Future opportunities for precision grazing management

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Precision grassland management

• The precision ‘arable’ approach is applicable to grassland management...
• ...but only when the herbage is *mechanically* harvested (i.e. when we can map yield)
• So what about when grassland is *grazed*?
• Can we use a precision approach to manage grazed grasslands?
Grazing management

• Measure the available herbage (kgDM Ha\(^{-1}\))
• Match this to the intake requirement of the animals to be grazed
• Control access e.g. using strip grazing

“You can’t manage what you can’t measure”
Residual sward height

<table>
<thead>
<tr>
<th></th>
<th>Intake per cow</th>
<th>Intake per hectare</th>
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<tbody>
<tr>
<td>High</td>
<td></td>
<td>High</td>
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<tr>
<td>Low</td>
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Requires removal of ungrazed herbage

**Optimum residual sward height**

Will reduce daily intake
Technology is already helping farmers to measure herbage mass:

- Rising plate meter
- Vehicle-based ‘Pasture Meter’
- ‘Pastures from Space’
The development of a noseband sensor allowed the opening and closing of the jaws to be recorded.

- This formed the basis of the ‘IGER Behaviour Recorder’ and Graze analysis software.
Grazing jaw movements

Chews

Bites and “chew-bites”

Time

Jaw movement amplitude

15 seconds
Bioacoustics

Microphone → Radio transmitter → Radio receiver connected to video camera i.e. the sound you will hear in the video is transmitted from the cows head

Noseband → ‘IGER’ Behaviour Recorder
Bioacoustics

Head up

Mainly chew-bites

No. 8 12

Two chews

Chews
Bioacoustics

Head up

Mainly chew-bites

No.  8  12

Two chews

Chews
Bioacoustics potential

• Originally needed the human ear to detect bites and chews, but algorithms have been developed to do this automatically

• Research has shown the energy density of chewing sound is proportional to bite mass, so has the potential to monitor intake

• Has the potential to detect different plant species and differences in herbage quality
• The microphone can pick up the sound of conspecifics grazing alongside the subject...

• ...so may need to be combined with other sensors e.g. accelerometers
Herbage availability

High herbage availability

Few bites · Many chews

Low herbage availability

Many bites · Few chews
Commercial bioacoustics

• Bioacoustics are already being used in an on-farm monitoring system

• The SCR ‘VocalTag’ uses bioacoustics to detect rumination behaviour

• Used to monitor health and help predict oestrus
Automatic release gates

- Timed release gates are already available
- The gate to the next paddock could be opened automatically based on sward depletion e.g. bite:chew ratios
Robotic fence

- Moving, robotic fence introduced in 2007, but no longer for sale
- Cost approx. £15,000
- Reduces trampling and fouling
- 12% more grass utilized
- Would it be more effective if fence movement was linked to sward depletion?
Virtual fencing

• A ‘virtual fence’ system replaces temporary electric fences with a virtual fence line
• i.e. a series of latitude and longitude coordinates
Virtual fencing

• The animal is fitted with a collar which can:
  - Determined its position (e.g. using GPS)
  - Can deliver an acoustic ‘warning’
  - Can deliver an electric ‘stimulus’
- When the animal approaches a **virtual boundary**...
- ... it receives a **warning sound**
If the animal reaches the virtual boundary it receives an electric shock.

Animals learn to use the warning signals to avoid receiving a shock.
An Australian company (AgerSens) is bringing the first commercial virtual fence system to market this year.

Ethical concerns over ‘shock collars’ means this approach is less likely to be adopted in the UK.

An alternative approach is to use positive reinforcement to direct animal foraging.

- e.g. use auditory cues to help direct animals towards a reward e.g. fresh herbage.

Perhaps use both, only resorting to negative reinforcement when the animal’s welfare is at risk?
Summary

• Precision technologies can improve the efficiency of grazed herbage utilization and remove some of the risk.
• Bioacoustics has the potential to measure a range of parameters relevant to grazing management.
• A variety of technologies to control animal access to pasture are becoming available.
• These tools need to be integrated into ‘smart’ grazing management systems.
• These technologies are not designed to replace the skills of the expert stockperson.
Any questions?