CLASSIC LIVESTOCK MANAGEMENT SERVICES.

TRIAL NO. 1.
TENDERNESS TRIAL

WARNER BRATZLER SHEAR FORCE TEST.

The aim of the trial is to examine whether there is a positive correlation between the subjective assessment of live cattle using the CLMS system of measuring tenderness on the hoof with the mechanical measurement of meat samples from the same animals after processing using the Warner Bratzler shear force test. The Warner Bratzler test was selected because it is the most accurate method of measuring tenderness available at the time. Despite some criticisms of this test, it is the best available at present.

ABSTRACT.

It would be expected that if cattle are well finished with an even fat cover and have a typical beef confirmation as outlined by stud breeders and the show judging industry, they would naturally have tender meat.

However, there has been considerable consumer disappointment with the quality of meat, and beef in particular, that is currently being presented for consumption by the market and this has led to unwanted criticism of meat quality. It would seem that just because an animal has the industry accepted confirmation qualities that have been publicised as a requirement for meat quality, they are not necessarily presenting with tenderness on the dining tables of the world. There is considerable debate as to why this is the case and a range of reasons are regularly being presented for debate and occasionally researched. The reasons range from what the animals are being fed through to the way they are handled before and after processing.

This research has been carried out to determine in more detail what, if any, specific traits can be used to identify tenderness in beef.

HYPOTHESIS

The CLMS grading system can indicate the quality of meat an animal will produce before that animal is processed.

METHODOLOGY.

1. A live assessment of a group of 16 cattle was undertaken prior to them being processed. They were graded using the CLMS grading system with cattle graded on a scale of one to five with five being the lowest quality meat.

2. The main traits used to identify these cattle for tenderness were the shape of the rib and jaw bones. The palatability was assessed by feeling the skin and hair softness just behind the shoulder along with the tightness and thickness of the skin and the prominence of a darker, greasier strip along the backbone.

3. The cattle were ear tagged for identification and to indicate their tenderness and palatability scores using the Classic Livestock Management System certified tagging system.

4. A number of details of each animal including age, weight at the time of evaluation and the identification tag details were recorded.

5. A record of feeding management practices and daily weight gains have been recorded to provide a comparison between graded groups.

6. Careful monitoring of each individual carcass through the processing procedure to ensure that individual identification was maintained. Each carcass was clearly identified after slaughter.

7. On reaching its final destination for boning out, a sample of the round (knuckle) weighing 250 gms. was taken, identified and frozen for shipping to Rutherglen Beef Research Centre for a Warner Bratzler shear force test.

8. The round has been selected because it is the closest to a mid-point cut between the primal and secondary cuts.

9. The following are the criteria for the shear test :-
   a) Fully thaw frozen samples.
   b) The meat to be cooked using the Faberwer half grill method.
   c) The internal temperature of the meat not to exceed 67 degrees Celsius.
   d) Cooking time – 3 min. or medium well done stage.
   e) Results to be tabulated so that results match identification numbers on each sample.

RESULTS

The following is the result of the trial conducted by Classic Livestock Management Services (CLMS) during August 2000. Attached is a copy of the research method used to obtain and measure the samples.

TABLE 1.

Warner Bratzler Shear Force Test Details.

Body No.	Fresh Weight(kg.)	WB. AV. Shear Test.	CLMS Live Grade.
111	199.8	4.40	2
137	253	4.96	3
141	234.7	5.71	4
143	231.9	6.40	4
210	181	3.01	3
214	190.7	4.57	4
219	185.1	4.59	4
233	159.8	4.44	2
234	272.8	3.00	3
239	201.9	3.25	3
246	214.9	7.01	4
251	205.2	2.49	2
253	263.7	7.49	4
255	280.7	4.94	4
269	274.7	3.99	3
271	214.8	3.48	3
Average ----		4.299	3.25

Analysis by CLMS Grades.

