Wheat as dairy cow feed

Nutritional value
Metabolisable energy (ME) of wheat has been generally considered as more or less constant for ruminants. However, tests conducted on 61 samples taken from HGCA-funded trials encompassing a wide range of growing conditions, showed ME varied from 12 to 15 MJ/kg dry matter. Crude protein varied from 90 to 160 g/kg dry matter.

Ideally, nutritional value of any feed is assessed using living animals. In practice in vitro tests of energy, protein and other grain quality characteristics are economically necessary but results often do not correspond well to animal performance.

The project used a test for energy that simulated rumen conditions. Grain and rumen microbes were placed in a container and continuously shaken. During incubation at body temperature, gas production was measured. Undigested starch was measured at the end.

Other tests included chemical analysis, specific weight, Hagberg falling number and grain hardness.

Variety and agronomy
Grain sections examined under a light microscope were grouped as ‘mealy,’ ‘steely’ or ‘piebald’. Starch fermented more rapidly in more mealy grains. Grinding mealy or steely grains resulted in the most rapid fermentation, indicating that any processing is likely to increase starch availability to rumen microbes. However, rapid starch fermentation can cause excessive rumen acidity.

Soft varieties had a higher proportion of mealy grains compared with hard varieties, although actual variety was relatively unimportant. Near infrared reflectance spectroscopy (NIRS) proved useful to relate grain hardness to mealiness (Figure 1).

This project confirmed that as starch levels in raw grain increase, so protein falls and vice-versa (Figure 2).

Increasing fertiliser nitrogen raised protein content. High or low starch samples may be produced by manipulating fertiliser supply.

Crops given more nitrogen fertiliser produced grain with higher nitrogen contents and higher proportions of steely grains. For example, a low nitrogen Riband sample (10.5 g/kg N dry matter) was all mealy, whereas only 61% of a
higher nitrogen sample (22.2 g/kg N dry matter) was mealy. Other aspects of agronomy had little effect on feeding value.

**Specific weight**

Grain price is often determined by specific weight. However, this bears little relationship to feed quality, especially above 70 kg/hl. NIRS would appear better at predicting nutritional value, particularly grain hardness and protein content.

**Wheat or maize**

Maize samples had lower nitrogen (13.6 to 14.7 g/kg dry matter) and higher starch contents (729 to 753 g/kg dry matter) than wheat. Maize fermented more slowly and less completely.

For highly productive animals maize may have an advantage. Slower fermentation is less likely to cause unduly low rumen pH. More starch will be available for intestinal digestion and absorption as glucose, which is in critical balance in high yielding animals. However, at current prices, wheat is clearly more economic than maize.

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**Summary**

There is a significant market for feeding wheat to ruminants, especially dairy cows. Wheat's high starch content appears to enhance milk protein content, possibly by providing energy for rumen microbes. However, cereal starch may be digested too quickly in the gut resulting in excess rumen acidity. Studies funded by HGCA and the Milk Development Council have therefore sought to increase feeding value of wheat in compound feeds.

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