



Compte-rendu du congrès intitulé « Qualité durable de la viande bovine en Europe »

Compte-rendu du congrès d'Octobre 2015 intitulé « Qualité durable de la viande bovine en Europe » qui s'adressait à la fois à des scientifiques et des professionnels

Mots-clés : Viande bovine, Qualité

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Cet article est une compilation des résumés des conférences présentées au congrès intitulé « Qualité durable de la viande bovine en Europe » qui s'est tenu les 1^{er} et 2 octobre 2015 à l'Université de Milan en marge de l'exposition universelle sur l'alimentation de demain. Les présentations sont sur le site <http://www.afbini.gov.uk/index/news/news-releases/news-releases-archive-2015.htm?newsid=29464>.

Résumé :

Des scientifiques et des représentants de la filière « viande bovine » en Europe se sont réunis les 1^{er} et 2 octobre à Milan à l'occasion d'un congrès intitulé « Qualité durable de la viande bovine en Europe – un congrès pour les professionnels et les scientifiques ». Le but de ce congrès était de faciliter les échanges et de consolider les liens entre les acteurs de la filière viande bovine et les chercheurs en viande. De courtes présentations ont eu lieu sur 15 sujets relatifs à la qualité, la compétitivité et la durabilité de la production de viande bovine en Europe. Ces présentations ont traité de la qualité gustative en bouche de la viande bovine produite en Europe, et des applications pratiques par les acteurs de la filière des résultats scientifiques afin d'améliorer la qualité et la durabilité de la production de la viande bovine en Europe. Les présentations ont également porté sur les outils disponibles ou en préparation pour aider à la production de viande bovine de bonne qualité. Les congressistes ont participé à deux réunions de travail pour réfléchir aux questions suivantes : « Comment l'Europe peut-elle valoriser au mieux sa production de viande bovine ? » et « Que faut-il faire pour assurer la durabilité de la production de viande bovine en Europe durant les 10 prochaines années ? ». Cet article présente un résumé des présentations et des réflexions issues des deux réunions de travail.

Abstract: Report of the workshop "Sustainable beef quality for Europe – A workshop for industry and scientists"

Beef industry representatives and scientists from across Europe met on 1-2 October 2015 in Milan for a workshop entitled "Sustainable beef quality for Europe – a Workshop for Industry and Scientists". The aim of the workshop was to facilitate knowledge exchange and strengthen links between scientists and industry across Europe. Short presentations were given on 15 topics of relevance to the quality, competitiveness and sustainability of European beef. These covered the eating quality of European beef, the practical application of science by the beef industry to improve quality, sustainability of European beef production and the tools available or in preparation to assist the industry in the delivery of quality beef. Participants also contributed to two workshops which asked "How can Europe get the best value from its beef?" and "What is needed to ensure sustainability of the European beef industry for the next 10 years?". This article presents a summary of these articles and the outcomes of the workshops.

INTRODUCTION

Beef is an important agricultural product in Europe (Hocquette and Chatellier, 2011), but it is also expensive. The industry is aware of a need to meet consumer expectations for consistency and quality. Furthermore, there are environmental concerns regarding beef production (de Vries *et al.*, 2015; Gerber *et al.*, 2015). Efforts are being made to bring together industry and scientific knowledge on sustainable quality beef production through a thematic network, to enable best practice to be established across Europe. The fragmented nature of the beef industry across Europe means that it is essential that the industry works together to ensure its future economic development. The aim of the workshop was to facilitate knowledge exchange and strengthen links between scientists and industry across Europe.

The meeting was organised by Dr Linda Farmer of the Agri-Food and Biosciences Institute (AFBI), Dr Laura Nuccilli of the British Embassy in Rome (who sponsored the meeting), Prof Antonella Baldi (University of Milan) and Dr Kees de Roest (Centre for Research on Production of Animals, Italy). The meeting was held at the University of Milan and was associated with the Milan Food Expo 2015.

SESSION 1: BEEF AND THE ROLE OF EATING QUALITY

This session was organised in four presentations. First, Ray Bowe (Head of Food Safety & Quality, Musgrave Retail Partners Ireland), gave a presentation which included an introduction to Musgrave and described the importance of Beef Quality to the Musgrave Brands including the processes that are applied to assure quality across their supply chain. It also included an overview of beef quality factors that the retailer sees as critical to the consumer's purchasing decision so that quality is right every time.

Then, Declan Troy from Teagasc (Ireland), gave a talk entitled "Consumer perceptions and the role of science in the meat industry".

The relationship between consumer perception of quality and the food industry's drive to satisfy consumer needs is complex and involves many different components. Science and innovation play a major role in equipping the industry to respond to consumer concerns and expectations (Troy and Kerry, 2010).

This presentation examined the main elements of consumer perception of meat with focus on the red meat sector. Emphasis was placed on perception at point of sale particularly the intrinsic quality cues of colour, packaging and degree of visual fat. The state of the art developments in increasing consumers' perception at this point were discussed. Experienced quality cues such as tenderness and flavour are well known as being of immense importance to consumers at point of consumption. The latest technological developments to enhance the quality experienced by consumers were addressed. Background cues of safety, nutrition, animal welfare and sustainability were also discussed.

Finally, opportunities and challenges facing the industry were outlined. It was concluded that the meat industry needs to invest in and embrace an innovation agenda in order to be sustainable and satisfy consumer demands.

