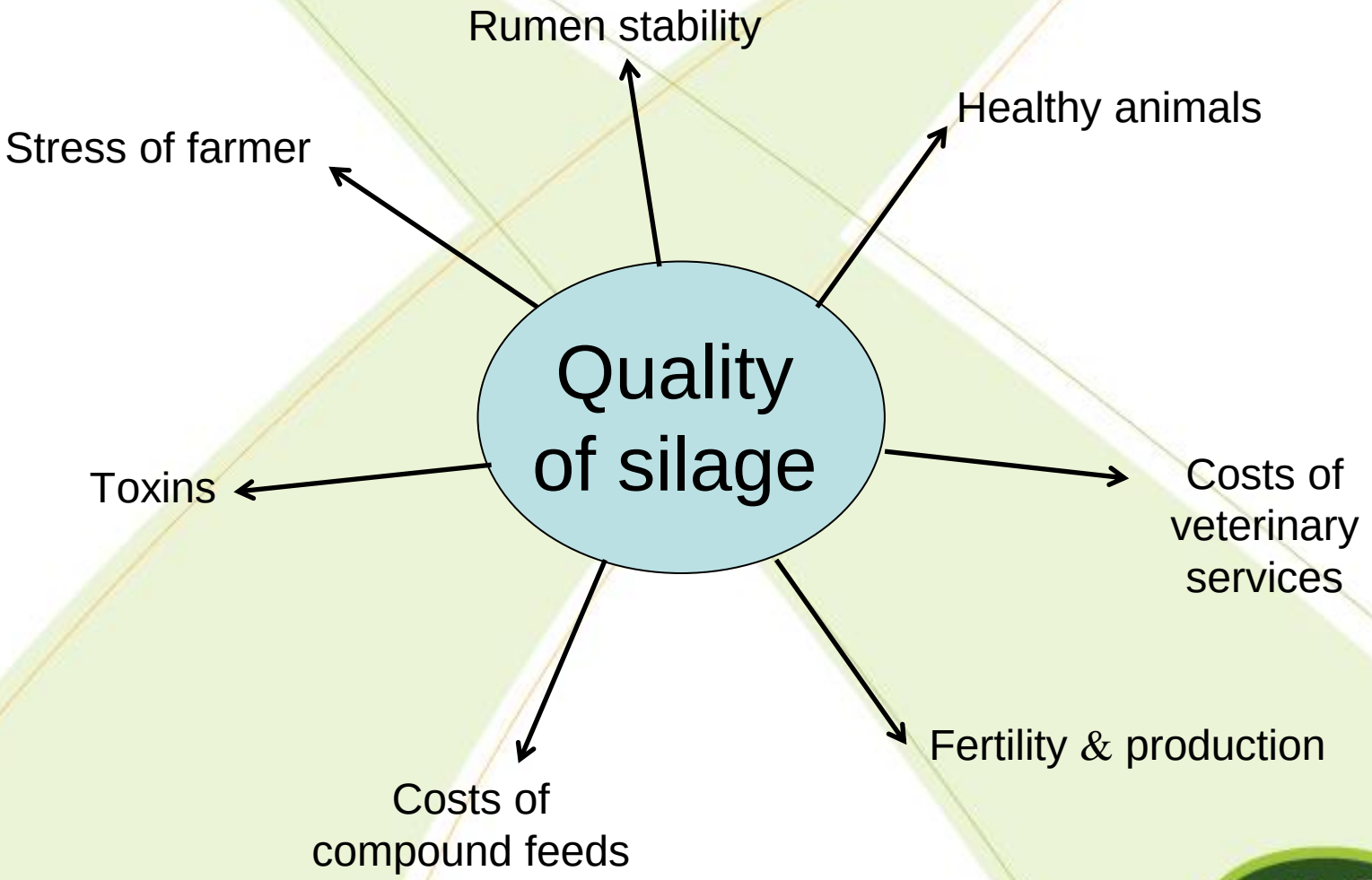
The cheapest milk is the one you milk from your bulk feed

DVM Simon Holik
VVS Verměřovice

Zambia 2023

na farmě ve formě



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➢ Requirements of dairy cows:

Structural fiber required

Proper grain disruption, starch and energy utilization

Clamping / compressibility, ability of ensiling

Homogeneous material with the large surface area

➢Cows like a sweet taste

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Good quality silage increases fiber (NDF) digestibility

Cows respond to any 5% increase in NDF digestibility:

Increase of DMI (dry matter intake) by + 0,63 kg

Increase of avg. daily milk prouction by + 0,9 kg

(Oba & Allen 1999, Jung et al 2004, Ferraretto & Shaver 2013)

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Silage production

- **When does it start ?**
  - → **agrotechnics, field work**
  - → **the road to the dairy starts in the field**