Grade	No. tested	WB Test
1	0	0
2	3	4.40
		4.44
		2.49
Total		11.33
Average		3.79
3	6	4.96
		3.01
		3.00
		3.25
		3.99
		3.48
Total		21.69
Average		3.61
4	7	5.71
		6.40
		4.57
		4.59
		7.01
		7.49
		4.94
Total		40.71
Average		5.81
5	0	0

CONCLUSION

As explained, the Warner Bratzler Shear Force test was selected to test the tenderness of the meat samples taken in this trial because at the time of the trial, it was generally accepted as the most accurate of the current methods for objectively measuring meat tenderness.
Previous work with this method of testing, in conjunction with taste tests, has indicated that a score of 3 in the CLMS grading system is equivalent to a score of 4.5 or less on the Warner Bratzler scale. The CLMS grading system has been designed so that animals that score 3, 2, or 1 using the system will have an acceptable level of tenderness for sale as current retail cuts. Animals that have scores of 4 or 5 are considered too tough in any cuts to be used for anything other than value adding.
With this in mind, it can be seen that of the 9 samples that scored in the CLMS 2 or 3 range, only one was outside the 4.5 WB test range at 4.96. The 7 that scored 4 on the CLMS grading system all had higher than 4.5 readings and averaged 5.81.
Body no. 251 had the lowest WB test score of 2.49 and also graded as very tender on the CLMS system with a score of 2. Very few animals grade better than this on the system.
This trial indicates a strong correlation between the CLMS live grading system and the WB Shear Force test for measuring tenderness.

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APPENDIX 1. – CONSUMER RESPONSE TO TENDER MEAT

A marketing study at Kansas State University (Aug. 2004) revealed that consumers will pay up to $2.67 more per pound for guaranteed tender meat. A ranch in West Texas is already conducting tenderness tests, with the cows rated high in tenderness prepared as steak cuts while those that do not pass the test are ground into hamburger meat.
This equates to approximately Aus$5.85 per kg. on current exchange rates for retail sales.

The average price for a body of beef paid to the retailer by the consumer at present is around $12.00/kg. This cost includes all the buying, transporting and processing costs needed to get the meat onto the shelf.
If we work on the producer being paid $2.00 per kg. liveweight, then this is about 16% of the average retail sale price for a body of beef.
16% of $2.00 is $0.32 so if producers of tender meat were to receive a premium for their meat on the basis of the Kansas example, they could expect to receive about that amount extra for their meat given that all things remain equal.
At that rate, it should mean that the producer who grows tender meat could expect about an extra $0.32 per kg. for his animal. For a 400 kg. animal this means an extra $128.00 live weight per head for guaranteed tenderness. Instead of getting $800.00 per head for the 400kg. animal, it would now be worth $928.00.

TRIAL NO. 2
MEAT AND MILK QUALITY RELATIONSHIP.

ABSTRACT

There has been a long held belief amongst some cattle producers that there is a relationship between meat and milk quality. However, there is little in the way of evidence to support this view. This has prompted the company, Classic Livestock Management Services to explore ways of finding sound evidence that would support this view.

CLMS has developed a system of identifying meat quality through the assessment of a number of traits that animals have. Each identified trait is scored by a trained evaluator with a score of 5 being the lowest for quality, consistency, balance and functionality and a score of 1 being the best. They have conducted taste tests and a Warner Bratzler Shear Force test to verify their system in terms of identifying meat quality consistently in cattle that score highly on their grading system.

With the identification of the A2 beta casein protein gene in New Zealand in 2003, it became possible to identify higher quality milk using DNA testing of hair from cattle.

With this in mind, CLMS took hair samples of cattle that were graded for meat quality and sent to laboratories registered to carry out the appropriate A2 tests in New Zealand and Melbourne, Australia, for testing to see if there was a correlation between meat quality and A2 milk.

HYPOTHESIS.

Cattle that score highly on the CLMS grading system for meat quality will produce high quality milk.

METHODOLGY.

