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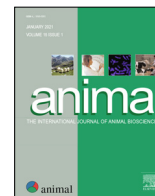
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Construction of beef quality through official quality signs, the example of *Label Rouge*

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ABSTRACT

The European Union promotes high-quality food products and protects agricultural traditions. With that vision, Regulation (EU) 1151/2012 defines quality schemes such as protected designations of origin, protected geographical indications and optional quality terms that link quality and tradition to legal labels. These quality schemes are completed by national initiatives. *Label Rouge* is an official regulated sign of premium quality in France that explicitly aims at higher product quality. Each *Label Rouge* product has to comply with production and processing conditions stated in its published specifications. Here, we analyse commitments made under *Label Rouge* books of specifications for beef to show how the *Label Rouge* quality-sign constructs quality. In order to provide a frame, product quality has been broken down into a set of seven quality attributes: commercial, organoleptic, nutritional, safety, technological, convenience and image-value, where image-value quality attributes encompass the ethical, cultural and environmental dimensions associated with how a food is produced and processed, and its origin. The specifications highlight 'communicative certified characteristics' (characteristics set out in the specifications that are certified and communicated to the public) and specify how the meat needs to be farmed and processed to attain superior quality. Analysis of all 16 *Label Rouge* books of specifications for beef, based on scientific expertise and the literature, showed that commitments in these specifications are linked to the seven groups of quality attributes and that they concern the whole continuum of the chain, from animal type to on-farm conditions, transport to slaughter and through to meat ageing. Commitments concerning the whole herd and the selection of label-eligible animals, carcasses and meat particularly enhance organoleptic and image-value attributes. *Label Rouge* builds quality through commitments on the production, transport and beef ageing conditions, and offers a strong referent for the beef sector on how to better meet more qualitative consumers' expectations.

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Implications

Analysis of the beef *Label Rouge* production specifications has shown how this quality-sign constructs quality—largely in its organoleptic and image-value attributes. It mobilises pivotal factors for shaping quality attributes at various stages of the chain, from choice of animal type through to ageing of the meat. The beef *Label Rouge* specifications impose a series of commitments from producers and processors, and successive sortings are carried out on animal, carcasses and meats that may qualify for the label. *Label Rouge* offers a benchmark for the beef sector on how to better meet more qualitative consumers' expectations.

Introduction

The European Union promotes high-quality food products and protects agricultural traditions. Alongside organic food covered by Regulation (EU) 848/2018 (European Commission, 2018), Regulation (EU) 1151/2012 (European Commission, 2012) defines quality schemes that link quality and tradition to legal labels. Three labels are certified, i.e. Protected Designation of Origin (PDO), Protected Geographical Indication (PGI) and Traditional Speciality Guaranteed (TSG), in addition to optional quality terms such as 'mountain product'. They refer to products whose quality arises from 'identifiable specific characteristics' linked to either geographical specificities (PDO, PGI) or traditional practices or recipes (TSG). Aside from legal regulation, each certified registered product is governed by a specific production standard that sets out the defining characteristics of the final product (such as size,

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colour, texture), and that gives instructions for some or all of the steps in production and/or processing, meaning that the quality of the product is based on authenticity or differentiation. These quality schemes are completed by national initiatives: *Label Rouge* is an official regulated sign of premium quality in France. In 2019, beef *Label Rouge* production accounted for 2.6% of French beef output, but registered + 3% growth against 2018 (INAO, 2019). The *Label Rouge* sign explicitly aims to deliver superior quality, as stated by the national Rural Code: 'the *Label Rouge* production-standard defines a set of distinct set of specific traits and properties that establish a superior level of quality, the main points to control-check and the methods for assessing them (Article R641-2.8)' (République Française, 2017). The superior quality of a *Label Rouge* food is grounded in superior organoleptic attributes that are perceivable to consumers, in farming practices that stand apart from their commoditised standard-grade equivalents, in the image-value of the product and in presentation or convenience attributes (INAO, 2021).

Ongoing *Label Rouge* management is stringently regulated. The production specifications, which are drafted by operators, have to be validated by the government agency responsible for foods produced to quality sign standards, National Institute of Origin and Quality (INAO), before being published in the government gazette of the French Republic. *Label Rouge* must comply with the national regulation in force for all food products; even if its commitments do not include regulatory information, *Label Rouge* products are thus subject to it. Each production standard comes with a quality assurance plan that sets out a programme of controls: audits check the respect of the commitments while a sensory assessment programme checks product's quality. The demonstration of the superior quality of a *Label Rouge* product is therefore an integral part of the quality control programme. Audits are performed by a certifying body on predefined criteria based on visual, documentary or analytic examination. Regular sensory tests provide assurances that the superior quality over commodity or standard products is maintained.

Even though *Label Rouge* is a French-developed quality label, it benefits from a European support. In 2017, EU financial support 'Enjoy! It's from Europe' was granted to a promotion campaign for *Label Rouge*. 'Enjoy! It's from Europe' is the EU co-funded promotion policy to support commercial development of European agricultural products (European Commission, 2015). In the case of *Label Rouge*, the EU contribution covered 70% of the promotion campaign budget from 2018 to 2020 for meat, processed meat, and eggs, and targeted Belgium, France, Germany, the Netherlands and Sweden, in order to develop awareness and drive interest from potential distributors (European Commission, 2017). The concept of superior quality delivered by the *Label Rouge* also extends to foreign products, *Label Rouge* Scottish Salmon being one example (Sylvander et al., 2007).

