

Ensiling

MAIZE KOFASIL[®] LIQUID

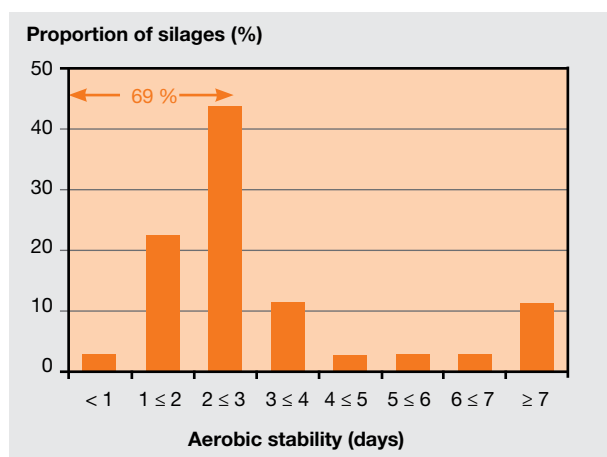


Silage additive to ensure the aerobic stability of silage from maize and whole cereal plants, heavily wilted grass, maize ear products, high-moisture grain, pressed sugar beet pulp, brewer's grains and grain stillage.

Problem

The quality of silage will decrease when exposed to the air. This is the case both when the silage is stored in a silo which is insufficiently sealed from the air as well as when a large cutting surface is generated by removing silage to feed it to animals, thus exposing the remaining silage to extra air.

The decrease in quality is mainly due to yeasts which quickly multiply in the presence of oxygen. They decompose lactic acid, sugar and other nutrients into carbon dioxide and water and release energy which causes 'heating upon exposure'. The following illustration presents the results of an Australian survey (New South Wales Department of Agriculture) as an example, where the major share of maize silages proved to spoil fast when exposed to air (aerobically stable for less than 3 days).



If silage is exposed to air for a longer period, moulds also start to play a part in decomposing lactic acid. The increase in the lactic acid content causes the pH value to increase, providing a good breeding ground for undesired bacteria. The spoilage process will continue, accelerated by the increased temperature. Extended break-down of nutrients, enrichment of harmful bacteria (enterobacteria, clostridia, Listeria) and possibly also the formation of toxic metabolic products by moulds (mycotoxins) significantly affect the quality of the silage, possibly even to the extent that it becomes unfit for use as feed.

In a feeding trial where fattening bulls were fed maize silage containing varying degrees of aerobically spoilt fractions, nutrient intake and digestibility were proven to already decrease considerably at a content of only 5% of moulded silage from the top layer of the feed stack (table 1).

Another trial has shown that in the parts of the feed stack where the silage is affected by spoilage due to moulds, harmful bacteria also manage to multiply to a great extent. Table 2 contains the results of the microbiological study into the clostridia spore count in the maize silage of an agricultural establishment. This was so high that it endangered both the animals' health and the milk quality. Until that time, high clostridia spore counts had mainly been assumed to occur in grass silage containing butyric acid and displaying butyric fermentation.

Table 1:
Reduction of nutrient intake and digestibility due to aerobic spoilage of maize silage

Parameters	Share of aerobically spoilt silage (% of DM)			
	0	5.4	10.7	16.0
DM consumption (kg/animal and day) (relative)	7.95 (100)	7.35 (92)	6.95 (87)	6.66 (84)
Digestibility of the organic matter (%) (relative)	75.6 (100)	70.6 (93)	69.0 (91)	67.8 (90)

Kansas State University, USA

Table 2:
Clostridia and mould spore count in the maize silage of an agricultural establishment

Parameters	Core of the stack	Stack surface	Mould nests
pH	3.7	4.8	7.0
clostridia spores (MPN/g)	115	15,800	214,000
yeast and moulds (KBE/g)	5,000	100,000,000	25,000,000

NIZO food research, The Netherlands

Silage which has been exposed to air and affected by moulds also implies a serious potential risk for animal health because of the production of mycotoxins. Various moulds, such as *Penicillium roqueforti*, produce toxic metabolic products during their growth process in silages (table 3).

Table 3:
Generation of mycotoxin Roquefortin C in aerobically spoilt maize silage

Duration of air access (weeks)	Roquefortin C (mg/kg DM)
1	3
2	18
3	42
6	115

FAL Braunschweig

However, aerobic instability and decreased quality due to moulds are not limited to maize silage. Many other types of silage face the same risk, specifically if the silage has a good fermentation quality. Moulds can occur in all types of silage and are a reliable symptom of an insufficiently airtight silo. However, the inclination for heating upon exposure at the cutting surface of the feed stack and for deep penetration of moulds into the feed stack is extremely significant in those silages which contain only

very little acetic acid, are relatively dry and have been insufficiently compacted during ensiling. The risks are extremely high in maize silage with over 35% of dry matter, grass silage with over 45% of dry matter and all maize ear silage (including CCM and high-moisture maize grits), high-moisture grain, brewer's grains and pressed sugar beet pulp.

