DLG Information 1/2004/en

Forage evaluation

Part A - DLG key for the evaluation of fresh herbage, silage and hay using a sensory test

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Evaluation of fresh herbage, silage and hay using a sensory test

Field of application

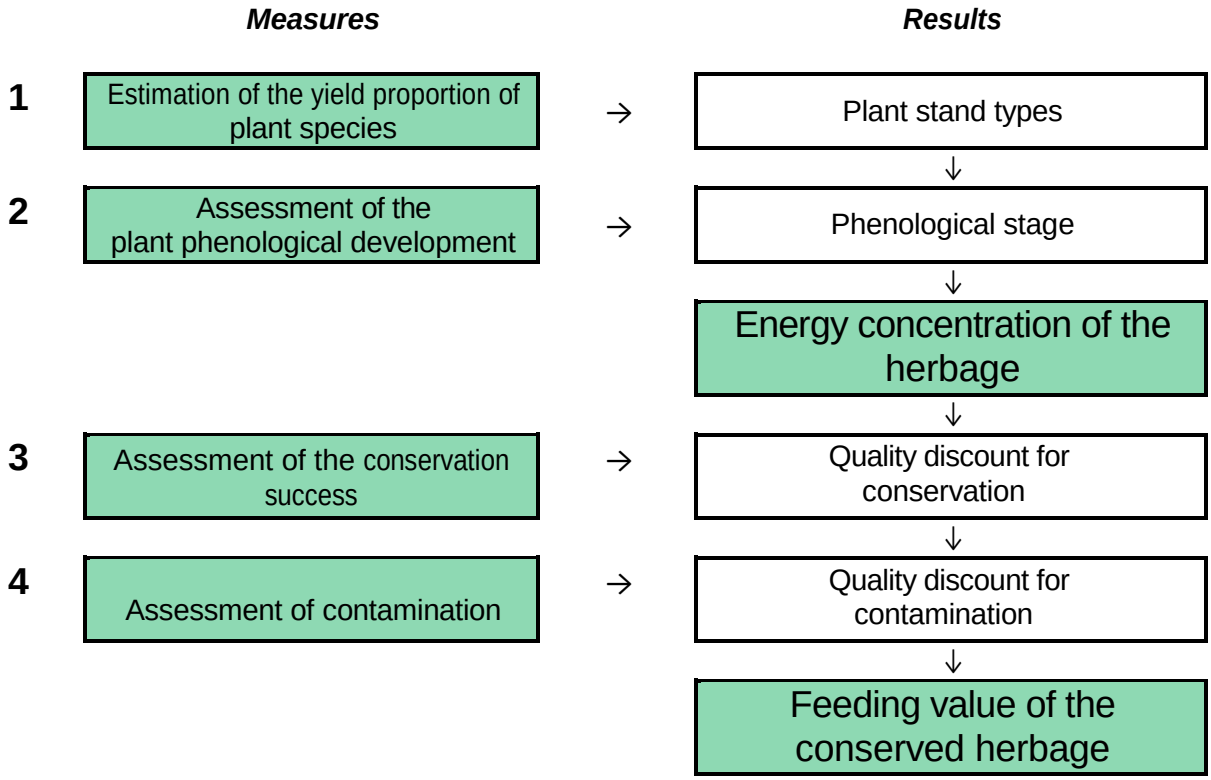
This estimation framework (DLG key) can be used to estimate the energy content of fresh herbage based on the ***plant population*** and the ***phenological stage.*** The sensory test can also be used to determine the ***conservation success*** and thus derive the energy value of grass silage, hay and maize silage.

As milk yields per cow increase, the quality of forage and its correct assessment become more important. With regular use of this valuation code, the quality of forage on forage-producing farms can be monitored and successively improved without great effort.

As an important tool, it complements the chemical forage analysis in the laboratory, in which the individual crude nutrients (crude protein, crude fibre etc.) and various fermentation characteristics (e.g., organic acids and pH value) as well as energy content and fermentation quality are determined (see Forage Evaluation Part B: "DLG key for evaluating the fermentation quality of ensiled green fodder on the basis of chemical analysis" and Forage Evaluation Part C: "Equations for estimating the energy content").