- **When does it end ?**
  - → **by picking / loading and feeding**

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Quality vs Losses

- **How much does it cost to produce quality silage ?**
- **How much does it cost to produce poor quality silage ?**
- **Loss compensation:**
  - purchase of expensive meals SBM, RSM
  - purchase of fats
  - purchase of other expensive supplements for TMR
  - natural losses (at harvest) up to 4%
  - secondary losses (low aerobic stability, secondary fermentation, spoilage) up to 25%

  → **result of our poor quality work while silage making**
- **What poor quality silage causes ?**
  - loss of milk production
  - loss of milk quality (fat, protein, SCC)
  - poor reproduction
  - poor health status
  - **loss of economical efficiency of milk production on farms**

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Ensiling

➢ The silage management – composition of the technological procedures

- optimal maturity
- optimal dry matter

} we can only partially influence
- weather conditions (rains, drought, wet fields, sudden changes)

- length of cutting, stubble
- application of silage inoculant **Formasil Maize**
- speed of transport and filling of pit
- height of clamped layer
- intensity of clamping
- cover of pit with plastic foil
- driven fermentation and silage maturation
- technique of silage loading from pit
- front wall management in pit (leftovers)

} **- fully in our competence**
- we decide what resulting quality and stability of silage will be

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Harvest – day „D“

goal ➔ harvest crop at the

optimal maturity stage and
ideal dry matter and

preserve it for several months

Harvest – day „D“

Harvest – day „D“

Harvesting 20 rows of corn all at once

Kemper adapter, width shot of cutter 15 m !!!

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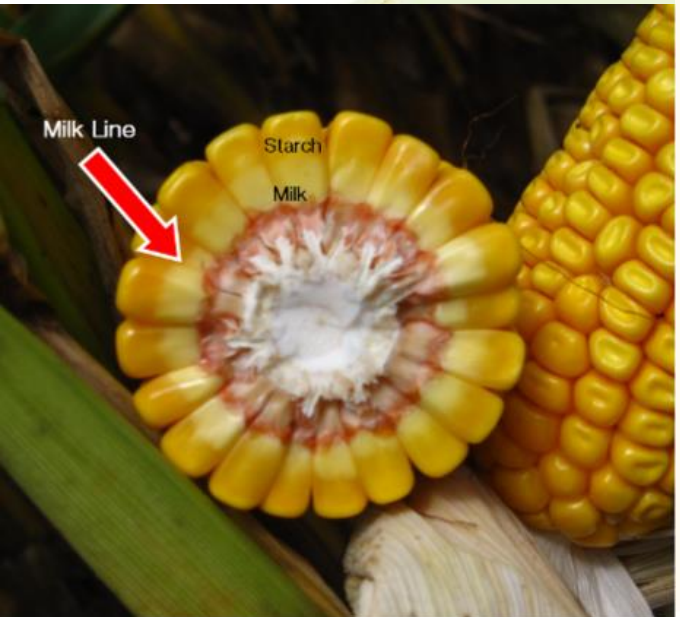
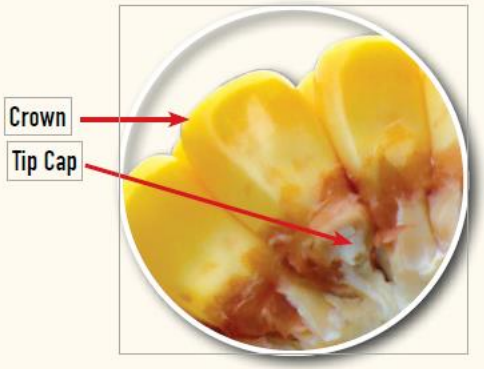
➢ Optimal maturity, dry matter and cut length

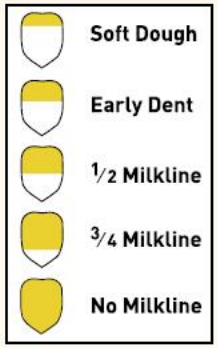
Optimal maturity: **milk-wax stage of grain**

Corn silage	Optimal dry matter	Optimal cut length
Standard	32 – 33%	10 – 15 mm
Shredlage	32 – 35%	22 – 30 mm

Absolut min. cut length - 8 mm
➔ rumination







The Milk Line moves from CROWN of kernel to TIP CAP. Speed of this movement varies based on hybrid, available moisture and fertilizer, heat, sun. Optimum harvest timing is around ½ milk line.