There is little literature available on this subject. Excerpts from reports documenting the identity of milk high in beta casein protein from work carried out by Dr. Corey McLachlan in Aukland, New Zealand were reviewed.
There is literature available that indicates there are methods such as the Warner Bratzeler Shear Force test that can identify differences in meat tenderness after processing. More recently, DNA testing has indicated that there are up to 7 major genes that influence tenderness and that science has identified 4 of these using DNA tests.

To be able to research this hypothesis, it was determined that there were two areas of data that needed to be collected.

a) The evaluation grades of the trial cattle to determine their meat quality grading using the CLMS grading system.
b) The collection of hair samples to be DNA tested for milk quality.

1. The collection of meat grading scores was carried out on 120 cattle of varying breeds including Jersey, Guernsey, Wagyu x, Angus, Brahman, Santa Gertrudis, Droughtmaster and a variety of crosses within these breeds.

2. Cattle were graded using the CLMS grading system in a crush where the main evaluation traits considered were bone shape, hormonal activity, body capacity and angularity. The evaluation was conducted by trained evaluators and a score was given for each animal for meat quality with a score of 5 indicating the lowest quality and a score of 1 representing the highest quality of meat.

3. The scores were tabulated and recorded electronically with the ear tag number of each animal being recorded with their meat quality grading score.

4. While the cattle were being graded for meat quality, a quantity of hair was removed from the swish of each animal independently with follicles attached for DNA testing.

5. Each sample was placed in an envelope and marked with the individual ear tag number for each specific animal.

6. The samples were then sent to the Agrisearch Laboratory, Melbourne, the Australian testing laboratory for the A2 Corporation at the time, for analysis to determine whether they were A1, A2 or A1/2 for milk quality.

7. When the DNA results were obtained they were compared with the ear tag numbers for meat quality grading and the results recorded.

RESULTS.

The following table shows the comparison of the results obtained from the DNA tests and compared with the meat grading scores.

17/07/2003 – NORTH DALZEIL

TOTAL GRADED – 29 HEAD

TAG NO.	TEND.	DNA/A1 -A2	BREED
125	3	A2	WAGYU
138	2	A2	WAGYU
503(Fitz)	4	A1	WAGYU
1769(Fitz)	4	A1	WAGYU
42	3	A2	WAGYU
356	3	A2	WAGYU
200	3	A2	WAGYU
9429	5	A1	BRAFORD
9423	5	A1	BRAHMAN
9430	5	A1	BRAHMAN
9394	5	A1	BRAHMAN
9431	3	A2	BRAHMAN
9419	3	A2	BRAHMAN
9409	5	A1	BRAHMAN
9415	5	A1/2	BRAFORD
9425	5	A1	BRAHMAN
9385	3	A2	BRAHMAN
9443	4(flat 1 side)	A2	BRAHMAN
9387	5	A1	M/GREY
32	3	A2	WAGYU X
344	3	A2	WAGYU X

356	3	A2	WAGYU X
42	3	A2	WAGYU X
47	3	A2	WAGYU X
503	4	A1	WAGYU X
529	3	A2	WAGYU X
59	3	A2	WAGYU X
69	3	A2	WAGYU X
87	3	A2	WAGYU X

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DATE: 22/10/2003 - MURGON FEEDLOT

TOTAL GRADED - 40 HEAD

TAG NO.	TEND.	DNA-A1/A2
32	3	A2
344	3	A2
356	3	A2
42	3	A2
47	3	A2
503	4	A1
529	3	A2
59	3	A2
69	3	A2
87	3	A2
100	3	A2
105	3	A1/A1
117	3	A2
124	3	A2
125	3	A2
133	3	A2

138	2	A2
139	3	A2
1673	3	A2
1769	4	A1
200	3	A2
250	3	A2
2570	3	A2
2587	3	A2
262	3	A2
274	3	A2
279	3	A2
287	3	A2
2925	3	A2
293	3	A2
32	3	A1/2
344	3	A2
356	3	A2
42	3	A2
47	3	A2
503	4	A1
529	3	A2
59	3	A2
69	3	A2
87	3	A2

JERSEY STUD – NEW SOUTH WALES.