Procedure

The following procedure should be used to evaluate forage from permanent grassland vegetation (for maize silage, see page 14).



1 Categorisation of plant stands by type

Grass proportion	*Stand type*	*Symbol*
Grass-rich (> 70% grasses)	***Ryegrass-dominated*** (bottom/pasture grasses) - predominantly ryegrass or Poa species	**G 1**
	Not ryegrass-dominated (tall/meadow grasses) *- e.g. cocksfoot, meadow foxtail, meadow fescue, false oat-grass, golden oat grass*	**G 2**
Balanced (50 - 70% grasses)	***Fine-leaved*** herb and clover species *- bottom/pasture grasses predominate among grasses*	**A 1**
	Coarse-stemmed herb and clover species *- tall/meadow grasses predominate among the grasses*	**A 2**
Clover- or herb-rich (< 50% grasses)	***Fine-leaved*** herb and clover species *- bottom/pasture grasses predominate among the grasses*	***K 1***
	Coarse-stemmed herb and clover species *- tall/meadow grasses predominate among the grasses*	***K 2***

2 Determination of the phenological stage **(see pages 6 and 7)**

1. The **phenological stage in the first growth** is usually determined on dandelion. Dandelion is well suited for determining the phenological stage by randomly counting at least 30 plants. It is not possible to determine the phenological stage on preserved dandelion, as it undergoes emergency ripening during wilting and thus conveys a false phenological stage. However, if dandelion flowers are present in the preserved forage, this is usually a reliable sign that a first growth is investigated.
2. If **cocksfoot** is present in the stand, it can also be categorised according to its developmental stages. Where cocksfoot is absent, other stand-forming grasses should be investigated in the same way.
3. As the plants predominantly do not form generative stages in the **regrowths** (exceptions: e.g. ryegrass, annual meadowgrass, to some extent cocksfoot), the growth period can only be determined on a calendar basis (duration of regrowth: < 4, 4 - 6, 7 - 9, > 9 weeks).
4. If the inflorescences in the preserved forage are almost exclusively from **timothy**, this signals a first regrowth, as this species blooms very late, usually only in the first regrowth.

Energy concentration of the green forage

The energy concentrations of the green forage can be derived from the ***plant population*** and phenological ***stage.***

	Energy concentration (in MJ/kg DM[#]) in green forage											
Stand type	***G_1***		***G_2***		***A_1***		***A_2***		***K_1***		***K_2***	
Phenological stage 1st growth	ME	NEL	ME	NEL	ME	NEL	ME	NEL	ME	NEL	ME	NEL
I Stem elongation	12.0	7.2	11.7	7.0	12.0	7.2	11.7	7.0	11.7	7.0	11.2	6.7
II Before ear emergence*)	11.7	7.0	11.2	6.7	11.7	7.0	11.3	6.8	11.3	6.8	10.8	6.5
III Beginning of ear emergence*)	11.2	6.7	10.5	6.3	11.2	6.7	10.7	6.4	11.0	6.6	10.5	6.3
IV End of ear emergence*)	10.7	6.4	9.8	5.9	10.7	6.4	10.0	6.0	10.5	6.3	9.8	5.9
V Flourishing	10.0	6.0	9.2	5.5	10.2	6.1	9.3	5.6	10.0	6.0	9.2	5.5
VI After anthesis	9.2	5.5	8.3	5.0	9.5	5.7	8.7	5.2	9.5	5.7	8.5	5.1
VII Start of seed ripening	8.3	5.0	7.5	4.5	8.8	5.3	8.0	4.8	9.0	5.4	7.7	4.6
Regrowths Duration (weeks)												
< 4	10.7	6.4	10.3	6.2	10.8	6.5	10.5	6.3	10.8	6.5	10.5	6.3
4 - 6	10.3	6.2	10.0	6.0	10.5	6.3	10.2	6.1	10.5	6.3	10.0	6.0
7 -9	9.8	5.9	9.5	5.7	10.0	6.0	9.7	5.8	10.0	6.0	9.5	5.7
> 9	9.3	5.6	9.0	5.4	9.5	5.7	9.2	5.5	9.3	5.6	9.0	5.4