The risk of the silage becoming aerobically unstable is increased enormously when, due to the high capacity of the harvesting machines and the resulting faster supply of the crop to be ensiled, it is not possible to sufficiently compact the ensiled crop. This will result in a porous feed stack, enabling the carbon dioxide created during fermentation to seep away more easily and oxygen to penetrate more deeply. The risk of aerobic instability of the silage is further increased if the silage is removed too slowly due to an unfavourable balance between the daily silage requirement for feeding and the cutting surface of the feed stack.

Top layers whose quality has been affected can be removed while taking the feed from the silo, but this is problematic since it requires extra effort. In addition, the look and smell of the silage cannot be relied upon to determine how deeply the quality defects have penetrated into the stack. In addition, the instinctive protective reaction of animals, preventing them from taking in spoilt silage fractions, is no longer effective now that most farmers use mixing vehicles for feeding.

Concept

Due to the typical nature of the processes used to prepare, store and administer silage, all technological possibilities must be used

- to ensure the aerobic stability of the silage and
- to minimize the exposure to air of the silage.

However, experience shows that for certain types of feed there are limits to the use of only technical means to prevent aerobic spoilage of certain types of feed under certain conditions. No matter how good technology has become, it is not always successful in generating aerobically stable silage, nor can the causes of quality defects be identified in every single case. Problems due to aerobically unstable silage are all the more likely to occur where, for example, the silage usage is not in line with the number of animals (insufficient turnover in the silo) or where the silage is not removed from the silo under technologically optimum conditions.

PRODUCT

MAIZE KOFASIL® LIQUID combines two substances which are used as foodstuffs preservatives with a strong yeast and mould inhibiting action, i.e.

- sodium benzoate and
- sodium propionate.

Both these substances are neutral salts, contained in this product in their highest possible concentrations as aqueous solutions. Contrary to acid preparations, this ready-to-use liquid preparation is neither caustic nor corrosive, and is highly user-friendly as a result.

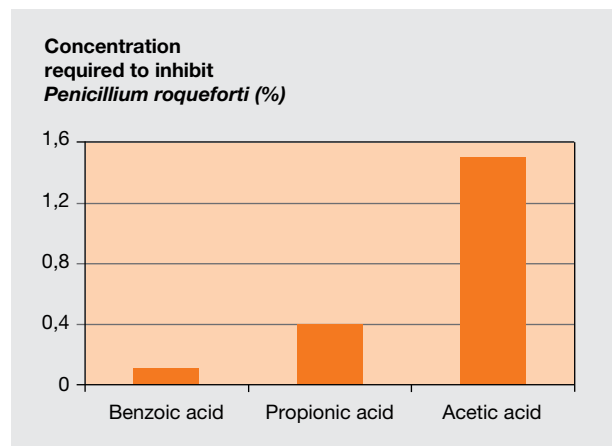
By enriching the silage with lactic acids, benzoic acids are released from the sodium benzoate and propionic acids are released from the sodium propionate during the fermentation process. These acids have an inhibiting effect on yeast and moulds. The adjacent graph containing results obtained by FAL Braunschweig shows that both acids are considerably more effective than acetic acid. This means that insufficient acetic acid content in the silage can

MAIZE KOFASIL® LIQUID was developed to provide agricultural establishments with a silage additive whose use - under otherwise unchanged conditions - will result in silage with a significantly lower sensitivity to air, i.e. silage with significantly improved aerobic stability. The silage additive should be suitable specifically for silages which can be expected to contain very little acetic acid, the natural yeast and mould inhibitor. In addition, it should enable optimum quality to be ensured during silage preparation free from aerobic spoilage whenever there is a specific risk of this, or in other words: **MAIZE KOFASIL® LIQUID** should act as a general „safety additive“ in view of the sensitivity to air of silage.

A further objective of developing this product was to formulate a user-friendly preparation which was free from the disadvantages of concentrated acids which can only be used if special work and corrosion safety measures are taken.

be compensated by even relatively low doses of the two inhibitors introduced as a part of **MAIZE KOFASIL® LIQUID**.

The use of **MAIZE KOFASIL® LIQUID** enables use to be made of the inhibiting action of acids on yeast and moulds, without having to actually handle any acids since they are not released until the fermentation process in the silage has started.



Recommendations for use

MAIZE KOFASIL® LIQUID is to be used as follows: 3 to 5 litres of **MAIZE KOFASIL® LIQUID** for every ton of silage depending on the type of feed and the expected risk of aerobic spoilage.

The dosage amounts listed in table 4 are specifically recommended for preparing silages using **MAIZE KOFASIL® LIQUID** additive.

