

CATTLE STANDARDS AND GUIDELINES – SPAYING

DISCUSSION PAPER

Prepared by the Cattle Standards and Guidelines Writing Group, February 2013

ISSUES

The main issues are:

- 1) Recommended methods
- 2) Pain relief
- 3) Ability to perform the required task
- 4) Age.

RATIONALE

Spaying is important for animal husbandry and on-farm management of female cattle in extensive pastoral environments particularly where there are difficulties with bull control. The reasons for spaying include:

- Prevention of unwanted mating and pregnancies to maximize survival of females, particularly with the risk of dystocia in maiden heifers
- Reduced mounting behavior resulting in less bruising and injuries to themselves and other cattle (particularly in feedlots)
- Allows flexibility to finish (fatten) females under variable seasonal conditions for turn off which allows for better management of stocking rates and overall herd welfare outcomes.

RECOMMENDATIONS

The writing group reviewed the reasons for spaying and the methods used and agreed that the procedure is necessary for cattle husbandry in extensive areas. Circumstances will dictate the choice of method, no one method being ideal in all circumstances. All methods are associated with a degree of pain and, from this point of view; no one method is markedly superior to others. On the basis of limited scientific evidence Dropped Ovary Technique has apparent advantages over flank spaying. Appropriate pain relief should be used and the writing group believe that this is necessary for flank incisions but the regime for a reasonable level of pain relief is yet to be determined.

The requirement for pain relief for the flank approach will lead to an improvement in cattle welfare. Effective drugs are available for cattle but the exact meaning of 'pain relief' and the regimes of Cattle spaying discussion paper public consultation version 1.3.13

treatment to be applied have to be determined in the context of what is reasonable for the veterinary profession to deliver to cattle.

The banning of the use of spreaders for passage spaying in heifers will prevent this method from being used on heifers. The DOT is a suitable alternative method.

The standards are recommended for the following reasons:

- Desirable for cattle welfare – pain relief requirement will protect cattle welfare and reinforce the need to perform the procedure with appropriate care. Industry communications and extension campaigns aim to promote the recommended guidelines.
- Feasible for industry to implement – The requirement for pain relief for flank approaches will be difficult to implement for industry (especially in the extensive areas). It sends a clear message for cattle welfare. For most large-scale cattle enterprises the requirement for pain relief will make DOT spaying more attractive.
- Feasible for government to implement – Verification should present no unusual difficulties. Compliance and enforcement policy will be an important aspect of regulation based on the interpretation of ‘pain relief.’
- Important for the cattle welfare regulatory framework. The current MCOP for Cattle states that spaying is a necessary procedure, DOT spaying is the preferred method, and that operators should be trained and competent, and using appropriate pain relief. The writing group believes that this recommendation must be incorporated in a standard.
- The valid outcome sought is that spaying is only done where necessary and in a manner that minimises pain and distress. It was felt that requirement for pain relief for the flank approach will not cause a decline in cow calf welfare due to spaying not being able to be done if required. The ban on spreaders does not prevent heifers from being spayed by other methods.

The writing group recommends that the following standards be introduced into legislation and the following recommended guidelines be published for industry consideration.

STANDARDS AND GUIDELINES PROPOSAL

OBJECTIVE

Spaying is only done where necessary and in a manner to minimise the risk to the welfare of cattle, particularly pain and distress.

STANDARDS

- S6.7 A person spaying a cow must be a veterinarian or, if permitted in the jurisdiction, be accredited or be under the direct supervision of a veterinarian or a person who is accredited.
- S6.8 A person in charge must use pain relief when performing the flank approach for spaying or webbing of cattle.
- S9.9 A person must not use vaginal spreaders to spay small or immature female cattle.

GUIDELINES

- G.1 The dropped ovary technique (DOT) for cattle spaying should be used in preference to other surgical methods, where possible.

NB This material relates to the surgical procedures and has been written to reflect a single chapter in the document.