➢ Corn harvest stage

- **Dry matter of the whole plant 32 – 33%**
  - **from it dry matter of corn cobs 45 – 55%**
  - **dry matter of grain 60 – 65%**
  - **the rest of plants without cobs 24 – 25%**

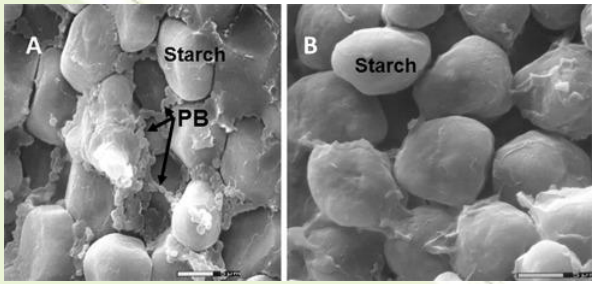
- **At this stage, the storage of nutrients, especially starch and sugars, is completed.**
- **At this stage – the highest fibre digestibility**

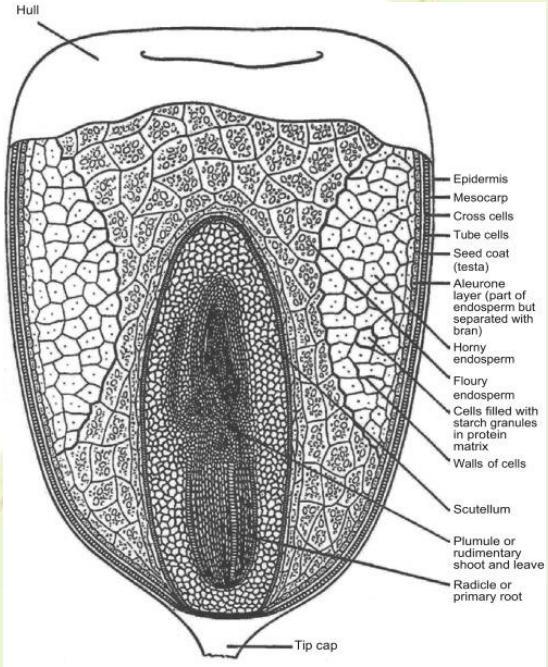
➢**Cows like a sweet taste**

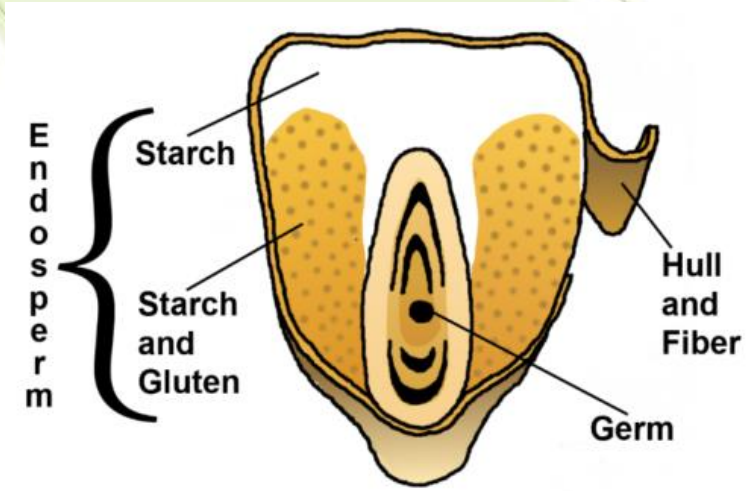
Corn harvest stage

- Dry matter of the whole plant 32 – 33%
  → the best energy efficiency of corn silage

  - zein – gluten is protein forms internal structure of corn kernel
  - the protein coats the starch granules
  - the protein limits swelling and fermentation of starch in the rumen if DM of the whole plant > 35%







➢ Corn harvest stage

➢ Dry matter of the whole plant >35%

- less sugars
→ much slower fermentation of silage
→ lower palatability for cows – lower feed intake

➢Cows like a sweet taste

- more starch but lower fermentability of starch in the rumen
→ more starch by-pass the digestive tract and ends in manure

- rapidly declining fiber digestibility
→ fast lignification of plants

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Stubble

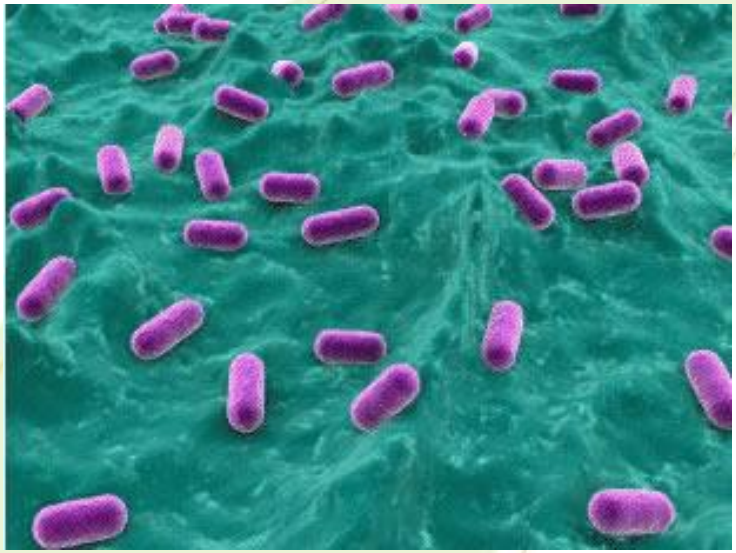
corn 30 – 50 cm

- ☞ **NO soil contamination**
- ☞ **NO yeast + undesirable bacteria *Clostridium***
- ☞ **NO undigestible parts full of lignin**

