



WHAT IS THE FUTURE FOR UK BEEF GRADING?

HCC Scholarship 2017

USA Study Tour

Clare James BSc (Hons)

Conclusions made are of the authors personal opinions

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Summary

The EUROP Grid, used for grading cattle carcasses in the UK is enforced by European legislation. It is a prediction of beef yield, estimating conformations and fat class. Such grid is deemed insufficient in meeting UK consumer demands, as it does not consider beef quality. With discussions that the UK is exiting the European Union, the opportunity has prevailed to develop a grading system that meets consumer demands. To gain an understanding of beef quality grading, the researcher visited the United States of America, having meetings with industry, sector leaders and meat scientist.

The United States Department of Agriculture grading system evaluates both yield and quality, with predominate marbling assessment. The research highlighted that such marbling focus is not relevant in the UK market, due to its health focused consumer, with potential research areas recommended in meat colour and pH monitoring. Recommendations for the future of UK beef grading includes the need to design a UK specific advanced yield evaluation and a quality beef assessment, that meets the need of the UK supply chain and its stakeholders. Grading is recommended to be Ribeye only assessment being deemed an adequate representation of whole carcass quality. Consumer facing grades are also recommended to advance consumer product awareness, increasing assurance and gaining trust in the supply chain. It is concluded that a new beef grading system for cattle should deviated from the already established to minimise confusion and must be designed to meet UK demands.

Personal Profile

Clare James

Pistyll Gwyn
Llanyre
Llandrindod Wells
Powys
LD1 6EY

claregaynorjames@gmail.com

07917 318 902



Growing up on a sheep and beef farm in the remote area of Mid Wales has provided the ability to live, work and understand the requirements and personal demands of the agricultural industry. This background in the livestock sector has fuelled aspiration to work and progress within the industry.

Graduating from Harper Adams University in 2017, with a First Classed Honours Degree in Agri-Business, and a Level 5 Certificate in Management and Leadership. Presented with the awards of 'Best Student on Course,' and the Irish Bowl for recognition as 'The Student who has demonstrated outstanding qualities in being involved in the University community and is highly employable'. During the 4-year degree, a placement year was completed with Dunbia meat processor in their North West Division, as well as the completion of research into Dark, Firm and Dry Beef.

Have been highly involved with Young Farmers since the age of 11, having won numerous Public Speaking awards and two National Cookery competitions.

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Gratitude is extended to those who gave up their valuable time to advance the researchers knowledge. Without their guidance, assistance and hospitality, the study tour would not have been as enjoyable and beneficial.

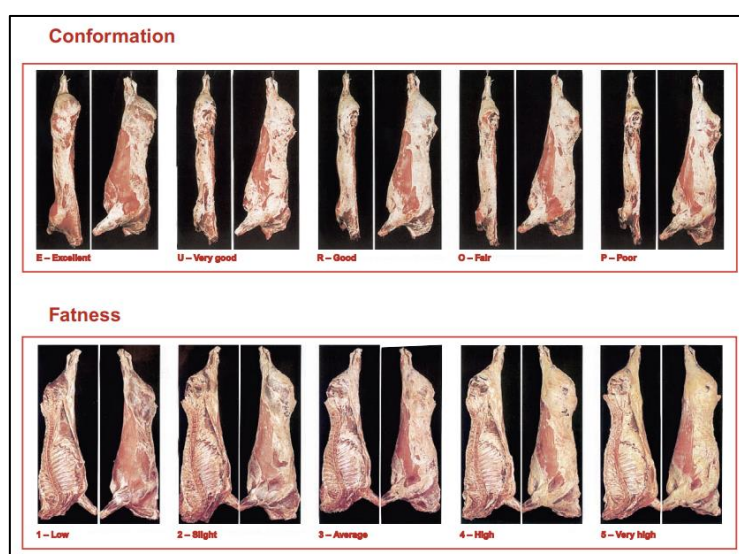
Thanks, is also extended to HCC for their generous sponsorship.

Conclusions made are of the authors personal opinions.

