

Animal identification practices

Animal identification systems, to the extent practicable, should be in place at primary production level so that the origin of meat can be traced back from the abattoir or establishment to the place of production of the animals.

Source: FAO/WHO, 2004.

INTRODUCTION

Livestock identification is essential to modern farming and underlies all successful management. Various types and methods of identification have been developed for application under different circumstances.

In the earliest times, branding was used to associate animals with their owners. Many pastoral tribes developed sophisticated systems of identification based on skin colours and patterns.

The need to identify an animal in order to track its path through the production chain and eventually into food products – known as traceability – has become central to many identification systems in recent times.

THE RATIONALE FOR IDENTIFICATION

There are two main reasons for putting identification marks or devices on animals: proof of ownership and management/traceability.

Establishing proof of ownership

Since the earliest of times, people have sought means of identifying livestock in order to place their mark of ownership on them. Livestock recovered after theft could be returned to their

rightful owner, and the person in whose hands they were wrongfully found could be prosecuted.

Hot branding

Branding animals (Photo 3.1) with hot irons has been in use for some 4 000 years. While placing a permanent mark on the animal, branding has several disadvantages:

- Size limitation means that the number of symbols that can be put on to the animal's skin is limited and individual identification cannot be effected.
- Branding damages and devalues the animal's hide – the more prominent the mark, the greater the damage and the financial loss.
- A poor branding technique or the use of ambiguous symbols negatively affects readability of the brand. The use of series of coded symbols as is current in modern practice renders readability difficult.
- "Blotching" of brands – a technique of overbranding used by stock thieves – easily renders brands unreadable.
- Normal growth of the animal distorts brands applied at a young age, so that by the time the animal reaches adulthood, the brand is no longer legible.
- Growth of hair, especially the forming of a long hair coat during winter, can often make brands almost invisible.
- Different stock owners may – intentionally or unintentionally – use the same or similar brands, thereby causing confusion.
- The position of brands on the animal – usually placed at the lowest possible points on the limbs to minimize damage to the hide – also makes reading them difficult, especially when animals are standing in pens, and the structure of the pen obscures the view.
- The fact that branding is left to the owner of the animal means that brands, even within the same herd, vary greatly in appearance and readability. Brands can be copied illegally and used by others. Lack of central control over the use and application of brands underlies many of the problems experienced with their use.
- Welfare questions have also begun to be raised with respect to the use of brands. The fact that branding causes pain and distress can no longer be ignored.



R. PASKIN, MEAT BOARD OF NAMIBIA

PHOTO 3.1

Avoid: unreadable cattle brands in Namibia – branding cannot be used for the clear and unambiguous identification needed for modern traceability

Despite the obvious disadvantages of branding, the technique remains cheap and for this reason it is still used to effect owner identification, especially in developing countries. If brands still have any use at all, it is to identify an animal's owner. They cannot be used to identify an animal for the purposes of modern management and traceability. Where there is currently no feasible alternative to hot branding for identification of animal ownership, the standards outlined in Box 3.1 should be rigorously adhered to.

Cold branding

Cold branding, using liquid nitrogen to cool an iron to extremely low temperatures for the purpose of marking an animal, has all the disadvantages of hot branding – except that it is presumed to be less painful. It is also expensive and difficult to apply, and out of the reach of poorer farmers.

Tattooing

The use of tattoos has as its underlying philosophy the identification of the animal's ownership, as is the case with branding. There is no central control over the application of tattoos, the number of symbols that can be used on any individual does not enable individual identification and – most importantly – readability presents a great problem. Animals are normally tattooed inside their ears, which

means that an animal has to be physically caught and examined, first to establish whether it has been marked at all, and second to attempt to make out the symbols that have been used in the tattoo. These difficulties render tattoos usable only for ownership confirmation. Another disadvantage comes with identifying successive owners – whereas an animal may be branded at several places on its body to mark several successive owners, only two ears are available for tattoo marks.

