

## Sustainability of permanent grassland on a low moor soil with different N and K nutrient management

K. Orlovius<sup>1</sup> and J. Pickert<sup>2</sup>

<sup>1</sup>Agricultural Service of K+S KALI GmbH, Bertha-von-Suttner Straße 7, D-34131 Kassel, Email: kristian.orlovius@kali-gmbh.com, <sup>2</sup>Landesamt für Verbraucherschutz und Landwirtschaft, Gutshof 7, D-14641 Paulinenaue Germany

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**Introduction** After the reunification of Germany fertilisation with P and K was strongly reduced in the eastern states of Germany due to the poor financial situation of the farms. Particularly on sites with a low nutrient delivery capacity, such a nutrient management strategy implies the risk of decreasing soil fertility. On a low moor soil with permanent grassland a 4 - year trial with different N and K fertilisation was set up to study the development of dry matter production and K concentrations in the grass.

**Materials and methods** The fertiliser trial was conducted in Paulinenaue about 50 km Northwest of Berlin on a low moor soil with permanent grassland with an average water table at 80 cm during the growing season. The trial was carried out with four randomised replicates. In each year three cuts were harvested and analysed. The climatic conditions, with an average precipitation of 513 mm and 9 °C mean temperature, can be classified as continental. Before the beginning of the experiment the nutrient status of the soil was analysed showing: pH<sub>CaCl2</sub>: 6.0, 84 mg/kg P<sub>DL</sub>, 110 mg/kg K<sub>DL</sub> and 183 mg/kg Mg<sub>CaCl2</sub>. The fertiliser treatments comprised increasing amounts of K rates with 0-77-160-240-320 kg/ha K<sub>2</sub>O at a constant N rate of 160 kg/ha. With two additional treatments the effect of 0 and 160 kg/ha K<sub>2</sub>O without N fertilisation was tested. All K rates were given in one application at the start of growth; the N fertilisation was divided in 80 kg/ha N at the start of growth and 80 kg/ha after the first cut.

**Results** Omission of K application led to a steady decline in dry matter yields and K content in the plants. Without N application the average yield difference between the control and 160 kg/ha K<sub>2</sub>O amounted to 1 t/ha (Table 1). The negative effect of K omission was aggravated through N application. At the N rate of 160 kg/ha the yield losses between the highest K rate and the control plot were 3.5 t/ha in the first year and the gap between 0 and 160 kg/ha K<sub>2</sub>O widened tremendously to 8.1 t/ha in the fourth year. From the beginning of the trial the very K deficient situation on both controls (without and with N fertilisation) was confirmed. At the low rates of K and N fertilisation during the duration of the trial the K concentration in the plant DM decreased further to a level below 0.7% K. The increasing K rates led to increased K leaf concentrations in all years. A K application of 240 kg/ha K<sub>2</sub>O at 160 kg/ha N increased the K concentration to exceed the desired 2% K. Without N application the same level was already attained with 160 kg/ha K<sub>2</sub>O due to the significantly lower yield level.

**Table 1** Effect of different N and K fertilisation on the development of DM yields and K concentration in a 4-year experiment

N	K <sub>2</sub> O	year					year				
		1	2	3	4	mean	1	2	3	4	mean
kg/ha		DM (t/ha)					K concentration (% K in DM)				
0	0	3.59	4.00	4.63	1.96	3.55	0.74	0.73	0.55	0.65	0.67
0	160	4.32	4.59	4.85	4.22	4.50	2.06	2.26	2.16	2.10	2.15
160	0	5.90	4.32	4.29	1.32	3.98	0.87	0.67	0.58	0.50	0.65
160	77	8.37	8.51	9.83	7.31	8.50	1.31	1.16	0.99	0.96	1.11
160	160	8.74	9.34	10.66	8.26	9.25	1.64	1.76	1.34	1.35	1.52
160	240	8.81	9.67	10.98	9.18	9.66	2.06	2.32	2.16	2.14	2.17
160	320	9.35	10.12	10.71	9.43	9.90	2.45	2.74	2.37	2.05	2.40

**Conclusions** The results of the present study show very strong effects of N and K fertilisation on DM yield and K concentration in the grass. On a low moor soil an NK reduction led within a few years to a very fast decline in DM yields to less than 2 t/ha, which cannot sustain a sound economic system. An extensive grassland management (without N fertilisation but 160 kg/ha K<sub>2</sub>O) led to a low but stable yield level of 4.5 t/ha. An intensive grassland management with 160 kg/ha N and K fertilisation based on the K uptake could sustain the yields at a high level of 9-10 t/ha DM without exceeding the K content in the growth.