- G.2 Spaying should only be done where there are no alternatives and the procedure results in either:
- Life-time benefits to cattle welfare, or
 - Better herd management, or
 - A reduced work health and safety risk.
- G.3 Spaying should be done with pain relief. Operators should seek advice on current pain minimisation strategies.
- G.4 Spaying should be planned with consideration to the health and age of cattle, weather, staff availability and facilities, including the use of temporary or permanent yards.
- G.5 Good hygiene practices should be implemented in relation to facilities, hands, handling and instruments. Disinfectant should be used and changed frequently.
- G.6 Effective but not excessive restraint should be used to minimise movement, and to enable the procedure to be done quickly and efficiently.
- G.7 Equipment for restraining cattle should only be used:

- For the minimum time necessary with the minimum restraint necessary, when it is suitable
 - If it is in good working order.
- G.8 Calves should be separated from their mothers for the shortest possible time unless they are to be hand-reared or weaned onto a solid diet.
- G.9 Bleeding from surgical wounds should be minimised by selecting an appropriate method, preventing overheating of calves and allowing them to settle after mustering.
- G.10 Infection should be minimised by avoiding muddy or dusty yards, and wet weather.
- G.11 Spaying should not be undertaken during extreme weather.
- G.12 Cattle should be inspected regularly and with minimal disturbance for signs of post-operative complications during the healing process, and appropriate action taken.

The term pain relief is used throughout this document to mean the reduction of behavioural and physiological responses by an animal to a painful stimulus to a level judged to be reasonable. Drugs are the common means by which pain relief is achieved and they act in various ways on the peripheral and central nervous systems and may be applied topically or by injection. The range of drugs available for use in cattle and the effectiveness and duration of pain relief provided is often limited.

The assessment of pain is an inexact science. The types of pain and their perception are often not understood and are known to vary at different ages and between individuals. In considering the use of pain relief, cattle should be given the benefit of the doubt.

Where there is a requirement for 'pain relief', the procedure must be done by a veterinarian or under veterinary supervision for the use of analgesic drugs. Supervision can be direct or indirect. See glossary for more information.

METHODS

For the purposes of this paper, the term '**spaying**' is used for any method of sexual neutering of female cattle to prevent breeding by the surgical removal of ovaries or fallopian tubes.

The common methods of cattle spaying in Australia are: dropped ovary technique (DOT), ovarian removal by flank or passage approaches and fallopian tube removal (webbing) by flank or passage approach. All methods require a similar degree of livestock handling and the heifer or cow is required to be legally identified by an ear mark. It is not intended to engage in a full discussion of all the advantages and disadvantages of each spaying method or the various alternative strategies to spaying.

All spaying methods (except webbing) result in the immediate loss of the conceptus until approximately 4.5 months of pregnancy when the uterus takes over hormonal maintenance of the pregnancy until just before full term when it reverts back to the ovaries. However those pregnancies surviving without functional ovaries will be born pre-mature and pre-mature calves are likely to have

poor survival in most circumstances. Abortion in the cow is defined as foetal death and expulsion between day 45 and day 265 of pregnancy (average gestation is 285 days). Webbing permits survival and normal-term delivery of the calf.

The DOT method requires a per-rectal manipulation of the spaying tool which is inserted into the abdominal cavity via a small puncture in the vaginal wall. The DOT spaying tool is a blunt flattened rod with a key-hole shaped opening that conceals a sharp cutting surface. The method is not able to be done in animals that are more than four months pregnant or within four weeks since calving or that have small (juvenile) or abnormally large (pathological) ovaries.

Flank spaying requires an incision of all layers of the left para-lumbar abdominal wall, after which only the skin is sutured on closure. The ovaries are removed with a 'spay mate' an instrument which has a concealed cutting surface, or with long-handled spaying scissors. This method is applicable to all stages of pregnancy and effectively results in the loss of the pregnancy. Foetuses at an advanced stage of gestation will be born approximately one month early as a consequence of the loss of the ovaries.

The webbing method is usually reserved for pregnancies beyond the 4 months stage. With the flank approach, an incision of all layers of the left para-lumbar abdominal wall is required to resect a short length of the fallopian tubes. The passage approach is also possible. The ovaries are left intact and in-situ with generally no effect on any pregnancy and a lesser risk of haemorrhage. It is considered under legislation to be a spaying method as the cow is rendered incapable of further conception.

The passage spaying method is not widely used in Australia. It involves a sizeable per-vaginal incision to allow manipulation of the ovaries which are removed. The method cannot deal with advanced pregnancy because the ovaries cannot be retracted into the pelvic cavity. The method is difficult to perform in heifers and small cattle due to the small dimensions of the pelvis. The use of vaginal spreaders is not supported.

The Kimberling-Rupp method is not known to be done in Australia. It is a similar per-vaginal method to the DOT method using a cylindrical tool that results in exteriorisation of the severed ovaries. The limitations with respect of stage of pregnancy are similar but greater than for the DOT method.