Management and traceability

The need for identification of stock has evolved. In many circumstances, confirming ownership is no longer the central need. Animals themselves need to be identified in order to record their progress in terms of weight gain, fertility, susceptibility to sickness, etc. and thus facilitate breeding selection and management. Identification of animals is also necessary when carrying out diagnostic procedures (e.g. testing for brucellosis) so that animals that show up serologically positive can be culled.

More recently, the need has arisen to identify animals for the purposes of traceability. Where a problem is detected in a live animal far along the production chain, or even in meat derived from the animal (e.g. the detection of potentially harmful tissue residues or a disease such as bovine spongiform encephalopathy [BSE]), it has become necessary to trace backwards along the production chain to establish when and how the problem occurred. Steps can be taken to correct the problem, and give reassurance to consumers that quality control of the production chain is in place.

Various techniques for placing identifying marks on or within an animal's body have been developed for effecting identification that meets these management needs.

Visual tagging

Tagging animals – usually with plastic tags affixed to their ears – has been in use for decades. Many farmers have used handwritten tags as a management tool. Durability of these tags has long been an issue, especially as the tags often fall out or become bleached and unreadable.

Great strides have been made in the production of tags, however, and tamper-proof “dual tags” that can be printed with laser

Box 3.1 Hot branding

Where branding is used for proof of ownership, the following standards should apply:

- The characters/symbols used should be large and clear (at least 7 cm high).
- Characters should be alphanumeric and not pictorial, for ease of storage on a database register.
- The brand should be placed at a prominent place on the hide, e.g. upper thigh, rump or shoulder.
- Animals must be firmly restrained for branding.
- The branding iron must be heated to red heat and pressed to the animal's skin for 3–5 seconds.
- The iron must be re-heated to red hot before use on another animal.
- Owner brand symbols should be registered with a central authority.



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PHOTO 3.2

GOOD PRACTICE: calves with double ear-tagging in the United Kingdom: tamper-proof pre-printed tags are widely used for animal identification



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PHOTO 3.3

GOOD PRACTICE: animal with double ear-tagging in Italy

printing technology are now available that have a high retention rate and remain readable for many years (Photos 3.2 and 3.3). Tags can easily be inserted by most farmers using an applicator that correctly fits the tag to be used.

These tags can be printed with alphanumeric codes several characters long which will effectively and uniquely identify the individual

animal, and are clearly and quickly readable from a distance of around 2 m. The tags can easily last the life of a slaughter animal and can be used to register its progress at all the steps along the production chain. Within their own management systems, farmers can easily establish databases based on such identification to monitor progress in terms of other parameters such as weight gain and feed conversion.

Tags have been developed in various shapes and sizes for different species of animal, with larger plastic tags in vogue for cattle and buffalo and small tags – either plastic or metal – being more suited to use in sheep and goats.

Alphanumeric codes may be used on these tags and are easily stored in computerized databases. The main disadvantage here is that the recording of an animal's identity as it moves along the production chain must be done manually, and may be subject to errors in transcription.

Bar-coded tags

The advent of bar codes has brought about further progress in ear-tag development. Tags printed with bar codes have all the advantages of visual tags in terms of retention and readability – except that reading and recording are effected electronically through the use of a bar code scanner or reader. The possibility of human error is thus eliminated. However, there is one problem – the presence of dirt on a bar code often renders it unreadable, meaning that the tag may have to be physically cleaned before it can be read.

Another obvious disadvantage is the need for an electronic infrastructure – a system of computers linked to scanners – for bar code usage to be effective on a wide scale. The financial outlay associated with bar code usage thus limits its use to countries where the needed infrastructure can be afforded and maintained.

Bar coding is usually combined with visual coding.

RFID tags

The latest development in identification – the use of radio frequency identification devices (RFIDs or microtransponders) – has advanced the use of technology in livestock identification still further than that of bar codes. Transponders are available in several types that have different



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PHOTO 3.4

A variety of tags. Clockwise from top left: tag with microtransponder (in the female half of the tag); bar-coded fold-over sheep tags; fold-over sheep tag in locked position; male/female visual tag for a bovine

capabilities in terms of programmability (the more sophisticated chips can actually be used to record information about the animal in which they have been placed) and in terms of the distance from which they are readable. The cheapest chips can be used for pricing items in supermarkets and are readable by a scanner from a distance of only a few centimetres, while more powerful versions can be read electronically from several metres.

