

## ANIMAL HEALTH GUIDE

# Feed Quality

**Feed quality is the primary driver of feed intake and animal productivity.** Factors of major importance include dry matter (DM), crude protein (CP), metabolisable energy (ME), digestibility, carbohydrates and fibre. The quality of all components of the diet need to be considered relative to animal requirements.

### Dry Matter (DM)

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Dry matter is the amount of a feed left after the removal of water (moisture) at 65°C and is expressed as a % of the fresh weight. The dry matter intake of ruminant animals varies depending on a wide range of factors including animal species, size, physiological state (e.g. dry, lactating, pregnant), level of production, body condition and feed quality.

### Crude Protein (CP) (% DM)

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Crude protein (CP) is a laboratory estimate of the protein in feeds based on its nitrogen content (e.g. for forage-based feeds  $CP = N \times 6.25$  where N is 16% by weight of the protein). However, it is rightly termed crude in that it assumes all N in the feed is in the form of protein, but N can be present in other components as well. It provides no assessment of protein quality. If green leafy temperate pasture forms the majority of a diet, CP content will generally be surplus to requirements. CP requirements are about 7% for maintenance, 10-14% for growth and a minimum of 15% to maintain milk production in lactating cows.

### Metabolisable Energy (ME) (MJ/kg DM)

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ME is a measure of the energy in feed that is available for maintenance, growth, pregnancy and production in sheep and cattle. ME is calculated using a well-established equation.

### In vitro Organic Matter Digestibility (OMD) (% DM)

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OMD estimates the total organic matter digested by the animal. It is measured in the laboratory (in vitro) and is calibrated against animal measurements (in vivo). Typically, feeds with an OMD greater than 70 are considered to be of good quality, while feeds with an OMD of less than 55 are considered to be poor quality.

### Fibre (Acid detergent fibre (ADF) and neutral detergent fibre (NDF)) (% DM)

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ADF and NDF are both measures of difficult-to-digest plant cell wall carbohydrates. Generally the lower the fibre the better, but not below 20% ADF or 30% NDF, because some fibre is required to stimulate rumen activity.

### Soluble sugars and starch (SSS) (% DM)

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SSS supplies the rumen microbes with energy for their synthetic activities. The normal range for pasture is 10-15%. If SSS is less than 10% rumen microbial fermentation is likely to be reduced with negative effects on digestion. Maize silage should be in the range 30-40% SSS. The normal range for pasture silage is 2-7% SSS and generally they are higher in the early to mid-afternoon as a result of photosynthesis.

### Lipid

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The normal range in pasture based diets is 2.5-4.5%. Too much fat (>7%) can interfere with fibre digestion and cause diarrhoea. PKE has higher levels at 7-10%.

### Ash

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Ash is a measure of the inorganic or mineral component of a feed. This includes macro minerals such as calcium, phosphorus, sodium, potassium and sulphur as well as the trace elements. High ash levels can indicate contamination of a sample with soil. Soil contamination is of particular concern when assessing silage quality as contamination can result in clostridial fermentation leading to unpalatable silage with low nutritive value.

### Silages (Additional quality indicators)

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Silage is a fermentation product and the chemical composition will reflect this. Key to well-preserved silage is fermentation under anaerobic conditions, dominated by lactic acid bacteria converting water-soluble carbohydrates to lactic acid, reducing the silage pH sufficiently for preservation. Depending on how well the ensiling process is managed the resulting silage may be of similar quality to the parent forage, although various factors can have a detrimental effect on quality. The following indicators are used, in addition to those given above to assess silage quality.

## pH

Well fermented pasture and maize silages made in a pit or stack should have a pH <4.5 and legume based silages should be <5. Wrapped silages are usually of a higher DM % and their pH should be <5. Higher values than these indicate a poor primary fermentation or subsequent spoilage.

## Lactic acid (% DM)

Is another means of measuring the extent of the fermentation. A high lactic acid content (>6 - 8%) is typically desirable for high moisture (>65%) silages. For wilted silages (<55% DM) a lactic acid content of 3 - 4% is typical. Lower levels indicate a poor fermentation.

## Volatile fatty acids (% DM)

**Acetic acid** should be <2%, **propionic acid** <1% and **butyric acid** <0.1%. If concentrations are higher than these values, poor fermentation or spoilage is indicated.

## Ammonia (NH<sub>3</sub>-N)/(% total N)

NH<sub>3</sub>-N concentration expressed as a percentage of the total nitrogen reflects the degree to which dietary protein has been degraded during silage fermentation. (NH<sub>3</sub>-N)/(% total N) should be <5% for maize silages. Values higher than these indicate excessive wastage and probably loss of quality.

TYPICAL FEED VALUES						
FEED	DM	ADF	NDF	CP	DIGESTIBILITY	ME
Chicory	10 - 15	20 - 24	30 - 60	20 - 30	80 - 90	12 - 13.5
Fodder beet bulb	11 - 22	5 - 13	9 - 18	6 - 15		12 - 14
Fodder beet leaf	9 - 15	10 - 20	24 - 35	15 - 24		10 - 12
Kale leaf		12 - 20	15 - 26	13 - 23	75 - 90	11 - 13
Kale stem		20 - 30	25 - 40	7 - 13		10 - 12
Kale leaf & stem		14 - 27	19 - 33	10 - 20		10.5 - 12.5
Lucerne	15 - 45	15 - 25	30 - 50	15 - 32	60 - 80	9 - 12
Lucerne hay	80 - 90	30 - 45	35 - 50	5 - 7	50 - 65	8 - 10
Pasture	9 - 35	15 - 25	45 - 55	10 - 25	65 - 75	10 - 11
Rape leaf		12 - 20	15 - 24	12 - 25	75 - 90	12 - 14
Rape stem		25 - 40	30 - 45	5 - 10	75 - 90	9 - 12
Swedes leaf	13 - 17	13 - 18	15 - 20	15 - 30	> 80	11.5 - 13
Swedes bulb	7.5 - 12.5	12 - 18	13 - 20	6 - 12	> 85	12.5 - 13.5
Turnips leaf	11 - 15	17 - 22	20 - 25	13 - 24	80 - 90	12 - 13.5
Turnips bulb	8 - 12	14 - 23	13 - 26	7 - 13		13 - 14.5
Barley silage	24 - 35	22 - 35	35 - 50	7 - 12	55 - 60	8.6 - 10
Cereal silage	24 - 35	22 - 35	45 - 60	7 - 12	50 - 65	9.5 - 10.5
Lucerne silage	25 - 55	30 - 37	35 - 50	14 - 24	60 - 70	9 - 10.5
Maize silage	30 - 45	18 - 30	30 - 50	6 - 10		10 - 11
Pasture silage	15 - 40	25 - 35	35 - 50	10 - 20	60 - 67	9.5 - 10.5

Feed value references: ARL, Feedtech (2005), West Coast brassica manual (2006), NZAP occasional publication no. 7 (1980), Feed composition UK tables of feed (1992).

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