More than 65 people attended from seven countries, with industry and research well represented. The workshop included short presentations on 15 topics of relevance to the quality, competitiveness and sustainability of European beef. These covered the eating quality of European beef, the practical application of science by the beef industry to improve quality, sustainability of European beef production and the tools available (or in preparation) to assist the industry in the delivery of quality beef. These presentations are summarised in the following sections.

Participants were also involved in two workshops which asked "How can Europe get the best value from its beef?" and "What is needed to ensure sustainability of the European beef industry for the next 10 years?"

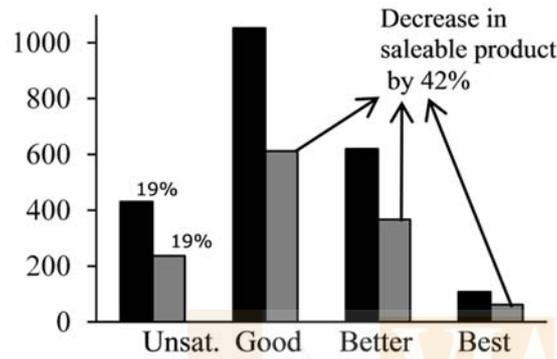
A summary was provided of a project aiming to further foster the links between industry and researchers associated with the beef industry, which has been submitted for funding as an EU thematic network under Horizon 2020. If successful, it is hoped that "EuroBeef" will build on the foundations laid in this workshop.

The third presentation of this session by Sarah Bonny and co-workers (David Pethick, Graham Gardner, Isabelle Legrand, Jerzy Wierzbicki, Paul Allen, Rod Polkinghorne, Jean-François Hocquette and Linda Farmer) dealt with eating quality of European beef. Variable beef eating quality is a major driver of declining beef consumption (Lyford *et al.*, 2010). 'Threshold' type quality assurance systems, which exclude animals or carcasses on the basis of pre-slaughter factors or abattoir measurements, are one method used by the industry to address this. This study aimed to demonstrate the impact of applying a threshold type system to ensure eating quality and the cost of non-compliance to this system. A total of 18 different muscle types were assessed from 774 carcasses, of which 93% were from the beef production industries of Europe (France, Poland, Ireland, Northern Ireland). The beef underwent consumer testing using four different cooking methods by over 15,000 untrained consumers (using MSA techniques, Watson *et al.*, 2008). During testing, consumers were asked to rate the beef samples as one of four options: unsatisfactory (unsat.), good everyday (good), better than everyday (better) or premium (best).

Evaluation of the data showed that more than 19% grilled sirloin, 25% grilled rump, 17% roast rump and 53% roast topside were rated as "unsatisfactory" by consumers.

The failure rate of grilled striploins was not affected by the use of standard industry threshold criteria and 42% of product assessed as good quality by consumers would have been discarded (Figure 1). This result was similar for the other muscles in the database. The inability of the threshold criteria to increase the average quality of beef demonstrates the need for more complex quality prediction and guarantee systems within the European beef industry.

Figure 1: Number of samples in each quality category for grilled striploins (black) and after applying threshold criteria (grey). The % failure is displayed above the fail column



Threshold criteria:
 pH > 6
 > 30 months (Females and Steers)
 > 18 months (Bulls)
 Conformation < O+
 Fat score < 3
 < 7 days ageing (Females and Steers)
 < 14 days ageing (Bulls)

The last presentation of this session by Linda Farmer and co-workers (Terence Hagan, Octavio Oltra and Jonathan Birnie) was about understanding consumer preferences for beef eating quality. The eating quality of beef includes the appearance, odour, flavour and texture of the cooked product. As beef is often an expensive item, past experience of eating quality, as perceived by the final customer and their families, will be important for 'repeat purchase'.

Many scientific studies have been undertaken on all aspects of beef eating quality. These generally fall into one of three categories:

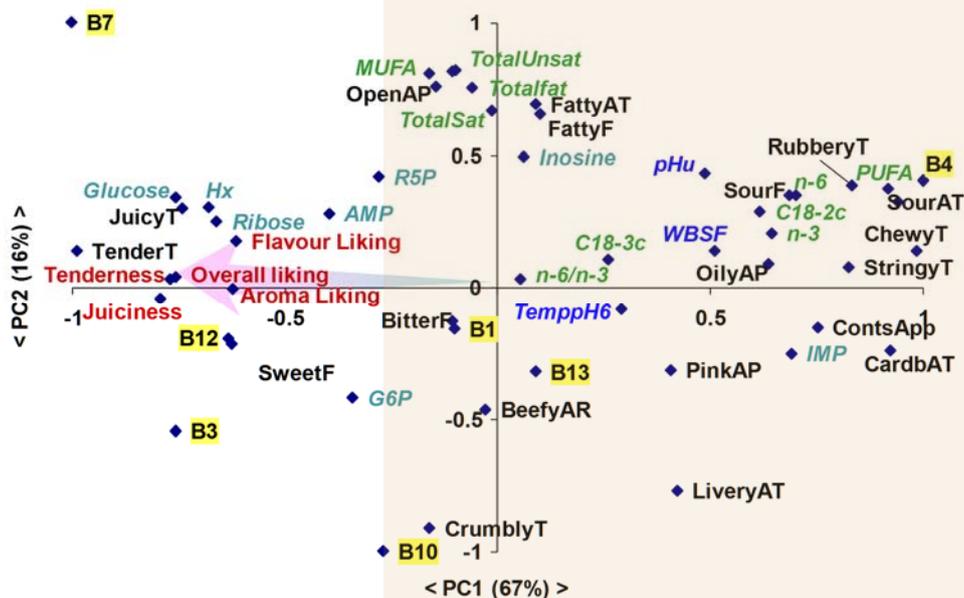
- Impact of production or processing factors on the sensory quality of the meat, as perceived by consumers or trained panels.
- Meat quality assessments using shear force, pHu, marbling, etc.