Minimal height 30 cm

During ensiling there is microbial warfare occurring – fight for substrate

- "Good Bugs"
  - Lactic Acid Bacteria
    - Homofermentative (acidifying)
    - Heterofermentative (anti-fungal)



- "Bad Bugs"
  - Yeasts
  - Moulds
  - Clostridia
  - Enterobacteria

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WE MUST
CONTROL THE
FERMENTATION
PROCESS

Forage preservation

- **Driven bacterial fermentation – Formasil Maize**

  selected bacteria
  forage preservation by acidification
  anaerobic conditions
  → to eliminate effect of „bad bugs“

- **Wild uncontrolled fermentation**

  - nature

  *** native yeasts, molds, clostridia, enterobacteria form soil and plants – „bad bugs“**
  → production of weak acids, alcohol, CO_2

  - silage without any preservative - inoculant

→ loss of: dry matter, energy, quality, aerobic stability of stored forage

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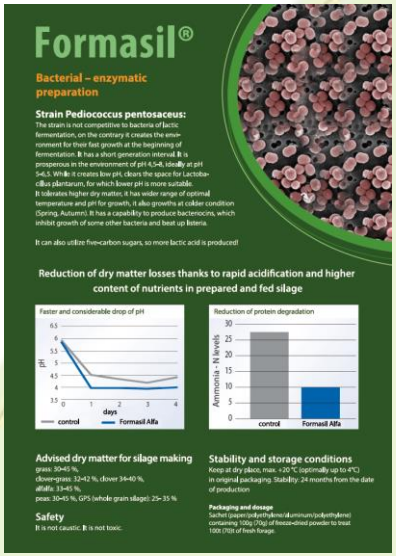
Formasil®

- Private registered brand of the silage inoculant product line
- Specially selected strains of bacteria
- High enzymes activity
- Increases the silage palatability + DMI
- Suitable even for „older“ vegetation
- Effective even at higher dry matter
- Increases aerobic stability at the feedout time – direct effect of *Lactobacillus buchneri 40788* (patentováno)



Formasil	Grass, clover-gras
Formasil Alfa	Alfalfa, clover (high crude protein)
Formasil Cool	1st cut (rezidual sugars – aerobic stability) Higher dry matter – aerobic stability
Formasil Maize	corn

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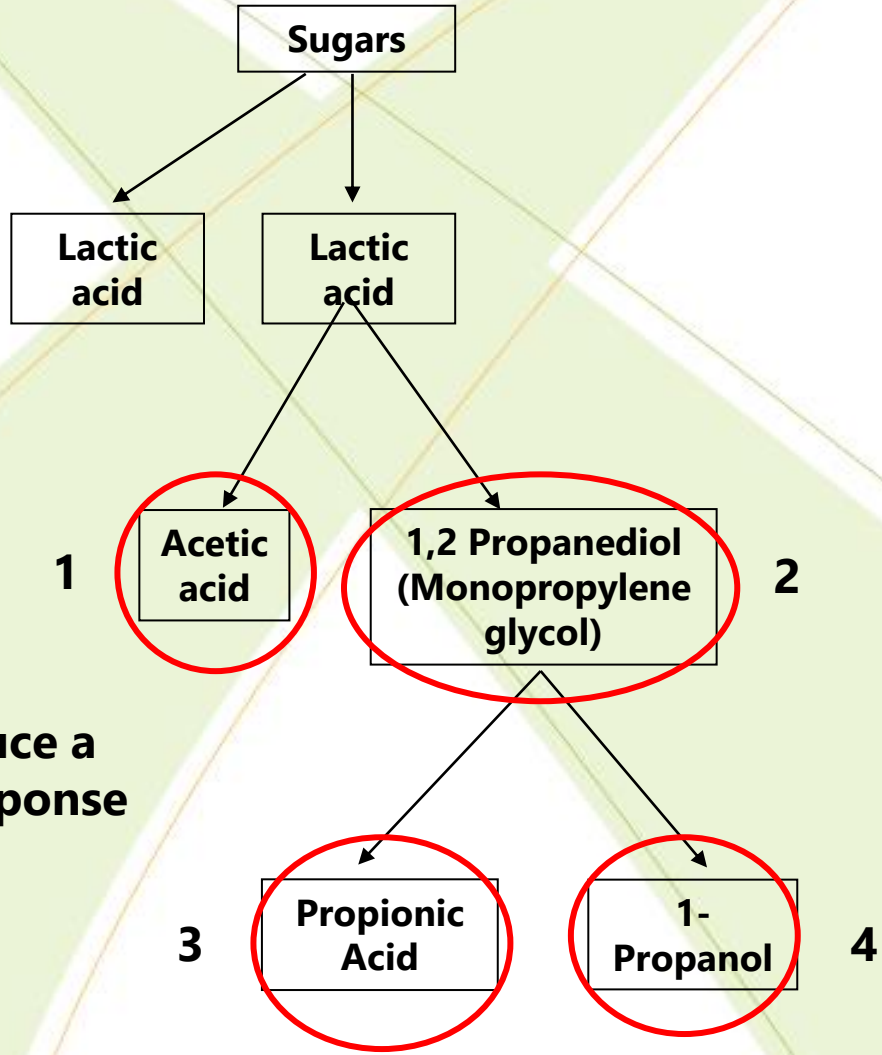
Formasil® MAIZE

