

Genotype and environment effects on feed grain quality

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Abstract

The extent of genotype and location effects on chemical composition and nutritive value of grains fed to animals was surveyed. The review covered the winter cereals (wheat, barley, oats, and triticale), the summer cereals (sorghum and maize), and the pulses (field pea, lupins, faba beans, and chickpea) when fed to cattle, sheep, poultry, pigs, rats, and mice.

The bulk of the literature does not meet the statistical criteria required to differentiate genotype and environment effects. When the criteria were satisfied, significant genotype differences were shown to exist for chemical composition in wheat, barley, triticale, and sorghum, for nutritive value as determined by methods *in vitro* in wheat, barley, oats, triticale, and sorghum, and *in vivo* for wheat, barley, triticale, sorghum, and maize. Valid comparisons across grain species are few, but *in vitro* gas production ranks wheat > oats > barley. Significant location, year, genotype × location, genotype × year, and genotype × location × year effects were reported for nutritive value for some grains.

Wheat feeding trials with poultry indicate that environment can affect apparent metabolisable energy (AME) as much as, if not more than, genotype. A greater range in nutritive value appears to exist in barley than in wheat. The information is unclear in the case of triticale, where despite some reports claiming that grain of this species has high lysine content, the difference does not appear to translate to improved performance in animals. Insufficient studies exist for oats despite it being one of the most widely used on-farm feed grains. No examples could be found of studies with rye.

The most thoroughly researched grain has been sorghum, which is principally grown in developed countries for feeding to livestock. Here, some definitive studies have been conducted to define the extent of genotype, location, and genotype × environment interaction effects. Scope exists to enhance the nutritive value of sorghum by breeding through modification of endosperm composition, tannin content, and improved protein digestibility. Variation in endosperm composition in maize due to simply inherited mutations provides the opportunity to improve its nutritive value.

This review indicates that before any plant breeding is undertaken for feed grain quality, a better understanding of what determines nutritive value and the relative importance of genotype and environment in modulating these factors is required.

Full Text

<http://www.publish.csiro.au/nid/40/paper/AR98162.htm>