TOTAL GRADED – 51 HEAD

	JERSEY	STUD
A2 TRIAL		**22/04/2003**
TAG NO./NAME	**TENDERNESS**	**MILK GRADE**
593	3	A2
128	3	A2
S9	2	A2
19	3	A2
S11	3	A2
738	2	A2
818	3	A2
628	2	A2
Pink Tag	3	A2
596	3	A2
Orange Tag	2	A2
906	3	A2
942	2	A2
172	4	A1
S10	4	A1
S1	2	A2
894	4	A1
Pink - 2Tags	3	A2
719	2	A2
857	3	A2
S2	4	A1
833	3	A2

143	3	A2
665	4	A1
105	4	A1
994	4	A1
970	3	A2
S8	5	A1
70	4	A2
11	5	A1
846	3	A2
660	4	A1
S3	3	A2
S4	3	A2
966	4	A1
182	4	A1
188	3	A2
S6	4	A1
655	4	A1
666	4	A1
727	3	A2
973	4	A1
874	3	A2
574	4	A2
115	4	A1
716	3	A2
S5	4	A1
43	4	A1
884	4	A1
S7	4	A1
881	4	A1

CONCLUSION.

In the first part of the trial with North Dalziel cattle, 29 cattle were tested. Out of those 29, 17 which graded score 2 or 3 on the CLMS system for tenderness, DNA tested positive for A2 milk. A further 10 scored 4 or 5 on the CLMS grading system and DNA tested positive for A1 milk. Of the other 2, one scored 5 on the CLMS grading system and tested A1/A2. This means that this animal is on the borderline and may test slightly A2 some years and slightly A1 other years. The other animal that tested as A2 graded 4 on the CLMS system but as noted had a variation in bone shape between each side jawbone and so could have been considered as borderline also.

So in this part of the trial there was a direct correlation between A2 milk and tender meat in 27 out of the 29 samples. In both the other cases, the samples could be considered to be on the borderline and therefore inconclusive.

In the second part of the trial, the cattle were all Bos indicus or Bos indicus cross. Forty samples predominately of the better quality cattle had hair samples taking and sent away for DNA testing. Thirty five head that graded as score 3 on the CLMS grading system DNA tested as carrying the A2 milk genes. Three head graded as 4 on the CLMS system and DNA tested as being A1 quality milk and 2 that graded as 3 for tenderness on the CLMS system cam back as A1/A2 for milk quality. Again, this shows a direct correlation for 38 out of the 40 head tested and an inconclusive result for the other two.

The third part of the trial was conducted on the cows at the Fairbrae Jersey stud herd at Kyogle. As the cows were being milked they were graded for meat tenderness using the CLMS grading system. On completion, the CLMS scores were compared with the stud's herd records and the above results were obtained. These results show that 27 cows scored 2 or 3 on the CLMS grading system and were also A2 for milk quality. A further 23 scored 4 or 5 using the CLMS grading system and were A1 for milk quality. The remaining sample scored 4 for tenderness but was A2 for milk quality. This was the only variation in the 51 head tested.

Overall, the results show a direct correlation between meat tenderness and A2 high quality milk for 115 out of the 120 samples tested. Of the others, 4 of the 5 could be considered as inconclusive with only one being different.

This leads to the conclusion that with over a 95% correlation there is a strong relationship between meat tenderness and milk quality.

TRIAL NO.3.
OMEGA 3/6 FAT TRIAL.

INTRODUCTION

The effects of fat in meat as part of the human diet has been widely debated in recent years as the levels of obesity and heart disease have increased. There have been a number of studies conducted that indicate that fat in meat, and beef, in particular, is detrimental to human health. There are a number of different types of fat deposited in the meat tissue in beef. Some of these, such as saturated fats and trans fats, have been proven to be detrimental to human health as they raise cholesterol and lead to coronary heart disease. Other fats, such as the cis monounsaturated and polyunsaturated fats do not harm human health, and are, in fact, beneficial.

