

REVIEWS

REVIEW: Sheep Traceability Systems in Selected Countries Outside of North America

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ABSTRACT

Sheep are produced world-wide; more than one billion domesticated sheep populate the planet. To keep up with the ever-changing animal production industry, many countries outside of North America have initiated either mandatory or non-mandatory systems for sheep identification. Sheep identification is primarily for the control of potentially harmful diseases that may have devastating effects if they occur and are not properly managed. Australia, Namibia, and the countries within the European Union have mandatory sheep identification as a method of control and traceability for sources of disease. Non-mandatory animal identification systems are in place in several other countries, which allows those participating to continue exporting sheep meat to countries requiring sheep identification. Most countries with sheep identification use a visual ear tag system with information to allow for trace-back of the animal to its premises of origin. To record changes in ownership or geographic location of animals through the production chain,

movement records are required in many countries and must be filed with proper authorities. To ensure a closed-ended system, countries with mandatory sheep identification are also required to have means of recording the death (i.e., termination) of a sheep either for slaughter or rendering purposes to ensure complete traceability of that animal throughout the production chain. Means of identification and tracking of animals continue to become more advanced, and the need for animal identification becomes progressively more critical to ensure the health and safety of the world sheep population.

Key words: animal identification, animal traceability, countries outside of North America, sheep, sheep meat

INTRODUCTION

Since the discovery of animal diseases, humans have been trying to limit the chances of spreading these diseases for the protection of human and animal health (Souza-Monteiro and Caswell, 2004). The ability to track animals through a production system can help minimize the extent of a disease outbreak investigation. “Tracking” has been defined by some

as the ability to follow the path of an item (sheep) as it moves downstream from beginning to end (birth to harvest or death; Smith et al., 2005). Schwagele (2005) defines tracing, which employs tracking, as the ability to identify the origin of an item upstream via records, and can be much more difficult to assess if tracking was not accomplished thoroughly. Changing regulations in the world market and desires to maintain the ability to compete for customers of sheep meat have forced some nations to develop mandatory systems for traceability of live animals (Barcos, 2001; Meat Board of Namibia, 2002; EC, 2004; Saa et al., 2005).

There are approximately one billion sheep in the world (FAOSTAT, 2008). Major sheep-producing countries outside of North America include Australia, China, New Zealand, and countries within the European Union (EU; Meat and Livestock Australia, 2006). Some of those countries, and others, have mandatory systems for sheep identification that are intended to protect against the spread of a major disease outbreak.

The objective of this review is to describe and compare the tracking

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and tracing schemes of major sheep producing countries outside North America that have and do not have mandatory sheep identification. In addition, this paper briefly overviews the means by which animals are identified, individually and as a group. Movement records, termination records, identification, and ability to locate the origins of a sheep in countries with mandatory and non-mandatory government-audited sheep identification programs are discussed below. This review is 1 of 4 reviews that describe 1) animal identification in North America (Murphy et al., 2008); 2) swine identification in selected countries outside North America (Meisinger et al., 2008); and 3) identification of cattle in selected countries outside North America (Bowling et al., 2008). When taken as a group, these reviews offer insight into animal identification and traceability throughout several countries in the world.

REVIEW AND DISCUSSION

Premises Identification and Registration

According to Meat and Livestock Australia (2003), the ability to trace product back to its origin has been increasingly sought after by consumers. The origin of the product, in this instance sheep meat, must be traced all the way back to the premises on which the animal in question was born to have complete traceability. The basis for many country's traceability systems is the identification of properties or holdings from which the sheep originated and on which the sheep were held. Among countries that have an "advanced" animal identification system, all allow a code or individual premises identification number (assigned by the government) to represent the property, holding, or premises on which sheep are grown.

Countries with an official animal identification program in place for sheep include, but are not limited to, Australia and the United Kingdom

(UK). The Australian identification method uses a Property Identification Code issued by the state government. The code is an 8-figure, α -numeric series that identifies the state and region in which that particular holding (i.e., geographical location) is located (Meat and Livestock Australia, 2003). The UK Department for Environment and Food and Rural Affairs (DEFRA) has issued guidelines describing how a 9-digit number, the County Parish Holding number, is to be assigned to all holding locations in that nation (DEFRA, 2005). The County Parish Holding number is specific to a certain UK county (first 2 numbers in sequence), parish (the following 3 numbers in sequence), and individual keeper or rancher (final 4 numbers in sequence; DEFRA, 2005). The UK guidelines are in accordance with EU regulations that denote all ovine animals must be identified and registered in their respective territory (EC, 2004).