- Detailed chemistry and biochemistry of texture and flavour.

In one of several studies, beef sirloins from a range of sources and eating qualities were evaluated by consumers, a trained taste panel and a range of instrumental methods (Farmer *et al.*, 2010; Oltra *et al.*, 2010). Statistical methods including cluster analysis, external and internal preference mapping were used to evaluate the relationships between these measurements. Figure 2 shows an external preference map for grilled sirloin.

These studies demonstrate that there are clear associations between the perception of eating quality by trained panellists and consumers, meat quality measurements and precursors of flavour.

Figure 2: External preference map for grilled beef sirloin for principal components, PC1 and PC2



SESSION 2: IMPROVING QUALITY IN PRACTICE

This session also comprised four presentations. The first one by Jonathan Birnie (Dunbia, UK), was entitled “Beef quality - an industry approach”. Jonathan talked about the view of research from the processors perspective. He outlined the areas where research can make a difference, from farm level through to customer level. He referred to the difficulties of commissioning and delivering research within a fast paced, high pressure business. He discussed the processor/researcher interface, highlighting the difficulties in outlook and communication between the two groups and provided recommendations on how to engage with industry successfully.

Then, Vittorio Dell’Orto from University of Milan presented some applications of beef quality research in Italy. EU is the third largest beef producer in the world and Italy is the third beef producer in EU beef market and has one of the highest average beef consumption. Almost 80% of the beef cattle are produced in intensive farms in the North of Italy. Psychological and ethical factors play an important role in consumer behaviour and perceived quality and they have to be improved, as well as eating quality, especially considering the intensive farming system. Nowadays, not only in Italy, there is a growing concern within the consumers about the healthiness and environmental impact of beef. The Italian beef industry is starting to address these points, improving nutritional characteristics and reducing environmental impact mainly through animal nutrition, e.g. feeding flaxseed to increase muscle omega 3 and essential oils and their active components to reduce methane production and feed efficiency. Welfare is another concern for intensive farming and Lombardy and Emilia Romagna Experimental Zooprophyllactic Institute (IZSLER) developed a welfare and biosecurity assessment system that gives to each farm a “welfare classification. This system can provide in the future the opportunity for a welfare labeling of animal products. Large scale farms represent also an opportunity to improve beef quality, as they are more prone to invest in new technology or apply new research findings. The use of on-line devices for meat quality evaluation at the abattoir gives a constant and reliable feedback on product quality to the farmers. For example, the chromameter is currently utilised for objective color classification of veal. Future applications can be represented by the inclusion of meat quality and feed efficiency traits in the genetic selection and the application of preventive strategies and risk assessment to reduce antibiotics utilization. At abattoir level, achievable goals through the application of the research outcomes in the next years can be represented by the improvement of the actual carcass classification system, unrelated with meat quality; the utilization of new and more informative on-line devices for meat quality evaluation, useful also for carcass classification and genetic selection and the adoption of technologies as innovative packaging to improve shelf life and product aspect that can help to reach new markets.

The third presentation by Rod Polkinghorne from Australia dealt with the Meat Standards Australia: an example of consumer driven research and commercial application (Pethick *et al.*, 2015). While many beef grading systems have sought to provide an indication of consumer satisfaction, they have not delivered sufficiently to provide a consistent and reliable eating experience. In large part, this

reflects a single grade being applied to the entire carcass, in fact a grouping of significantly different component cuts, largely on the basis of appearance rather than any direct eating quality indication (Polkinghorne and Thompson, 2010).

The unique feature of Meat Standards Australia (MSA) is that it is derived from consumer testing of cooked beef portions with the consumer ratings determining grade standards at an individual meal portion level. Statistical evaluation of consumer score relationships to potential grading inputs related to animal, processing and value adding processes is utilised through a prediction model that predicts consumer scores for 135 cut by cooking method combinations within each carcass (Watson *et.al.*, 2008). Rather than assigning a carcass grade, cuts are assigned individual predicted grades based on expected eating quality at a nominated days ageing and via up to 8 cooking methods. This approach describes the cooked result for individual beef meal portions facilitating reliable and simple consumer friendly beef description.

MSA has been developed over a 20-year R&D period with in excess of 100,000 consumers participating. The first prediction model was introduced in 2000 at which point the industry was largely skeptical and less than 100,000 carcasses were graded annually. The system is voluntary, but subject to strict standards if adopted, and over time commercial experience has seen close to universal adoption and annual grading of over 3 million carcasses. MSA is now a critical pillar of the Australian beef industry used to support company branding and as a central trade description. Economic analysis (Griffiths and Thompson, 2012) indicates a net industry benefit exceeding A\$1million per year with the largest proportion flowing to livestock producers where an MSA grade typically provides a 15 to 20% premium.

The system continues to be developed through R&D with MSA a requirement for most branded beef programs, including retail and food service specifications, and rapidly being adopted to support company brands in export as well as the domestic markets.