1.0. Introduction - The UK Beef Grading System

The UK Beef Industry under obligatory compliance from European legislation ⁽¹⁾. Implemented a 'Community scale for the classification of carcasses of adult bovine animals' ⁽²⁾. Regulations require European abattoirs which slaughter in excess of 75 cattle a week to utilise a carcass visual yield assessment for conformation and fat ⁽²⁾. The EUROP grid in Figure 1 shows the assessment for Conformation, which is the visual appraisal of shape and muscle development over the shoulders, loin and hind quarters ⁽²⁾. Grades are often in relation to cattle breeds, with double-muscled cattle receiving a higher grade. Fat is the visual observation of external fat cover.

In the UK grading of carcasses is done by the Meat Livestock Commission Service Limited (MLCSL) ⁽³⁾. UK meat processors utilising the EUROP grid as a yield assessment along with carcass weight, age and sex to issue payments, paying more for a higher yielding carcass.



(Source: MLCSL, Not Dated)

Figure 1 EUROP Grading of Beef Carcasses

1.1. Meeting Consumer Demand

The EUROP grid was initially introduced to uniform beef carcasses, however such grid only accesses external attributes with no consideration for meat quality ⁽³⁾. There is an increasing demand by consumers, for beef products which have guaranteed eating quality ⁽⁴⁾. This recognition that consumers demand quality, is being compromised under the current grading system. The UK beef industry has expressed concern ⁽⁵⁾, as it is understood that if a consumer has a negative eating experience they will drop out of the category for up to 12 weeks. Such causes apprehension and recognises that the EUROP grid is insufficient in meeting consumer demands.

Research ⁽⁴⁾ suggests that meeting consumer demands in relation to quality is critical in achieving competitiveness in the market place. The prevalent beef quality attributes that consumers recognise and could be monitored at grading, include taste/flavour, freshness, colour, tenderness, leanness, juiciness, and nutrition. Other areas of consumer recognition that influences purchasing is product branding and labelling.

With the UK currently negotiating Brexit. The industry is faced with the opportunity to re-evaluate how meat is segmented and categorised for the market place ⁽⁵⁾.

2.0. Travel to the United State of America (USA)

2.1. Why the USA was Selected to Study Beef Grading

The United States Department of Agriculture (USDA) grading system was selected for study, for a variety of reasons. The USA has the 4th largest cattle inventory, having 9.37% of the world's cattle, with India, Brazil and China topping the populations ⁽⁷⁾. They are a key player in the global export market being 4th in international rankings ⁽⁷⁾, even though the only export 9.6% of their total production ⁽⁸⁾. The USA also dominate in global consumption being recorded ⁽⁹⁾ to consume 24.8kg/capita in comparison to the UK at 18.2kg/capita.

The USA was the selected country to study being promoted to have a developed infrastructure including processing facilities, supply chain management and high focus on quality and genetics, claimed to be at the world's highest standards ⁽¹⁰⁾. USA beef production is highly praised globally for its product attributes, conducting visual lean assessment of the ribeye during grading ⁽¹¹⁾.

2.2. Study Tour - The Collection of Research

To understand the USDA grading system and gain an industry wide view, 2 and a half months were spent gathering research in Washington D.C. and the USA Mid-West, including the states of Missouri, Kansas and Colorado. Research was gathered from meetings with organisations such as the USDA, the Meat Importers Council of America, the North America Meat Institute, the USA division of the British Embassy, the National Cattlemen's Beef Association. Further research was gathered, from work with Meat Scientists and USDA Beef Graders, along with visits and assessment of varied size Processing Facilities and Meat Innovation Amenities. In order to gain perspective of the Supply Chain, visits were also made to Cattle Producers (breeders and finishing units), as well as consumer meat outlets including supermarkets, independent channels and restaurants.

Conclusions made are of the authors personal opinions.

3.0. The USDA Grading System

Meat grading in the USA is voluntary⁽¹²⁾, although is encouraged and utilised by the majority of medium and large size processors. Meat plants that operate USDA grading must employ a grader from the USDA Agriculture Marketing Service (AMS)⁽¹³⁾.