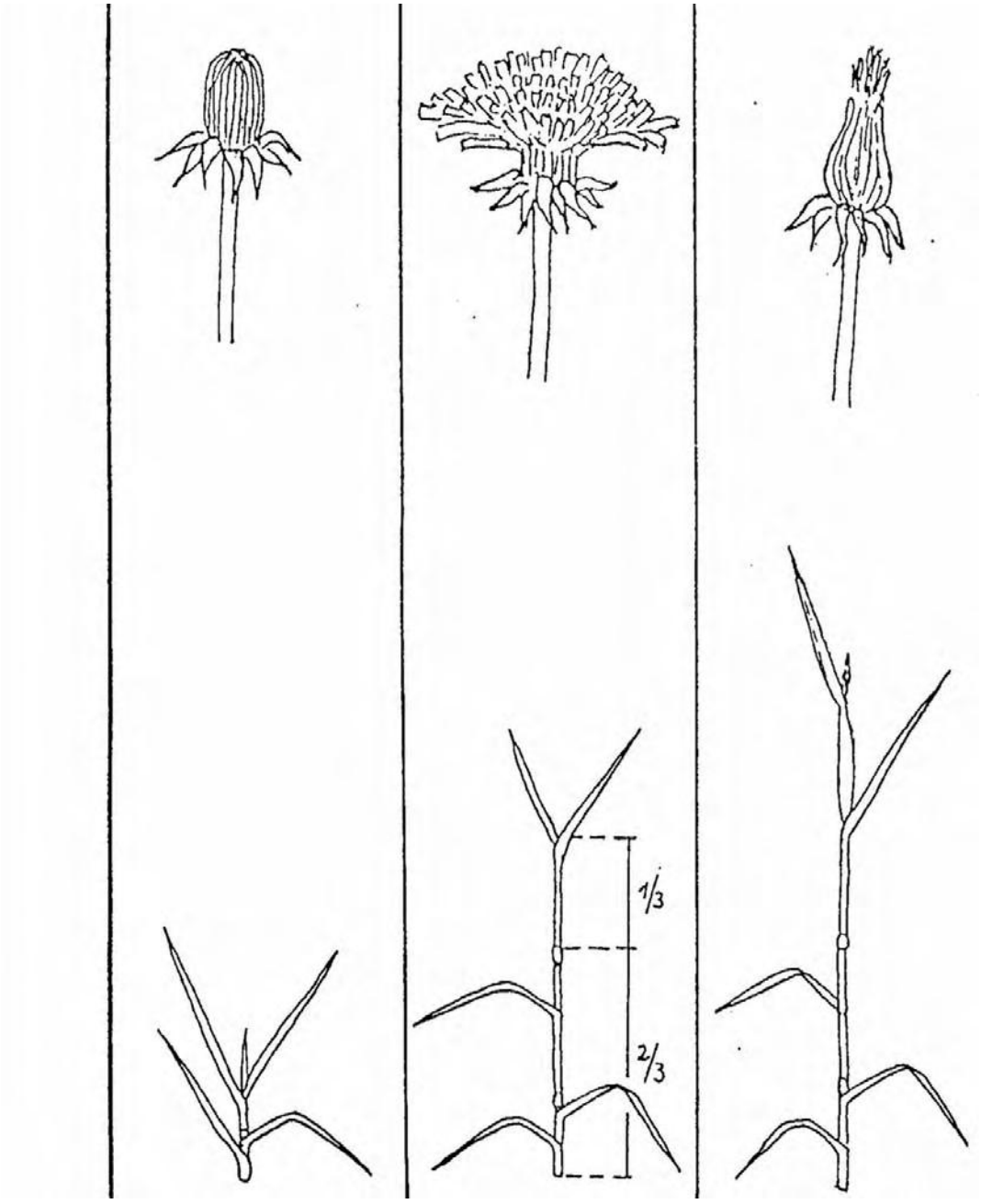
* Ear and panicle emergence
[#] DM – dry matter