Each *Label Rouge* product has to comply with production and processing conditions stated in its published specifications. Although *Label Rouge* is accessible to any kind of food product, its history led to a predominance of animal-sourced foods. The *Label Rouge* was originally created in 1965 for poultry meat (Westgren, 1999) and was then further extended to other food products. This quality sign relied on—and still relies on—a 'standardised technology' attached to a certified standard of specifications that differentiates it from the dominant standard-commodity process routes. In the case of poultry meat, farmers commit to use a slow-growing strain and late age of slaughter (81 days), thus producing meat of ideal texture and a better image (Baeza et al., 2021; Sylvander, 1994). The success of poultry *Label Rouge* has been linked to real higher quality attributes and to production methods that were close to traditional farming practices, in reaction against the standard-commodity products that con-

sumers found tasteless (Sauveur, 1997; Westgren, 1999). *Label Rouge*, as a quality scheme, asserts itself as guaranteeing a homogeneous benchmark of superior quality (Raynaud and Sauvé, 2000). The *Label Rouge* was designed by the first historical approach in the poultry sector that leant on the promotion of superior organoleptic and image-value quality attributes.

A previous study analysed the specifications for *Label Rouge* beef and classified them into four types according to breed and production area (Roche et al., 2000). However, deep change has since occurred in the *Label Rouge* sector and the associated regulation, which is now no longer tied to geographical area. Few studies have examined the links between *Label Rouge* production commitments and quality of animal-sourced foods, and they have only focused on poultry meat (Farmer et al., 1997; Westgren, 1999; Smith et al., 2012). To our knowledge, this has never been investigated for beef. The objective of this study was therefore to analyse how the *Label Rouge* specifications for beef help to shape superior product quality.

The quality of a product is defined by the set of properties that allow it to satisfy the expressed or implied needs of a user (Association française de normalisation, 2015). Here, we used the multi-criteria approach proposed by Prache et al. (2021), who broke down food quality into a set of seven dimensions: commercial, organoleptic, nutritional, safety, technological, convenience and image quality attributes. For beef, commercial quality attributes are grounded on carcass weight and classification under the standardised EUROP grading scheme based on carcass conformation and fatness. Organoleptic attributes reflect characteristics perceived through experience via the senses, typically colour, texture (tenderness and juiciness) and odour-flavour complex. Nutritional attributes are evaluated based on beef nutrient composition and its ability to cover human's nutritional needs. Beef safety attributes are tied to the hazards associated with its consumption (such as pathogenic micro-organisms, chemical residues, environmental contaminants). Technological attributes reflect the suitability of beef for preservation. The convenience attributes connect to its practical characteristics and use value (the time and effort it saves for consumers). Image attributes encompass the ethical, cultural and environmental dimensions associated with how beef is produced and processed and its origin. These latter attributes play a significant role in shaping consumer perceptions of beef and are particularly valued in products with quality signs, such as *Label Rouge*; they are now major drivers (and increasingly) of purchase decisions (Aboah and Lees, 2020).

Material and methods

Structure of *Label Rouge* books of specification

Commitments for *Label Rouge* products are split into two levels. The first level, called 'common production conditions', is generic and applies to a whole sector, such as lamb, veal, beef, duck, or pork. These may be considered as minimal commitments. The second level, the book of specifications strictly speaking, completes them with a set of more restrictive and specific commitments, each specific segmented *Label Rouge* product having the opportunity to exceed these minimal commitments. Common production conditions are designed by INAO, involving the National Committee of *Label Rouge*-PGI-TSG, representatives of certifying bodies and the *Label Rouge* promoting structure *Fil Rouge* (Inter-professional Federation for *Label Rouge*, PGI and PDO meat). Books of specifications are built up for each product by professionals of the sector, with the support of INAO, and they require approbation from the *Label Rouge* National Committee. These two levels (common production conditions, specific book of specifications) prove complementary, as they

follow the same plan with the same organisation. In this paradigm, the 16 *Label Rouge* books of specifications can be seen as variants around a set of ground rules imposed, depending on the specific production conditions implemented (Casabianca, 2018).

Each book of specifications shares the same core structure, as follows:

- i) Description of the *Label Rouge* product including the elements justifying its superior quality, summed up in the 'communicative certified characteristics' section, which correspond to the production specifications put forward in the book of specifications. They serve to promote the *Label Rouge* and as leverage for establishing the superior quality of the meat. The communicative certified characteristics that integrate features establishing a case for superior quality have been listed in each of the *Label Rouge* books of specifications. To illustrate, the *Label Rouge* LA2605 (Parthenaise-breed beef) highlights the breed, slow finishing, and ageing of the meat in its package of communicative certified characteristics.
- ii) Description of the standard-commodity comparator product and elements for comparing it against the *Label Rouge* product. This description can be general and it may vary among books of specifications. For instance, a standard-commodity comparator product may be described as 'dairy type, from any production system, typically aged for between 3 and 5 days'.
- iii) Description of the production methods, such as farming, slaughtering and meat processing practices. These practices are described through a list of criteria that is similar across all the books of specifications. This common-core organisation facilitated comparison of books of specifications.
- iv) Description of the main points to control-check. These are the major criteria to be checked, and for which the standard gives the type of control-check. Criteria correspond, for example, to a breed, stocking density, or feeding plan, matched to a visual, paperwork, or analytical control point. The main points to control-check are recapped and detailed in the quality assurance plans. These items have not been considered in the present study.

Analysis of *Label Rouge* books of specification

We analysed all 16 current books of specifications for *Label Rouge* beef (Table 1). We focused on the certified communicative

characteristics and the commitments, to highlight what the specifications put the most forward (breed, feeding, animal welfare, age at slaughter, type of finition, meat ageing, etc.).

