Australian Journal of Experimental Agriculture, 1995, **35**, 15–18

Implanting electronic identification transponders under the scutiform cartilage of beef cattle is inappropriate under Australian conditions

P. J. S. Hasker[A] *and J. Bassingthwaighte*[B]

[A] Queensland Department of Primary Industries, GPO Box 46, Brisbane, Qld 4001, Australia.
[B] Australian Meat and Livestock Corporation, GPO Box 728, Brisbane, Qld 4001, Australia.

Summary. Poor readout and recovery rates of electronic identification (EID) transponders at the slaughter of feedlot steers raise doubts about the suitability of the scutiform cartilage as a site for implanting EID transponders in commercial beef herds in Australia. At slaughter, a readout was obtained from 73% of 4630 implanted steers that were scanned. Failure to give a readout was due to broken and lost transponders. Less than three-quarters of the transponders giving a readout at slaughter were recovered. These results could not be totally attributed to implanting procedure as they were similar for different feedlot–abattoir combinations and different operators.

Introduction

Recording information on individual animals provides a basis for improved selection procedures in beef cattle herds and greater production efficiency. Attachment of electronic identification (EID) transponders could provide the mechanism for obtaining this information. Individual animals could be identified with minimal stress and this identity stored automatically in a computer, together with data about the animal. For widespread adoption in the beef industry, the attachment procedure must be simple, and the site of attachment must ensure the transponder is retained and protected from damage, tamper-proof, and easily scanned (in both the live animal and its carcass) and recovered at slaughter. For the technology to be used widely by beef cattle producers, at least 95% of transponders must give a readout 10 years after attachment to animals (Austen and Goldstein 1988).

Implantation should satisfy many of these requirements. Hasker *et al.* (1992) found an anal site unsatisfactory because of problems with retrieval of transponders at slaughter. For the present study, the ear was chosen as the implant site because ears implanted with transponders can be cut off at slaughter. This paper reports the performance of transponders implanted under the cartilagos scutiformis (scutiform cartilage) of cattle as assessed by the readout rate and retrieval of transponders at slaughter.

Materials and methods

The observations were conducted at 3 feedlots (A, B, C) and nearby abattoirs (A, B, C, respectively) to which steers were consigned for slaughter. The feedlots were typical of large feedlots in northern Australia with capacities of 10 000–25 000 cattle, and abattoirs had a throughput of 300–900 head/day. Yards were constructed of wooden posts and steel cable at feedlots A and C, and steel posts and rails at feedlot B. Concrete feed troughs were installed at each feedlot.

At feedlot A, 355 steers (Hereford, Angus, Hereford–Angus cross) initially 20 months of age and weighing 350–400 kg were implanted over 4 days (19–22 February 1991). At feedlot B, 4305 Hereford steers initially 24–30 months of age and weighing 420–450 kg were implanted over 48 days (25 February–10 April 1991). At feedlot C, 197 Brahman-cross steers initially 24–30 months of age and weighing 320–515 kg were implanted on 16 October 1991. The experimental steers were grain-fed under commercial conditions for 100–300 days.

Implanting

During the process of induction into the feedlots, the steers were implanted with a growth promotant (zeranol) and EID transponders while restrained in a steel squeeze crush with an hydraulic head bail. Further restraint, required by very few steers, was applied by a stockman holding the nose and the non-implant ear with his hands. This required little effort since the steers did not react violently while held in the bail. It was done mainly to hold the head of horned steers in a better position for treatment.

The EID transponders were encased in glass (29 by 3.6 mm) and had a maximum interrogation distance of 900 mm. The injection device was a multi-shot instrument with a 40-mm needle. It was loaded with a 10-shot disposable cartridge in which the transponders were immersed in an iodophore antiseptic (Betadine, Mundipharma B.V., The Netherlands).