The USDA grading system dates from the early 1900's, when meat scientist encouraged the government to generate funding for the 'National Livestock Market News Service'⁽¹⁴⁾. For the industry to utilise the market reporting data they developed grading standards, creating uniformity for market reporting. In 1926 processing plants trailed the grading system, a year later it was recommended to all processors⁽¹⁴⁾. Though the grade system has been edited throughout the last century, including 2017 edits, the fundamentals of quality grading⁽¹²⁾ and consumer focus remains. In 2013, 94% of steers and heifers slaughtered were USDA graded⁽¹⁵⁾, showing its popularity and relevance across the supply chain.

There are two fundamental elements to USDA grading; Quality Grading, this is the impact on palatability such includes tenderness, flavour and juiciness⁽¹²⁾, the evaluation of quality is considered the level of consumer appreciation. Yield Grading, is the prediction of the carcass cutability, including the estimation of boneless meat or the total retail cuts available⁽¹³⁾.

Grading is completed after 32-34 hours following slaughter⁽¹²⁾, once the carcass is fully chilled and prior to deboning. The carcass is quartered at the 12-13th rib, under USDA cutting standards, exposing the *longissimus dorsi* or ribeye muscle. This being the area in which the grading assessment is made.

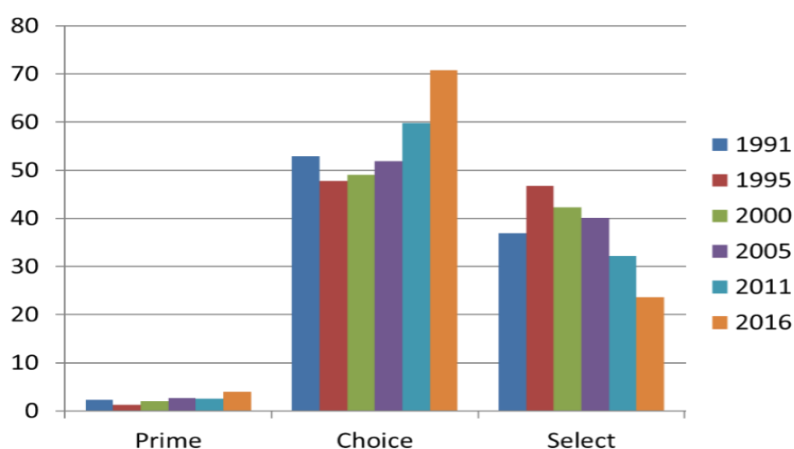
3.1. Grades

USDA under 30 month graded beef is categorised into three predominant segments; 'Prime', 'Choice' and 'Select'. Figure 2 illustrates the various grades.

- Prime – This is considered the superior product of the uppermost quality ⁽¹⁵⁾, having high levels of intramuscular fat (marbling). 3.95% of the total USA cattle production is graded 'Prime' ⁽¹⁶⁾ as shown in figure 3. The majority of 'Prime' beef is used, for what is described by the USA cattle industry, for 'The White Table Cloth,' being high paying restaurants and customers. Prime beef is also sold on the export market, with a percentage exported to Japan ⁽¹⁶⁾.
- Choice – This grade accounts for 70.8% ⁽¹⁶⁾ of total processed beef in 2016 and is said to guarantee a 75% good eating experience, with moderate Marbling.
- Select – Meat graded 'Select' is leaner with less marbling considered to have less flavour ⁽¹³⁾. It is often used in food service and accounts 23.62% of carcasses in 2016, as shown in Figure 3.



Figure 2 USDA Beef Grades Poster



(Source Adapted from: National Beef Quality Audit, 2016)

Figure 3 USDA Grade Distribution

Grades are utilised at the point of sale, shown in Figure 4. They provide the consumer with the understanding of what eating experience the beef should provide, aiming to eliminate negative eating. Grade labelling also provides the assurance that the beef has been government approved, being safe to eat.