Regarding the commitments, the written elements extracted from the listed common production conditions and the 16 official books of specifications are reported in Table 2. Their organisational structure is similar for all books of specifications. These elements correspond to various criteria (e.g. the breed, the castration and its modalities, the age at weaning, etc.; see column 2 in Table 2) connected to different themes (e.g. birth-to-weaning period, live-stock housing; see column 1 in Table 2) and the corresponding commitment (e.g. for the 'breed' criterion: obligation to use pure-bred and/or crossbred beef cattle breeds for common production conditions, or obligation to use a specific beef cattle breed in certain books of specifications; see columns 3 and 4 in Table 2). The data extracted from the books of specification were gathered in a database in order to allow the comparison of specification criterion by criterion.

For each criterion, we firstly counted the number of books of specifications that make specific commitments, exceeding the minimal commitments of the common production conditions (see column 4 in Table 2). For example, 13 books of specifications specified the breed allowed, whereas three books did not mention any specification beyond that of the common production conditions. For the different criteria, we secondly analysed whether and how commitments were related to the different quality attributes described above, based on scientific expertise and the literature (Table 3). Here, we especially favoured the criteria that are common to the 16 *Label Rouge* specifications and promoted in their communicative certified characteristics and elements supporting quality (Table 1), and we used the same order of presentation as that used in the *Label Rouge* specifications (Table 2). This presentation actually enables to show how beef quality is shaped throughout the production chain.

Results

Transversal analysis of the 'Communicative certified characteristics'

The communicative certified characteristics mainly correspond to the triad of breed, feeding (pasture included) and meat ageing, which are mentioned in most of the 16 books (Table 1). Other characteristics are also mentioned, but less often (in 1, 2 or 3 of the 16 books), i.e. traceability, age at slaughter, and animal welfare. The characteristics establishing a case for superior quality—such as

Table 1

List of *Label Rouge* books of specification inventoried by code number, type of product (meat, offal, or ground beef—fresh or frozen) and defining features.

Code number	Type of product	Specific book title	Communicative certified characteristics and elements supporting quality
LA0199	Fresh and frozen meat and offal	Aubrac, 'fermier'	Breed, Transhumance
LA0274	Fresh and frozen meat and offal	Charolaise	Breed, Feeding (pasture grazing), Beef ageing
LA0294	Fresh meat	-	Breed, Feeding (pasture grazing)
LA0386	Fresh meat	'Fermier'	Feeding (traditional, with linen), Traceability, Beef ageing
LA0389	Fresh and frozen meat, offal and ground beef	Charolaise	Breed, Feeding (pasture grazing), Individual sorting of animals, Beef ageing
LA0511	Fresh meat	Blonde d'Aquitaine	Breed, Feeding (pasture grazing), Beef ageing
LA0804	Fresh and frozen meat and offal	Salers	Breed, Feeding (pasture grazing), Beef ageing
LA0902	Fresh and frozen meat and offal	Blonde d'Aquitaine	Breed, Feeding (pasture grazing), Beef ageing
LA1189	Fresh and frozen meat and offal	Charolaise	Breed, Feeding (pasture grazing), Animal welfare (housing, transport), Reduction in drug use, Beef ageing
LA1297	Fresh meat	-	Feeding (pasture grazing), Animal welfare (housing, transport), Beef ageing
LA1693	Fresh meat	'Fermier'	Breed, Self-sufficiency, Animals in the same farm, Age at slaughter, Beef ageing
LA1791	Fresh and frozen meat and offal	Blonde d'Aquitaine	Breed, Age at slaughter, Beef ageing
LA1891	Fresh meat and offal	-	Breed, Beef ageing
LA1897	Fresh and frozen meat and offal	Gasconne	Breed, Feeding (traditional, pasture grazing), Age at slaughter, Carcass fatness, Beef ageing
LA2288	Fresh and frozen meat	Limousine	Breed, Feeding (traditional, pasture grazing)
LA2605	Fresh meat	Parthenaise	Breed, Slow finition, Beef ageing

Table 2Detailed breakdown of the themes, criteria and specifications underpinning the beef *Label Rouge*.

