Nitrogen Dynamics Following the Break-up of Grassland on Three Different Sandy Soils

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Introduction Nitrogen (N) is accumulated under grassland depending on factors such as soil type, management, and fertiliser input. Break-up of grassland stimulates mineralisation of organic N and may lead to increased soil mineral N and leaching losses (Lloyd, 1992). The objective of this study was to find out how site factors, e.g. soil, previous management and sward age, the following crop and the new level of N fertiliser affect the amount of inorganic N in autumn and the preceding mineralisation processes when grassland is ploughed in spring.

Material and methods The experiment had a three-factorial design with the main factors: site, crop following the break-up (barley + catch crop or maize), and level of N (i.e. 0, 120 or 160 kg/ha mineral N). All three sites are mainly sandy soils but of different origin and with differences in soil texture, organic matter, management and fertilisation history. Site 1, a plaggen soil, and site 2, a sandy podzol were mainly grazed and had little to moderate nutrient input. Swards were at least 15 years old, but the fields had been grassland for much longer. The third site is a deep-ploughed soil from shallow peat over sand and the 9-year-old sward had been used as cut grassland with high nutrient input via manures and mineral fertiliser. Among other characteristics, soil mineral N (Nmin), hot water-soluble N (Nhws) and N mineralised (Ninc), i.e. Nmin from *in situ* buried polyethylene bags minus Nmin at the start of incubation period, were analysed.

Results Results in the first year, after ploughing the grasslands in spring 2003, are shown in Table 1. Nmin in autumn and N leaching losses (not shown) were closely related. Differences between sites in Nmin were more pronounced than might be expected from Nhws or Ninc. Maize as a following crop stand seemed to stimulate the mineralisation more than barley, resulting in higher Nmin. The application of N fertiliser had no effect on Nhws or Ninc, but increased Nmin. N yields (not presented here) hardly differed between sites or level of N fertiliser. N mineralised (Ninc) from April to July corresponded well with Nmin in autumn (Figure 1).

Table 1 Means for hot water-soluble N (Nhws), N mineralised from April-July (Ninc), and Nmin in autumn

		Nhws (June) [mg/g soil]	Ninc (July) [kg/ha]	Nmin autumn [kg/ha]
Site	1	0.128 a	164 a*	117 a
	2	0.116 a	137 a	54 b
	3	0.103 b	164 a	134 a
Crop	Barley	0.109 b	128 b	53 b
	Maize	0.123 a	182 a	150 a
Fertilisation	N 0	0.113 a	154 a	74 b
	N 120/160	0.120 a	156 a	129 a

* values with different letters are significantly different at the P<0.05 level

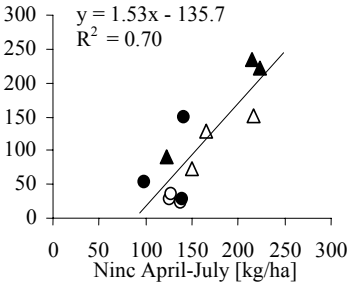

Figure 1 Relationship between N mineralised April-July (0-30 cm; Ninc) and Nmin autumn (0-90 cm). Barley = ●; maize = ▲; filled = N 120 (barley) or N 160 kg N/ha (maize); empty = no N

Conclusions The results demonstrate the strong effect of the stimulated N mineralisation after ploughing. Hot water-soluble N (Nhws) and N from incubation (Ninc) seemed to be similarly influenced by crop stand and fertilisation, though they only partly accounted for differences in Nmin between sites or level of N fertilisation. It is recommended that barley be grown instead of maize as a following crop and to minimise N fertilisation to reduce the risk of N leaching.

References

Lloyd, A. (1992). Nitrate leaching under arable land ploughed out from grass. *The Fertilizer Society*, 330, 1-32.