The last presentation which was prepared by Jerzy Wierzbicki (Polish Beef Association) and Agnieszka Wierzbicka (Warsaw University of Life Sciences) related to improvement of beef quality in Poland. Through the last 40 years, Polish beef industry has passed many changes that caused substantial demand decline to the EU lowest level of 1.6 kg per capita in 2013 (Małkowski, *et al.*, 2014). The authors observed changes which affected the Polish beef industry in recent years, in particular fast spreading trend of assuring high quality of beef. It also includes: the transformation of ownership, the transition from compulsory (PKN, 1996) to voluntary carcasses and cuts specification, market incentives to implement EUROP classification (before and after EU accession). In consequences of opening access to the EU market, slaughterhouses and cutting plants adapted to changed requirements in terms of product specification. The author observed new requirements concerning beef quality in the Polish market: stronger demand for aged beef and well marbled beef. Demand changes and new consumer behavior have been noticed which resulted in building opened quality assurance scheme such as “Quality Meat Programme” as well as commercial brands: “Uczta Kulinarna”, “Beef

Quality Standards”, “Wołowina z Pniew”. Consumers demand was observed in ProOptiBeef project. Polish consumers may pay more for beef if quality grade is guaranteed. During last 5 years, Polish and Australian scientists have worked on the prototype of Polish prediction

model which is analogous to the MSA model (Polkinghorne *et al.*, 2008). This work, funded by the EU ProOptiBeef project, has also established links to French meat and consumers.

SESSION 3: SUSTAINABILITY OF THE EUROPEAN BEEF INDUSTRY

This session comprised three talks. The first one by Kees de Roest (Italy), described the beef market in Italy and Europe. In Italy, the production of beef is based on (1) the fattening of beef calves imported from abroad (Charolais, Limousine, crossbreeds etc.), (2) male calves coming for the national dairy herd, (3) calves from the herd of suckler cows belonging to the local Italian beef breeds (Piemontese, Chianina, Marchigiana and Romagnola) and (4) cull cows. This generates the presence of very different beef qualities on the national market and a strong predominance of young bulls and heifers in the total number of slaughtered animals. With respect to the other EU countries prices of beef cattle in Italy are high due to its specialization in the fattening of calves of specialised beef breeds falling primarily in the category E2 of the SEUROP classification. Nevertheless, because of the high production costs the profitability of beef farms has been negative for many years and could only be mitigated by CAP premia. In the coming years, the foreseen reduction of the new CAP premia will further compromise the profitability of beef farms unlike the market price would create the necessary relief for the beef sector. Actually, beef farmers are facing a continuous decline of beef consumption both caused by the economic crisis which has eroded real income and by an increasing dissatisfaction about beef quality. In the future a strong emphasis has to be placed on payment systems which are able to remunerate the eating quality of beef in order to enhance more sustainable production systems.

Then, Nigel Scollan (UK), presented a scientist’s perspective for the future of European beef production. Promoting sustainability and security of food supply is intensifying at regional, national and global levels and incorporates key issues including (1) to feed everyone sustainability, equitably and healthily; (2) address needs for availability, affordability and accessibility, (3) diverse, ecologically sound and resilient systems and (4) building the capacities and skills necessary for future generations. Global demand for food is expected to increase by 70% by 2050 as a result of population growth. To meet this demand, the global production of meat and milk is projected to more than double. The bulk of the growth in meat is predicted to occur in developing countries, with China, India and Brazil already representing two thirds of current meat production.

Innovations and adoption of new approaches in beef production systems have lagged significantly behind progress in pig and poultry sector for many years. Across Europe we are experiencing a transition to beef produced extensively but finished indoors in a more intensive manner. There is an urgent need for investment in research to support the further development of “sustainable beef systems”, effective translation of associated science and technology into practice through knowledge exchange and training to elevate “skills” in the industry. Restructuring and refocusing beef production businesses are key to a viable and sustainable beef sector. It must be an industry, as noted above, capable of delivering positively on many fronts, producing high quality products for consumers, farming in a sensitive and environmentally

friendly manner in a “climate changed world”, resource efficient and delivering to maintain and enhance our countryside and rural communities.

Challenges in the beef sector are large and some of the key issues (but not exclusive) are highlighted below:

- Environmental impact: for beef systems there are challenges as reflected in the large variation in the emissions from beef systems ranging from 14-32 kg CO₂ equivalents per kg of product, which is much greater than that of pork and poultry. Improvements in nutrition, genetics, health and welfare is essential to reduce emissions and that the industry engages closely with policy makers and key stakeholders to solve problems and to emphasise the multiple roles of beef animals in for example food security, landscape and biodiversity, rural communities.
- Improving the delivery of safe and high “quality” (including nutritional) products produced from beef production systems which are environmentally sound and of high welfare standards will become more important. This is related to the increasing price for beef reflecting changes in global availability but also major increases in input costs. It is also related to increasing consumer expectations as price increases demand for quality rises.
- Improvements in the efficiency with which animals turn feed protein into human-edible is required exploiting integrated approaches to exploiting developments in genetics and nutritional research. Emphasis on driving continuous improvements in rumen efficiency is essential.
- Enhanced utilisation of useful “measurements” and utilisation of “data” to drive improvements in beef production systems.
- Increased development of novel methods to assure the authenticity of beef beyond species-species difference to the development of robust systems to underpin specific breeds linked to geographical origin and ideally individual farms.