CORN SILAGE

- **Biological inoculant for corn silage preservation**
- **Contains 2 types of bacteria that complement each other**
- ***Pediococcus pentosaceus NCIMB 12455***
- ***Lactobacillus buchneri NCIMB 40788***
- **Bacterial ferments inhibit yeasts and molds**
- **Yeasts and molds cause aerobic unstability, spoilage**
- **Easy to use: dilution and aplication**
- **The solution usable for 48 hours.**

Heterofermentative bacteria

Unique metabolite pathway of *Lactobacillus buchneri 40788*



All four products produce a powerful anti-fungal response

● ***patented*** ●

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Lactobacillus buchneri 40788 : vissible effect

What do the cows say?

- **Milk Production Trial:** Dr. D. Patterson, The Agricultural Research Institute of Northern Ireland, Hillsborough
- Compare cows fed untreated grass silage with **Formasil®** treated silage
- **Results:**

Silage Dry Matter Intake

Control	Formasil® treated	Improvement
9.65 kg/day	10.56 kg/day	9.4%

Milk Yield

Control	Formasil® treated	Improvement
26.58 litres / day	27.84 litres / day	1.3 litres / day

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What do the cows say?

Milk Composition

Milk Constituents	Control treated	Formasil® treated	Improvement
Butterfat	1138g	1203g	7.7%
Protein	747g	818g	9.5%

» **Conclusion:** This trial showed that **Formasil®** treated silage significantly improves dry matter intake, milk yield and milk constituent level

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Same story for corn silage

- **Source:** Dr. D. Leaver, Wye Colledge, University of London, Ashford, Kent
- 35% DM maize silage treated with **Formasil Maize** compared with untreated silage
- Yield, Fat, Protein and Dry Matter Intakes were again increased with the treated silage

	Untreated	Formasil Maize	Improvement
Milk Yield (kg/d)	26.7	27.4	0.7
Fat (%)	4.26	4.37	0.11
Protein (%)	3.27	3.31	0.04
DM Intake (kg/d)	19.6	19.8	0.2

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It is not a presservative as a preservative

Sil-All vs Formasil Maize

evaluation of the analysis protocol

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ANALYSIS PROTOCOL FEED NO. 80021

Type of feed:	**Maize silage**		
Customer:	[redacted]		
Farm (warehouse):	(Sil all)	Date of delivery:	26.08.2021
Nutritionist:	Holík Šimon	Date of analysis:	01.09.2021

Parameter	Unit	Value in the sample	Value in the DM	Used method
DM	%	52,31	100,00	VVS
Starch	%	15,98	30,55	VVS
Crude protein	%	3,67	7,01	VVS
ADF	%	13,17	25,17	VVS
NDF	%	22,61	43,23	VVS
Ash	%	2,00	3,83	VVS
Crude fat	%	1,40	2,68	NIR
Crude fibre	%	11,37	21,73	VVS
RFV			149,10	Výpočet
NEL	MJ/kg	0,00	0,00	-
Calcium	%	0,00	0,00	-
Phosphor	%	0,00	0,00	-
Magnesium	%	0,00	0,00	-
Potassium	%	0,00	0,00	-
Copper	mg/kg	0,00	0,00	-
Mangan	mg/kg	0,00	0,00	-
Zinc	mg/kg	0,00	0,00	-
Lactic acid	%	0,78		EXT
Acetic acid	%	0,76		EXT
Butyric acid	%	<0,01		EXT
pH		0,00		-
KVV	mg KOH/100g	0,00		-
Free ammonia	%	0,00		-
Level of proteolytic processes	%	0,00		-
Aflatoxin	ug/kg	0,00		-
Zearalenon	ug/kg	0,00		-
T2-toxin	ug/kg	0,00		-
DON	mg/kg	0,00		-

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Type of feed:	**Maize silage**		
Customer:	[redacted]		
Farm (warehouse):	(Formasil)	Date of delivery:	26.08.2021
Nutritionist:	Holík Šimon	Date of analysis:	01.09.2021