Figure 4 Images from Retailer Meat Counters

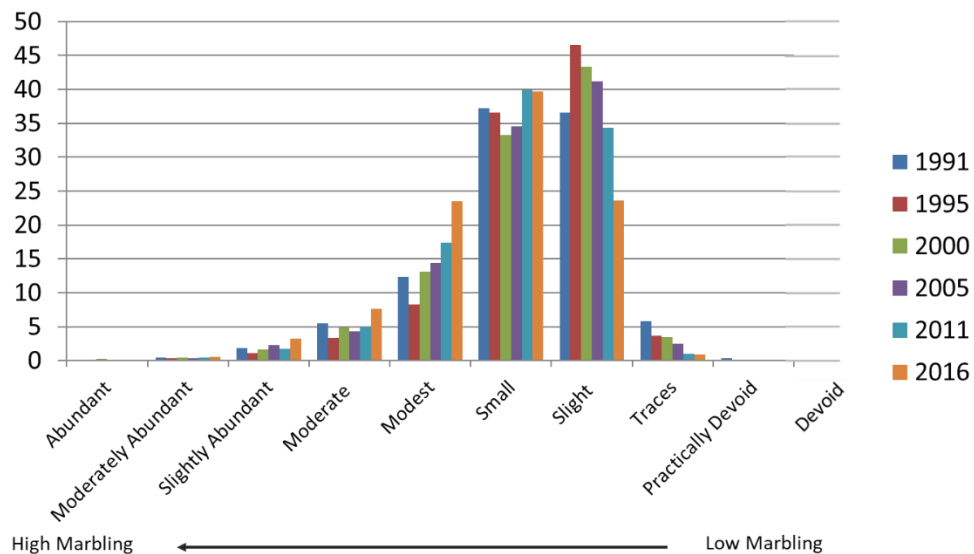
Other grades less commonly used as retailer marketing includes, 'Standard' and 'Commercial' grades. These can either be lean young cattle or well flesh cows, they are commonly sold store brand meats, with their grade being unlabelled ⁽¹³⁾. 'Utility', 'Cutter', and 'Canner' grades are said to be cull cow grades ⁽¹³⁾, they are predominantly used for processed products including ground beef.

3.2. Quality Grading

3.2.1. Marbling Assessment

The evaluation of marbling is a visual appraisal, that assesses the volume and distribution of intramuscular fat in the visual lean of the ribeye between the 12-13th rib⁽¹²⁾. It is deemed an adequate measure of marbling distribution throughout the carcass, with marbling considered to be a reliable measure of quality. Increased levels of intramuscular fat is considered to advance the palatability and tenderness of meat⁽¹⁷⁾.

Marbling scores are categorised into 10 degrees, shown in Figure 5 which highlights the distribution of grades and how this has altered from 1991-2016⁽¹⁹⁾. Each marbling degree can also be divided further into 0-100⁰ subunits, although usually discussed in tenths⁽¹²⁾.

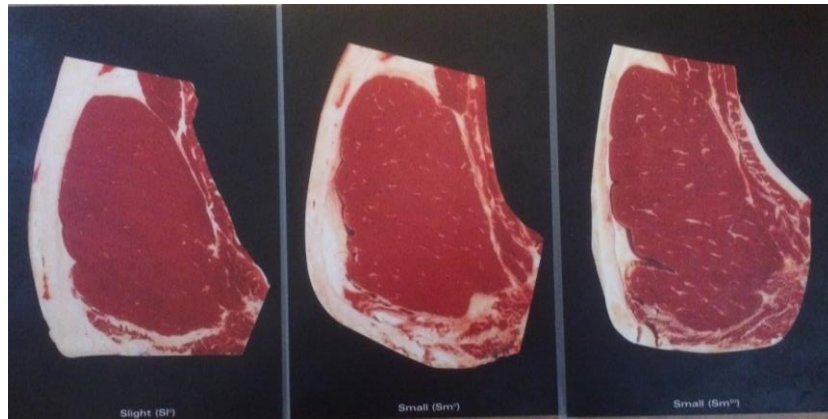


(Source: Adapted from National Beef Quality Audit, 2016)

Figure 5 Marbling Score Distribution

Each marbling grade has an associated image, ensuring consistency at the point of grading. Such marbling images used by graders are shown in Figure 6.