The last presentation by Maeve Henchion from Teagasc (Ireland), was entitled “Meat consumption, trends and quality: a market perspective”. This presentation looked at current and projected meat consumption patterns, identified quality attributes of importance to consumers in different markets and finally specifically looked at credence attributes of quality related to sustainability and ethics. It concluded by identifying the implications of these findings for the meat industry as well as the policy framework that impacts its future.

Drawing on secondary data sources on meat consumption on a global basis, this presentation examined current and projected meat consumption patterns. It did so by looking at different meat types and different regions. It found that meat consumption will continue to increase globally, particularly for poultry, driven by growth in population, rising incomes and increased urbanisation. However, the influence of factors

such as income and price are expected to have less of an influence in more mature markets, with quality becoming a more important influence on consumer choice (Henchion et al., 2014).

Quality is a complex concept so that much research has been undertaken internationally to identify the dimensions of quality that are important to consumers. In this presentation, the findings of a systematic review of this research were presented to identify quality dimensions of importance to consumers and examine how the relative importance of these dimensions can vary in different markets.

SESSION 4: TOOLS FOR DELIVERING QUALITY BEEF

This session of four presentations was introduced by a talk by Steven Morrison and Mark Browne (AFBI, UK) on BovIS, a tool providing feedback to farmers. Valuable data already exists in large quantities within the red meat supply chain that could be used more effectively to support informed decisions at producer level helping efficiently deliver beef in line with market requirements.

To harness this largely unexploited potential, Agri-Food and Biosciences Institute (AFBI) through government and farmer levy body funding have developed the Bovine Information System (BovIS). This data capture and analytics platform is freely available to the Northern Ireland beef industry. BovIS, is a unified database which assimilates animal information from the government animal traceability database (APHIS - Animal & Public Health Information System) and data from seven major abattoirs in Northern Ireland. Almost 90% of the beef output of Northern Ireland is captured with BovIS.

At an individual producer level, key benchmarking data is generated relating to beef production in terms of growth and carcass quality in addition to dam and sire performance. Information is available on breed, gender, age, carcass weight and their interactions on growth and carcass weight. This information can be used to identify breeding and management strategies to meet market specifications in the most efficient manner. This valuable data could be integrated into future genetic improvement and meat eating quality initiatives.

It concluded by examining credence attributes related to sustainability and ethics in particular as consumer concerns on such issues could mean that demand for livestock products will “heavily moderated by socio-economic factors such as human health concerns and changing socio-cultural values” (Thornton, 2010). It examined what these quality attributes mean from a consumer perspective, discussed the implications of these issues for the supply chain and the broader policy framework.

Dr Morrison has described how the system was developed, provided examples of how it is currently used by primary producers and outlined potential future developments.

Isabelle Legrand and Christophe Denoyelle from Institut de l’Elevage (the French Livestock Institute) presented practical steps towards improved quality in France.

France, like other countries, observed a lack of clarity for the consumer at the self-service meat retail cases. This consumer doesn’t know meat cuts and cooking methods well enough to buy and prepare meat properly. Moreover, some muscles have a very heterogeneous quality. In order to prevent the risk of consumers’ disappointment, the French meat stakeholders have launched a new denomination within a legal framework. This denomination is required since December 13, 2014 and concerns only beef, veal and lamb/mutton sold in the self-service department of large and medium-sized retailers. Three compulsory pieces of information replace the previous cuts’ names on the new case ready label: the cooking method, the quality potential and the name or the kind of cut. Thanks to the cooking method, the consumer is guided to prepare the meat in a suitable way. Quality potential is illustrated by stars (* to ***) and linked to tenderness for quick-cooking cuts and to “softness” for slow-cooking meats. Cuts well known by consumers (tenderloin, striploin, rump...) keep their usual name. The other ones are grouped under generic names (steaks, roasts, bourguignon...) to be clearer (Figure 3).

Figure 3: French communication regarding the new denomination



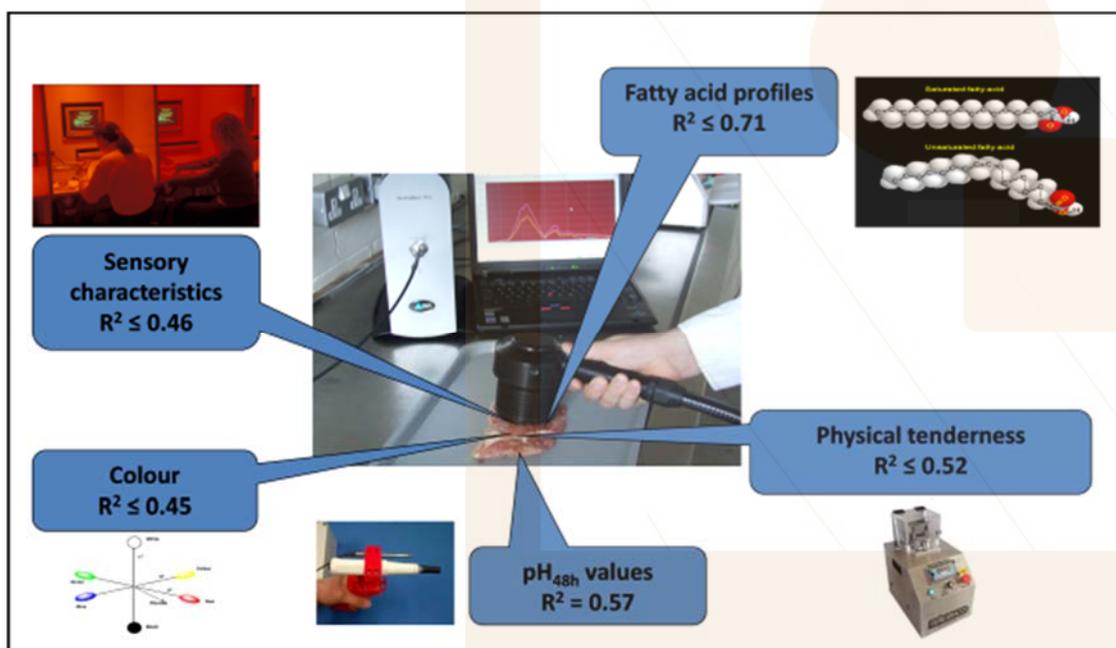
This new approach implies new ways of working for industrials and retailers, because it aims at both making meat purchase and cooking easier for the consumer and improving meat consistency for every quality level. For that purpose, it takes into account quality gaps between different kinds of muscles and also differences between and inside muscles for quick-cooking cuts. It also requires specific muscle preparation conditions for each quality level. This professional decision has been formalised into cutting specifications, which must be followed by the cutting stakeholders.