Microtransponders have the same disadvantage as bar codes, however. There is a need for an expensive electronic infrastructure to make them work, and the transponders themselves are very expensive. An ear tag containing a transponder may cost two or three times more than a simple visual tag. RFIDs may break down and become unusable, although this happens in a very small percentage of cases. In the final analysis, transponders represent one of the greatest strides made to date in relatively easy identification of livestock.

RFID implants

The subcutaneous implantation of microtransponders is done with a device not unlike a large hypodermic syringe, and it should be able to be carried out by many farmers. These implants are normally placed beneath the skin of the ear.

Apart from the costs and other disadvantages that apply for tags containing microtransponders, they may also migrate under the skin, meaning that they will have to be

“searched for” in many cases. Outwardly, the animal bears no sign that it has been marked with a transponder. This may be of great help in catching livestock thieves, but it means that every person wishing to establish the identity of an animal has to carry an electronic scanner.

Nevertheless, the use of subcutaneous transponders makes it possible to identify livestock invisibly and permanently in a more reliable manner than branding or tattooing could ever do.

RFID boluses

Microtransponders can also be placed inside ceramic boluses which can be dosed to young ruminant animals and remain permanently in the reticulum. While this permanently and invisibly identifies the animal, the dosing procedure may be difficult and out of the reach of many farmers. Boluses are notoriously expensive.

Intrinsic identification

Various other means of identification – the recording of unique retinal patterns inside the eye, noseprints, genetic fingerprinting of animals – are all in their pioneering stages. All require complex and expensive apparatus for the testing/recording of each individual, together with the establishment of sophisticated databases. While these methods are all more foolproof than those listed above, they are not at this stage regarded as practical and cheap enough for day-to-day use on the farm.

A summary of the characteristics of the different livestock identification systems is presented in Table 3.1.

BASIC REQUIREMENTS FOR AN IDENTIFICATION SYSTEM

Having been through an overview of the need for identification, as well as the means or devices available, it now becomes pertinent to note the requirements of an identification system. Knowing what is needed, as well as what resources are available, will eventually lead to the choice of an appropriate means.

Ideally, an identification system should meet the following requirements:

- The means of identification should be clear and easily readable (visually or electronically).

TABLE 3.1 Comparison of livestock identification systems

ID type	Readability	Cost	Durability	Transcription	Central control
Hot branding	poor	cheap	good	manual	not possible
Cold branding	poor	expensive	good	manual	not possible
Tattoo (in ear)	very poor	cheap	good	manual	not possible
Ear tag (visual)	good	reasonable	fair	manual	possible
Ear tag (bar code)	good (if clean)	reasonable	fair	electronic	possible
Ear tag (transponder)	excellent	expensive	good	electronic	possible
Subcutaneous transponder	excellent	expensive	good	electronic	possible
Intra-ruminal transponder	excellent	expensive	good	electronic	possible
Genetic methods	difficult	expensive	good	complex	essential

- The identification used must be centrally produced and controlled so as to establish a broad norm or standard in terms of quality and readability and eliminate human error as far as possible. Achieving uniform quality throughout is essential.
- The means of identification should not be easy to copy (to prevent forgery) and should not be transferable from one animal to another (to prevent theft of identification and fraud). This means that the tag, transponder, bolus or any other means used should physically break and become unusable should an attempt be made to remove it from one animal and place it on another. Central production of the device by sophisticated means will also place copying it out of the reach of the average person.
- The means of identification should also be durable – i.e. capable of remaining on or in the animal for a good length of time. This may mean from birth to slaughter or, in the case of dairy animals, for the entire productive life of the animal. Practically, for ear tags, this means that a high retention rate is required.
- The means of identification should not cause pain or discomfort to the animal, should not damage the hide or the meat, and should not become a portal of entry for infection. It should also not contaminate the meat in any way.
- The form of identification should be easy to apply to the animal and not require expensive or sophisticated equipment; the identification itself should also not be excessively expensive.
- Effective use of the identification system should be on a wide scale but not require an infrastructure beyond the means of the farming community or country that is using it.

