system	N	Reed	10	64
2005	horizontal filter	N	Reed	5	32
2005	horizontal filter with straw	N	Reedgrass	5	32
2006	wetland bufferstrip	N	Reed	25	75

RESULTS AND DISCUSSION

P retention in the subsurface flow filter

After 2 years the retention of N and P is still rather low: 32% of total P is and 15 %. of total N. The inflow nutrient concentration varies from 2 to 12 mg/L N and from 0.1 to 1 mg/L P. Reed establishment was very poor during the first two years, but significantly improved during the third year. Retention of P was primarily due to adsorption of P to the wetland soil.

Table 1 Measured input and output amounts (kg), absolute amounts (kg en kg/ha filter) and procentuele retention for the periode Januari till July 2008 (weak 2-24).

	Cl	N-kjehldahl	NO_3	NH_4	P-totaal gefiltreerd	PO_4	SO_4	N-totaal ongefiltreerd	P-totaal ongefiltreerd
in (kg)	529	100	74	21	10	7	914	169	10
uit (kg)	434	84	64	14	7	5	772	144	7
retentie (kg)	95	16	11	6	3	2	143	26	3
retentie %	18	16	14	31	30	28	16	15	32
retentie (kg/ha)	728	124	81	49	23	16	1094	197	23

N retention

The amount of water led into the wetlands was adjusted to the removal capacity of the wetlands; low in the winter and high in the summer. The drain water contained on average 26 mg N L-1 (96%) nitrate and hardly any P. The SF and SFF-straw systems functioned very well with a removal capacity of about 60%. SSF-reed did not functioning well. Reed was growing badly and probably the amount of carbon produced in the system was limited.
The negative removal rate of phosphorus is a disadvantage of SSF straw.

Measurement		SF	SSF-reed	SSF-straw	wet buffer strip
Hydraulic load (mm day-1)	average	29	58	58	80
	winter	11	22	22	
	summer	56	112	112	
average N-NO3	in	26	26	26	38
mg l-1	out	13	19	9	34
N-total	in	2652	5304	5304	12230
kg ha-1	out	1226	3958	1768	11490
retention	%	54	25	67	6
average P-PO4	in	0.003	0.003	0.003	0.003
mg l-1	out	0.002	0.002	0.040	0.001
P-PO4	in	0.3	0.5	0.5	0.8
kg ha-1	out	0.2	0.3	8.9	0.4
retention	%	24	34	-1589	46

CONCLUSIONS

We conclude that man-made wetlands with reed offer opportunities to comply with the European Water Framework. Integration of the wetland into the farm is neccesary and the space claim is an important factor for the farmer.