In recent times, fats high in omega 3 (for example fish oil) have been promoted as being good for human health. Apart from not raising blood cholesterol, the omega-3 fats have been shown to improve cardiac function and lower the occurrence of sudden death. A precursor of these fats, alpha linolenic acid (ALA), is found in plants and cattle grazing these plants show levels of ALA in their meat fats to some degree. *Interestingly, a study in the USA indicated that grass fed cattle can have even higher levels of omega 3 than fish. (Probably highly selective, as this maybe so for ALA, but not the other omega 3s).* Another group of fats known as omega-6 fats are also found in plant foods. Both these and the omega-3 fats are known to be essential for human health.

The company, Classic Livestock Management Services (CLMS), decided to see if they could clarify this debate by seeing, firstly, if it was possible for cattle fed on different diets to have different levels of omega 3 and omega 6, and secondly, if it was possible to select animals that may have higher levels of omega 3 and poly unsaturated fat from those that didn't.
It would also be important to see if there was a relationship between fat quality and beef quality and if there was a method of selecting these animals using the current CLMS system.

HYPOTHESIS

That different cattle will have different levels of omega 3 and omega 6 and that it is possible to identify those cattle using the CLMS evaluation system.

METHODOLOGY

In total, 64 cattle were tested in this trial.
Of these 18 were fed totally grass fed.
The other 46 were initially raised on grass and then finished on grain although the time on grain was not consistent for all. Those with the sample prefix “P” were grain fed for 90 days without access to grass. Those with the prefix “M” were grain fed for up to 90 days in a paddock feeder situation with some access to limited grass and roughage.
All cattle were under 20 months of age and of various breeds. They were raised in the mild, near subtropical climate of south eastern Queensland in Australia.

The 18 grass fed cattle were all graded using the full CLMS grading system for meat quality prior to processing and then again after processing by using the jaw bone to ascertain the fineness and shape to confirm their CLMS grade where 5 was the lower quality and 1 the higher.
The 46 cattle that were grain finished were all graded on the jaw bone for fineness and shape after processing and their CLMS grade recorded.
A sample of brisket fat weighing approximately 10 grams was then removed from each animal, placed in a small plastic air tight bag with the animal’s ear tag identification number and sample number attached and frozen for freight to the testing laboratory.
All cattle grades were recorded against their ear tag and then given a sample number.
The sample numbers prefixed by the letters “RO” are the grass fed samples.
Those prefixed by the letter “P” were taken during processing at the Pittsworth abattoir and were the cattle fed on 90 days grain.
Those with the letter “M” prefix were taken at the Millmerran abattoir and were from cattle fed on grain from 60 – 90 days with some grass/roughage.
The grass fed samples were all processed at the Millmerran abattoir.

The identified samples were then sent to the University of Adelaide where they were analysed to determine the levels of:

Myristic Acid.	Margeric Acid	Alpha- linolenic Acid
Myristolic Acid	Stearic Acid	Conjugated linoleic Acid
Palmitic Acid	Oleic Acid	Total fatty Acids
Palmitoleic Acid	Linoleic Acid	SFA Sum

Sub-samples of fat were removed from the 64 samples supplied. They were liquefied at 100°C for fatty acid and melting point determination. Fatty acids were identified and quantified by gas chromatography. Particular fatty acids were identified by comparison with known standards.

The results are shown in the attached table. Up to13 fatty acids were detected in most samples. A number of minor constituents were absent in some samples. The results are expressed as a per cent of the total fatty acids present (normalised). Total saturated fatty acids (SFA) and total cis mono unsaturated fatty acids (MUFA) are also shown, as is the melting points of each sample, which were determined separately. Mean values for each specific fatty acid of the animals in each group are shown.

RESULTS.

See attached file.

CONCLUSION.

