ALLIANCE GROUP LIMITED

in association with

ABACUSBIO LIMITED

Summary Paper: **Alliance Meat Quality Trials, 2007-2008**

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Background

Meat quality is increasingly important to New Zealand lamb meat markets. The quality of lamb is made up of a number of traits including; meat and fat colour, pH, tenderness and factors affecting the eating experience such as taste, juiciness and smell. The nutritional quality of meat is increasingly important to consumers as well. This includes the amounts of vitamins, essential minerals (such as iron) and types of fatty acids (such as omega 3).

Alliance has two major lamb market product types; frozen lamb and chilled lamb. The meat quality issues around these market types are slightly different:

- The frozen market requires a greater emphasis on meat tenderness (a lot of electrical stimulation has been taken out of processing which means there is greater variation in tenderness);
- The chilled market requires a greater emphasis on colour stability and more consistent ultimate pH;
- Consumer preference related traits such as flavour, juiciness, texture and odour are important for both markets.

Traditionally in New Zealand we have focused on processing and packaging as the main avenues for improvement of lamb meat quality. However, meat quality is influenced by a number of non-processing factors such as; genetics, feed type and quality, age, sex, castration status and stress levels. For these Alliance trials we decided to evaluate two variables contributing to variation in meat quality as follows:

1. Evaluating genetic variation in meat quality via the Meat & Wool NZ funded CPT resource
2. Evaluating pasture effects on meat quality in partnership with PGG Wrightson

The role of genetics in meat quality

The CPT evaluates sires from differing sources throughout NZ every year for a number of traits. A total of 143 sires have been evaluated so far, 25 of which were assessed in 2007-2008 season (the progeny analysed for this trial). The sires evaluated represent the leading industry sires across a range of breeds and as such, the CPT is an excellent resource for evaluating leading genetic sources in previously unselected traits, such as meat quality.

The main aims of the Alliance CPT meat quality trial were as follows:

- To evaluate meat tenderness in frozen and chilled lamb loins from CPT progeny;
- To evaluate meat colour stability and ultimate pH variation in chilled lamb loins from CPT progeny;
- To evaluate taste panel traits in frozen lamb loins;
- To determine the heritabilities of meat quality traits (amount of variation which can be attributed to genetics);
- To evaluate the relationship between meat yield and growth and meat quality.

Key Findings

There were significant effects of sex, rearing rank, site (where the CPT lambs came from and were killed) and pH on meat quality traits. For all subsequent analyses, these factors were adjusted for.

The table below shows the heritabilities of the meat quality traits measured as part of this trial. Colour stability traits had relatively high heritabilities. For example, deterioration, which is the speed at which the meat deteriorates (goes from a red to a brown colour), had a heritability of 0.38 which means that ~30-40% of the variation of this trait can be attributed to genetic influences. This means that progress in selecting for animals with superior meat colour would be relatively fast in a selection programme. The main difficulty is that colour stability is a hard trait to measure on a large scale.

Tenderness of meat frozen at 24 hours was variable with a number of samples exceeding 8kgF (which is considered tough). However, there was very little variation in tenderness of meat which had been aged for eight weeks and none of this aged meat was tough (averaging 2.96kgF). This shows tenderness is not an issue for our chilled markets. pH also had a moderate heritability of 0.23. However, the overall variation of pH measurements was low and very few samples exceeded a pH of 5.8. This indicates that we do not need to select for pH in a breeding programme.

Heritabilities of the taste panel traits (aroma, flavour, texture, succulence and acceptability) were very low. This was to be expected as taste panels measurements are very subjective, even when trained panellists are used, as in this trial.