The transponders were implanted under the scutiform cartilage which projects laterally from the base of the ear on the dorsal plane (Fig. 1). This cartilage is triangular with its

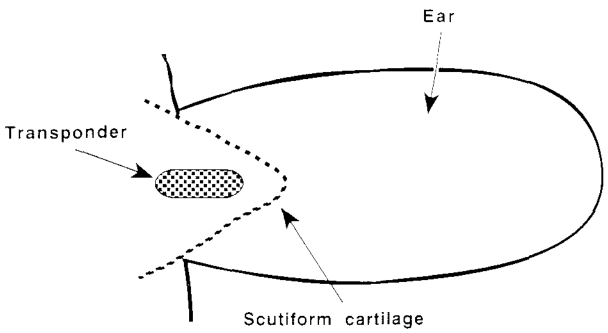

Figure 1. Dorsal view of ear showing the location of the transponder in the scutiform cartilage.

base facing towards the skull and the apex pointing to the tip of the ear. To implant the transponder, the ear was grasped towards its base by the left hand with the palm facing up so that the fingers could be closed together over the dorsal aspect. The needle was inserted into a depression which is palpable just in front of the apex of the cartilage and approximately on the midline of the ear, and thrust its full length under the scutiform cartilage and towards the base of the ear. At that point, the transponder was deposited into the tissue at the base of the ear by depressing the plunger. The plunger remained depressed as the needle was withdrawn.

This procedure required more exact positioning and insertion of the needle than when implanting hormone growth promotants. The EID implant site is further toward the base of the ear and the transponder is placed under the cartilage. Growth promotant sites are closer to the tip of the ear and the capsule is placed under the skin.

The time available for implanting each animal was limited, as the feedlot managers wished to maintain the throughput of their normal induction procedure. On average, implanting took about 10 s at feedlots A and C and about 3 s at feedlot B. At feedlots A and B, most steers were implanted by the feedlot stockmen, whereas one of the authors (J. Bassingthwaighte) implanted all steers at feedlot C.

At each feedlot, ears were scanned with a handheld interrogator immediately after being implanted, At feedlot C, the steers were also scanned with a stationary interrogator as they moved down a race at 7, 42, and 98 days after implanting.

Slaughter

At each abattoir, implanted ears were scanned with a handheld interrogator after the steers were stunned but before hide removal.

Steers from feedlot A were slaughtered 192, 201, 248, and 318 days after the last day of implanting. It was standard slaughter procedure at this abattoir (abattoir A) to leave ears attached to the hide. For ears giving a readout, slaughtermen sliced the ear near the base in an attempt to retrieve the transponder. Locating the transponder was sometimes difficult and the slaughter chain was stopped for the search. The abattoir management and slaughtermen objected to these delays. Ears were not collected for later examination; therefore, it was impossible to determine whether no readout meant a non-functioning transponder or that the transponder had been ejected from the ear. The first consignment of 80 cattle was slaughtered at short notice by feedlot management and no data on readout were recorded.

At feedlot B, 4159 steers were slaughtered at about 100 and 150 days after implanting. The remaining 146 were fed for a longer period and not processed for this trial. At this abattoir, it was standard procedure to remove the ears from the hide during slaughtering. During this process, the slaughtermen removed the transponders from those ears that gave a readout, if the transponder was located in the time available. The ears that gave an initial readout but from which transponders were not removed were scanned immediately on being detached to ensure the transponders remained with the ears; if an ear gave no readout, the head was scanned with a handheld interrogator. These ears and those that had given no initial readout were collected later for examination.

From feedlot C, 196 steers were slaughtered at 138 days after being implanted; one died before the due slaughter date. It was standard practice at this site to remove the ears from the hide, but the speed of the slaughter chain (900 steers/day) prevented slaughtermen from attempting to retrieve transponders during this procedure. All implanted ears of trial steers were collected. Ears giving no readout when scanned at the time of removal from the head were scanned with a metal detector to determine whether the transponder had been lost or was malfunctioning. This proved unreliable because of the presence of steel in structures on the slaughter floor.

At abattoirs B and C, ears that had given a readout were placed in containers separate from those that had not. All ears collected were scanned again later and were dissected to recover the functioning and non-functioning transponders and to identify ears from which transponders had been lost.