MAKING THE RIGHT CHOICE

Given that this publication is aimed mainly at farming communities in developing countries, it now becomes possible to begin making an evaluation of some of the methods available against the background of country needs.

Identification is now associated not only with management needs, but also with market requirements. New standards in terms of traceability of the animal and its products are now becoming the norm, increasing the need for individual identification. Increasingly sophisticated veterinary disease surveillance and control measures also require identification based, if not on the individual, at least on the group.

Brands and tattoos, with all their attendant disadvantages, should be used only where there is no current feasible alternative for identification of animal ownership, and should be phased out as soon as possible. Methods based on genetic characteristics (amino acid sequencing, noseprints, etc.) can also be discounted for developing farming communities on grounds of cost.

This leaves tags in their various forms, and the various forms of microtransponder. While the best methods will boil down to a tag-and-transponder combination (with the tag in the ear and transponder in the tag, under the skin or in the rumen), these will be expensive. The technology is tried and tested, but costs may be excessive.

The most cost-effective option for most developing countries will be either a combination of visual and bar codes on tags, or visual ear tags alone.

It goes without saying that the tags will need to be centrally produced and distributed in

order to exercise the maximum control over the identification system and ensure quality norms; they will also have to be constructed so as to be tamper-proof. In practice, this may mean the use of a “male–female” tag combination where the two halves of the tag lock into each other, or the use of a folding tag where two parts of the same tag fold over and lock into each other.

Farmers are more likely to opt for larger plastic tags for cattle or buffalo, while smaller folding aluminium or bronze tags are likely to be chosen for sheep or goats. Small button-type plastic tags may be popular for pigs, and folding metal tags work well for ostriches.

The requirements of the market and the farming community need to be combined with economic and practical considerations when making the choice. It is important, however, that standards not be relaxed in such a way as to compromise the integrity of the system. Using cheap tags which fall out, or allowing farmers to write their own tags, or using cheap “reject” transponders with a high failure rate will undermine an identification system and defeat its purpose.

ESTABLISHING A CENTRAL REGISTRY

Aside from the technical issues surrounding the methods of identification, there is also the need to establish a registry where codes relating to livestock identification can be stored. An institution that registers identification marks or codes provides a central reference point that enables the origin of an animal to be established and determines means and standards for identification.

Functions of a central registry

The organization charged with keeping records of livestock identification would be under state supervision (if such identification were mandatory) or under the control of a private organization (e.g. an agricultural union) if the identification scheme were voluntary and private. Such a body would have some or all of the following functions:

Creation and maintenance of a register of identification codes of livestock

A comprehensive register listing all identification codes in use, linking them to the

animals, their owners and the properties/holdings on which the animals are kept.

Creation and allocation of codes

Livestock owners would be required to apply for codes with which to identify their stock; the registry would allocate these codes so that animals or groups of animals would be uniquely identified. This would eliminate the possibility of different livestock owners using the same identification codes.

Determining standards and methods for livestock identification

The central registry would also set the standards and specifications for the means of identification to be used, e.g. if ear tags were to be used, the registry would determine the type, size, colour and coding (alphanumeric, bar) to be used.

Other issues to be addressed would be the age at which identification is to be applied to an animal (at birth, at weaning or on leaving the farm of birth); and the level of identification preferred (group identification, where all animals wear the same identification mark, or individual identification, where each animal is assigned a unique identity number).

Control of distribution of identification devices

There should be a mechanism to control or channel the ordering of approved identification devices from the farmer to the manufacturer and back to the farmer to ensure that the correct identification codes are used as determined by the registry and that standards are adhered to.

The farmer would order a number of devices, which he/she would then assign to the animals to be identified; the code given to each animal would, in the case of individual identification, be reported to the registering authority. The authority would have a record of the identification codes allocated to the farmer, combined with a list of codes given by the farmer to individuals.