3 Assessment of the conservation success

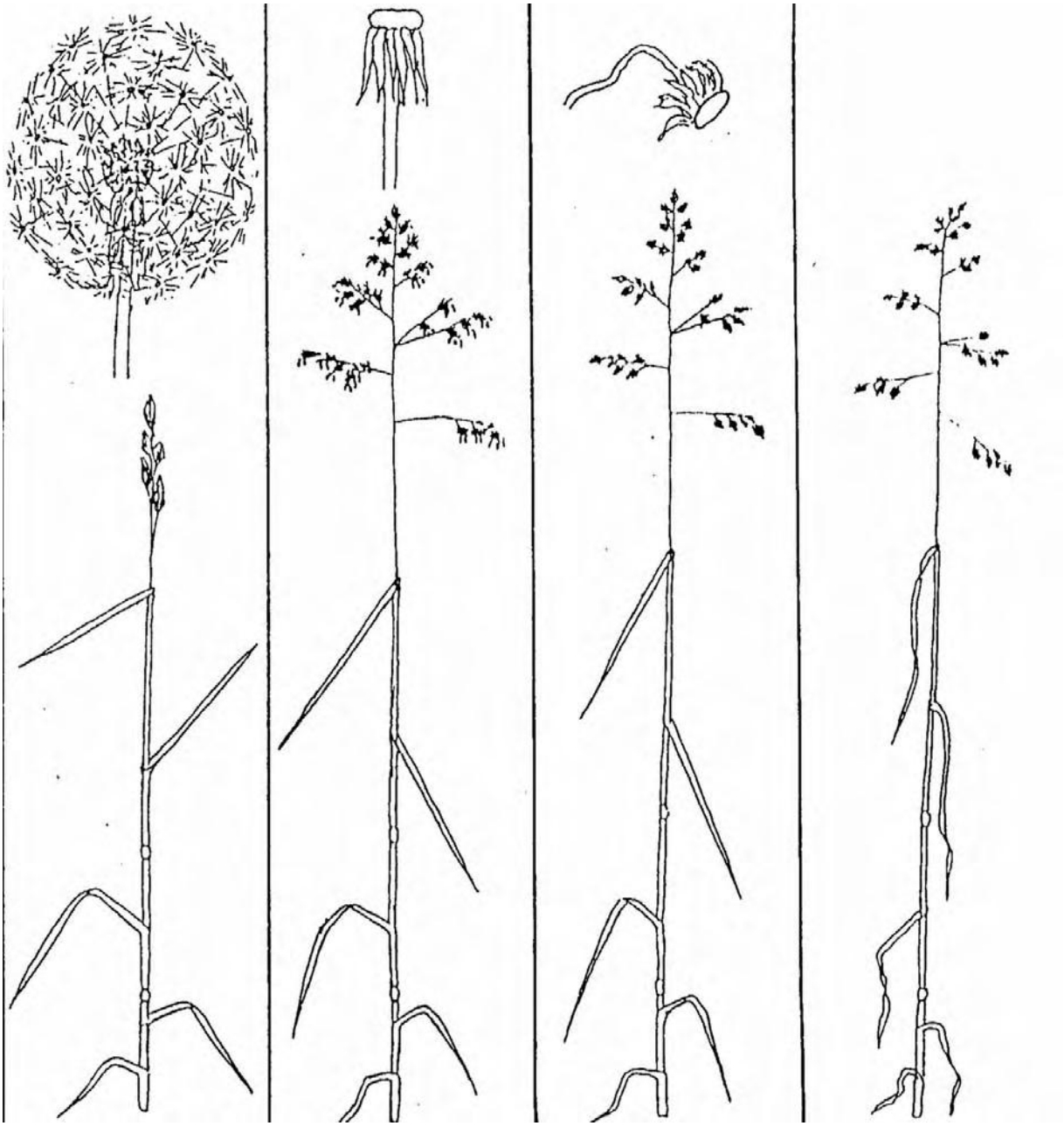
The smell, colour and ***texture*** of silage and dried herbage are then assessed by means of a sensory test. When assessing the conservation success, quality discounts are made for various shortcomings in the conservation process based on the best forage quality. The following part is treated separately for grass silage, dried herbage and maize silage.

