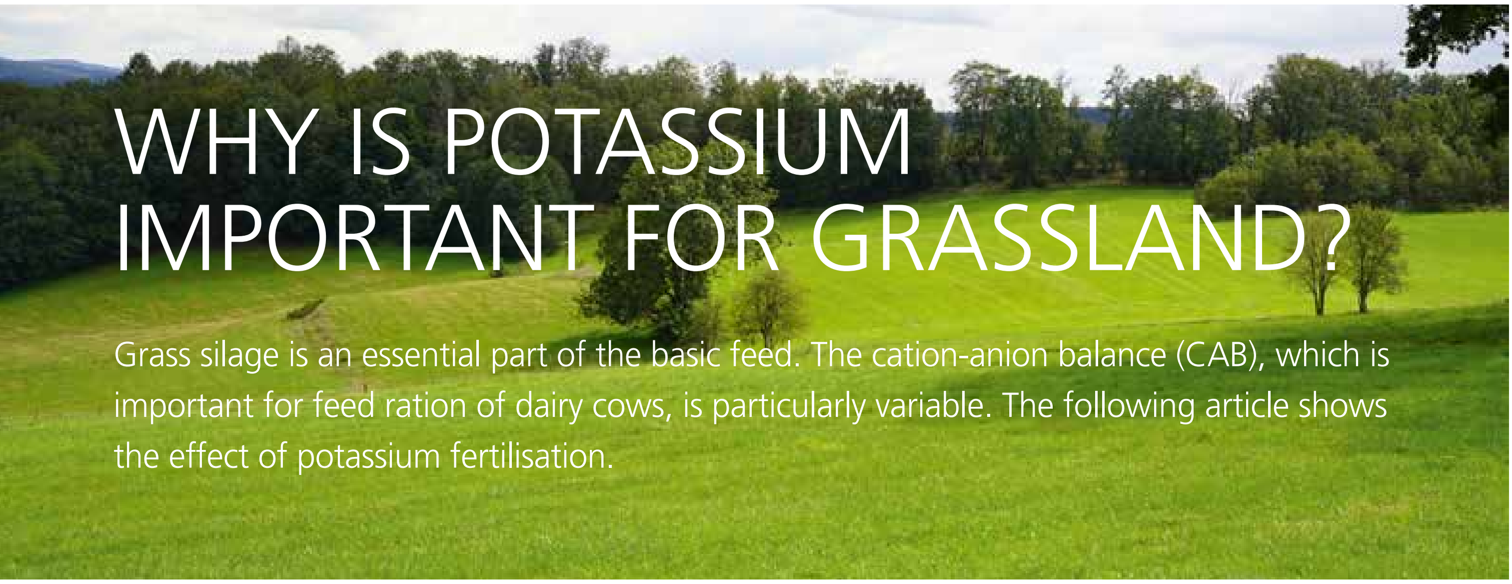


WHY IS POTASSIUM IMPORTANT FOR GRASSLAND?

Grass silage is an essential part of the basic feed. The cation-anion balance (CAB), which is important for feed ration of dairy cows, is particularly variable. The following article shows the effect of potassium fertilisation.

Good, professional practice in feeding dairy cows includes maintaining a dietary cation anion balance (DCAB) in the pre-calving diet to prevent or treat milk fever.

The DCAB is calculated from the content per kilogramme of dry matter of the cations potassium (K) and sodium (Na) as well as the anions sulphur (S) and chloride (Cl).The DCAB, with the DCAB-relevant quantity elements in grams per kilogram of dry matter (g/kg DM), was calculated using the following formula: DCAB meq/kg DM = (43.5 * Na + 25.6 * K) - (28.5 * Cl + 62.3 * S)

With regard to the feeding of lactating dairy cows, a negative influence of a low to negative DCAB of the rations resulting from high ration proportions of rapeseed meal as a substitute for soybean meal is also currently being discussed. The DCAB should not be below 150 meq/kg DM during lactation feeding in order to counteract negative effects on the feed intake and performance of the cows. The DCAB varies particularly strongly in grass silage. DCAB monitoring of feed samples carried out on farms in northern Saxony-Anhalt in 2017 and 2018 showed that DCAB varies between years and growths and the type of potash fertiliser used. It was also lower in all samples from fenland sites than in samples from mineral sites. Low or negative DCABs must be compensated via the ration design.

