

Use of potassium chloride for the ensilage of green fodder

The present invention relates to the use of potassium chloride in
5 combination with ensiling aids known per se such as sodium propionate, calcium propionate, sodium formate, free formic acid and/or propionic acid.

The production of silage has great economic importance in animal
10 nutrition. A number of additives are known for improving the fermentation process and for improving the silage quality. Thus, the currently valid list of ensiling agents tested by the Deutsche Landwirtschaftliche Gesellschaft (DLG) describes the use of salts of formic acid and propionic acid, nitrite compounds, sorbic
15 acid, formaldehyde-generating compounds and sugar-containing materials, e.g. molasses. In addition, the addition of lactic acid bacteria cultures or enzymes is also described.

In general, it is necessary for the successful production of very
20 good silage that a sufficient amount of lactic acid is produced as quickly as possible and this is retained in the silage during the entire storage period. Prerequisites for sufficient production of lactic acid are the presence of a sufficient amount of fermentable carbohydrates, anaerobic conditions in the mass of
25 fodder and low temperatures. There are close interactions between these parameters. If atmospheric oxygen is present, fermentable carbohydrates can be consumed by plant parts which have not yet died off and by aerobic microorganisms. This process results in a nutrient loss which inhibits the development of lactic acid bac-
30 teria and at the same time makes possible the growth of organisms which damage silage. This process proceeds until the atmospheric oxygen has been consumed. Under unfavorable conditions, this leads to the rapid lowering of pH necessary in the fodder to be ensiled not being achieved. Under these conditions, clostridia
35 can form butyric acid which can reduce the quality of the silage or even ruin it completely.

Gross, Riebe; "Gärfutter" Ulmer-Verlag 1974, p. 155 and
Mc Donald, Henderson, Heron; "The Biochemistry of Silage", 2nd
40 Edition Chalcombe Publications 1991, p. 213 disclose the use of sodium chloride as ensiling salt. It is assumed that the increase in the osmotic pressure promotes fermentation by the lactic acid bacteria and suppresses the development of clostridia and other harmful fungi.

Nevertheless the silage suffers a continual weight loss resulting from sugar and starch respiration by the undesired micro-organisms.

- 5 It was found here that potassium chloride suppresses the formation of chlostrida without this knowledge resulting in practical use for silage. Furthermore, the replacement of sodium chloride by potassium chloride and the joint use of potassium chloride and sodium chloride has also been studied (Shockey et al., Journal of
10 Diary [sic] Science (1991), Vol. 74, No. 1, pp. 155-159 and pp. 160-166).

It has now been found, surprisingly, that the use of chloride-free ensiling aids known per se in combination with effective
15 amounts of potassium chloride for the ensilage of green fodder makes it possible to achieve very good results in respect of the storage of the silage.

When the same amounts are employed as hitherto, ie. from 1 to
20 10 kg of the total amount of the ensiling aid per metric ton of green fodder, the use of potassium chloride leads to significantly lower dry weight losses. The cause of this is not known, since no significant advantage of potassium chloride would have been able to be expected in the case of a purely osmotic action.

25 In particular, the present invention provides ensiling aids selected from the group consisting of sodium propionate, calcium propionate, sodium formate, free formic acid and/or propionic acid in combination with effective amounts of potassium chloride
30 for the ensilage of green fodder.

Ensiling agents known per se in conjunction with which potassium chloride can be used are, for example, the ensiling agents named in the list published by the DLG (5th edition, date: April 10,
35 1995). Most of these comprise calcium formate as an alternative to sodium propionate, calcium propionate, sodium formate and/or formic acid and propionic acid, and some also comprise dicalcium phosphate, sodium chloride, sodium benzoate, sodium bisulfite, sodium nitrite, hexamethylene tetramine, (cane) molasses, sorbic
40 acid, salts of inorganic acids (phosphoric acid compounds, sodium compounds, magnesium compounds) and further mineral materials, mineral supports, trace elements. Ensiling agents which are preferably additionally added also include bacterial cultures such as lactic acid bacteria, enzymes or enzyme complexes, particular-
45 ly when they are adsorbed on/applied to a support. Also suitable are sugar-containing products which contain fermentable carbohy-

drates, such as, in addition to the molasses mentioned above, cooked potatoes, coarse-ground cereals or dried whey.

The weight ratio of the specified ensiling agents known per se, in particular sodium propionate, calcium propionate, sodium formate, propionic acid and/or formic acid, to potassium chloride is generally from 90:10 to 30:70, preferably from 60:40 to 40:60.

In general, the ensiling agents are used in an amount of from 1 to 10 kg, in particular from 2 to 5 kg, per metric ton of material to be ensiled. The exact amount depends on the type of material to be ensiled, in particular on whether it is material which is easy to ensile, moderately difficult to ensile or difficult to ensile. More exact values are given in the abovementioned list from the DLG and in the corresponding instructions for the individual ensiling agents. The amount of potassium chloride used is generally from 0.2 to 9 kg/metric ton of green fodder, preferably from 0.5 to 6 kg/metric ton and in particular from 1 to 4 kg/metric ton.