Theme	Criterion ¹	Specification from common production conditions ²	Specification from the specific Label Rouge books (number of Label Rouge books concerned) ²
Animal characteristics, housing and stocking density	Birth-weaning		
	1	Breed	Beef cattle breeds, purebred or crossbred
	2	Sexual type and age at castration	For males, only steers (i.e. castrated animals) are eligible for the <i>Label Rouge</i> . Age at castration ≤ 12 months
Livestock housing	3	Weaning	Age at weaning ≥ 4 months
	4	Litter and bedding	Tie-stall or free-stall housing: wall-to-wall slatted flooring prohibited, plant-based litter only (except in higher-altitude upland farms if the cowsheds offer the requisite comfort with effluent effective waste and effluent management). Free-stall flooring must be kept clean and dry. Dry and soft litter to ensure optimal comfort.
	5	Type of barn	<ul style="list-style-type: none"> – Tie-stall barn: $\geq 1.80 \text{ m} \times 1.15 \text{ m}$ – Free-stall barn: $\geq 2.50 \text{ m} \times 1.20 \text{ m}$ – Free-stall on deep litter: $\geq 6 \text{ m}^2/\text{LU}$ – Loose-housed: Manger space $\geq 0.7 \text{ m}/\text{LU}$
	6	Herd size at finishing	<ul style="list-style-type: none"> • Tie-stall barn housing authorized only for winter-season finishing (1)
	7	Animal welfare	Permanent access to appropriate watering. Adequate-quality water.
	8	Barn vents/openings	Draft-free ventilation (preferably natural ventilation, otherwise fan-driven air exchange). Housing lit by natural daylight so that the animals can be clearly seen during the day, with lighting possible at night.
	9	Cleanliness/Ongoing maintenance	All livestock barns and buildings cleared out and cleaned at least once/year. For good hygiene practice and better image: buildings, surroundings and access ways all kept tidied, tended and in good repair.
	10	Stocking density	Stocking density $< 2 \text{ LU/ha}$ of main fodder area and > 0.30 hectares of pastures per LU
	11	Time at pasture	Adherence to traditional cycles of switching between outdoor grazing and indoor housing Pasture grazing ≥ 5 months/year
Feeding Grazing and stabling periods	12	Arrangements	The in-barn stabling period can be skipped (100% free-range) if weather conditions allow. However, 100% free-range animals must have access to shelter.
	13	Medication	All prophylactic or therapeutic inputs prohibited.
	14	Feed materials	List of spec-compliant feedstuffs authorized for use in compound feed blends for reproductive herd: cereals and cereals by-products, oilcrops and oilcrop by-products, legumes and legume by-products, tubers, rootcrops and rootcrop by-products, other grains and fruits, forages, other plants, dairy by-products, minerals and derivatives, bacterial fermentation products
	15	Authorized forages and additives	Hay, haylage and silage all perfectly well-conserved. Silage done without added chemical preservatives.
	16	Feed self-sufficiency	Prohibited additives : urea, non-dairy animal-sourced products
	17	Feeding plans	Diet exclusively dictated by beef cattle-herd management system and tightly connected to the pasture-stable cycle.
			<ul style="list-style-type: none"> • Purebred only (13) • Crossbreds authorised (2) • Age at castration ≤ 10 months (2) • Age at weaning ≥ 6 months (2) • Age at weaning ≥ 5 months (1) • Plant-based litter only (15) • Maximum of 30 animals/batch (11) • Maximum of 24 (1), 20 (1) and 14 (1) animals/batch • Maximum of 5 animals/30 m² (1) • All animals can gain access to manger space at the same time (6) • Improved animal welfare (bedding, stress-free handling) (1) • Openings $\geq 1/15$th of floor space area (1) • Insect and rat pest control (at least once a year or after turning out the herd to pasture) (2) • Access ways in good repair, no slurry seep-out (2) • Integration of farm buildings with the local landscape (1) • No land application of sewage sludge or slurries (1) • $< 1.4 \text{ LU/ha}$ (1) • Pasture grazing ≥ 6 months/year (11), ≥ 7 months/year (2), ≥ 8 months/year (1) • Transhumance $> 800 \text{ m}$ and ≥ 4 months/year (1) • Further details concerning access to a watering point or shelter (e.g. serviced springs and upkeep hedging) (3) • Medicated feeds prohibited without veterinary prescription (1) • Antibiotics prohibited unless for veterinary health purposes (1) • Comprehensive and detailed list of prohibited feed additives (15), including a list of prohibited feed materials and additives (soy, palm oil) (4) • Silage-only diet prohibited (4) • Restrictive positive list of spec-compliant forages (3) • Positive list of spec-compliant additives and processing aids (1) • $\geq 50\%$ (2), $\geq 60\%$ (1), $\geq 70\%$ (2), $\geq 80\%$ (2) • Feeding plans are stratified by livestock age-phase (pre-or post-weaning, finishing) and by type of feed.

Table 2 (continued)

Theme	Criterion ¹	Specification from common production conditions ²	Specification from the specific Label Rouge books (number of Label Rouge books concerned) ²
Finishing	18	Finishing type	<ul style="list-style-type: none"> • Maternal milk: unlimited on-demand access in practically all pre-weaning feeding plans, regardless of season (summer/winter). Certain books of specifications extend the suckling period to the end of the first winter or year of life. • Grazing: unlimited on-demand access throughout the grazing season. Some books of specifications add further conditions (e.g. at least 6 months, from 10/05 to 10/11; grazing during the winter-season period). • Dry forages: unlimited on-demand access as a rule, although some books of specifications limit access to dry forages, which they see more as a feed-supplement option. • Conserved forages: authorized, mainly during winter period, within the specified limits. The standards span a wide range of stipulations on use of conserved forages for finishing, and should be adapted to sex and age. • Supplements and concentrates: authorized in practically all the books of specifications, within specified limits, and regardless of cycle period. The stipulations on supplements and concentrates during finishing vary widely and should be adapted to sex and age. One book stipulates that flaxseed must be incorporated into diet for finishing. • Pasture or trough-feeding (strictly or not) (11), including 3 that specify the season
	19	Length of the finishing period	<ul style="list-style-type: none"> • $\geq 1, 2$ or 4 months for strictly trough-fed finishing (7); $\geq 4, 5$ or 6 months (7); ≥ 2 or 3 months depending on animal age (1)
	20	Feeds prohibited for use in finishing	<ul style="list-style-type: none"> • Silage (2) • Conserved forages excluding grass and legumes (1)
	21	Treatments	<ul style="list-style-type: none"> • Silage, haylage and maize (1) • Withholding period extended to 30 days before slaughter, animals free of leucosis/tuberculosis/brucellosis (1)
Pre-slaughter and slaughter			
Pre-slaughter	22	Age at slaughter	<ul style="list-style-type: none"> • Further restrictive specification on age at slaughter (13)
	23	Animal comfort	<ul style="list-style-type: none"> • Pro-welfare-friendly practices (15)
Carcass and meat			
Carcass and meat	24	Eliminative defects	<ul style="list-style-type: none"> • Conformance to breed phenotypes (coat, pigmentation, muscling, etc.) (1) • Good animal health prior to shipment (2) including free of leucosis/tuberculosis/brucellosis (1)
	25	Carcass chilling	<ul style="list-style-type: none"> • Extended electrical stimulation protocol (5) • Progressive chilling, electrical stimulation prohibited (5) • Condensation build-up prohibited (2)
	26	Carcass conformation	<ul style="list-style-type: none"> • More restrictive ("U or R" or "E or U") (3)
	27	Carcass fatness	<ul style="list-style-type: none"> • More specific (stated "R+" and "R=") (3) • More restrictive (2 or 3 only) (5) • Stated fat traits (white-coloured cover fat) (1)
	28	Minimum carcass weight	<ul style="list-style-type: none"> • Minimum and maximum carcass weights (16): • with carcass weights stratified by breed or age of the animal (3)