The feed sample to be tested should be representative of the feed batch to be assessed. It is advisable not to conduct the evaluation in barns or directly at the silo due to other odours that do not belong to the sample. Sufficient lighting conditions must be ensured. The sensory assessment should be carried out at room temperature, if possible.

Note:
Only clearly identified quality deficiencies will reduce the final score!



	I	*II*	*III*
Phenological stage	**Stem elongation**	**Before ear/panicle emergence**	**Beginning of ear/ panicle emergence**
Cocksfoot	Uppermost stem node 10 cm above the soil	Base of the ear at 2/3 stem length	First panicle tips emerge from the leaf sheath
Dandelion	Beginning of anthesis, 1/4 of the plants flourished	All plants flourished, 1/4 faded	All plants flourished, 1/4 has seed stands



IV	*V*	*VI*	*VII*
End of spike/panicle emergence	**Flourishing**	**After anthesis**	**Start of seed ripening**
Panicle fully emerged, complete stem elongation still not reached	Stem elongation completed	faded, stems still green	Stem yellow, husks separate from fruits at beating on the hand
All plants have seed stands	Only naked inflorescences	Inflorescences are withered or rotten	

Grass silage

The best grass silage **in terms of the preservation process:**

- Smells pleasantly sourish (flavourful, condimental); is free from butyric acid; has no perceptible acetic acid odour and is free from other odours, that do not belong to the sample (e.g., barn, musty).
- In contrast, **autumn silages** can also smell grassy and fresh due to lack of or only slight fermentation and then generally only have low storage stability.

Odour:
Check for malfermentation, warming, yeast and mould formation

a) Butyric acid (smell of sweat or rancid butter)

	Discount (scores) for reductions in quality	
Not perceptible	***0***	
Weak, only perceptible after finger test (rubbing)	***2***	
Weakly perceptible even without a finger test	***3***	
Clearly perceptible from a distance of approx. 1 m	***5***	
Strongly perceptible even from some distance, faecal-like	***7***	

b) Acetic acid (pungent, acrid smell; smell of vinegar)

Not perceptible	***0***	
Weakly perceptible	***1***	
Clearly perceptible	***2***	
Strongly perceptible, unpleasant pungent smell	***4***	

c) Warming (roasting odour)

Not perceptible	***0***	
Weak roast flavour, pleasant	***1***	
Distinct roast flavour, slightly smoky	***2***	
Strong roast flavour, mildewed, unpleasant	***4***	

d) Yeasts (must-like smell, fermentation-like/mash-like odour)

Not perceptible	***0***	
Weakly perceptible	***1***	
Clearly perceptible	***2***	
Strongly perceptible, fermentation-like	***4***	

Total score discount for reductions inquality	

Carry-over scores for reductions in quality	

e) Mould (musty smell)

Not perceptible	***0***	
Weakly perceptible	***3***	
Clearly perceptible	***5***	
Strongly perceptible	***7***	

Colouring:

Check for weather influences during wilting and for malfermentation or mould

Hint:
Wet, leaf-rich silage has a darker colour than dry, stem-rich silage. This does not necessarily lead to a score discount. Silage also becomes darker in colour due to malfermentation.

a) Browning

	Discount (scores) for reductions in quality	
Normal colour	**0**	
More brownish than common	**1**	
Clearly browned	**2**	
Strongly browned	**4**	

b) Yellowing

Normal colour	**0**	
More yellowish than common	**1**	
Clearly faded	**2**	
Strongly faded	**4**	

c) Other observations

Bilious green due to strong butyric acid fermentation	**7**	
Visible mould infestation: Do not feed silage!	**7**	

Total score discount for reductions in quality	

Carry-over scores for reductions in quality	

Texture:

Check for microbial decomposition of plant parts and mould

Plant parts not affected	***0***	
Plant parts only slightly affected at cut surfaces	***1***	
Leaves clearly affected, greasy	***2***	
Leaves and stems severely affected, rotted, dung-like	***4***	

Estimation of the DM content using a wring test

If the silage is moist, form a ball and then press the silage. If DM content is ≥ 30%, form a strand from the silage and wring it vigorously once (***no follow-up!***).