However, this first step doesn't take into consideration all the factors affecting meat quality such as differences between animals and ageing effect. In order to go ahead, the French beef inter-branch organization is considering how the beef market segmentation could be improved for the fresh or frozen quick-cooking meats (excluding ground beef) at the self-service retails cases. Three market segments could be defined: "standard", "core" and "premium" segments, as well as specifications for the first two of them through precise factors (such as animal age, carcass ultimate pH, EU conformation, EU fatness, animal type crossed with its EU

classification and/or weigh and ageing duration). Meats failing to meet the specifications would be shifted towards transformation. Nevertheless, this discussion has not yet been concluded.

Then, Rainer Roehle, Dave W. Ross and Carol-Anne Duthie from the Scotland's Rural College (UK). In a research project entitled 'Research towards an integrated measurement of meat eating quality (IMEQ)', various technologies were developed and tested to predict beef carcass and meat eating quality under commercial abattoir conditions (Roehle *et al.*, 2014). Beef carcass quality determined by video image analysis (VIA) predicted accurately muscle weight ($R^2=0.81$), but less accurately predicted fat weight ($R^2=0.61$) using computer tomography as reference method. Meat eating quality of beef was predicted by various advanced spectroscopic techniques, such as visible and near infra-red spectroscopy (Vis-NIR), Raman spectroscopy, and hyperspectral imaging. Based on accuracy of the available systems, Vis-NIR was the most robust system under commercial abattoir conditions.

Figure 4: Vis-NIR predicts various meat eating quality criteria



The Vis-NIR technique is robust (Figure 4), showing an ability to estimate a range of sensory panel attributes (R^2 up to 0.22, 0.14, 0.46 for tenderness, juiciness and flavour of the rump muscle, respectively), physical tenderness (R^2 up to 0.52 for slice shear force at 14 days post-mortem), pH at 48 hours post-mortem ($R^2 = 0.57$), a range of fatty acids relating to nutritional quality (R^2 up to 0.71), and also colour parameters L^* (lightness, $R^2 = 0.44$), a^* (redness, $R^2 = 0.35$) and b^* (yellowness, $R^2 = 0.45$). In particular, Vis-NIR has been shown to accurately predict extremes of meat eating quality criteria with correct predictions between 93% and 100% using rump muscle samples. Vis-NIR is offering a new on-line method for sorting carcasses based on meat eating quality criteria and for providing predictions of difficult and costly to measure meat eating quality traits for a feedback system to the producers and for genetic improvement programmes.

The fourth talk by Jean-François Hocquette and co-workers (Jerzy Wierzbicki, Rod Polkinghorne, Isabelle Legrand, Koenraad Duhem, Linda Farmer, Sarah Bonny and David Pethick and the Eurobeef consortium) was entitled "A European 3G beef quality system?".

The beef industry in Europe is very complex, encompassing different breeds, animal types (cull cows, heifers, steers and young bulls) and production systems. The EUROP grid (based on carcass conformation and fatness) which is used to determine the value of carcasses for payment of producers has resulted in a disconnection between retail price of beef and eating quality. This explains, at least in part, the failure of beef to meet consumer expectations and the decline of beef consumption within the EU. International standards for the assessment of beef eating quality would allow the identification and pursuit of the most sustainable development strategies for the beef industry (United Nations Economic Commission for Europe, 2015).

A consumer driven modelling tool was developed in Australia to predict eating beef quality for 135 individual muscle × cooking method combinations. The EU-funded ProSafeBeef project and other national projects evaluated this Meat Standards Australia (MSA) grading scheme and found that it would be possible to manage a similar system for the European beef industry. This new grading system may be called 3G (for Global Guaranteed Grading) and would not be in competition with niche markets based on premium beef or official quality labels (PDO, PGI, etc) which also include quality traits related to tradition, know-how, specificity and authenticity. Instead, it would underpin existing brands and labels and more importantly help regulate the mass market for which no grading system exists.