Select

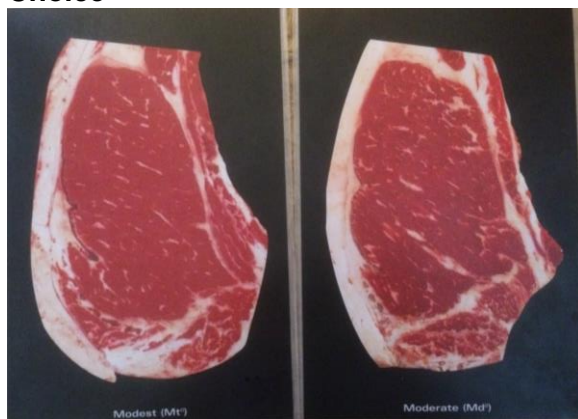


Slight (SF)

Small (Sm°)

Small (Sm⁵⁰)

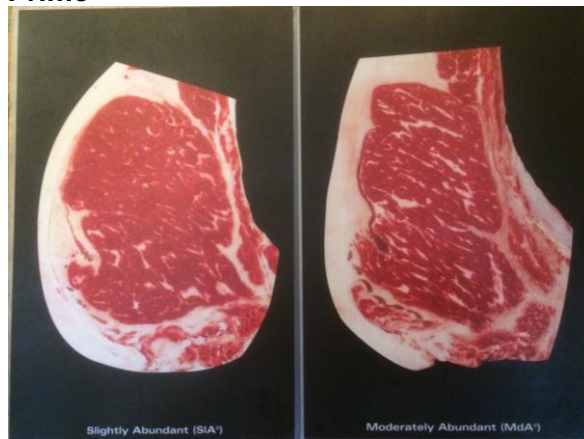
Choice



Modest (Mt°)

Moderate (Md°)

Prime



Slightly Abundant (SIA°)

Moderately Abundant (MdA°)

Figure 6 Official USDA Marbling Photographs

3.2.2. Maturity

In comparison to the UK, the USA do not have the ability to identify the age of cattle through a mandatory traceability system ⁽¹¹⁾. Therefore, the USDA grading system estimates the age of the beef carcasses through ossification (bones/skeleton analysis) or dentification (evaluating the animal's teeth) considered of advanced accuracy ⁽¹²⁾.

The age of a beef animal at slaughter directly impacts the compositions and quality of meat ⁽¹⁷⁾. For this reason, cattle are categorised under different maturity groups shown in Table 1, the level of maturity then also impacts the grade that is received, shown in Table 2. For example, cattle over 42 months cannot receive a 'Prime' grade.

Table 1 USDA Maturity Scale

USDA Maturity	Age in Months
A	0-30
B	30-42
C	42-72
D	72-96
E	>96

(Source: Adapted from Shircliff, 2015)

Table 2 Maturity impact on Grade

Degrees of Marbling	Maturity				
	A	B	C	D	E
Abundant					
Moderately Abundant					
Slightly Abundant	Prime			Commercial	
Moderate					
Modest	Choice				
Small					
Slight	Select			Utility	
Traces					
Practically Devoid	Standard			Cutter	

(Source: Adapted from Shircliff, 2015)

3.2.3. Lean Colour and Texture

Lean colour and texture is visually analysed during quality evaluation, however not recorded, with older cattle considered to produce a darker coloured meat having reduced tenderness ⁽¹²⁾. Lean colour is a direct determination of shelf life ⁽¹⁷⁾, with carcasses under a USDA system being analysed for Dark, Firm and Dry (DFD) beef and for blood splash ⁽¹⁸⁾. Such identification of DFD devalues meat, and under USDA grading the producer is penalised ⁽¹²⁾, in the UK the manufacturer stands this expense.

3.3. Yield Grading

3.3.1. Ribeye External Fat Thickness

The fat thickness around the ribeye is measured at the three quarters point from the backbone. This individual measurement is considered accurate to predict overall carcass fatness ⁽²⁰⁾. Such measurement directly impacts the concluding yield grade.