Structuring identification codes

How codes are structured depends on the type of device used and the level of identification required. When a system uses alphanumeric visual coding or bar coding, there is a fair

amount of latitude in terms of how codes can be structured, which may affect the ease with which a system works.

Should identification be required only at group level, and the group to be identified is the group or herd to which an animal belonged immediately prior to slaughter, the system can be very simple. A code can be structured so that a part of the code, for example, designates the district where the herd is kept, another part designates the farm, and another part the owner (if the farm has more than one owner). Should the identification system require individual identification of the animal, a final component of the code could identify the individual animal (Box 3.2).

Where visual coding is used, and code symbols are widely known, the origin of an animal or group of animals would be easily recognized (at least to district level) without needing to refer to the central register.

Where individual identification is required for the entire life of the animal, and there is a possibility that the animal will move to a number of different holdings during its lifetime, it matters little that the identification code be structured in a particular fashion. A code designed to designate a particular farm becomes obsolete once the animal is moved. This is particularly true where unique digital codes are

pre-programmed into microtransponders by their manufacturers; structuring codes in a specific way is then not possible.

Creating a register

A register of codes could be either manual or computerized. Where a relatively small number of farms are involved, and identification to herd level only is required, a manual system would present few problems. However, where a large number of herds are involved, and particularly where individual identification is needed, the use of a computerized system is unavoidable.

Software for such registers is commercially available, but often at excessive cost. For developing countries, it is usually far cheaper (and simpler) to commission the programming of a system tailored to local needs.

An identification register should meet the following minimum specifications:

- The register should contain a comprehensive list or database of all codes issued and the names of the approved livestock owners to whom they have been issued.
- The register should also contain a list of all properties or holdings owned by the farmers to whom identification codes have been allocated.
- There must be a system of cross-referencing to enable linkage of animals and their

Box 3.2 Structuring visual identification codes

The code AC002001 might be broken down as follows:

AC (district symbol)	002 (farm registration no.)	001 (farmer identification)
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All animals from this farm would carry the code AC002001 should they belong to farmer A; if another farmer, farmer B, also had animals on this same farm, they might carry the code AC002002, for example.

Should one wish to go a step further, extra digits could be added to identify the individual animals on these farms. Should farmer B have 20 cattle, they would be marked with codes running (for example) from AC002002001 to AC002002020.

If these codes were printed on ear tags, they could be broken up for ease of reading, perhaps with the group or herd code separated from the animal's individual serial number. For example, the fifteenth animal of farmer B would be identified as follows:

AC002002
015



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PHOTO 3.5

“Male” and “female” halves of a pre-printed tamper-proof bovine ear tag; note the presence of the computer-generated logo intended to make forgeries difficult

identification codes to their owners and to the holdings on which they are kept. The system should enable queries using any of these variables as a basis, e.g. a query based on an animal's identification code should show the animal's owner and the farm where it is kept, while a query based on the holding should return the names of owners using that holding, together with the identification codes of their livestock.

- The full particulars of all livestock owners, including physical and postal addresses and telephone numbers must be stored in the database.
- Where individual identification of animals is required, at least the species, sex and approximate birth date of the individual should be kept in the register; further data on breed birth mass, weaning mass and other performance data are optional.

STANDARDS FOR THE MEANS OF IDENTIFICATION

Standards for the means of identification (i.e. tags or transponders to be used) are essential and must be carefully spelled out. The list below serves as a minimum set of standards that would satisfy a modern animal identification system.

- The means of identification used should not be capable of contaminating meat or offal in any way, and should not damage the meat or the hide of animals.
- Once an animal is in a head clamp, identification should take no more than

30 seconds to apply, pose no undue risk to the operator and cause minimal discomfort or danger to the animal.