(continued on next page)

Table 2 (continued)

Theme	Criterion ¹	Specification from common production conditions ²	Specification from the specific Label Rouge books (number of Label Rouge books concerned) ²
Ageing	29	Meat colour	Specified redness (bright, deep, dark or light) (16), including: <ul style="list-style-type: none"> • An even colour (3) • Exclusion of any out-of-spec muscle (2) • 24h or 48h to reach the requisite pHu (2)
	30	Meat pHu	pHu ≤ 5.8.
	31	Carcass trimming	Systematic on-line pH measurement in a muscle according to dress-out
	32	For exceptional conformations	Beef ageing duration potentially shortened for double-muscled or class-E carcass
	33	For grilling cuts and roasts	Beef ageing duration: <ul style="list-style-type: none"> ≥ 10 full days (full side of beef or quarter side) ≥ 13 days (vacuum-packed). Skirt steak and beef fillet have no specified beef ageing duration.
Deep-freezing	34	For braising and boiling cuts	Beef ageing duration ≥ 2 days
	35	Time-interval between slaughter and deep-freezing	Ageing duration to be adhered to before moving to deep-freeze. Freezing prohibited for cuts of beef and offals—only deep-freezing is authorized (down to a -18°C core temperature in no more than 6 h)
	36	Packing and portioning	Specified packing (16), including: <ul style="list-style-type: none"> • Vacuum-packed (8), including packing under modified atmosphere (6) • Product is to be packed on-site in the meat cutting facility (2)

Abbreviations: LU = Livestock units; pHu = ultimate pH.

¹ The criteria are structurally articulated in the same way across all the beef *Label Rouge* production specifications.

² The specifications have been broken down and detailed according to whether they were taken from the common production conditions (column 3) or from the specific books of specifications (column 4). Numbers in brackets give the number of *Label Rouge* books of specifications concerned.

Table 3Effect of each of the various criteria specified in the 16 beef *Label Rouge* books of specification on the beef quality attributes.

	Criterion ¹	Organoleptic	Sanitary	Nutritional	Convenience	Technological	Commercial	Image-value
Animal characteristics, housing and stocking density								
1	Birth-weaning	Breed	x	x		x	x	x
2		Sexual type and age at castration	x	≈				x
3	Weaning							x
4	Livestock housing	Litter and bedding	≈					x
5		Type of barn						≈
6		Herd size at finishing						x
7		Animal welfare	x	≈				x
8		Barn vents/openings						x
9		Cleanliness/Ongoing maintenance		x				x
10	Pastures	Stocking density						x
Feeding								
11	Grazing and stabling periods	Time at pasture	x	x				x
12		Arrangements						x
13	Feed rations and supplements	Medication		x				x
14		Feed materials	x	x	x		x	x
15		Authorised forages and additives	≈	x	x			x
16		Feed self-sufficiency						x
17		Feeding plans	x	x				x
18	Finishing	Finishing type	x	x				
19		Length of the finishing phase	x			x		
20		Feeds prohibited for use in finishing	x	x				x
21		Treatments		≈				x
Preslaughter and slaughter								
22	Preslaughter	Age at slaughter	x	x				
23		Animal comfort	x			x		x
Carcass and meat								
24	Carcass and meat	Eliminative defects	x	x		x		
25		Carcass chilling	x	x		x		
26		Carcass conformation	≈				x	
27		Carcass fatness	x		x		x	
28		Minimum carcass weight	x				x	
29		Meat colour	x		≈		x	
30		Meat pHu	x	x		x		
31		Carcass trimming					x	
32	Ageing	For exceptional conformations	x				x	
33		For grilling cuts and roasts	x					
34		For braising and boiling cuts	x					
35	Deep-freezing	Time-interval between slaughter and deep-freezing	x	x				
36		Packing and portioning	x		X	x		

x indicates there is a quality-trait effect, ≈ indicates there is non-significant or unconfirmed effect.

Abbreviation: pHu = ultimate pH.

¹ The criteria and their numbers match the criteria set out above in Table 2.

breed or time at pasture—are very often associated with organoleptic quality attributes such as ‘taste of the meat’, ‘light marbling’, ‘fine texture’, ‘distinctive flavour’. In addition, the feeding plan is linked with tradition, particularly adherence to natural cycles (outdoor grazing–indoor housing cycles and periods).

Transversal analysis of the commitments of *Label Rouge* beef specifications

The books of specifications refer to 36 criteria: from animal type (breed, sexual type, age at slaughter) to on-farm practices (feeding regime, animal welfare, use of veterinary drugs, etc.), the environment (stocking density, feed self-sufficiency, type of building, etc.) and on to transport, lairage and slaughter, as well as processing of the meat (Table 2). For some criteria, the common production conditions are considered as sufficient, only few books of specification being more restrictive. For other criteria, on the reverse, many books of specification are more restrictive than the common production conditions.

Criteria considered as sufficient in the common production conditions concern several aspects of the meat production chain.