Strong effluent leakage already with light hand squeezing	***< 20%***
Strong effluent leakage with strong hand squeezing	***25%***
Effluent leaks between the fingers during wringing, hands get wet	***30%***
No effluent leakage between fingers during wringing, hands are still moist	***35%***
Hands still shine after wringing	***40%***
Only a slight feeling of dampness/moisture on the hands after wringing	***45%***
Hands stay completely dry	***> 45%***

pH value:

Check for insufficient acid formation

Note:
Silage can also be evaluated without pH determination.

DM content in %					
up to 20	***21 - 30***	***31 - 45***	***> 45***		
< 4.0	< 4.3	< 4.7	< 5.0	***0***	
4.0	4.3	4.7	5.0	***1***	
4.4	4.7	5.1	5.4	***2***	
4.8	5.1	5.5	5.8	***3***	
5.2	5.5	5.9	6.2	***4***	
> 5.2	> 5.5	> 5.9	> 6.2	***5***	

Total score discount for reductions in quality	

Assessment of the fermentation quality

Total score discount for reductions in quality				***Loss of energy value*** compared with green forage in MJ/kg DM	
without pH value	with pH value	Grade	***Judgement***	ME	NEL
0 - 1	0 - 2	1	***Very good***	***0.3***	***0.2***
2 - 3	3 - 5	2	***Good***	***0.5***	***0.3***
4 - 5	6 - 8	3	***Needs improvement***	***0.7***	***0.4***
6 - 8	9 - 11	4	***Poor***	***0.9***	***0.5***
> 8	> 11	5	***Very poor***	***> 0.9***	***> 0.5***

Additional reduction in quality due to contamination

	MJ / kg DM	
	ME	NEL
Palm of hand after DM determination (wring test) with light dirty marks	0.3	0.2
Slight but clearly detectable contamination (grains of sand, soil particles, slurry residues)	0.7	0.4
Heavy contamination	1.0	0.6

Overall assessment of grass silage

Energy content expressed as ***ME*** or ***NEL***	MJ / kg DM
Green forage	
Reduction in quality caused by preservation	
Additional reduction in quality due to contamination	
Energy content of the grass silage	

Note:
If the feeding value of the silage shall be predicted after harvesting has been completed, a grade of 2 at best should be assumed for favourable weather conditions with extended field drying times, and a grade of 3 at best for field drying times of more than 2 days.

Dried herbage

When assessing the conservation success in relation to the best feed quality, discounts apply to various shortcomings in the conservation process. With regard to the preservation process, the best dried feed:

- has a light green to dark green colour
- smells flavourful, neither musty nor burnt and has no odour that do not belong to the sample
- still contains leaf parts corresponding to the starting material

Colour:

Check for effects of precipitation, heat and mould

	Discount (scores) for reductions in quality	
Perfect green colour	***0***	
Faded or slightly browned	***2***	
Heavily faded or heavily browned	***5***	
Visible mould infestation	***7***	

Odour:

Check for mould infestation or heat exposure

Flawless, flavourful hay odour	***0***	
Bland or slightly burnt or other unpleasant odour	***2***	
Musty, dull or more strongly burnt	***5***	
Very musty or very burnt	***7***	

Texture:

Check for inappropriate mechanical treatment

Soft (leaves present)	***0***	
Leaf-poor (leaves predominantly still present)	***3***	
Very leaf poor (leaves only partially present)	***6***	
Almost only stems, straw-like	***9***	

Total score discount for reductions in quality	

Assessment of the drying quality

Total score discount for reductions in quality			***Reduction in value**** compared to green forage in MJ/kg DM	
	Grade	***Judgement***	***ME***	***NEL***
0 - 1	1	***Very good***	***0.8***	***0.5***
2 - 3	2	***Good***	***1.0***	***0.6***
4 - 5	3	***Needs improvement***	***1.2***	***0.7***
6 - 8	4	***Poor***	***1.4***	***0.9***
> 8	5	***Very poor***	***> 1.4***	***> 0.9***

* Values apply to field drying. With barn-dried hay, the losses are 0.2 to 0.3 MJ NEL/kg DM lower.

