Intake factors in dairy cattle

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Although the concept of feed intake is relatively simple, the factors affecting it can vary dramatically. These factors may include animal characteristics such as genetic selection or propensity to eat, and neurologic and hormonal feedbacks pertaining to satiety, metabolic conditions, and diseases.

The feed itself can affect intake from a variety of characteristics, including moisture, taste, fat content and fibre content. Because ruminants rely on fermentation to provide nutrients from volatile fatty acids to microbial protein, they risk being affected by disturbances from feed changes and factors affecting microbial growth.

As ruminants, dairy cattle are essentially consuming feed at all times. As such, some of the satiety controls and monitors found in monogastric animals may not be effective to the same levels as in dairy cattle.

**Rumen and gut effects**

Does rumen fill cause satiety? In evaluating rumen fill researchers have used inflated balloons in the rumen to simulate fill, resulting in decreased voluntary intake. However, at physiological levels this feedback mechanism is unlikely to be the sole or major reason for decreased intake.

Research on sheep has demonstrated that the duodenum has receptors affected by titratable acidity but not glucose or osmolality. Moreover, it has also been demonstrated that the infusion of propionate to the liver results in decreased in-
take with feedback to the brain via nerve transmissions. This is interesting when one considers that propionate is the primary gluconeogenic volatile fatty acid (VFA). Circulating ketones such as β-hydroxybutyrate can reduce feed intake in both monogastrics and ruminants. Produced during negative energy balance and a lack of glucose, ketones can lead to a continuous spiraling down in dry matter intake (DMI).

Feed management
Feed formulation is the area in which management can most greatly affect DMI. Within common diets, DMI can be fairly well predicted based upon the energy content of the diet and the level of milk production. They do not predict potential intake and subsequent production. Fats and high simple carbohydrate diets can certainly increase caloric density. However, issues of absorption and acidosis can limit their use. Today's dairy cattle intake is often restricted by the physical constraints of moving enough feed through the system. Toward this end, it is important to maximise the digestible fiber portion of the diet.

Neutral detergent fiber, as a measure of forage quality, is important in predicting forage DMI. However the digestibility and rate of digestibility are also important in predicting intake. Enzyme, chemical treatments and genetic selection for more digestible NDF portions have resulted in increased digestibility and subsequent intake. For cattle to consume new or continue eating new feed, the previously consumed feed contents must disappear through a combination of digestion and passage. Feed fiber utilization is maximised through good fermentative characteristics in the rumen which include both proper pH and available nitrogen for bacterial growth.

Weather effects
Dairy cattle have a fairly wide thermal neutral zone from 5 to 20°C and are generally more tolerant of cooler temperatures. It is the combination of temperature and humidity which affect the “comfort” of the cattle. The combination of heat and humidity can decrease feed intake by 10-25%, and in extreme conditions up to 55% (Table 1).

Management tools to deal with heat and humidity include the use of misters, fans, reduced crowding and dietary changes to include more fats and less fiber.

Improved intake
DMI is a result of the innate ability of dairy cow to consume feed based upon genetics which affect gut volume, sensory and hormonal controls. Dairy producers need to maximise this potential for DMI through dietary selection and the provision of an environment conducive to maximal feed intake.

### Table 1
Temperature and humidity levels that can negatively affect milk production.

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Humidity (%)</th>
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<tbody>
<tr>
<td>29</td>
<td>15</td>
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<td>26</td>
<td>30</td>
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<td>25</td>
<td>50</td>
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<td>24</td>
<td>65</td>
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<td>22</td>
<td>90</td>
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Source: Chase, Cornell University

Feeding frequency
Presentation of feed through either new feeding or pushing in of currently offered feed has been shown to increase feeding behaviour.

Mycotoxins
Feed intake can also be reduced by the presence of mycotoxins, especially trichotoxins such as deoxynivalenol (DON or vomitoxin) and T-2 toxin (T-2) in the feed. Fescue pastures or hay containing alkaloids lower heat tolerance and subsequently reduce dry matter intake.

Moisture content
Diets containing over 50% moisture have generally been associated with decreased intake. This reduced feed intake is related to the fermented products of such diets rather than the water content per se.