Based on these results and perspectives, Eurobeef has been proposed as a thematic network in the European value chain of beef production; it is led by “Institut de l’Élevage”, (France), partnered by INRA (France), Agri-Food and Biosciences Institute (NI, UK), Polish Beef Association, Centro Ricerche Produzioni Animali (Italy), Teagasc (Ireland), Agriculture and Horticulture Development Board (AHDB, UK), European Livestock And Meat Trading Union (UECBV) as workpackage leaders and other partners from Spain and Romania. The project is intended to enhance organizational innovation along the whole beef value chain. Part of the project will be based on a European data base with sensory data obtained with the MSA protocol on about 24000 beef samples from about 700 Polish, Irish, English or French carcasses. The volume of standardised data available will provide statistically sound correlations between various factors and beef eating quality traits which could help to the development of a European 3G prediction model for beef eating quality.

The last presentation about EUROBEEF was by Koenraad Duhem and Linda Farmer. EUROBEEF is a European Thematic Network intended to link the various European beef supply chains and foster exchanges between their stakeholders from farm to plate, to enhance innovation in order to improve competitiveness and sustainability. One of the main objectives is to identify and make available at the European scale predictive tools that will assist the industry to ensure quality and sustainability of beef production.

This proposal was submitted to the EU for funding in the framework of the EU Programme for Research and

OUTCOMES FROM WORKSHOPS

Delegates were invited to participate in two workshops during the meeting, by engaging in informal discussion during the break period, and by adding their comments using sticky notepaper on to posters provided. The notes were colour-coded to identify scientist and industry contributions. Fortynine suggestions were made by delegates during Workshop 1, with 35 contributions to Workshop 2.

Workshop 1 aimed to find out “*How can Europe get the best value from its beef?*”. As an aid to discussion, the following questions were posed: *What are the challenges? What are industry’s goals? How to deliver consumer needs? What does the industry need? What are the knowledge gaps?*

Perhaps the most notable finding was the high level of agreement between the delegates from industry and research backgrounds. Comments highlighted the need to reduce inconsistency of quality and to develop methods to monitor eating quality as of key importance. While this might be

Innovation - Horizon 2020. If successful, “EuroBeef” will involve all participants in the European Beef Industry in discussions on how innovation may be implemented along the whole beef value chain. The purpose is to collaborate to make the European beef industry more sustainable and competitive.

The objectives of Eurobeef are to respond to the following questions:

“How can farmers, their organisations, slaughter-houses, meat processors and retailers work all together to supply the European regional and International markets and consumers’ meat demand, while improving sustainability of the beef industry?” The response will be the organisation of a dialogue between all stakeholders. The project will focus on the consumer view and go ‘upstream’ along the supply chain to include production systems.

The core themes will be:

- Networking and improving contacts and dialogue;
- Regional comparison and mapping of beef supply chains;
- Industry needs regarding beef eating quality and consistency;
- Scientific information on eating quality of the current European beef supply;
- Identification of tools and mechanisms for optimising beef eating quality;
- Criteria and tools to improve the beef quality and the sustainability of beef production systems;
- Development of a Stakeholder Driven Research agenda.

The proposal is led by Institut de l’élevage (France), partnered by Agrifood and Biosciences Institute (Northern Ireland, UK), Asoprovac (Spain), Asociația Crescătorilor și Exportatorilor de Bovine, Ovine și Porcine din România, Centro Ricerche Produzioni Animali, Institut National de Recherche Agronomique (Italy), Polish Beef Association, The Agriculture and Horticulture Development Board - Organisation of English beef and sheep industry (UK), The Irish Agriculture and Food Development Authority (Teagasc, Ireland), Union Européenne du Commerce du Bétail et des métiers de la Viande (Belgium).

We expect to hear whether this proposal has been successful during 2016.

expected given the subject of the meeting, it was notable that this aspect was emphasised strongly by both industry and researcher comments were. Likewise, both industry and research delegates suggested that a greater understanding of consumers is needed, together with halting the decline in consumption. Both felt that there should be greater communication with consumers, especially of the positive benefits of beef as a source of protein and nutrients. There were differences as well, with industry respondents highlighting the need to identify the cost of unacceptable quality to the industry and to increase profits while researchers focused on increasing consumer trust and scientific understanding.

Workshop 2 asked “*What needs to be done to ensure sustainability of the European beef industry over the next 10 years?*”. The following questions were posed: *What are the challenges? What are industry’s goals? Where are the*

knowledge gaps? Where is a concerted approach needed (and where individual company approaches)?

Some of the same issues arose as discussed for Workshop 1. Both industry and researchers highlighted the need for efficiency at farm level and for better knowledge of the nutritional benefits of beef. Fewer industry delegates contributed to this workshop, but those who responded

CONCLUDING REMARKS

The meeting covered a wide range of topics both from a scientific and industry viewpoint. However, the discussion and the workshops highlighted a number of themes which were of particular interest to those present.

The fact that close to 20% of grilled sirloin is deemed unsatisfactory by consumers of beef across Europe presents a challenge to both industry and researchers. While inconsistency is inevitable in a natural product, this level of dissatisfaction is undesirable in a premium food.

The need to engage and communicate with the consumer, and ensure that they are aware of the positive health benefits of beef consumption as well as the alleged adverse effects was a recurring theme. Likewise, the arguments against beef production based on carbon emissions needs to be balanced by a discussion of the land management benefits of beef production.

