

The meat quality of lambs grazing perennial wheat with different companion legumes

Benjamin Holman¹, Gordon Refshauge², Matthew T. Newell², David L. Hopkins¹, Richard C. Hayes³

¹ Centre for Red Meat and Sheep Development, NSW Department of Primary Industries, Cowra, New, South Wales, 2794, Australia., ² Cowra Agricultural Research and Advisory Station, NSW Department of Primary Industries, Cowra, New South Wales, 2794, Australia., ³ Wagga Wagga Agricultural Institute, NSW Department of Primary Industries, Wagga Wagga, New, South Wales, 2678, Australia.

Objectives: There are agronomic and commercial advantages to grazing perennial cereal crops, especially when grown with a companion legume. This has led to the evaluation of novel perennial wheat material (Hayes et al. 2012). It is important to understand the effects of new forage combinations on the meat of grazing animals. A recent pen study found that lambs fed perennial wheat will achieve a comparable mineral status, growth rate, and carcass to those fed a conventional annual wheat (Newell et al. 2020; Refshauge et al. 2022). Further study demonstrated that lambs fed perennial wheat and lucerne (*Medicago sativa*) diets can produce meat of good everyday quality and which provides a dietary source of many fatty acids and minerals (Holman et al. 2022; Holman et al. 2021). Together, these findings affirm the suitability of perennial wheat and the meat quality benefits of growing it in combination with lucerne. However, little is known of the effect on meat quality of legume forages with contrasting nutritional profiles, or whether benefits observed in a pen study can be replicated under more normal grazing conditions. This study, therefore, compared the meat quality of lambs extensively grazing perennial wheat as a biculture with either clover, serradella, lucerne, or a mineral salt supplement.

Materials and Methods: This study was approved by the NSW DPI Animal Ethics Committee (ORA18/21/022). It followed a split-plot design whereby 3 crossbred ewe lambs (sub-plots) grazed each of 4 forage types (plots), that were replicated across 6 locations (blocks). This resulted in 72 experimental lambs, their initial allocation being stratified by liveweight. The forage types included perennial wheat (line 11955) in combination with either subterranean clover (*Trifolium subterranean*; PW+C), French serradella (*Ornithopus sativus*; PS+S), lucerne (PW+L), or a mineral salt supplement (PW). These were sown in 24 individual plots (~800 m² each, 6 plots per forage type) wherein lambs grazed, freely. After a 7 d adjustment period, the feeding study continued for 89 d and culminated in the slaughter of the lambs at a commercial abattoir. At 24 h post-slaughter, the carcasses were fabricated (boned out) and the *longissimus lumborum* muscles (LL) collected. Left LL were sectioned into equal halves that were assigned to each of 2 ageing periods (5 or 56 d). Aged samples were analysed for cooking loss, drip loss, and shear force. The 5 d aged samples were analysed for total moisture, ultimate pH, and sarcomere length. Data were analysed using Genstat (21st edition, www.vsni.co.uk). ANOVA models fitted with the fixed effects of forage type and the random effects of block, plot, and sub-plot were used to analyse the sarcomere length, total moisture, and ultimate pH data. The other quality variables were analysed using linear mixed models fitted with the fixed effects of forage type, ageing period, and their interactions, as well as the random effects of block, plot, and sub-plot. The level of significance was set at 5%.

Results and Discussion: Forage type did not affect lamb meat sarcomere length, total moisture, or ultimate pH ($P > 0.05$). In addition, there were no significant forage type effects on cooking loss, drip loss, shear force, or purge loss, both independent and as an interaction with ageing period. These results demonstrate that perennial wheat can be grazed with a variety of legume companions to produce lamb meat of comparable quality. Indeed, comparison against consumer thresholds, in the literature, suggests that all of the lamb meat was of high sensorial quality (Holman & Hopkins 2021). The absence of any forage type effect may be indicative of the preferential grazing by lambs. For instance, if the experimental lambs favoured the consumption of perennial wheat, so that it comprised the majority of their dietary intakes, this could have obfuscated the nutritional differences between the legume companions and resulted in the meat having similar physicochemical properties. Alternatively, it may be the lipid and oxidative properties of lamb meat that are affected by forage type - with past research finding these variables are most impacted by legume species, feed intake, and forage composition (De Brito et al. 2017). These propositions would require additional investigation. Shear force was observed to decline with ageing period, from 28.8 to 20.8 N ($P < 0.001$). Likewise, purge losses increased with ageing period, from 3.7% to 6.3% ($P < 0.001$). These findings are anticipated to result from the continuation of proteolysis during the ageing period.

Conclusions: This study affirms perennial wheat as a dual-purpose crop for meat production, when grazed under extensive systems and as a biculture with different companion legumes.

References:

- De Brito et al. 2017. *Compreh Rev Food Sci Food Saf* 16:23-38. Hayes et al. 2021. *Field Crops Res* 133:68-89.
Holman et al. 2022. *Vet Anim Sci* 15:100230. Holman et al. 2021. *Meat Sci* 180:108564. Holman & Hopkins. 2021. *Meat Sci* 181:108586.
Refshauge et al. 2022. *Small Rumin Res* 209:106639.

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