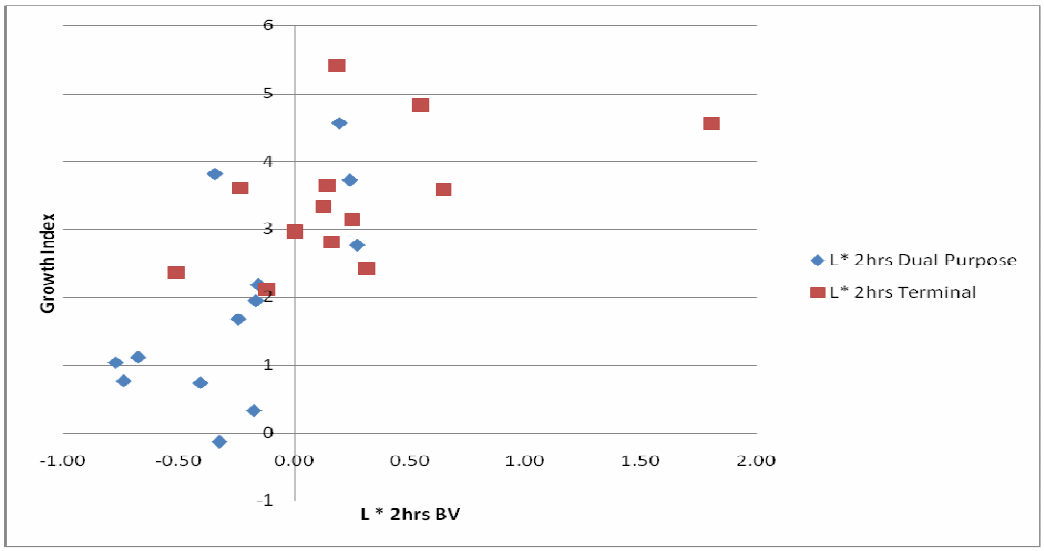
Heritabilities and standard deviations of meat quality traits. Note: All trait data are adjusted for fixed effects: sex, birth rearing rank, site and kill date. a* 2hrs, deterioration, L* 2hrs, tenderness and taste panel traits are also adjusted for pH.

Trait	Heritability	Standard deviation
a* 2hrs (meat redness)	0.47	1.12
Deterioration	0.38	22.26 (hrs)
L* 2hrs (meat brightness)	0.14	1.31
pH	0.23	0.10
Tenderness	0.22	2.19 (kgF)
Aroma	0.12	0.13
Flavour	0	0.17
Texture	0.05	0.17
Succulence	0	0.17
Acceptability	0	0.18

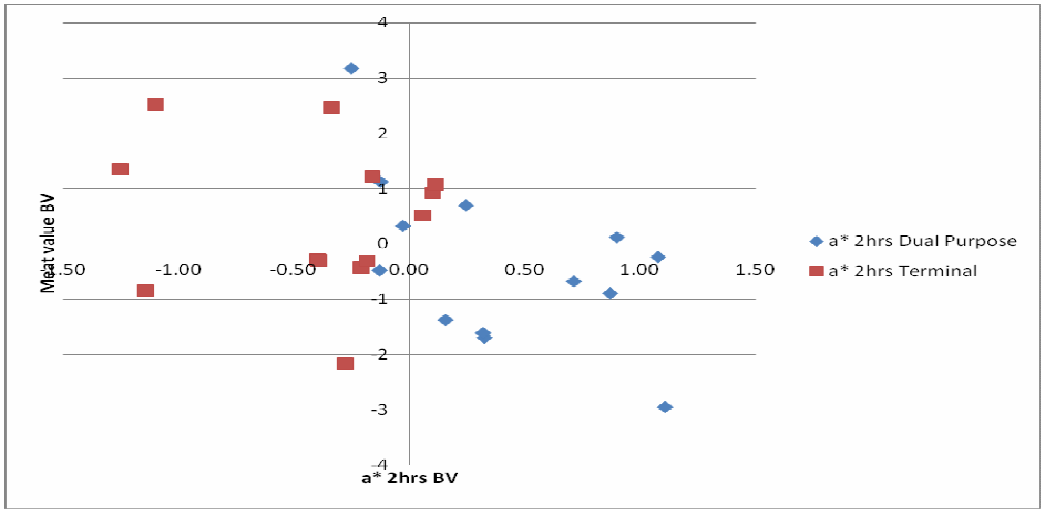
The relationships between meat quality and growth and yield traits were interesting. The sires with faster growing progeny tended to have higher L* breeding values (more white/bright), and higher yielding animals had lower a* values (less red-more brown) (figures below). This means that samples which come from faster growing and higher yielding animals tend to be more pale and more brown. There was also a genetic correlation between L* 2 hrs (brightness) and tenderness (kgF) (0.61), the more bright, or white the meat, the tougher it was.