References:

- de Vries M., van Middelaar C.E., de Boer I.J.M. (2015). Comparing environmental impacts of beef production systems: A review of life cycle assessments. *Livestock Science*, 178, 279-288.
- Farmer L.J., Oltra O.R., Moss B.W., Gordon A.W., Birnie, J. (2010). Attributes important for the eating quality of beef and lamb loin. In 56th International Congress of Meat Science and Technology, Jeju, South Korea.
- Gerber P.J., Mottet A., Opio C.I., Falcucci A., Teillard F. (2015). Environmental impacts of beef production: Review of challenges and perspectives for durability. *Meat Science*, 109, 2-12.
- Griffiths G., Thompson J. (2012). The Aggregate Economic Benefits to the Australian Beef Industry from the Adoption of Meat Standards Australia: updated to 2010/11. *Australasian Agribusiness Review*, Vol.20, Paper 2, ISSN 1442-6951.
- Henchion M., McCarthy M., Resconi V., Troy D. (2014). Meat Consumption: Trends and Quality Matters. *Meat Science*, 98, 561-568.
- Hocquette J.F., Chatellier V. (2011). Prospects for the European beef sector over the next 30 years. *Animal Frontiers*, 2, 20-28.
- Hocquette J.F., Van Wezemael L., Chriki S., Legrand I., Verbeke W., Farmer L., Scollan N.D., Polkinghorne R.J., Rødbotten R., Allen P., Pethick D.W. (2014). Modelling of beef sensory quality for a better prediction of palatability. *Meat Science*, 97, 316-322.
- Lyford C., Thompson J., Polkinghorne R.J., Miller M., Nishimura T., Neath K., Allen P. and Belasco E. (2010). *Australasian Agribusiness Review* 18, 1-17.
- Małkowski J., Zawadzka D., Pasińska, D. (2014). Aktualny i przewidywany stan rynku wołowiny. *Analizy Rynkowe, październik*. pp. 23-35.
- Oltra O.R., Farmer L.J., Moss B., Gordon A.W., Birnie, J. (2010). External preference mapping of beef: relationship of fatty acids and flavour precursors with consumer's preferences. *Advances in Animal Biosciences*, 1, 130-130.
- Pethick D.W., Thompson J., Polkinghorne R., Bonny S.P.H., Tarr G., Treford P., Sinclair D., Frette F., Wierzbicki J., Crowley M., Gardner G.E., Allen P., Nishimura T., McGilchrist P., Farmer L., Meng Q., Scollan N., Duhem K., Hocquette J.F. (2015). Beef and Lamb carcass grading to underpin consumer satisfaction. *Viandes & Produits Carnés*, VPC-2015-31-4-3. http://www.viandesetproduitscarnes.fr/phocadownload/vpc_vol_31/3143_hocquette_prediction_qualite_v viande_ruminants.pdf
- Polkinghorne R.J., Thompson J. (2010). Meat standards and grading: A world view. *Meat Science*, 86, 227-235.
- Polkinghorne R.J., Watson R., Thompson J.M., Pethick D.W. (2008). Current usage and future development of the Meat Standards Australia (MSA) grading system. *Australian Journal of Experimental Agriculture*, 48, 1459-1464.
- Roehe R., Ross D., Duthie C.A., Lambe N., Anderson C., Broadbent C., Bungler L., England S., Picken A., Robertson R., Peacock A., Green A., Hinz A., Gilchrist J., Richardson I., Nath M., Glasbey C. (2014). Research Towards an Integrated Measurement of Meat Eating Quality (IMEQ), FINAL REPORT 2013, Scottish Government and Quality Meat Scotland (QMS), (Project Number SCL/017/10), http://www.sruc.ac.uk/downloads/file/1875/imeq_report.
- Thornton P.K. (2010). Livestock production: recent trends and future prospects, *Philosophical Transactions of the Royal Society B*, 365, 2853-2867.
- Troy D.J., Kerry J.P. (2010). Consumer perception and the role of science in the meat industry. *Meat Science*, 86, 214-226.

highlighted the need to communicate to the consumer, including providing appropriate pricing structures. The greater number of researcher respondents emphasised the need for a 'one supply chain' approach, the need to assure quality (as in Workshop 1), as well as the need to highlight the benefits of grass management and beef production from grass.

Only by understanding consumer needs, wishes and behaviours across Europe can the decline in beef consumption be addressed.

The need for improved measurement techniques was highlighted and a number of speakers presented work on this topic. Participants highlighted the need for measurement techniques to monitor quality aspects of beef but also to measure the carbon sequestered by pasture.

The need for improved efficiency throughout the supply chain, including better use of waste products, was highlighted.

This event was deliberately planned to raise issues of current concern for European beef, both to the industry and to researchers, and to engage both groups in discussion of these issues. The feedback at and after the meeting suggested that the event was successful in meeting this goal.

United Nations Economic Commission for Europe, 2015. Specialised section on standardization of meat. Eating quality – proposals by the working group.
http://www.unece.org/fileadmin/DAM/trade/agr/meetings/ge.11/2015/GE11_07E_EatingQuality.pdf.

Watson R., Gee A., Polkinghorne R.J., Porter M. (2008). Australian Journal of Experimental Agriculture, 48, 1360-1367.

Watson R., Polkinghorne R.J., Thompson J. (2008). Development of the Meat Standards Australia (MSA) prediction model for beef palatability. Australian Journal of Experimental Agriculture, 48, 1368–1379.