Castration is one of them: only females or castrated males are eligible for *Label Rouge*, non-castrated males being prohibited. They also cover on-farm practices, animal welfare and the environment, such as prohibition of wall-to-wall slatted flooring and obligation of plant-based litter use. Proper ventilation and permanent access to water are also requested, and stocking density level is capped at two livestock units (LU) per hectare. Time in transport from farm to abattoir is capped at 24 h, and most of the books also include specifications dealing with preslaughter welfare (such as harmless flooring and walls, access to water, etc.). According to the common production conditions, the meat eligible for *Label Rouge* labelling only comes from carcasses with good conformation (E-U-R in the European system). Carcass fatness score should be two or three, i.e. the carcass should be neither too fat nor too lean. Six books are more restrictive by imposing minimum acceptable conformation cut-offs (only U-R or E-U) or stating specific conformation grades (scored R+ and R=). The common production conditions feature two other key criteria: ultimate pH of the meat (pHu) is to be ≤5.8 and beef ageing period is to be at least 10 days for grilling cuts (except for skirt steak and beef fillet) and 2 days for boiling cuts.

Packaging is often specified: eight books allow vacuum-packing and six accept modified atmosphere.

Regarding criteria with many specifications being more restrictive than the common production conditions, one of the most specified is the breed. *Label Rouge* only allows beef cattle breeds, and the majority of the books of specifications prove tighter by only authorising certain breeds: 11 of the 16 books allow only one breed, and two books allow specific breeds. The *Label Rouge* also specifies minimum (and sometimes maximum) age at slaughter according to sexual type, and 13 of the books of specification go further than the common production conditions: to illustrate, minimum age at slaughter for steers jumps from 30 months under the common production conditions to 36 months in two books of specifications. Regarding on-farm practices, pasture feeding is the rule during the grazing period and duration of the grazing period must be at least 5 months; but 11 books of specifications go further (6–8 months). Feeding regime is highly detailed: in addition to the common list of authorised ingredients, each book of specifications has developed its own feeding plan for the different stages of animal life and seasons of the year. Calves are suckled by their dam until at least 4 months of age, two books of specifications going further (5 or 6 months). Dried forages can be used all year round, but fermented forages and supplements are restricted in most of the books of specifications. The diet to be used for the end of the finishing period is often described for each sexual type and animal age or periods of the year. Maize silage is restricted in four books of specifications and prohibited in a further 3; flax is mandatory in one case. Age at slaughter is crucial and well-defined. Each of the 16 books specifies the minimum and maximum carcass weight for each animal type (age, breed, sexual type), which is consistent with the commitments regarding the breed and the age at slaughter, and the requisite meat colour.

How do the books of specifications' commitments connect to beef quality attributes?

Animal characteristics. The breed of the source-animal is a major criterion of the *Label Rouge*. Most of the books of specifications are built around a beef cattle breed (three for Charolaise-breed, two for Limousine-breed, two for Blonde d'Aquitaine-breed, and one each for Bleu Blanc Belge-breed, Salers-breed, Aubrac-breed, Gasconne-breed and Parthenaise-breed). This choice vectors a strategically clear and strong identity (Casabianca, 2018) that is conducive to good image-value quality attributes, as French livestock farmers—like the wider French beef sector and French consumers—are strongly attached to the livestock breed (Kondjoyan and Picard, 2019). It has a less clear-cut effect on organoleptic quality attributes, except colour (Ripoll et al., 2018). Bonny et al. (2016) showed that a number of meat pieces had better eating quality when sourced from 'dairy' breeds than 'beef cattle' breeds, thus confirming earlier findings by Jurie et al. (2007) who showed greater flavour in meat from Holstein vs Salers-breed cows. Note that 'dairy' breeds and 'Anglo-Saxon' genotypes, that mature earlier than mainland-Europe beef cattle breeds, yield redder meat at a given age (Lebret et al., 2015). Conversely, dairy breeds have a lower proportion of muscle in the carcass at a given carcass weight than beef cattle breeds (Aumaître, 1999). Breed may also modulate the meat fatty acid composition (nutritional attributes) via differences in intramuscular fat (IMF) content (De Smet et al., 2004; Mannen, 2012). Studies on the sexual type factor have established beef from females and castrated males are more tender than beef from intact males (Oury et al., 2007; Bonny et al., 2016). Beef from castrated males also has superior juiciness and flavour due to its higher IMF content (Salifou et al., 2013). The effect of sexual type can be explained by the level of testosterone production; in

castrated males, the lower testosterone production is associated with greater fat deposition (Venkata Reddy et al., 2015). Excluding intact males from the *Label Rouge* scheme is therefore fully justified from the point of view of beef organoleptic attributes. However, castration has negative effects on image-value attributes. Here, *Label Rouge* specifications favour beef organoleptic attributes at a penalty to image attributes. The commitment regarding calf suckling duration (i.e. weaning age) refers to image-value quality attributes.

Livestock housing and stocking density. The commitments regarding livestock housing, farm building and barn characteristics (appearance, ventilation, etc.), on-farm animal welfare and stocking density all refer to image-value quality attributes. Caps on stocking density favour pasture grazing, which is a key communicative characteristic of beef *Label Rouge* (Table 1).