3.3.2. The Ribeye Area and Carcass Hot Weight

To calculate an accurate yield grade, the visual lean of the Ribeye Area (REA) is measured. Shown in Figure 7, a plastic grid with each square measuring a tenth of an inch, is placed on the visual lean and the squares counted to predict the meat yield ⁽²⁰⁾.



Figure 7 Measuring the Ribeye Area

Carcasses are weighed prior chill and the hot weight is utilised to calculate the yield. Furthermore, in larger plants operating at high processing spends the REA can also be estimated from the carcass hot weight, shown in table 3.

Table 3 Carcass Hot Weights influence on REA

Carcass Hot Weight		Predicted Ribeye Area (REA)
lb	Kg	Inch ²
600	272	11.0
700	318	12.2
800	363	13.4
900	408	14.6
1000	454	15.8

(Source: Adapted from Shircliff, 2015)






3.3.3. Estimated Percentage of Kidney, Pelvic and Heart Fat

For USA cattle, the dressing specifications allows fat deposits of kidney, pelvic and heart fat (%KPH) to remain on the carcass at grading. Such fat, on average, weighs 1-4% of the total carcass hot deadweight and therefore is estimated then deducted from the weight ⁽²⁰⁾.

3.3.4. Calculating Yield Grade

Following the evaluation of fat thickness, REA, carcass hot weight and deductions of %KPH, the overall yield grade is calculated. The carcass is then categorised into five classifications of USDA yields ⁽¹²⁾, termed '1 to 5.' The Yield grade and its factors are shown in table 3.

Table 4 Yield Grade Description

Yield Grade	Description	Images	Fat Measurement at the 12th Rib (inch)	Percentage of Retail Cuts (%)	Percentage of USA Cattle 2016 (%)
1	Thin layer of external fat, showing visible lean		<0.1	≥52.4	9.5
2	Carcass is almost completely covered in fat, with some visible lean		0.2 - 0.3	50.1-52.3	34.6
3	There is a complete fat cover, with low levels of lean being visible		0.4 - 0.7	47.8-50.0	38.8
4	Completely covered in fat, with heavy deposits		0.8 - 1.0	45.5-47.7	14.6
5	Extensively fat		>1.1	≤45.4	2.5

(Source: Adapted from Shircliff, 2015., Boykin *et al.*, 2016., and Griffin and Boleman, 2014)

3.4. Grade Sheets and Recording

During carcass grading, scores are recorded and then producer payments issued. Table 5 is an example of how a small meat plant records the grading criteria. Table 6 is a grade sheet sent to a producer following the grading of their cattle. Producers were also issued a copy of the industry averages and how their cattle compare.

Table 5 USDA Grading example

Carcass Hot Weight (lb)	Dressing %	Ext Fat	REA	%KPH	USDA Marbling Score	Quality Grade	Yield Grade
803	61.3	0.20	12.0	2.0	Md ⁹⁰	Ch+	2.6
865	60.1	0.40	12.8	1.5	SIA ³⁰	PR	3.0
849	60.4	1.0	10.2	2.5	SL ⁸⁰	Sel+	5.5
790	60.1	0.15	12.0	1.0	Sm ⁵⁰	Ch-	2.2
928	61.9	0.80	10.0	3.0	Md ⁷⁰	Ch+	5.4

Table 6 USDA Cattle Grades Received by Producer

Carcass Hot Weight (lb)	Quality Grade	Yield Grade	Certified Angus	Marble	REA	Back Fat	DFD	Over 30 (Age)	Carcass Value (\$)
631	CH	3	X	680	11.29	0.47			Available on Request
849	PR	4		928	12.95	0.82			
829	CH	2		430	12.88	0.37			
715	CH	4	X	617	13.80	0.68			
964	CH	3	X	617	13.80	0.68			
617	PR	3	X	663	11.08	0.58			
More Examples and Grade Sheets Available on Request									

Further information can be provided upon request.

3.4.1. Camera Grading

In larger processing plant a camera is used alongside a human grader, utilised to reduce error and bias. Grade images are stored on site in the event of a producer or manufacture query. An example of REA Electronic Image Analysis and the grades assigned is shown in Figure 8.