Parameter	Unit	Value in the sample	Value in the DM	Used method
DM	%	46,82	100,00	VVS
Starch	%	15,47	33,04	VVS
Crude protein	%	3,17	6,76	VVS
ADF	%	10,76	22,97	VVS
NDF	%	18,14	38,74	VVS
Ash	%	1,50	3,20	VVS
Crude fat	%	1,29	2,76	NIR
Crude fibre	%	9,68	20,68	VVS
RFV			170,47	Výpočet
NEL	MJ/kg	0,00	0,00	-
Calcium	%	0,00	0,00	-
Phosphor	%	0,00	0,00	-
Magnesium	%	0,00	0,00	-
Potassium	%	0,00	0,00	-
Copper	mg/kg	0,00	0,00	-
Mangan	mg/kg	0,00	0,00	-
Zinc	mg/kg	0,00	0,00	-
Lactic acid	%	1,09		EXT
Acetic acid	%	0,62		EXT
Butyric acid	%	<0,01		EXT
pH		0,00		-
KVV	mg KOH/100g	0,00		-
Free ammonia	%	0,00		-
Level of proteolytic processes	%	0,00		-
Aflatoxin	ug/kg	0,00		-
Zearalenon	ug/kg	0,00		-
T2-toxin	ug/kg	0,00		-
DON	mg/kg	0,00		-

It is not a presservative as a preservative

Sil-All vs Formasil Maize

1. **<u>Health safety of feed – results of fermentation and assumption of aerobic stability:</u>**

   - low ash content at both silages → NO soil contamination, NO Clostridia, NO butyric acid ☺
   - low level of acids at both silages – due to the high dry matter
   (total acids level min. 2,5%, lactic acid 3x more than acetic acid, acetic acid up to 1%)

   - <u>Sil-All silage</u> – acids ratio 1:1 – risk of low aerobic stability during the feedout time
   acetit acids is very weak acid to keep pH level low
   observe the temperature of silage – first signal of spoilage

   - <u>Formasil Maize silage</u> – acids ratio 1,75:1 – better situation, still low content of lactic acid
   higher level of lactic acid increases the palatability and feed intake, it is more delicious ☺
   higher aerobic stability, less spoilage, less rumen indigestions ☺

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Sil-All vs Formasil Maize

1. **Health safety of feed – results of fermentation and assumption of aerobic stability:**

2. **Nutrient content:**
   - ***dry matter***: to high dry matter of both silages
     Formasil Maize has a bit lower DM content
   - ***starch***: excellent content at both silages
     Formasil Maize is even better + 2,5% of starch more – more fermentable energy in the rumen – more milk
   - ***ADF***: both silages are successful
     Formasil Maize is even better - 2,2% less, it is better
   - ***NDF***: both silages are excellent
     Formasil Maize is even better - 4,3% less (less of lignin, higher digestibility)
   - ***crude fiber***: both silages are successful
     Formasil Maize is even better – 1,05% less – higher digestibility, faster throughput via rumen → higher nutrient intake within 24 hours – more nutriens = more milk
   - ***ash***: low at both silages, very good parameter – health safety
   - ***RFV***: relative feeding value + 21,37 points at Formasil Maize thanks to better analytical parameters

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It is not a presservative as a preservative

Sil-All vs Formasil Maize

- **Which silage is better?**

Sil-All – worse parameters, but lower cost of treatment per ton ($ 0,4/ton)
Formasil Maize
- better parameters
- more sugars, less undigestible fibre
- higher palatability
- higher content & better ration of acids
- slightly higher costs of treatment per ton ($ 0,93/ton)

- **Cows like a sweet taste**

cost of preservative per ton of treated silage is the marginal cost

- **The price of the unit of RFV relative feed value is decisive:**

RFV value
- prediction of feed digestibility and feed usability
- prediction of milk production from the feed
- 1 ton of corn silage = $ 43

Sil-All:
RFV = 149,1
1 RFV = 0,289 USD

Formasil Maize:
RFV = 170,47
1 RFV = 0,252 USD

The RFV value is economically advantageous when using Formasil Maize

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Silage production ends at feedout time

- Significant influence on aerobic stability
- Management of the face wall
- Lefovers along the walls
- Uncovering the foil for 2-3-5 days ?
  - air / oxygen penetration – secondary fermentation
  - rain / water penetration – silage DM change – TMR change

The result of the right silage process and silage unloading

The result of the right silage process (high moisture corn) and unloading

3 basic conditions for the ensiling

1. **Plenty of fermentable sugars** – so that the final pH of the silage drops to 4 - 4,2 (minimum 3% sugars)

2. **Presence LAB** – produce lactic acid that preserves forage **Formasil Maize**

3. **Anaerobic conditions** – corn cut 1-1,5 cm and well clamped (ideally over 600 kg/m^3 of the fresh material)

Oxygen !