Table 4:
Dosage recommendations for MAIZE KOFASIL® LIQUID when preparing the silage

Type of feed	DM-Gehalt (%)	MAIZE KOFASIL® LIQUID (l / t)
Treatment of the entire feed stack		
silo maize	28 - 35	3.5
	35 - 40	4.0
	> 40	4.5
whole cereal plants	< 35	3.5
	35 - 50	4.0
	> 50	4.5
heavily wilted grass	40 - 50	3.0
	> 50	4.0
maize ear products (CCM, high-moisture maize grits)	55 - 65	3.0
	65 - 70	4.0
	70 - 75	5.0
crushed high-moisture grain	55 - 65	3.0
	65 - 70	4.0
	70 - 75	5.0
brewer's grain	25 - 35	4 - 5
grain stillage	20 - 30	4 - 5
pressed sugar beet pulp melassed non-melassed	20 - 28	3 - 4
	20 - 26	4 - 5
Partial treatment of the feed stack (upper third part)		
silo maize	28 - 35	4 - 5
whole cereal plants	35 - 60	4 - 5
heavily wilted grass	40 - 60	4 - 5

Application

As is the case with other silage additives, a precondition for **MAIZE KOFASIL® LIQUID** to take full effect is that it must be homogeneously blended into the silage crop. This is ideally achieved by adding the product at the moment when the feed is harvested or produced, i.e. on the forage harvester for cereal feed (maize, grass, whole cereal plants), in the mill or crushing plant for grain products (CCM,

high-moisture maize grits, crushed high-moisture grain) or in the industrial plant for industrial by-products (brewer's grains, stillage and pressed pulp). It is applied using common dosing equipment for liquid preparations. We recommend the dosing equipment supplied by SILA GmbH / Bitterfeld (marketed under the brand name SILASPRAY®).

Test results

The effectiveness of **MAIZE KOFASIL® LIQUID** has repeatedly been demonstrated in trials at various institutions. A summary of selected trial results is presented in table 5. Several trials under practical conditions have also shown the sustained improvement of the aerobic stability of silage by adding **MAIZE KOFASIL® LIQUID**. The research result shown in table 6 demonstrates that maize silage produced using this preparation was already

quite stable after a relatively short storage time in a closed horizontal silo. Untreated silage on the other hand required several months of storage to become less sensitive to air. Treating the silage crop with **MAIZE KOFASIL® LIQUID** also makes it possible to start feeding the silage to animals at an earlier stage without the risk of aerobic spoilage due to heating upon exposure.

Table 5:
Effect of MAIZE KOFASIL® LIQUID on the aerobic stability of silages

Trial	Type of feed	DM content (%)	Aerobic stability (days)		Research institution
			without additive	MAIZE KOFASIL® LIQUID¹⁾	
A	Silo maize	39	2.0	7.0	LWK Rheinland
B	Silo maize	41	2.0	7.0	LWK Schleswig-Holstein
C	Grass	40	5.0	7.0	LWK Weser-Ems
D	Grass	41	4.2	7.0	Landesanstalt f. Landwirtschaft Brandenburg
E	Grass	44	1.1	5.8	LWK Nordrhein-Westfalen
F	Pressed pulp	23	1.0	7.0	Humboldt University, Berlin
G	Pressed pulp, melassed	25	5.0	7.0	Humboldt University, Berlin

¹⁾ 4 litres of **MAIZE KOFASIL® LIQUID** to every ton of silage

Table 6:
Experience with the use of MAIZE KOFASIL® LIQUID in practical conditions

Horizontal silo I Maize silage (33% DM)			Horizontal silo II Maize silage (39% DM)		
Age of the silage (days)	Aerobic stability (days)		Age of the silage (days)	Aerobic stability (days)	
	without additive	MAIZE KOFASIL® LIQUID		without additive	MAIZE KOFASIL® LIQUID
44	2.8	≥ 9.0	42	1.2	5.0
91	2.7	≥ 9.0	89	4.2	≥ 9.0
111	7.3	≥ 15.0	200	10.0	≥ 15.0

Bavarian State Institute for Animal Breeding, Grub

DLG approval seal

MAIZE KOFASIL® LIQUID silage additive contains preservatives whose characteristics and harmlessness have been proven for quite some time, which are also used to a great extent as preservatives in foodstuffs and beverages and whose use is approved in accordance with European feed law.

Following effectiveness trials by independent institutions, the Deutsche Landwirtschaftsgesellschaft has awarded the **MAIZE KOFASIL® LIQUID** preparation the

DLG seal of approval for mode of action 2 „Improvement of aerobic stability“



MAIZE KOFASIL® LIQUID is a highly effective, comprehensively tested and user-friendly silage additive

- for preventing heating upon exposure,
- for fighting mould growth,
- for maintaining the nutritional value and
- for ensuring the hygienic quality

of silages.



MAIS KOFASIL[®] LIQUID