- The means of identification used should not cause pain or discomfort to the animal once it is in place.
- Identification must be readily readable from a distance of 1–2 m in the case of cattle and buffalo, and from a distance of 0.5–1 m in the case of smaller livestock. Ideally, it should not take more than a few seconds to read the identification (visually in the case of alphanumeric symbols or electronically in the case of bar codes or transponders).
- The means of identification used should be of uniform make and quality, and should be produced by means that reduce the possibility of forgery or unauthorized duplication.
- Ordering and distribution of identification devices must be centrally controlled by an institution mandated to register livestock identification to reduce the possibility of unauthorized or fraudulent use of existing identification codes.
- The means of identification used must be tamper-resistant in that it must not be possible to remove an installed identification from an animal without damaging it so as to render it unusable and unable to be transferred to another animal.
- Means of identification should be durable, have a high retention rate and be clearly readable for at least seven years after application. Ideally, a retention rate of over 90 percent is desirable, and any identification system should make provision for the replacement of lost or damaged identification devices.
- Identification codes shall be in alphanumeric form for ease of recording.
- Farmers should keep records of livestock and their identification codes on their farm.

SPECIFICATIONS VERSUS STANDARDS

Standards are intended to be a generic and minimum set of rules to which the identification method must conform. The set of standards above could apply equally to visual tags, bar-coded tags or subcutaneous RFIDs.

Once the registering body has been established and begun to evaluate local conditions and needs, the time comes to decide on the specific identification mechanism to be used and to describe the device exactly so that manufacturers know what to supply. It is entirely possible that an identification system in a developed country might give farmers a number of options to choose from, while in a developing country with more

economic constraints, there might only be one option.

The set of specifications describes in some detail exactly what the device should look like in terms of size, shape, colour and (where appropriate) electronic performance parameters (Box 3.3).

In the case of national livestock identification being made compulsory, legislation should be drafted (Box 3.4).

Box 3.3 Example of visual ear-tag specifications

- Dual (male and female) leaf-type tags; yellow in colour; black laser printing on tags (Photo 3.5).
- Male tag smaller (printed section of tag approx 55x20 mm); for application on outside (caudal surface) of ear.
- Female tag larger (printed section of tag approx 55x35 mm); for application on inside (cranial surface) of ear.
- Male component to bear the scheme logo and alphanumeric codes identifying farm of origin (font 10 mm high) and serial code to identify individual animal (font 8 mm high).
- Female component to bear scheme logo and an alphanumeric code identifying the farm of origin (font 10 mm high) underneath which there shall be a space 25x55 mm to provide for information to be added by the producer as necessary.
- The farm identification code shall not exceed 11 characters and the animal identification code shall not exceed 5 characters.
- The codes used shall be the codes used in the scheme identification database.
- The male and female tag components shall be joined when the tag is applied to the ear by a suitable applicator, by a locking device so that the two components cannot be separated without causing physical breakage of one or both tag components.

Box 3.4 Animal identification legislation

Drafting of legislation should be done in two parts:

- An Act of Parliament, which would define identification, the species to be identified, the parts of the country where the legislation would apply, create the central authority and define its powers, and define felonies. The Act would empower the responsible Minister, in collaboration with the central authority, to make regulations.
- A set of Regulations, to be promulgated by the Minister designated by the parent Act, which would precisely define the means of identification to be used, and make provision for all the mechanisms needed to administer and enforce identification.

A legal framework of this type enables changes to be made to the identification system through referral to a Minister only, without having to place an amendment before Parliament. This enables the system to be flexible and responsive.

• Checklist of relevant actions for the implementation of livestock identification •

Animal identification schemes are usually initiated by private organizations – farmers' unions, abattoir associations, marketing organizations and the like. The first step would involve investigating the requirements of the market to be served and the reasons for which identification is desired. Thereafter, the farming community must be assessed in terms of its willingness and ability to implement good identification practices.

Based on these findings, a suitable scheme can be devised. In seeking to create a Registering Body for Livestock Identification, consideration should also be given as to whether such a scheme should be compulsory or voluntary. A compulsory scheme may require the writing of appropriate regulations and the involvement of the relevant government departments.

Considerable time will also have to be spent on publicity and training in order to make such a scheme successful.

A checklist of activities to be undertaken in implementing an identification programme is shown below.