Currently, in breeding programmes there is a high emphasis on growth and yield. We may have reached a point where we need to re-balance this, if too much selection on these traits is adversely affecting meat quality. Selection for yield and growth is known to influence meat quality in other species including pig, beef and poultry. A trial specifically designed to examine these relationships in lamb is now underway (lambs born 2008). With this trial, we will be able to determine if growth and yield affect taste related traits as well.

Relationship of L* 2hrs (brightness) BV with the growth index from the CPT.



Relationship of a* 2hrs (redness) BV with the meat value index from the CPT.



Pasture effects on meat quality

The main aim of the pasture-meat quality trial was as follows:

- To determine if differing pasture species (plantain vs ryegrass) affects meat quality traits, including taste panel measurements

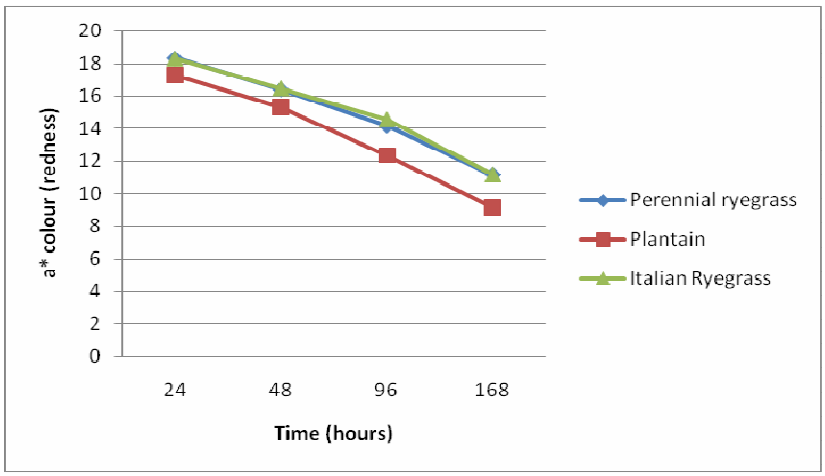
There were two trials run to evaluate the effects of pasture species on meat quality. Both trials were run at the PGG Wrightson Ceres Research Centre, Canterbury. Pasture treatments were plantain (cv Tonic), perennial ryegrass (cv Commando) and Italian ryegrass (cv Crusader). The first trial included lambs to weaning, and,ewes were randomly allocated to one of three pasture species treatment groups, from one week prior till lambing (8th August), until weaning (27th November). The second trial included store lambs, which were brought onto the pasture treatments at ~12 weeks of age until slaughter. This trial did not include an Italian ryegrass treatment as the trial was run during mid summer and Italian ryegrass is not strong in terms of quality at that time of year.

Key findings

There were significant differences in meat colour stability in the first trial between plantain and the ryegrasses but this difference did not occur in the second trial. The lambs (trial one, birth to weaning) which had been fed plantain had poorer colour stability than the lambs which were fed either perennial or Italian ryegrass.

The meat colour of lambs fed plantain degraded one-two days faster than the meat from either of the ryegrass treatments. There were no differences between treatments for any of the other meat quality traits measured, including taste related traits.

Pasture treatment effects on colour stability in pasture trial one (lambs from birth to weaning).



Conclusions

Both genetics and pasture contribute significantly to variation in meat quality traits. Genetic analyses of meat quality traits showed that both colour stability and tenderness traits could be included as part of a genetic selection programme to improve meat quality for international markets.

There were significant influences of lamb growth and yield on colour stability. A further investigation of the relationship between growth, yield and meat quality is underway to further understand these interactions, as well as examining the effects of growth and yield on taste panel traits. Potentially, in the future, we could improve meat quality traits indirectly by adjusting our growth and yield targets.

Further analyses of pasture species commonly used in New Zealand would give us a better picture for recommending pasture types for the improvement of meat quality.