European Union council regulations state in Article 7 of EC 21/2004 that member states shall ensure that a competent authority has a central register of all holdings (premises) relating to keepers of animals in their territory. The regulation also states that the register in question shall include the identification code of the holding, or if authorized by the competent authority, the keeper, occupation of the keeper, type of production, and species (EC, 2004).

Individual and Group Animal Identification

The ability to trace a meat product back to the premises of origin is of importance due to the potential health concerns associated with the animals that produced it and the other animals with which the animal of concern came in contact. Ultimately, individual identification of all animals and the ability to track or trace the movement of those animals throughout their lifetime would be ideal. Several sheep-producing

countries have already taken steps toward this goal (Table 1).

As mandated by the EU regulation EC No 21/2004, all animals (ovine) destined for intra-community trade or destined for shipment to third countries should be identified properly and all their movements should be traceable (EC, 2004). In the UK, orders exist describing how animals born after July 9, 2005, had to be identified as of November 30, 2005; identification must be in the form of an ear tag and include, in this order, the following: 1) the letters "UK," 2) the flockmark of the flock of birth, and 3) a unique number (England Order, 2007). The ear tag must be approved, made of non-degradable material, tamper proof, easy to read, designed to remain attached to an animal without being harmful to it, incapable of re-use, and permanently marked with the previously mentioned information (England Order, 2007).

Ear tag systems within the rest of the EU are similar in format. The Polish and Dutch ear tags, for example, contain the country codes "PL" and "NL," respectively. The tags also contain the individual animal ID number that can be combined with a barcode if the tag being used is large enough. Various tag sizes and styles have been approved for use; however, they must still contain the above information permanently recorded on the tag in addition to being tamper-proof. If these tags are lost, the animal keeper must order a new tag that is provided with the identical information described previously in addition to a "version number" which is recorded in Roman numerals to state that the new tag is not the original and is, in fact, the "subsequent tag" issued for that particular animal (i.e., "II" for second tag issued; LNV, 2006; Agency for Restructuring and Modernization of Agriculture, 2007). Furthermore, as of January 1, 2008, countries within the EU with a sheep population greater than 600,000 are required to use electronic identification devices in addition to the visual ear tags (EC, 2004; Saa et al., 2005).

Table 1. Comparison of traceability systems in major sheep producing nations

Country	Sheep population (1,000 hd) ¹	Premises identification ²	Individual sheep identification ²	Group or lot sheep identification ²	Electronic sheep identification ²	Recorded animal movement ²	Retire Animal Number ²
China	173,899.2	V	V	V	V	V	V
European Union	109,942.4	M	M	V	M ³	M	M
Australia	100,100.0	M	V	M	V	M	M
New Zealand	40,106.8	V	V	V	V	V	V
United States	6,230.0	V	V	V	V	V	V
Namibia	2,660.2	M	M	V	V	M	M
World	1,101,639.1	—	—	—	—	—	—

¹2006 sheep populations as reported by the Food and Agriculture Organization of the United Nations (FAOSTAT, 2008).

²M = mandatory, V = voluntary.

³Only mandatory in countries within the EU with sheep populations greater than 600,000 head.

The country of Namibia in southern Africa has adopted EU standards for animal traceability as a way to continue to market products to the European marketplace. The Farm Assured Namibian Meat Scheme describes the process for individual animal traceability. Yellow plastic tags are affixed to the individual animal that has its origins in Namibia, whereas animals with origins outside of the country receive a green tag (Meat Board of Namibia, 2002).

Australian sheep born after January 1, 2006, must have a permanent identification tag that contains breeder and Property Identification Code information, and sheep born before that date must be identified by January 1, 2009, before leaving the premises of origin (AAA Tags, 2006; Leader Products, 2007). Australian legislation does not mandate unique numbers assigned to each lamb; however, for managerial purposes, keepers are allowed to have numbers assigned to the individual sheep printed on the National Livestock Identification System (NLIS) tag being used. Different standardized colors of tags are to be used for different years of birth (e.g., 2006, red; 2007, sky blue; 2008, black) and are applied to the animal's right ear. Any animal that is either relocated from their property of birth, or loses the original breeder tag, will receive a

pink tag in the left ear (Dept. of Agriculture and Food Western Australia, 2007).