Feeding. The commitments around adherence to traditional outdoor grazing—indoor housing cycles and periods, level of feed self-sufficiency, and caps on stocking density (Table 2) refer to all dimensions of image-value quality attributes (animal welfare, close link to the territory, ecosystem services provided by grasslands—such as carbon sequestration, biodiversity, landscape and cultural identity—) (Hercule et al., 2017; Peyraud, 2020). Pasture grazing is a core commitment in *Label Rouge* specifications (Table 1). Beyond the beef image-value attributes, it improves the nutritional quality attributes of the meat via higher polyunsaturated fatty acids/saturated fatty acids and n-3/n-6 ratios (Venkata Reddy et al., 2015; Berthelot and Gruffat, 2018), this improvement being all the more important as the grazing period is long (Noci et al., 2005). It also involves greater and more intense physical activity, which are both factors that increase the tenderness and juiciness together of the exercised locomotor muscles (Oury et al., 2007; Gangnat et al., 2017). In addition, pasture herbage is an important source of antioxidants, which counter lipid oxidation and therefore contribute to meat shelf life, a convenience quality attribute (Mancini and Hunt, 2005). Note, however, that pasture finishing is by no means compulsory in any of the *Label Rouge* books of specifications. Conversely, one book does require linseed into the finishing-phase ration, which improves the nutritional properties of the meat (by increasing omega-3 fatty acid content; Scollan et al., 2014; Berthelot and Gruffat, 2018). Some *Label Rouge* books of specifications restrict or even prohibit the use of fermented forages in finishing-phase diet. Bilik et al. (2009) showed that the beef fatty acid composition was better in animals fed grass than in animals fed maize silage, with no difference between beef fed pasture grass or grass silage. This commitment thus also refers to image-value quality attributes (degree of intensification of the livestock farming system).

Preslaughter and slaughter. Age at slaughter, which is framed by *Label Rouge* specifications, has an influence on the beef organoleptic quality attributes. Higher age at slaughter leads to redder meat (Micol et al., 2010; Lebret et al., 2015) with less tenderness (Bonny et al., 2018a). Beef from older animals is less tender compared to beef from young animals (cull cows vs heifers, and intact or castrated males aged 33 vs 12 or 24 months; Lebret et al., 2015). Venkata Reddy et al. (2015) identified heifer beef as having superior characteristics in eating quality and a better healthy composition in fatty acids than steer, cow and bull. However, in cull cows, there is no age-difference effect (4 vs 9 years of age) in tenderness of the meat (Lebret et al., 2015). A decline in tenderness scores only really emerges when pushing the age gap to extremes, such as 11 vs 5 years of age for Charolaise-breed cows (Oury et al., 2007; Bonny et al., 2016). *Label Rouge* caps age at slaughter for cull cows at 10 years, thus minimising any animal age-driven risk for tougher meat. Flavour of the meat increases with animal age, which stems from the age-increasing IMF levels (Lebret et al., 2015).

The preslaughter and slaughter conditions are a hugely important factor in beef quality, as they can affect the safety, organoleptic, technological and image-value quality attributes of the meat (Terlouw et al., 2015). The *Label Rouge* books of specifications consequently attach a great deal of importance to preslaughter and slaughter conditions by specifying pro-welfare provisions that start on-farm and continue through time in transport (which they cap to a maximum) and at the abattoir. All of these commitments guarantee a production process that is favourable to beef quality (Flores et al., 2008; Terlouw et al., 2015). The *Label Rouge* sign does also mobilise some outcome-based requirements. Indeed, only carcasses with a fatness score between two and four and meat with a pHu < 5.8 pass as eligible for the label. These measures serve to eliminate over or under finished animals and dark-cutting meat that consumers find unappealing and that will cook out tougher and have a shorter shelf life (Ponnampalam et al., 2017). Furthermore, each *Label Rouge* book of specifications sets its own meat colour criteria, such as 'bright', 'deep', 'dark' or 'light' red. The beef ageing duration is an absolutely pivotal process-route factor for tenderness (Juarez et al. 2012; Legrand et al., 2016).

Analysis of the links between the specifications and the seven dimensions of quality attributes showed that organoleptic and image-value quality attributes are the most concerned by *Label Rouge* specifications (Table 3). Twenty two of the 36 criteria were judged as having a link with organoleptic quality attributes, among which breed, sexual type, feeding plan (and pasture feeding), age at slaughter, preslaughter handling conditions (particularly time in transport), meat pHu and ageing duration (Table 3). Organoleptic attributes are therefore shaped all throughout the chain, including the last transformation step. 19 of the 36 criteria were judged as connecting with image-value attributes (Table 3), among which breed, type of building and flooring, stocking density, pasture grazing and type of feedstuff in the feeding plan, animal comfort in the hours before slaughter. Image quality attributes are thus mainly shaped by on-farm commitments. Safety quality attributes are shaped all throughout the chain (on-farm and slaughtering practices, carcass and meat processing). Nutritional quality attributes are not part of the *Label Rouge* definition but are nevertheless shaped by some of the commitments: nine criteria, such as breed and feeding plans based on pasture grazing, relate to these attributes (Table 3); they are thus mainly linked with on-farms factors, especially feeding. Convenience quality attributes are part of the communication package for *Label Rouge* marketing, but only one criterion defining type of packaging was found to relate to this quality attribute (Table 3).

Discussion

The Label Rouge constructs quality by mobilising commitments throughout the beef production process

Here, we surveyed and analysed the entire set of common production conditions and books of specifications under the *Label Rouge* for beef, and identified their linkages with the core quality traits of beef. Some of these specifications are singled out as what are called 'communicative certified characteristics'; they refer to three main criteria—livestock breed, animal diet, and beef ageing duration—that essentially modulate organoleptic and image-value quality attributes. Our analysis of the linkages between commitments stipulated in the books of specifications and meat quality attributes further finds that the *Label Rouge* clearly prioritises organoleptic and image-value quality attributes. The choices among the specifications for the production of *Label Rouge* beef are therefore in line with the goal of delivering superior quality through organoleptic and image quality attributes.

The regulations governing *Label Rouge* certification states that *Label Rouge* products have to consistently maintain superior quality in comparison with equivalent standard-commodity products. Consequently, *Label Rouge* has to annually check the constancy of its superiority, and if the standard products improve, the *Label Rouge* has to improve in response. Even though the standard-commodity comparator product is described in the books of specification, the description remains broadly generic and non-restrictive (beef may come from beef cattle, dairy cattle or mixed-purpose breeds), and could be made more specific.