20 The fermentable fodder to be ensiled which can be employed for the use according to the present invention is in itself subject to no particular restrictions. Suitable materials are all types of fodder which are easy to ensile (slightly wilted grass and 25 other forage plants having a sugar content of more than 3% in the fresh mass, wilted grass having a dry content of more than 30%, wilted legumes having a dry content of more than 25%, whole-plant cereal, moist cereal and moist maize, pressed pulp), fodder which is moderately difficult to ensile (grass having a dry content of 30 from 20 to 25%, legumes having a dry content of from 25 to 30% and other forage plants having sugar contents of from 1.5 to 3% in the fresh mass) or fodder which is difficult to ensile (grass having a dry content of less than 20% or legumes having a dry content of less than 20% and having less than 1.5% of sugar in 35 the fresh mass and also grass or legumes which were incorrectly wilted). The material to be ensiled preferably has a moisture content of at least 60%, more preferably from 60 to 90% (corresponding to from 40 to 10% of dry material). The ensiling compositions of the present invention can be homogeneously 40 distributed in the material to be ensiled by, for example, laying down the material to be ensiled in layers and distributing the ensiling mixture of the present invention over each layer. In addition, it is also possible to mix the material to be ensiled with the ensiling mixture of the present invention prior to 45 introduction into the silo. Most preferred is the automatic

metered addition of the ensiling mixture at the discharge of the chopper by means of a special metering apparatus.

It is advantageous to use the finished mixture according to the present invention comprising ensiling agents known per se and potassium chloride. In addition, it is also possible to mix in the individual constituents separately. This variant is likewise subject matter of the present invention. The application of the ensiling mixture is then carried out either manually, by means of an applicator or by means of a metering apparatus which is preferably arranged at the discharge of a chopper.

The examples illustrate the invention.

15 Examples

Lucerne having a dry content of 19%, containing 45.1 g of water-soluble carbohydrates per kg of dry weight and 0.9% of water-soluble carbohydrates in the moist mass was ensiled in three 2 l experimental silos. The loss in mass in the silo was determined after 13, 30, 60 and 90 days and after 7 months. The same procedure was repeated using a batch of timothy having a dry content of 23.7%, containing 95.6 g of water-soluble carbohydrates per kg of dry weight and 2.3% of water-soluble carbohydrates in the moist mass. The results for storage for 7 months are shown in Table 1, for shorter times in Table 2.

In each of the examples, a total amount of the ensiling composition of 3 kg/metric ton of green fodder was applied; the weight ratio of sodium formate to potassium chloride was 50:50.

Dry weight losses (in % by weight)

Table 1:

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Ex.		Lucerne	Timothy
1	Control, untreated (Comparison)	16.2	5.8
2	Sodium propionate Sodium formate (Comparison)	7.1	3.0
3	KCl Sodium formate	5.8	2.7

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Table 2

Ex.		Lucerne				Timothy			
		Days				Days			
		30	40	50	90	30	40	50	90
1	Control, untreated	2.2	5.2	8.6	16.2	4.3	4.6	5.8	7.1
3	KCl/Sodium formate	2.5	3.4	4.0	5.8	2.2	2.3	2.7	3.4

Example 4

As described in Example 1, lucerne and timothy were ensiled and, after 120 days, the following average values from 3 batches were determined.

Ex.	Lucerne	Dry substance, corrected g/kg	Ammonia g/kg dry weight	pH	Ethanol g/kg dry weight	Lactic acid g/kg dry weight	Acetic acid g/kg dry weight	Propionic acid g/kg dry weight	Butyric acid g/kg dry weight	Isobutyric acid g/kg dry weight	Valeric acid g/kg dry weight
1	Control, untreated	175	11.6	5.6	10	1.8	45	12.5	52	7.5	12.5
4	KCl/ Sodium formate	194	2.9	4.7	11	56	42	5.0	1.5	0	0
Ex.	Timothy										
1	Control	230	1.7	4.1	12.5	55	30	0	2.5	0	0
4	KCl/ Sodium formate	243	1.5	4.0	4.2	85	19	0	0	0	0



We claim:

1. Use of ensiling agents known per se in combination with
5. effective amounts of potassium chloride for the ensilage of
green fodder.
2. Use as claimed in claim 1 of ensiling agents selected from
the group consisting of sodium propionate, calcium propio-
10 nate, sodium formate, free formic acid and propionic acid, in
each case in combination with potassium chloride, for the en-
silage of green fodder.
3. Use as claimed in claim 1, wherein the weight ratio of the
15 ensiling agents known per se to potassium chloride is from
90:10 to 30:70.
4. Use as claimed in claim 1, wherein the amount of potassium
chloride used is from 0.2 to 9 kg/metric ton of green fodder.
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5. An ensiling composition comprising as essential constituents
ensiling agents known per se in combination with effective
amounts of potassium chloride.
- 25 6. An ensiling composition as claimed in claim 5 comprising as
essential constituents sodium propionate, calcium propionate,
sodium formate, propionic acid and/or formic acid, in each
case in combination with potassium chloride.
- 30 7. An ensiling composition as claimed in claim 5 in which the
ensiling agents known per se and potassium chloride are pres-
ent in a weight ratio of from 90:10 to 30:70.

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