New Zealand does not have a mandatory animal identification system. An analysis of enhancing the animal identification system, conducted in December 2005, demonstrated "no dire need" for enforcing a mandatory sheep identification scheme (AITWG, 2005). The Animal Identification and Traceability Working Group assigned the task of determining the need for animal identification, including the ovine species, decided to wait to determine the effectiveness of the mandated EU animal traceability system already in place. Ultimately, the Working Group determined that as of December 2005, not all species of livestock were required to be individually identified, and that if all species were to require identification, then a single overarching scheme (i.e., herd or flock identification) would be sufficient for all species except the bovine and farmed deer, which were already under a government tracking system (AITWG, 2005).

China, the world's largest sheep producing nation (FAOSTAT, 2008), has developed plans for a beef traceability system (Howell, 2007). No traceability system or mandatory identification system has been initi-

ated for the sheep industry in that nation.

Animal Movement and Recording

Recording the movement and status of an animal through the production chain can improve the traceability of where an animal originated and the identification of other cohorts with which an individual animal came into contact. Movement records and methods of recording movement are similar between countries utilizing some form of a mandatory animal identification system. The differences between countries lie simply between the recordkeeping forms and the circumstances in which a movement record is required. Given the potential for complexity of a system to record individual animal movements, radio frequency identification devices (RFID), in addition to the use of computer databases, have been implemented and utilized to aid in determining the current location of an animal and from where it originated (Cunningham and Meghen, 2001; AgBiotech, 2003). The use of RFID has become commonplace in many countries and has been proven to be useful and economical in settings where large numbers of animals need to be processed in a relatively short period of time. Additionally,

the potential ability to control disease using a program with RFID can substantially minimize the economic losses of livestock as well as improve the quality and speed of the data collected (Saatkamp et al., 1995, 1997; Wismans, 1999). Furthermore, new forms of trade that have dramatically increased the speed of commerce will likely demand an electronic means of tracking an animal; many countries already require some type of animal identification that will allow quick and efficient means of locating a specific animal (Barcos, 2001). Alternative identification methods, such as barcodes and DNA fingerprinting, have been utilized in small amounts, yet have not become widely accepted due to potential complexities and complications or increased cost of implementation (Wismans, 1999).

According to Article 6 of EU regulation EC No 21/2004, as of July 9, 2005, whenever an ovine animal is moved within the national territory between 2 separate holdings, it shall be accompanied by a movement document based on a model designed by the respective territory (EC, 2004). Annex C of EC No 21/2004 (EC, 2004) provides definition regarding what is required of the model movement document that includes, but is not limited to, the identification code of the holding, the name and address of the keeper, total number of animals moved, the identification code of the holding of destination, the permit number of the transporter, date of departure, and the signature of the keeper. Records must be held by the keeper of the holding of destination for a minimum of 3 yr whereas an individual territory may mandate a longer record-holding period of time. The competent authority of the member state in which the movement took place must have a computer database in place to keep and hold animal movement records (EC, 2004). More recent regulations have been set forth by the EU Council stating that the competent authority of the region must conduct on-the-spot checks, without advanced warning, of animal records and

movement records of a minimum of 3% of holdings, covering a minimum 5% of animals in the member state, to ensure records are being kept and are in order (EC, 2006).

The UK has additional rules in place to accompany the EU regulations for animal movement documentation, which includes an evaluation of animals for any sign of foot-and-mouth disease before any movement. Furthermore, the conditions stated by DEFRA indicate that permitted movements can occur only by completing the movement document under "Sheep and Goats" (DEFRA, 2005). The "special movements" include movements to markets, assembly centers, slaughterhouses, artificial insemination centers, or ports of transfer. The Disease Control (England) Order 2003 (2003a,b) in part II, III, and IV of the DEFRA Sheep Gen License TOP Version 20, states that 1) these movements are allowed only by completing specific documents; 2) a 6-d standstill requires no movements from a premises in which a movement of any animal to that premises has taken place within 6 d; and 3) exemptions to this requirement include movements to markets, imported animals destined for export, movements to slaughter, veterinary treatments, artificial insemination centers, and diagnostic laboratories for testing.

Irish legislation also confirms the movement and record-keeping guidelines of sheep in the EU in Statutory Instruments 281 and 314, which in summary states that any ovine animal may not be moved unless properly identified by an approved ear tag. In addition, a person shall not move a sheep unless written notice is given to the district veterinary offices of both the area which a sheep is to be moved and the area to which the sheep is moving (Ireland Department of Agriculture and Food, 2001a,b).

