

The fate of nitrogen from crop residues

F.J. de Ruijter, H.F.M. ten Berge

Background and objectives

To reduce nutrient emissions, the Netherlands have defined crop-specific limits to N inputs. Some crops have a high N content in the crop residues, and instead of reducing N input, management of crop residues may contribute more to reducing N emissions.

To predict effects on N leaching of different options of management of crop residues, knowledge of the fate of N from crop residues is required.

The objective of this study was to monitor all emission routes of N from crop residues.

Materials and methods

A field experiment was setup at the end of October 2006 on sandy soil, groundwater level ca 150 cm. Previous crop was potato. Crop residues were applied by manure spreader.

Six treatments:

- Broccoli (136 kg N ha⁻¹), no tillage and rototillage
- Leek (92 kg N ha⁻¹), no tillage and rototillage
- Fertilizer (150 kg N ha⁻¹)
- Blank

Observations:

- N in residues (using litterbags)
- Denitrification
- NH₃ emission
- Soil mineral N (0-30; 30-60; 60-90 cm)
- Microbial biomass N
- Nitrate in soil water (extracted at 30, 60...180, 210 cm)
- N uptake by spring barley (July 2007)

Table. Increase of nitrate concentration in groundwater (mg NO₃ liter⁻¹) at different treatments compared to the blank. Average of the measurements at 150, 180 and 210 cm depth at March 14 and 28 and April 11.

	N input (kg ha ⁻¹)	Nitrate groundwater (mg NO ₃ liter ⁻¹)	
		No tillage	Rototillage
Fertilizer	150	328	-
Broccoli	136	166	212
Leek	92	105	106

Results and discussion

N in crop residues decreased quickly after application (Figure). Incorporation of crop residues decreased ammonia emission but increased denitrification.

Half of March, almost all fertilizer N was leached below 90 cm. Between 49 and 77 percent of the N in crop residues was not accounted for by the various measurements (Figure). This N is largely leached to layers deeper than 90 cm and increased nitrate in upper groundwater (Table). Measurements will continue until July 2007.

Removal of crop residues in autumn will reduce nitrate leaching to groundwater. Further study is required on treatment and re-use of the residues and their effects on emissions to assess the effects of the system as a whole.

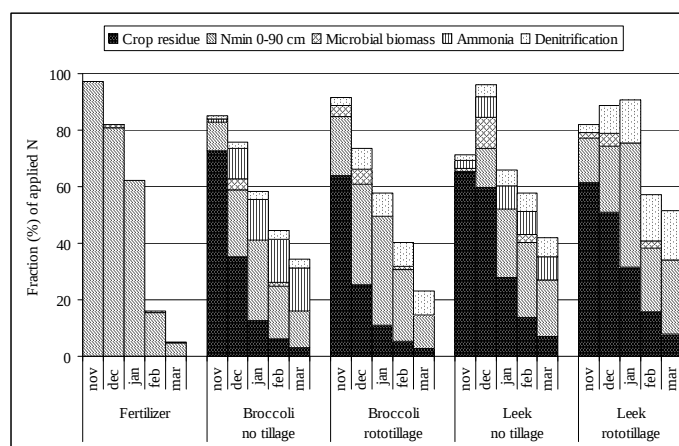


Figure. The fate of N from crop residues applied at the end of October. Samples were taken around the mid of each month and compared with the blank. N not accounted for is largely leached to layers deeper than 90 cm.

Conclusions

- N in autumn applied crop residues of Broccoli and Leek was largely mineralised during winter
- 50 percent or more of the N in crop residues leached to groundwater
- Removal of crop residues will reduce N leaching