The “Domino Effect” of Air during Aerobic Spoilage

- **Silage is exposed to air**
  - **Yeast species** will “wake up” and use lactic acid as food
    - Number of yeasts increase
      - Highly degradable nutrients are destroyed
        - **Heat is produced**
          - pH increases
            - **Moulds** / Bacteria “wake up” causing further spoilage
              - More heating
                - **Massive spoilage**

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Hot spots
Fermetation by yeasts
Spoilage starts

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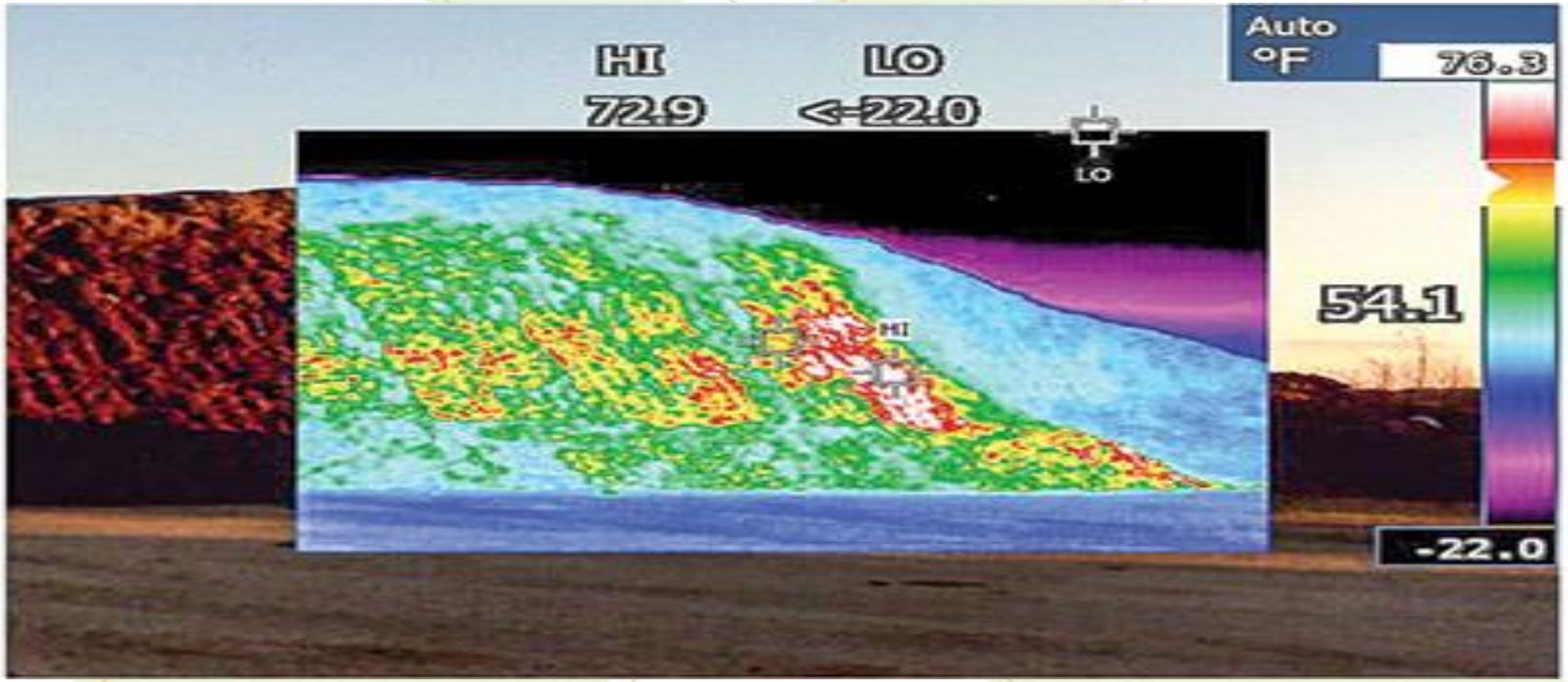
Thermal cameras can tell the story



- Areas of yeast activity can be detected with thermal imagining
- Parts of the silo with poor density will also appear hot

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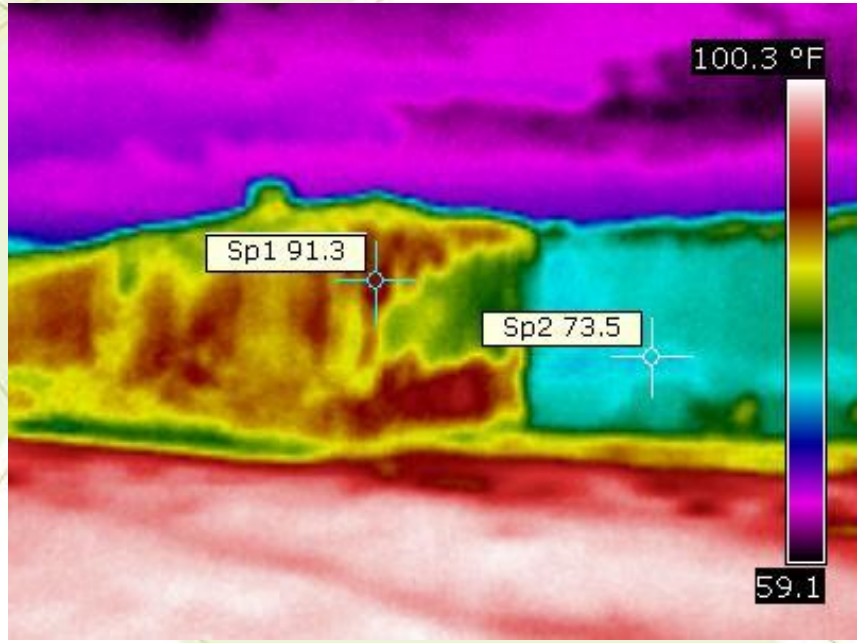
Thermal cameras can tell the story