Implanted ears were inspected for signs of infection (scars, swelling, purulent exudate) immediately after stunning, before the body was hoisted onto the slaughter chain.

Analyses of data

Chi-squared tests were applied to data from each location to compare the percentages of readouts over time. For location B, data for 7 pens slaughtered at 100-day intervals after implantation were combined as were the 2 pens slaughtered at 150-day intervals after implantation.

Results

Transponder readout

At each abattoir, about three-quarters of the steers scanned at slaughter gave an EID readout (Table 1). Transponders lost from the ear were the main cause of readout failure. The transponder loss rate was about 50% higher from feedlot B steers than from feedlot C steers. There was a significant decrease in readout over time at feedlots A ($P<0.05$) and C ($P<0.001$) but not at feedlot B ($P>0.05$) (Fig. 2).

Transponder recovery

At abattoirs A, B, and C, respectively, transponders were recovered from >93, 94, and 97% of ears giving a readout, or nearly three-quarters of the steers slaughtered (Table 1). The removal of a transponder during slaughter was not practical when it was not located immediately.

Table 1. Readout and recovery of electronic identification transponders at slaughter

Value as a percentage of steers scanned is in parentheses
No attempt was made to recover transponders giving no readout at abattoir A

	Abattoir A	Abattoir B	Abattoir C
No. of steers scanned	275	4159	196
Readout obtained			
No. of readouts	212 (77)	2996 (72)	151 (77)
No. of transponders recovered	198 (72)	2817 (68)	146 (74)
No. of transponders not recovered	14 (5)	179 (4)	5 (3)
Readout not obtained			
No. of non readouts	63 (23)	1163 (28)	45 (23)
No. of transponders recovered	—	93 (2)	12 (6)
No. of transponders not recovered	—	1070 (26)	33 (17)

At abattoir B, nearly half of the transponders were removed by the slaughtermen.

At abattoirs B and C, transponders were found in 8 and 27% of ears giving no readout at slaughter. This represented 2 and 6% of steers that were slaughtered (Table 1). At abattoir B, 25–30% of transponders retrieved from all implanted steers were found in the muscle below the cartilage towards the skull. The remaining transponders at abattoir B, and all those retrieved at abattoirs A and C, were found in a central position under the cartilage. Non-functioning transponders were retrieved from both locations.

A single transponder was located in the boning rooms: at abattoir C, a transponder was found on a piece of neck trim. Subsequent discussions with boning room staff failed to determine whether it was embedded in the muscle or attached to the selvage. The day's production of 1500 cartons of boned-out beef was scanned with a metal detector to identify suspect cartons. X-raying of 13 suspect cartons did not show any trace of transponders.

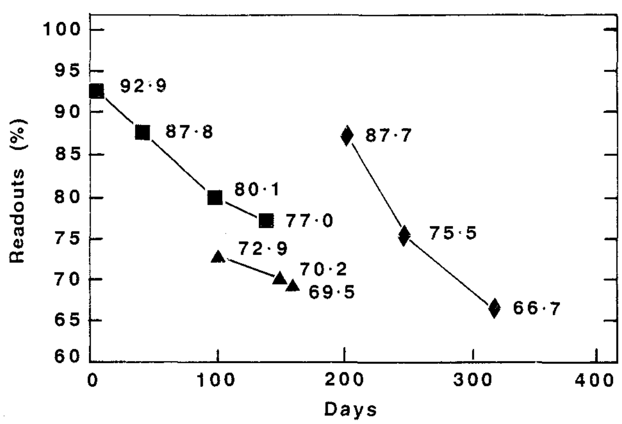

Figure 2. Readout of electronic identification transponders over time. Significant decreases with time occurred at feedlots A (P<0.05) (◆) and C (P<0.001) (■) but not at feedlot B (▲).

Infection

At all feedlots, signs of infection at slaughter were observed in <1% of implanted ears; at slaughter, broken transponders were retrieved from all infected ears.