The Republic of Namibia's Farm Assured Namibian Meat Scheme, in compliance with the EU regulations mentioned previously, has methods in place to record and identify animals and animal movements

within their country. The Namibian Meat Scheme Manual has outlined requirements of permits and documentation to accompany animals in transport (Meat Board of Namibia, 2002). Animal health inspectors are assigned to monitor sales and other movements, and the Meat Board's Border Control Officers are assigned to monitor sales and movements across borders, which require specialized export documentation forms to be completed (Meat Board of Namibia, 2002). The Namibian Meat Scheme follows guidelines originally set forth by Namibian legislation for control of animal diseases and theft — regulations that have been in effect since the 1950s. Livestock movement permits are issued by state veterinary offices or animal health inspectors and must be completed before any animal movements. Prior to loading, animal brand marks or ear tag numbers must be recorded by the farmer or acting agents and the permit then must be carried by the transporter at all times during transport (Meat Board of Namibia, 2002).

Movement of sheep within Australia requires documentation in the form of the National Vendor Declaration Waybill for sheep and lambs, or another type of registered form of the respective state from which a sheep or lamb is to be moved (NSW Dept. of Primary Industries, 2006). The length of time in which a movement record must be held depends largely upon the state. In the State of Queensland, a movement document must be held for a minimum of 5 yr, whereas the State of New South Wales requires a movement document to be held for a minimum of 7 yr (NSW Dept. of Primary Industries, 2005, 2006). Regardless of the length of time a document must be archived, all movement documentation of sheep or lambs in Australia must contain the number and type of stock, the date the movement took place, the Property Identification Code or address of the property where the stock was last held, and the Property Identification Codes

on the tags attached to the stock to identify the origins of the animals (NSW Dept. of Primary Industries, 2006).

Termination Records

The EU has set down a broad regulation for the recording of animal termination records (death certificates). The regulation describes how the traceability of food-producing animals and any other substance intended to be, or expected to be, incorporated into a food shall be established at all stages of production, processing, and distribution (EC, 2002a). Although it is difficult to determine by review of related literature whether or not there is legislation within individual member states regarding the recording of animal identification of sheep at the abattoirs, legislation in Ireland further verifies the previously mentioned EU regulation (FSAI, 2005).

The EU also has regulations for recording the movement and use of animal by-products. The regulation states that any person receiving or transporting animal by-products must keep and hold records of consignments from which the by-products originated for a minimum 2 yr. The regulation states that plants producing animal byproducts must have a traceability system in place (EC, 2002b).

Animal termination records in the African country of Namibia are present; however, they are limited to the recording of individual animal deaths on production premises. The State Veterinary Services of Namibia has forms for recording livestock deaths on the animal holding facility that are submitted bi-annually to the State Veterinary Services Office by the keeper (Meat Board of Namibia, 2002).

Recent Australian regulations do not require an approved NLIS tag for sheep born before January 1, 2006, sold to abattoirs; however, by January 1, 2009, all sheep sent to slaughter must be identified by an NLIS tag. In addition, movement

records must accompany the sheep to the abattoir. Sheep sold "over the hooks," or sold to the slaughterhouse directly from the farm of origin, do not require a NLIS tag. These exemptions to the animal identification regulations still must be recorded by the abattoir in the form of the movement document, such as a National Vendor Declaration Waybill, and retained for a minimum of 7 yr (NSW Dept. of Primary Industries, 2006). Furthermore, the National Vendor Declaration Waybill, which was first used in 1996, is kept by the abattoir as the method of tracing the origin of food animals for response to any food safety situation (Dept. of Agriculture Fisheries and Forestry, 2006). Simply, the termination records of sheep harvested in Australia are kept by slaughterhouses in the form of National Vendor Declaration Waybills or some other type of paper-based system designed by the abattoir.

IMPLICATIONS

There are appropriate processes in place in many countries to verify the origin of an ovine animal and to track the animal through its lifetime; this review simply outlines some of the major sheep-producing countries. The countries for which sheep traceability is mandatory have common systems in place including premises identification, animal movement recording, animal identification, and recording of animal termination. The use of visual ear tags seems to be the most widely accepted means of identifying ovine animals; however, the use of RFID tags may soon become the more practical universal technological advance able to accommodate the vast and rapid movement of sheep at a relatively low cost to the producer. The precedence has been set and it remains for other nations without mandatory regulated animal identification to utilize the information available to improve their ability to manage flock health and to maintain their ability to remain competitive in the international marketing of sheep meat.

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