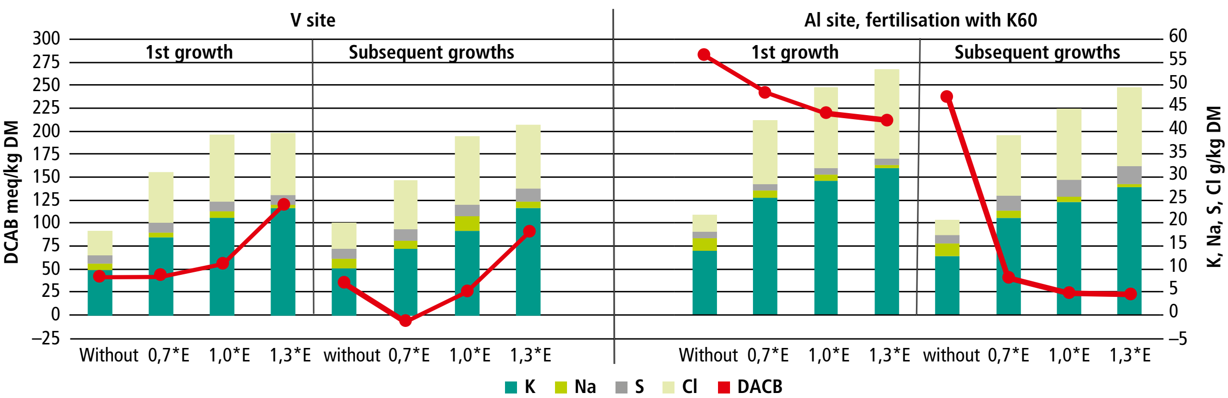
Potassium fertilisation importance for grassland yield

Potassium fertilisation based on removal is necessary on grassland to exploit the site's typical yield potential. This is especially true for fenland sites with a low potassium supply capacity, but also applies to mineral grassland sites. This is also shown by the potassium fertilisation trials carried out in 1997 on an Al site (alluvial site) in the Elbe floodplain and on a V site (weathered site) in the southern Harz (see table). Reduced yields of 10 to 22 % due to the lack of potassium fertilisation alone were observed on both mineral trial sites. The potassium contents then fell significantly below the 20 g potassium/kg DM assumed as removal (see table, without K, K content g/kg DM). Potassium contents below 15 g potassium/kg DM show a potassium deficiency affecting yield in a 3- to 4-cut utilisation.

DCAB lower in subsequent growths

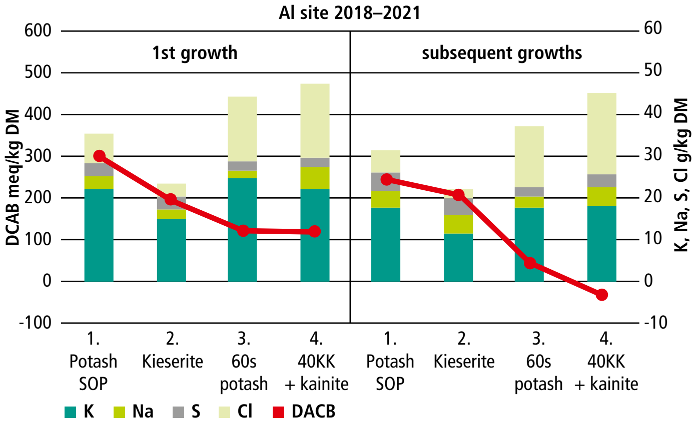
Since 2016, potassium fertilisation trials with the potassium fertiliser K60 have analysed DCAB-relevant mineral contents in all growths and calculated the DCAB. It was found that the DCAB was generally lower in subsequent growths than in the first growth. On the V site, the DCAB increased with a potassium fertilisation at or above the withdrawal (1.0*E) and confirms: low potassium contents in the grass due to an omitted or suboptimal potassium supply lead to a low DCAB (see Fig. 1, V site). On the Al site, on the other hand, the DCAB fell with increasing potassium fertilisation, caused by the high chloride content of the fertiliser in the grass

FIG. 1: MINERAL CONTENT AND DCAB IN THE 1ST GROWTH AND IN THE SUBSEQUENT GROWTHS* 2016–2021



*on a V and an Al site without potassium fertilisation, with a potassium fertilisation of 70 % of the removal (=0.7*E), after a removal of 20 g K/kg DM (=1.0*E) and a fertilisation of 130 % of the removal (=1.3*E)

FIG. 2: MINERAL CONTENT AND DCAB AS A FUNCTION OF THE FORM OF K FERTILISATION ON AN AL SITE



growth of the fertilised trial variants (see Fig. 1, Al site).