Whilst this trial is not as conclusive as the others that CLMS have conducted, it does provide some interesting observations. There are not, for example, the strong correlations that were evident in the A2 milk/meat tenderness trial.
However, some conclusions can be considered that could be valuable and may well add some more pieces to the jigsaw puzzle that will enable us to identify high quality meat producing animals on the hoof.
One of the first factors to consider is that omega 3 levels in meat are more influenced by feed than characteristics like tenderness and milk quality, especially A2. In this trial the grass fed animals had a higher reading for omega 3 in all but one sample. This provides the clearest outcome of any of the factors considered in this trial. This outcome supports work done in the USA that found a similar result.

Given that many of the traits used for evaluation in the CLMS grading system are predominately genetically determined, it is expected that there would be some variations in a trial such as this where what is being tested can be altered by the animal's diet. Therefore, it is not expected that the correlation between omega 3 levels and meat quality could be 100%.

One of the difficult things to determine is what an acceptable level of omega 3 is needed to be considered effective and positive in each sample and to provide a reasonable human intake. This could well vary with the climatic conditions and type of feed available to the animal. There have been cattle that have recorded over 2.0% for omega 3 in some samples taken in New Zealand and the southern temperate states of Australia. In these areas, the pasture species and quality vary considerably, usually better, to those of south east Queensland, which is close to a subtropical climate and is where these cattle were raised.

In this trial, a reading of 0.3 has been used as the acceptable level.

The following are the main conclusions that this trial has highlighted. All cattle that had a CLMS grading of 3+, 3, 3- or 2 in the trial would be considered acceptable for tenderness i.e. eating quality. (See results from trial no.1.)
The major points concerning the data are as follows:

- The mean value of the MUFA is high. This is mainly due to the very high values of approximately half the samples. Lower values ranged from 53% to approximately 57%, while higher values range from 58% to 63% with one value reaching 69%. This higher group are similar to those of Japanese Wagyu and Wagyu-cross steers (Yang et al. 1999), Korean steers (Siebert, unpublished data) and Jersey-cross steers (Siebert et al. 2003).
  There is no strong correlation in this group between MUFA and tenderness.

- High MUFA values in cattle are due to the conversion of the normal saturated fats of cattle to a mono-unsaturated form. This conversion is limited in cattle both at pasture or when animals are fed some concentrated feeds (e.g. cottonseed meal). The present data show very high values of palmitoleic and oleic in some animals. This characteristic is a desirable meat trait as it lowers the melting point of intramuscular fat, raises palatability and has health benefits in man as these *cis* (not *trans*) fatty acids lower cholesterol.

- Most animals showed low saturated fatty acids (SFA) due to the conversion mentioned above. Values for palmitic acid and stearic acid are low, particularly for animal R02.

- One omega-3 fatty acid can occur in meat fatty acids. It is alpha linoleic acid or 'ALA' (18:3 (ω3)). It is more common in cattle at pasture. It is rarely, or only at low levels, present in cattle on cereal based lot feeds, unless 'protected' oil seed supplements are provided. It was present in some animals of the present group, probably in those that were mainly at pasture, or not long removed. Animals at pasture can reach values of 1.0% in Australia, between 2 and 3 % in New Zealand.

- Poly-unsaturated fatty acids are not present to a high degree in cattle fat despite the fact that the diet of grain fed animals is relatively high in omega-6 and sometimes omega-3 oils. The reason for the low values is that rumen microorganisms convert the unsaturated fats to saturated forms. Linoleic acid (18:2(ω6)) was found in a number of animals, with a mean value of 1.66%. None was found in some animals.

- One further fatty acid of interest is conjugated linoleic acid (CLA), a fatty acid that has been shown in laboratory studies to have anti-cancer properties. It was present in all but one sample. Its presence is partly dependent on the activity of the enzyme which converts saturated to mono-unsaturated fatty acids, but not entirely so.

