

# Effect of temporary grasslands of different age, composition and management on winter wheat yields in a crop rotation

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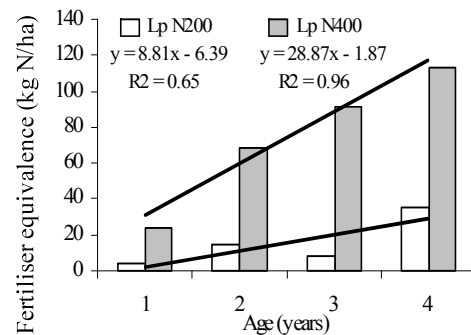
**Introduction** Organic nitrogen (N) accumulates in the soil in temporary grasslands. This accumulation is especially important when mineral N fertilisation is high. Legume-based temporary grasslands may also supply the soil with nitrogen through fixation of atmospheric N, for instance in organic farming. When ploughing temporary grassland, great amounts of mineral nitrogen can be released through the process of decomposition and mineralisation of soil organic matter. This mineral nitrogen can be taken up by succeeding crops. The aim of this experiment was to evaluate the effect of temporary grasslands of different ages, N fertilisation levels and legume contents on winter wheat yields in a crop rotation.

**Materials and methods** The experiment was established on a sandy loam soil. From 1999 to 2002, grassland was sown each year in four complete randomised blocks. Each block was divided to give the following treatments: perennial ryegrass (*Lolium perenne*, cv Merlinda ) (Lp) with no N fertilisation (N<sub>0</sub>), Lp with 200 kg N/ha (N<sub>200</sub>), Lp with 400 kg N/ha (N<sub>400</sub>) and a non-fertilised red clover (*Trifolium pratense*, cv Merviot)/perennial ryegrass (*Lolium perenne*) mixture (Tp+Lp). In Oct. 2003, all grassland plots at the four different ages (1, 2, 3 and 4 years) were ploughed and winter wheat (*Triticum aestivum*, cv Drifter) was sown. The previous Lp N<sub>0</sub> swards were used to establish a calibration curve by fertilising wheat with 0, 50, 100, 150 and 200 kg N/ha.year (in three dressings). On the previous Lp N<sub>200</sub>, Lp N<sub>400</sub> and Lp+Tp swards, no N fertiliser was applied to the wheat. In Aug. 2004, wheat was harvested and grain dry matter (DM) yields were measured.

**Results** Grain DM yields of wheat cultivated on the previous red clover based plots were similar for all years to that of the 50 kg N/ha fertilised reference wheat (Table 1). The DM yield of non-fertilised wheat sown after the 4 year old Lp N<sub>200</sub> grassland was similar to that of wheat fertilised with 50 kg N/ha. For the younger grasslands (1, 2 and 3 years old) no differences were noted between the previous Lp N<sub>200</sub> grassland and the non-fertilised reference wheat (Table 1). Grain yields of non-fertilised wheat cultivated after the previous Lp N<sub>400</sub> grassland of 3 and 4 years old were similar to that obtained for the 100 kg N/ha fertilised reference wheat while wheat yields after 2 and 1 years old Lp N<sub>400</sub> grasslands were, respectively, similar to the 50 kg N/ha and non-fertilised reference wheat (table1). Yields of wheat cultivated after previous Lp N<sub>200</sub> and Lp N<sub>400</sub> significantly increased with the age of the grass (Figure 1).

**Table 1** Grain DM yield (t/ha) and statistical analysis ( $\alpha=5\%$ )

Fertilisation		Age of sward (years)			
Grassland (kg/ha)	Wheat (kg/ha)	4	3	2	1
0	0	3.9 nop	4.3 mno	3.3 pq	3.2 Q
0	50	5.6 ghij	5.7 ghi	4.9 jklm	4.6 klmn
0	100	6.7 ef	6.9 e	6.0 fg	6.0 fg
0	150	8.3 bc	8.5 abc	7.3 de	6.9 e
0	200	9.1 a	8.6 ab	7.8 cd	7.4 de
200	0	5.0 ijklm	4.5 lmno	3.8 opq	3.4 pq
400	0	7.2 de	6.8 e	5.2 hijk	3.9 opq
Tp+Lp (0)	0	5.8 gh	5.5 ghij	5.2 hijkl	5.2 hijk



**Figure 1** Fertiliser equivalence for Lp N<sub>200</sub> and Lp N<sub>400</sub> of different ages

**Conclusions** Introducing red clover based temporary grasslands in a crop rotation is of potential value in organic farming. Indeed, the present results show wheat grain DM yields of up to 5.8 t/ha are obtained and are not significantly influenced by the age of the sward; the mean production of wheat grain is around 5.0 t DM/ha in Belgian organic farms in the same region. In conventional farming, the N fertilisation of wheat can be reduced by 63 kg/ha (mean of the 4 years) after red clover mixtures (data not shown). Grasslands of 4 years old allow a saving of 36 (N<sub>200</sub>) and 113 kg N/ha (N<sub>400</sub>) for the fertilisation of a succeeding wheat depending on the N fertilisation level. This may be of great interest considering the price and the environmental impact of mineral fertilisers.