Influence of different potash fertilisers

As no potassium fertilisation was applied, fertilisation with chloride-containing potassium fertilisers can also lead to low DCAB in grass silage. Since 2018, fertilisation variants with a consistently high potassium application of 146 kg K/ha with different forms of potassium fertiliser have been investigated. The chloride-based potash fertilisers (K60 [60erKali] and a combination of 40 grain potash [40 KK] + Kainite) were compared with the sulphate-based potash fertiliser PotashSOP. The non-potash variety was fertilised with kieserite. The potassium content was similarly high in the potassium fertilised varieties, regardless of the potassium fertiliser used (see Fig. 2; columns 1, 2 and 3). Potassium fertilisation with PotashSOP (column 1) resulted in an increase in DCAB in all growths at very low chloride levels. Potassium fertilisation with 40 KK + Kainite (4th column) always resulted in the highest chloride content in the trial, because while a fertilisation of 100 kg potassium/ha with 60 potash (3rd column) results in 95 kg chloride/ha, a fertilisation of 100 kg potassium/ha with Kainite (40 KK + Kainite; 4th column) results in 460 kg chloride/ha. The DCAB of the 40KK + Kainite treatment was even negative in the subsequent growths (see Fig. 2; 40KK + Kainite; subsequent growths). As DCAB can drop to very low levels in subsequent growths, a second potassium application with a sulphate potassium fertiliser may be useful in problematic locations at high potassium applications and a split application.

Conclusion

Crop management practices such as potassium fertilisation are primarily aimed at producing high yielding forage crops. **Nevertheless, the effects of potassium fertilisation on the DCAB-relevant mineral content in grass and in grass and grass silage should be known.**

The DCAB of rations is of great importance when feeding dairy cows. It varies greatly in grass silages. **In grassland, DCAB is influenced by location, water supply, growth and potassium fertilisation.** In order to exploit the yield potential, it is necessary to apply fertiliser based on the yield potential.

The DCAB results of the silages used are important in order to optimise the DCAB through targeted selection and composition or supplementation of the diet. The DCAB increases as a function of the potassium content. The use of chloride-containing potash fertilisers can, depending on the location, counteract this effect or lead to a decrease in DCAB to negative values, despite high potassium contents in the growth due to high chloride contents. **The use of sulphate potassium fertiliser increases the DCAB as a function of the potassium content of the plant.** As high potassium applications should be divided, a switch to sulphate-containing potash fertilisers for the second application on problematic sites can be considered to increase the DCAB in subsequent growths.

RELATIVE DM YIELDS AND POTASSIUM (K) CONTENTS IN THE PLANT OF A FERTILISED VARIANT WITH A REMOVAL OF 20 GRAMS OF POTASSIUM/KG DM (1.0*REMOVAL) AND A VARIANT WITHOUT POTASSIUM FERTILISATION (WITHOUT K)[1]

site	K-Fertilisation		1997–2001	2002–2006	2007–2011	2012–2016	2017–2021
Al	1,0* removal	DM yield dt/ha=100 %	75,6	75,2	92,8	61,2	55,4
		K content g/kg DM	31,2	28,2	27,2	27,7	28,2
	without K	DM yield %	93	89	86	93	79
		K content g/kg DM	27,4	19,5	16,8	15,0	14,3
V	1,0* removal	DM yield dt/ha=100 %	89,5	84,4	102,3	105,4	92,7
		K content g/kg DM	27,0	28,8	24,1	20,7	22,5
	without K	DM yield %	95	84	92	77	82
		K content g/kg DM	18,0	11,5	10,4	10,3	10,4

[1] Weighted average of all growths in trial pentads, Al = alluvial site, V = weathering site

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