- Thermal camera detects hot parts of silage
- Fermentation caused by yeasts is NOT visible to the eyes

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Economical advantage of using preservative Formasil Maize

➔ heating silage in numbers - daily losses

LOSSES

Temp increase in silage above ambient temp (°C)	Daily DM losses (%)		
	20% DM	30% DM	50% DM
5	1.6	1.2	0.7
10	3.2	2.3	1.5
15	-	3.5	2.2
20	-	-	2.9
25	-	-	3.7

15th International Silage Conference, 2009

- The temperature increased by 10 °C, silage DM 30%, DM daily loss = **2,3%**
- Oxygen can penetrate 2m into a clamp face (depending on density)
- Volume of silage affected 15 (width) x 2 (depth) x 3 (height) = **90m^3**
- At a density of 225 kg/m^3 this represents **20.25 tonnes**
- 2.3% losses = 20.25 x 0.023 = 0.47 tonnes of DM lost daily, 1 ton = $ 43

→ **the daily loss of feed for aprox. 25 dairy cows**
→ **the daily loss of $ 20,21**

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Economical advantage of using preservative Formasil Maize

➔ total losses in the whole pit vs benefit of Formasil Maize

Parameter	Treated silage Formasil Maize	Untreated silage
Secondary aerobic fermentation **Loss of: dry matter, energy – NEL** (feedout time, yeasts, molds…)	**Losses 0%**	**Losses 10 %**
Stored silage	**1.000 tons**	**1.000 tons**
Loss of feed – silage in tons	**0 ton**	**100 tons**
Loss of feed – silage in USD **(1 ton = $ 43)**	**$ 0**	**$ 4.300**
Cost of tratment (inoculant) per 1 ton	**$ 0,93**	**$ 0**
Total costs including loss:	**$ 930**	**$ 4.300**
Economic efficiency of preservation: **Formasil Maize**	**1 : 4,62**	**Losses are 4,62 times higher than cost of treatment by Formasil Maize !**

Primary losses (field, up to 4%) are the same for both groups

Secondary losses (feedout time, secondary fermentation, heating, spoilage 10% (20%) for untreated group only – NO preservative – NO protection)

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Economical advantage of using preservative Formasil Maize

➔ Sil-All vs Formasil Maize

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TAKE HOME MESSAGE

Recommendations for corn silage 2022 and beyond

- **The right silage management**
- **Corn dry matter at harvest 32-33%**
  Chop length 10-15mm
  effect on: starch & sugars contentent, production of acids, aerobic stability, digestibility and usability of corn silage plus potential milk production
- **Driven fermentation**
  ☞ **Formasil® Maize**
- **The right way of silage removal from pit**
- **Front – face wall management**

SILAGE SUPPORT INFOLINE

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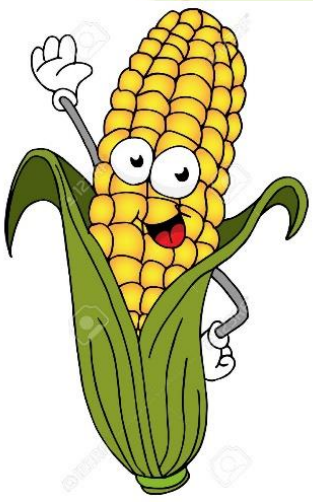

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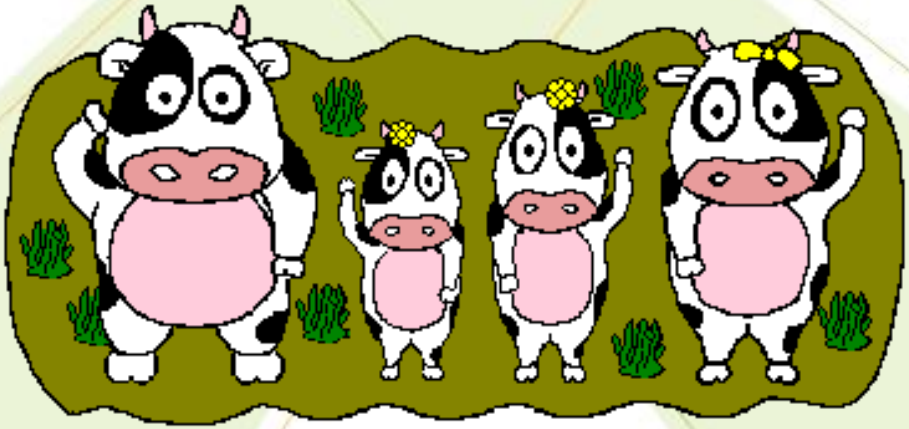

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