New Methods for Identification and Evaluation of Intake Characteristics of Grass Varieties

Robert Orr and James Cook

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Plant breeding priorities at IGER have gradually changed since the establishment of grass breeding at the former Welsh Plant Breeding Station in 1919, reflecting the changing needs of the farming community and society at large. The current

interest in and emphasis on grazing is based, in part, on a need to reduce the costs of livestock production in order to sustain a viable UK agriculture which can operate in world markets. There is a need to produce meat and milk using welfare-friendly methods in pastoral systems that consumers perceive to be ‘natural’. There is also a need to minimise pollution.

Livestock production systems based on grazing offer a greater probability of long-term environmental sustainability than those based on high levels of concentrate supplementation or using housed animals.

**Grass breeding and testing**

Ideally, grass varieties should be bred to satisfy the particular requirements of specific grazing systems and be evaluated using appropriate methodologies. This may not necessarily mean breeding for increased intake and production, if it is at the expense of other desirable traits.
Current UK national testing procedures for forage grasses consider 'simulated grazing' yield (measured using frequent cutting), midseason digestibility, ground cover, winter hardiness and disease resistance. We propose that for varieties destined for grazing use, identifying grazing-related traits would facilitate the development of varieties for grazing with reliable selection criteria. Screening varieties for intake characteristics would also identify those which are best suited to particular grazing systems.

Large-scale grazing trials for routine variety assessment are expensive in terms of land, animal and labour resources, and require quantities of seed that may not be available in the early stages of variety development. In addition, the potential value of grass cultivars under grazing cannot necessarily be drawn from feeding value assessments with housed animals.

At IGER, therefore, we are developing rapid, small-scale, low-cost screening methods that are required both during the breeding programme and the subsequent evaluation for the identification of plant traits that are correlated with herbage intake by sheep and cattle grazing at a field scale. This article describes some of the methods under development.

Measuring grass intake potential

In order to investigate the extent of any differences in grass intake potential under grazing, 15 intermediate-heading perennial ryegrass varieties, with five replicate paddocks of each variety, were compared under continuous variable stocking management with sheep (Figure 5.1). Daily herbage intake was measured using alkane markers in grass and faeces, along with eating time which was measured using the IGER Behaviour Recorder (http://www.ultrasoundadvice.co.uk), and mean intake rate was calculated. There were marked differences (Figure 5.2) in intake rate amongst the diploid (d), tetraploid (t) and tetraploid hybrid (th) varieties tested with some having values nearly 20% higher or more than 20% lower than the control variety for this heading group (Fennema).

Correlation of intake with plant characteristics

To relate these differences in intake to plant characteristics which could be targeted in grass breeding programmes, intake measurements were made on five grass varieties (AberDove, Belramo, Glen, AberExcel and Twins) along with a suite of detailed chemical (digestibility, nitrogen and water...
soluble carbohydrate concentrations) and morphological factors (see box above). There were significant differences between the five contrasting varieties in ingestive and ruminative behaviour, in plant morphology and in plant chemistry. An example of potentially important morphological data is shown in Figure 5.5b. Work is now in progress to identify plant traits that are correlated with grass intake.

**Measuring bite mass**

Currently, short-term, small scale assessment methodologies are being developed to measure bite mass. Evaluations used boxes (dimensions 85 x 44 x 14 cm) containing compost growing medium sown with either Belramo, Glen, AberExcel or Rosalin varieties at a sowing rate of 1600 seeds m⁻² (Figure 5.6). The boxes were kept in a glasshouse and the grass cut to 6 cm from the soil surface at 5 and 8
weeks after sowing. They were moved outdoors to an arena before each test, in which each variety was offered to one of four yearling Simmental x Holstein heifers 11 weeks after sowing in an experiment with a Latin-square design. Each box was weighed accurately (± 0.1 g) before and after a period in which the heifer was allowed to take approximately 50 bites (Figure 5.7). Samples of the grasses were weighed, dried and then weighed again in order to calculate bite mass (dry matter).

The tests were recorded on video and the actual number of bites was determined (Figure 5.8). The heifers ate the grass readily from the boxes and the mean time between the 'before' and 'after' weighings was 8 min. A mean number of 51 g 3.9 bites was taken. Bite mass tended to be higher for Glen than Belramo (diploids) and higher for AberExcel than Rosalin (tetraploids), similar to rankings for intake rate when these varieties were grazed in the field by continuously-stocked sheep (Figure 5.2). The technique provided a relatively quick assessment of intake characteristics of the four grass varieties.

In 2003, ingestive behaviour will be measured for groups of heifers rotationally stocked in 1-day paddocks on these same varieties and compared with data from the short-term methods. If successful, the methodologies developed in this project could be used by plant breeders and variety evaluators to identify useful genetic material and produce grass varieties optimised for grazing systems for a range of circumstances/management.

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