Figure 8 Electronic Image Analysis of REA

4.0. Recommendations for UK Beef Classification in Summary of the USDA Grading System

The USDA Grading System is highly commended for recognising beef quality ⁽²⁰⁾ and is praised in its ability to identify the attributes demanded by the consumers. When considering the development of the EUROP grid in the UK, the USDA system can be drawn upon for some guidance. Such guidance includes the need to have a grading system that suits the individual country's needs for production and consumption. Research in the USA provided the reminder that the UK is its own country with its unique laws and climate, therefore should develop a grading system that represents its own industry and stakeholders.

4.1. The Need for Both Quality and Yield Grading

The two segments of USDA grading are often unclear to consumers ⁽¹⁷⁾, with the majority of consumers only being aware of Quality Grade, which is promoted at the Point of Sale, shown in Figure 4. USA consumers demand marbled beef, that is 'Cherry Red' in colour, therefore the grading system ⁽¹²⁾ has been designed to reflect consumer requirements. Research has established that USDA quality grades influence customer purchasing decisions. UK consumers have considerations for extrinsic and intrinsic meat attributes ⁽⁴⁾, it is highly recommended that quality grading is a necessary addition to UK beef evaluation.

In contrast, Producers and Manufacturers are dependent on both Yield and Quality Grades. Both influence the sale value of beef cattle at slaughter, evaluating the volume and palatability of the meat ⁽¹²⁾. Therefore, it is deemed necessary that both a yield and consumer facing quality attributes are assessed at the point of grading, and a recommendation for future UK grading.

4.2. Quality Grading

4.2.1. Consumer Knowledge of Grades

USDA grades are criticised for causing ‘substantial confusion’ with low consumer knowledge on what ‘Prime’, ‘Choice’ and ‘Select’ differences are ⁽¹⁵⁾. Research suggests the need for advanced consumer education of grades or the need to advance terminology using more descriptive phrases that explains clearly what attributes the meat possess ⁽¹⁵⁾. However, the grades terms utilise positive descriptions, therefore minimising a negative image. For example, calling one meat grade ‘poor’ can relay a negative image to the consumer.

Therefore, under recommendations if a quality grade becomes utilised in the UK, it is suggested that positive word association is exploited. It is also suggested that advanced marketing to gain consumer understanding of a new system should be exploited, this could also gain advanced customer interest in beef product in turn hoping to increase consumption.

4.2.2. Providing Product Assurance

Consumers associate product quality with meat attributes and their personal appreciation of the product, such a colour and taste. Quality is also associated with food safety ⁽¹⁷⁾. Therefore, USDA grading is used as consumer facing assurance scheme, providing the guarantee that the product is safe, and that meat produced adherers to legislation. Such quality labelling has deterred the need for vast Farm Assurance Programmes in the USA, for example the UK’s Red Tractor Scheme, which its criticised for its lack of consumer engagement ⁽²¹⁾.

USDA quality grading and the labelling style, shown in Figure 4, is deemed to add value and assurance for food production at the point of sale. This quality labelling utilises some ability to connect producers and consumers building confidence and aiming to advance supply chain knowledge ⁽²¹⁾. Grade labelling also aims to establish trust in the supply chain being a recognised label for consumers.

With UK consumer pressure demanding high-quality production, that is sustainable ⁽²³⁾, environmentally advantageous and focused on welfare ⁽¹⁷⁾. A consumer facing grading system has the opportunity to meet and advance consumer trust and engagement.

4.2.3. Ribeye Only Assessment

During USDA grading the *longissimus dorsi* is the only muscle assessed ⁽²⁰⁾. According to various industry representatives and independent meat scientists this is deemed adequate, claimed to be an accurate representation of the whole carcass ⁽¹²⁾. Furthermore, ribeye only assessment is relevant being of the highest value cut ⁽¹⁶⁾, and therefore of high importance to the carcasses overall financial worth. In addition, evaluation on more muscles is deemed unnecessary, and costly in both time and value.