Discussion

The poor success rate with transponders in this study, as assessed by successful readouts over time and recovery at slaughter, raises serious doubts about the suitability of this particular combination of transponder and implant site for identifying beef cattle in Australian feedlots. The percentage of functioning transponders at slaughter was well below the acceptable minimum of 95% over 10 years required for the practical application of this technology (Austen and Goldstein 1988).

Many of the transponders were apparently lost. They were very smooth, and we consider that many may have been expelled by movement of the muscles at the base of the ear. Development of transponders with surface projections to anchor them might provide a solution. The transponder may also need to be more robust. Many of the broken transponders, particularly from feedlot C, were centrally positioned under the cartilage. This suggests that the cartilage provided insufficient protection for the transponders against pressures created by the steers, such as when rubbing their heads on posts or having contests for dominance.

The poor recovery rates at slaughter are a cause for concern. Transponders not recovered from ears giving a readout when first scanned at abattoirs B and C either fell to the floor when the ear was removed or were removed with the hide.

The significant numbers of implants located in the muscles below the cartilage at slaughter of cattle from feedlot B contrast with the experience at the other abattoirs. The most likely explanation for this difference is the greater throughput at the feedlot during induction, which prevented careful insertion of the needle. Also, it was apparent that, although instructed, the stockmen did not take greater care when inserting transponders than when implanting growth promotants. Implanting the growth promotants at the same time may have contributed to this misunderstanding. However, the similarity in readout rates at slaughter for all abattoirs suggests that whether transponders were positioned under the scutiform cartilage had little effect on losses and breakages.

We have no explanation for the conflicting results of the effect of time after implantation on transponder functioning between feedlot B and feedlots A and C. It is unsatisfactory that readout rates were declining steadily after 319 and 138 days at feedlots A and C, respectively. At that rate of decline, less than half of the transponders would have given a readout after 5 years.

Even with the extreme care exercised in the abattoirs during this study, one transponder was found in the boning room. For the implantation of transponders to be used commercially, control procedures must ensure that none enter the food chain.

The similar results with the different feedlot–abattoir combinations and different operators show that the scutiform cartilage site is unsuitable. The trial was conducted in a commercial environment, and when handled, the steers reacted with the usual vigour of rangeland cattle. The implanting procedure may have contributed to the poor readout and poor recovery of transponders; however, if it is to be practical on commercial beef properties, successful application should require little technical skill. It must also be a quick operation to minimise labour. One of the authors (J. Bassingthwaighte) is experienced with the procedure; even so, 23% of transponders he implanted could not be read after 138 days. It is extremely unlikely that these rates could be bettered, or even equalled, under a range of commercial situations.

Conclusion

Our observations indicate that transponders can be implanted under the scutiform cartilage of beef steers both quickly and easily. However, losses of implants and breakages are significant. Further research is warranted to develop more robust implantable transponders that would remain in place, to identify more suitable sites for attachment of EID transponders to cattle, or to improve implanting techniques. Unless these difficulties can be resolved, there is little chance that this technology will replace existing methods of identifying beef cattle (ear tags, tattoos, fire brands), and the potential benefits will not be realised by the Australian beef industry.

Acknowledgments

The authors thank the Meat Research Corporation for funding and the following for their co-operation: Aus-Meat, Texas Instruments (Australia), and the management and staff of Australia Meat Holdings feedlots and abattoirs in Aubigny and Beaudesert, Queensland, the Killara Feedlot in Quirindi, New South Wales and Midco Abattoir in Macksville, New South Wales.

References

Austen, K., and Goldstein, P. (1988). Appendix 2. Specification for electronic devices for individual animal identification. *In* 'Animal Identification—the Modern Way'. AMLRDC Report No. 88/5. pp. 22.

Hasker, P. J. S., Round, P. J., and Slack, D. J. (1992). Implantation and recovery of identification transponders in the anal region of steers. *Australian Journal of Experimental Agriculture* **32**, 689–91.

Received 14 October 1993, accepted 27 July 1994