Additional reductions in quality due to contamination

Shake the hay vigorously over a light-coloured surface and then assess the particles on the surface. Green particles are fallen off leaf or stem particles, brown or black particles indicate soil contamination.

	MJ / kg DM	
	ME	NEL
Only occasionally dirt particles or stones More green than brown particles	0.3	0.2
Regularly distributed dirt particles (grains of sand, soil particles) or small stones	0.7	0.4
Heavy contamination, surface littered or soil particles larger	1.0	0.6

Overall assessment of dried herbage

Energy content expressed as ***ME*** or ***NEL***	MJ / kg DM
Fresh herbage	
Reduction in quality caused by drying	
Additional reduction in quality reduction due to contamination	
Energy content of the dried herbage	

Maize silage

Best maize silage with regard to the preservation process

- smells pleasantly sourish (flavourful, bread-like), not like alcohol or butyric acid, it also has no perceptible acetic acid smell and is free of foreign odours,
- it smells neither like yeast nor mouldy and
- depending on the type of variety, it has a more golden-yellow colour (earlier senescing maize) to yellow-olive colour (stay-green types).

Odour

	Points for quality deduction	
Pleasantly sourish, flavourful, bread-like	***0***	
Slighty alcoholic or acetic acid odour	***1***	
Strong alcoholic or roasted odour	***3***	
Musty or slight butyric acid odour	***5***	
Disgusting, putrid smell, like liquid manure	***7***	

Texture

Unchanged (similar to material at harvest)	***0***	
Slightly affected, plant parts friable	***1***	
Severly affected, greasy, slimy	***2***	
Rotted	***4***	

Colour

Colour similar to the material at harvest	***0***	
Slight colour shift	***1***	
Strong colour shift	***2***	

Mould

Visible mould infestation: Do not feed silage!	***7***	

Total score discount for reductions in quality	

Determination of the stage of maturity and the DM content during ensiling

Description	*% DM*	*Characteristics*
Start of maize cob formation	***17***	Grains not fully formed
Milk stage of maturity	***20***	Grains formed, green-white, without filling
	22	Grain content milky
Start of dough stage of maturity	***25***	Grain content yellowish and viscous
	30	Grain content doughy to floury
End of dough stage of maturity	***35***	Grain content floury, grain can still be scratched with a fingernail
	38	Mature grains, grain can hardly be scratched with a fingernail

Estimation of the energy content

		Energy content in MJ/kg DM					
Cob proportion		***low***		***medium***		***high***	
Description	***% DM***	***ME***	***NEL***	***ME***	***NEL***	***ME***	***NEL***
Start of maize cob formation	17			9.4	5.6		
Milk stage of maturity	20	9.5	5.7	9.7	5.8	9.8	5.9
	22	10.0	6.0	10.3	6.2	10.7	6.4
Start of dough stage of maturity	25	10.2	6.1	10.5	6.3	10.8	6.5
	30	10.3	6.2	10.7	6.4	11.0	6.6
End of dough stage of maturity	35	10.5	6.3	10.8	6.5	11.2	6.7
	38	10.7	6.4	11.0	6.6	11.3	6.8

Assessment of the fermentation quality

Total score for Reduction in quality	***Grade***	***Judgement***	***Impairment*** compared to green plants in MJ/kg DM	
			ME	***NEL***
0 - 1	1	***Very good***	***0***	***0***
2 - 3	2	***Good***	***0.2***	***0.1***
4 - 5	3	***Needs improvement***	***0.5***	***0.3***
6 - 8	4	***Poor***	***0.9***	***0.5***
> 8	5	***Very poor***	***> 0.9***	***> 0.5***

Additional reduction in quality due to contamination

	MJ / kg DM	
	ME	NEL
Dirt visually recognisable	0.5	0.3

Overall assessment of maize silage

Energy content expressed as ***ME*** or ***NEL***	MJ/kg DM
Forage of green plants	
Reduction in quality deduction caused by preservation	
Additional reduction in quality due to contamination	
Energy content of the maize silage	

Publisher: **German Agricultural Society,**
- DLG - Committee for Feed Preservation -

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Updated reprint November 2004

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