This trial has not provided a very strong indication that the CLMS grading system can identify cattle that are high in omega 3. However, it is encouraging in as much as 80% of the sample that were graded as 3+ or better (tender) on the CLMS system were higher in omega3.
The other factor that could have some influence on this result is that whilst CLMS trials indicate around a 98% accuracy rate is consistent for meat tenderness using this system, there is also a belief that meat tenderness is mainly a genetic trait and not as much influenced by the environment and feed as fat quality. The data that may give an indication of how much fat quality is influenced by the type of feed cattle are fed hasn't been researched as yet, so it is difficult to say how significant the 80% result is. Looking at it from the CLMS evaluation perspective, it could be that feed influences from 20 – 25% of the quality factor and genetics up to 80%. Whether this is a valid way of looking at the result is debatable. Certainly, the quality of the feed would have an influence on how much the fat quality changed during an animal's lifetime.

In further summarising the results, the three different groups of cattle have been examined individually as well as comparatively. Each of the groups are prefixed by the letters P, M and RO as explained in the methodology. The following are some of the observations.

A. Omega 3 – 6 comparisons

1. 20 of the 46 samples in the 2 grain fed herds (P &M) had an omega 3 reading of 0.3 or better (43%) and 6 had a reading of 0.5 or better (13%). Average reading = 0.24.

2. In the grass fed herd (RO), 14 out of the 18 had a reading of 0.5 or better (78%) and 1 had a reading of less than 0.3 (94% 0.3 or better). Average reading = 0.55

3. Comparing omega3:omega 6 –

   Grain fed herd – Omega 6 total = 70.95 - average = 1.54
   Omega 3 total = 11.18 - average = 0.24
   Average Ratio of Omega 3:6 = 1:6

   Grass fed herd - Omega 6 total = 30.31 - average = 1.68
   Omega 3 total = 10.01 - average = 0.56
   Average Ratio of Omega 3:6 = 1:3

B. Evaluation comparisons.

Any grades of 3.5 (3+) or less on the CLMS grading system are acceptable for meat quality.

1. Grain fed – P herd – 9 graded 4/5 for meat quality
   - 10 graded 3.5 or better for meat quality.
   - All the grade 4 & 5 cattle had no omega 3.
   - 80% of those graded as 3.5 or better had some omega 3 reading.

2. Grain fed – M herd - 7 graded 4/5 for meat quality
   - 20 graded 3.5 or better for meat quality.
   - 17 out of 20 graded 3.5 & better had 0.3 omega 3 or better.
   - 85% of those graded as 3.5 or better had 0.3 omega 3 or better.

3. Grass fed – RO herd - 4 graded 4/5 for meat quality
   - 14 graded 3.5 or better for meat quality.
   - 1 out of 18 graded 3 and had less than 0.3 omega 3.
   - 94% of those graded as 3.5 or better had 0.3 omega 3 or better.

One conclusion from this is that in all herds, over 80% of the cattle graded as having good meat quality also had 0.3 omega levels or better.

C. Melting Points.

Taking 35 degrees as an average melting point and comparing melting points to CLMS grades.

1. Grain fed – P herd – 9 graded 4/5 for meat quality
   - 10 graded 3.5 or better for meat quality.
   - 5 of the 9 x 4/5 grade were above 35 degrees.
   - 4 of the 10 x 3.5 or better grade were 35 degrees and below.

2. Grain fed – M herd - 7 graded 4/5 for meat quality
   - 20 graded 3.5 or better for meat quality.
   - 6 of the 7 x 4/5 grade were above 35 degrees.
   - 10 of the 20 x 3.5 or better grade were 35 degrees and below.

3. Grass fed – RO herd - 4 graded 4/5 for meat quality
   - 14 graded 3.5 or better for meat quality.
   - 3 of the 4 x 4/5 grade were above 35 degrees.
   - 10 of the 14 x 3.5 or better grade were 35 degrees and below.

The melting points do not provide a strong indicator one way or the other of meat quality although there is a greater significance in the grass fed herd than the grain fed herds. They do not show the same degree of correlation that has been evident when using microwave tests to compare fat from tough and tender animals.