ACTIVITY	✓
Assessment phase:	
Market needs	
Farmer abilities	
Initial design proposals	
Planning:	
Identification and involvement of stakeholders in planning	
Identification standards	
Registration and control (including software design)	
Logistics of distribution	
Specification of devices	
Cost implications and cost-bearing	
Central registering body – structure, functions, resources	
Drafting of legislation/registration (if necessary)	
Awareness and training:	
Formulation of publicity message	
Undertake publicity campaign through relevant media	
Identify categories of people to be trained:	
– farmers	
– extension workers	
– distribution network	
– other	
Creation of appropriate training materials	
Set training dates, venues and execute training	
Implementation phase:	
Set implementation date	
Finalization of necessary software, purchase of equipment	
Creation of registration body	
Creation and testing of register	
Tender for device manufacturers, appoint manufacturers	
Begin registration process, ordering and distribution of identification devices	
Monitor progress	

Summary

- The two main reasons for having a system of livestock identification are proof of ownership and traceability/management facilitation. The requirements and type of identification used for these two goals differ.
- Means of identification currently used include:
 - **Branding and tattooing as marks of ownership.** These two methods suffer severe disadvantages in terms of readability and control over their application and use. They are thus unusable for traceability or management purposes.
 - **Various forms of ear tagging using visual codes, bar codes or transponders.** Advances in tag manufacturing technology have made tags a reliable and now popular form of identification.
 - Bar coding and transponders require the use of scanning equipment, which makes their use expensive.
 - Transponders may also be used subcutaneously or internally.
- Basic requirements for an identification system include:
 - clear readability of the identification device;
 - central control over the production, allocation and distribution of identification devices;
 - devices must be difficult to counterfeit and be non-transferable (tamper-resistant);
 - devices must be durable, cost-effective and easy to apply;
 - devices should not cause pain or discomfort to the animal.
- In developing countries, visual tags are often the devices of choice.
- A livestock identification system must have a central registering authority with the following functions:
 - registration and allocation of identification codes;
 - keeping of a register of codes, and the farmers, holdings and animals to which they have been assigned;
 - standard-setting for animal identification.
- There is a difference between standards and specifications for identification:
 - “standards” refers to a set of criteria which must be met by any device used by the system;
 - “specifications” refers to the exact appearance and performance of the device (which must meet the standards).
- Animal identification as to the place of origin should be maintained.

Bibliography

- Barcos, L.O.** 2001. Recent developments in animal identification and traceability of animal products in international trade. *Rev. sci. tech. Off. int. Epiz.*, 20(2): 640–651 (available at <http://www.oie.int/eng/publicat/rt/2002/BARCOS.PDF>).
- EC.** 2001. *Final report of a mission carried out in Uruguay from 25 to 29 June 2001 in order to evaluate the situation with regard to outbreaks of foot and mouth disease*. DG(SANCO)/3342/2001. Brussels. (available at http://europa.eu.int/comm/food/fs/inspections/vi/reports/uruguay/vi_rep_urug_3342-2001_en.pdf).
- FAO/WHO.** 2004. Draft code of hygienic practice for meat. In *Report of the 10th Session of the Codex Committee on Meat Hygiene*. Alinorm 04/27/16. Rome (available at ftp://ftp.fao.org/codex/Alinorm04/AL04_16e.pdf).
- FVE.** 1997. *The “stable to table” approach to animal health, animal welfare and public health*. Brussels (available at <http://juliette.nfrance.com/~ju15296/gvpdu/stabltbl.pdf>).
- McGrann, J. & Wiseman, H.** 2001. Animal traceability across national frontiers in the European Union. *Rev. sci. tech. Off. int. Epiz.*, 20(2): 406–412 (available at <http://www.oie.int/eng/publicat/rt/2002/MCGRANN.PDF>).
- USDA–APHIS.** 1994. *Animal identification practices in beef cow/calf herds*. USDA report, January 1994 (available at http://www.aphis.usda.gov/vs/ceah/cahm/Beef_Cow-Calf/chapa/chapid.pdf).
- Van den Ouwelant, E.P.** 2002. *A systems approach to traceability in the meat sector*. Wageningen University, Netherlands. (MSc thesis)