As demonstrated in this study, *Label Rouge* specifications mainly concern organoleptic and image-value quality attributes. The scientific literature nevertheless showed that some of the practices not yet addressed under *Label Rouge* specifications could serve to further improve these quality attributes. For instance, pelvic hanging of the carcass can improve beef organoleptic quality attributes (Bonny et al., 2018a). Castration, although authorised, has negative effects on image-value attributes, and the specifications fail to detail when and how castration is practised; this practice could ultimately be restricted or even prohibited (Bonny et al., 2018a). Specifications could also be expanded further to better encompass convenience quality attributes.

Which interest to associate the Meat Standards Australia approach?

Some publications suggested that the Meat Standards Australia (MSA) eating quality grading system, developed in Australia for beef and currently being tested in Europe (Legrand et al., 2016), may support branded products, including the beef *Label Rouge* (Hocquette et al., 2011; Bonny et al., 2018b). *Label Rouge* and MSA are indeed both cuts based labelling and consumer focused. The implications of such a suggestion must be carefully considered. Actually, the reputation of *Label Rouge* for superior quality of food is well established, and it has been shown that the value of a quality sign diminishes if it is accompanied by another sign on the same product (Hassan and Monier-Dilhan, 2006). More generally, Bryla (2017) highlighted that the mixing of quality signs, labels, mentions, on product packages, leads rather to confusion than constitutes an indication for buyers.

First, the key quality attributes differ between *Label Rouge* and MSA. If both approaches focus on organoleptic attributes, image-value attributes, which are now major drivers of purchase decisions (Aboah and Lees, 2020), are also key quality attributes for *Label Rouge*, whereas not for MSA. Moreover, the two approaches are structurally very different. *Label Rouge* constructs quality essentially via production/transformation process commitments (animal characteristics, farming practices, transport practices, beef ageing practices, etc.) affording superior organoleptic and image-value quality attributes, whereas the MSA system is essentially grounded in outcome-based requirements. The few outcome-based requirements for *Label Rouge* concern meat pHu and colour, and annual sensory testing to check that assurances that the superior quality of *Label Rouge* meat over standard-commodity meat is maintained. For its part, the MSA system features few production process commitments: only on-farm requirements governing nutrition and welfare in the two weeks before slaughter, and preslaughter protocols to minimise animal stress (Bonny et al., 2018a; Hocquette et al., 2020). One final point for discussion is whether one approach more reliably qualifies the organoleptic quality of the beef produced. Both systems mobilise the same common factors of variability in organoleptic quality attributes (animal genetics, sexual type, carcass weight, meat pHu and ageing duration) or factors that are practically equivalent (animal age for *Label Rouge* vs ossification, as an indicator of animal physiology maturity, for MSA). Some of the factors mobilised in the MSA system are not mobilised in the *Label Rouge* scheme as they involve practices that

are either banned in Europe (use of hormonal growth promotants) or are not relevant in Europe (carcass hanging method). Conversely, some of the factors mobilised in the *Label Rouge* scheme are not mobilised in the MSA system as they mainly involve image quality attributes (breed differentiation, calf suckling duration, adherence to traditional outdoor grazing–indoor housing cycles and periods, level of feed self-sufficiency, stocking density, etc.). However, given how the organoleptic quality attributes of beef are inherently subject to broad variability (even with similar on-farm, slaughter and postslaughter conditions), one can fear that the *Label Rouge* approach could end up endorsing beef that is not superior quality and excluding beef that is superior quality. Nevertheless, the MSA system is also exposed to this risk, as it qualifies beef cuts based on a predictive model that carries some degree of predictive error and that uses certain variables that are scored by visual assessment, which may introduce inaccuracies and biases (Hocquette et al., 2020). The proportion of beef samples allocated to the correct quality grades ('unsatisfactory', 'good every day', 'better than every day', and 'premium') using the MSA grading scheme thus came to 68% (Bonny et al., 2018a). This system-vs-system (*Label Rouge* vs MSA) comparison has however never been specifically studied. So, it remains unclear which interest the MSA system could have for *Label Rouge*. This could explain why the *Label Rouge* sector was not receptive for using it (Hocquette et al., 2011).

Conclusion

Label Rouge stands out in the European quality sign landscape: it is only recognised in France, and is defined in the regulations as 'a superior level of quality'. Analysis of the different beef *Label Rouge* production specifications has shown how this quality-sign constructs quality—largely in its organoleptic and image-value quality attributes. It mobilises pivotal factors for shaping organoleptic and image-value quality attributes at the various stages in the chain, from choice of animal type through to ageing of the meat. The *Label Rouge* imposes a series of producer commitments at the various steps in the process route (choice of breed, length of the grazing period, animal welfare, transport and lairage conditions, how long the meat is aged), and successive sortings are carried out on animals, carcasses and meats which may qualify for the quality sign. The *Label Rouge* scheme offers an example of a quality management tool that mobilises commitments throughout the production process and that explicitly links its standard-compliance specifications to core meat quality attributes.

In 2017, at the request of the French Ministry for Food and Agriculture, French operators in the animal-sourced food industry drew up sectoral plans designed to better account for societal and environmental concerns, chiefly by upgrading product quality. The sectoral plan for French beef sets out to better meet more qualitative consumer expectations (organoleptic and image-value quality attributes), highlighting the need for new product quality indicators. The sector endorses a move to write a minimum set of organoleptic criteria into the books of specifications for all official quality signs. The *Label Rouge*, which shapes product quality throughout the value chain, offers a benchmark on how to make this valued-adding move.

Ethics approval

Not applicable.

Data and model availability statement

None of the data were deposited in an official repository. The data that support the study are public.

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Declaration of interest

None.

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