4.2.4. Marbling

To produce a carcass of high marbling content both genetics and higher feed volumes are required. The USA due to its climate and land topography have adapted a corn (maize) feeding based system ⁽¹⁰⁾, along with genetic development utilising predominantly Aberdeen Angus cattle. The UK, on the other hand, with its extensive grass-based feeding would struggle to achieve USA levels of marbling ⁽¹⁷⁾.

Furthermore, research ⁽¹⁷⁾ suggests that intramuscular fat and texture is demanded by the USA consumer. However, such may not be relevant in the UK. It was reported ⁽²³⁾ that over a six-month period during 2016, a total 28% of British meat eaters reduced or limited their meat consumption. With 49% of the population having concerns that eating high volumes of meat will have a negative impact to health. With the British consumer highly focused on health, it is

predicted that high levels of intramuscular fat would be unpopular and therefore a marbling grading is not recommended.

4.2.5. pH and Colour Evaluation

USDA grading does not measure pH and only assess colour at a low observation, selecting dark cutters ⁽¹²⁾. Meat & Livestock Australia (MSA) ⁽²²⁾ however do assess pH, lean colour and fat colour as quality attributes, stating that they are factors correlating with eating superiority. The MSA have reported that beef with a pH exceeding 5.70 has reduced eating quality. Meat and fat colour also alters intrinsic quality of beef ⁽²²⁾. Therefore, the evaluation of pH and colour is recommended to be studied as a potential addition for UK grading and may have the ability to replace marbling evaluation.

4.3. Yield Grading

4.3.1. Fat Classification of the EUROP Grid Alongside Additions

The current EUROP Grid is a yield prediction ⁽²⁾, it is already understood by UK producers and manufacturers having been utilities for some 37 years ⁽¹⁾. If UK grading is completely changed to a USDA or MSA style, with these changes could come confusion, high costs would also be incurred for manufacturers and producers in the adaption of a completely new system. Therefore, it is recommended that changes should deviate from the already established fat classification on the EUROP grid. Such recommendations suggest that fat cover under the current system could remain as the yield grade name classification (3, 4L, 4H) with additional features added, such as accurate fat measurement and REA. Conformation, however, should have producer payments adjusted to lesser importance and considered to be removed in due course, as it solely focuses on the shape of the carcass.

4.3.2. Yield Considerations

The USDA grading system pays carcasses on hot weight ⁽¹²⁾, the UK focus on carcass cold weight ⁽¹⁾. It is recommended that cold weight payment is continued to minimise confusion, and with this already deemed adequate change is unnecessary.

Yield grade adjustments for fat deposits of KPH are unnecessary for UK grading due to current UK carcass dressing specifications ⁽³⁾. It is not recommended that dressing specifications are altered as it is deemed they are appropriate for the current UK market place.

A simple addition to develop accuracy and reliability of yield grading is measuring the REA and the thickness of fat. Such measurements will provide the ability to exceed yield assumptions. Furthermore, quantitative assessment could provide trust between manufacturers and producers minimising bias.

4.4. Implementation of a New UK Grading System

The industry is advised to invest the time and knowledge to progress a grading system that meets the UK consumer needs and is to the capability of UK producers. A new grading system needs to be introduced timely, in coherence to the production life span of cattle, and with full industry and supply chain awareness, input and communication. The development of camera grading is deemed advantageous, but not essential, in achieving product competitiveness.

5.0. Conclusion

In conclusion, a UK quality grading system in conjunction with accurate yield assessment is deemed essential to progress and advance the competitiveness of the UK beef industry. If consumer demands for beef quality are to be met, a quality grade system is imperative to the future of the sector. The USDA system with its marbling assessment is not recommended due to UK consumer health awareness, however MSA measurements for colour and pH may exceed this, with further research recommended. A consumer facing grading system is deemed advantages to gain product understanding and minimise a negative eating experience.

The UK cattle industry must invest money and time in gaining knowledge of its consumers and the cattle production, in order to develop its own grade system. Such development of a UK specific grade should allow UK beef to meet UK consumer and UK producer demands.

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