Immuno-spaying is currently not available as no vaccine is licensed for the use in cattle in Australia at the present time. Vaxstrate was such a product released around 1990 that did not achieve commercial success.

Effective long-term (6 months plus) therapeutic or vaccine alternatives to for contraception are currently not available in Australia. Research work is continuing in this area and may deliver an alternative to spaying in 3-5 years time.

CATTLE WELFARE IMPLICATIONS

Benefits of spaying

The major welfare benefit of spaying is the prevention of unwanted mating and pregnancies thus promoting survival of female cattle not suitable for breeding due to poor conformation or not suitable for breeding and subsequent lactation due to an advanced age. Flexibility to finish (fatten) females in difficult seasons and to meet market specifications under variable seasonal conditions is the major benefit to cattle producers.

Detriments to welfare

The major welfare detriments are the pain from the procedure, consequential healing issues that may occur including severe and fatal haemorrhage, infection and a reduced growth rate in the short and longer term. The role if any of chronic pain or consequences is not well understood.

In 2011, Petherick *et al* reported a study of spaying in *Bos indicus* heifers and cows and suggested that spaying is unlikely to cause more distress than dehorning. Caution needs to be exercised with this finding as there have been few behavioural and physiological studies comparing surgical husbandry procedures in this breed and age of cattle. In that study, flank spaying and DOT spaying were found to cause similar acute pain responses in female *Bos indicus* cattle but the inflammatory and pain responses in flank spayed cattle were still significantly increased four days after the procedure. Healing of the flank incision was not generally complete until day 42 post-operation. DOT spaying has a significantly greater impact on cattle than routine yard handling and artificial insemination. The impact of procedures was generally greater in cows than heifers.

Provision of pain relief for spaying

The evaluation of the pain response in cattle is difficult. Stafford, Chambers and Mellor 2006 concluded that there are a limited number of analgesic drugs registered for use in cattle and concerns include costs and residues. Ketoprofen (non-steroidal anti-inflammatory drug - NSAID) and lignocaine (local anaesthetic) appear to be the most successful combination registered to abolish the short to medium term pain response. This finding was based on earlier work by Stafford, Mellor and Todd *et al.* 2002 for castration of calves.

MLA 2009 has reported that flank or DOT spaying results in acute pain and distress to cattle for up to eight hours. A possible strategy for reducing this response is the administration of ketoprofen™ at the time of spaying. Research is required to assess the effectiveness of ketoprofen for spaying cattle.

The provision of local or epidural anaesthesia is not practical. Epidural anaesthesia in particular carries a high risk of paralysis and requires a high level of skill.

Under extensive grazing management operations in northern Australia, where more than 50% of beef cattle are run, the following practical considerations apply:

- Calves born after the second mustering round in say late September to December will be up to nine months old at branding on the first possible mustering round in the following midyear and a high proportion of cows will be pregnant again, limiting the spaying method options

- Where one mustering round is undertaken, the opportunities to manage pregnancy status are fewer
- The issue determining when the first muster is done and thus when castration, branding, dehorning and spaying are done, is the ability and cost of achieving a clean muster. Open country with very little uncontrolled surface water can yield 95% clean musters whereas in forest/timbered country or hilly terrain, clean musters are rarely a financially justifiable option
- The number of mustering rounds is not a measure of operational efficiency
- Adverse seasonal conditions will exacerbate the difficulty or cost of achieving clean musters.

There is merit in extensive situations for spaying heifers at their first selection round. Cull heifers can be drafted and spayed at around yearling age, and when the impact is lower than that of spaying cows.

Summary

Where no drugs are given and relegating passage spaying too little usage, the most humane options are:

- DOT method in heifers
- DOT method in cows
- The webbing method in pregnant cows
- Flank spaying.

With a flank incision it is possible that local anaesthesia plus ketoprofen would reduce the pain response to nil but the application of local anaesthetic (L-block in left para-lumbar fossa) is currently not practical. Local anaesthesia is not applicable to per-vaginal methods or ovarian transection but cattle subjected to these surgeries may benefit from ketoprofen administered before or during spaying. The professional and ethical question is whether concurrent NSAID is to be considered adequate and reasonable for the provision of pain relief?

ABILITY TO PERFORM THE REQUIRED TASK

A person must have knowledge, experience and skills to perform a general husbandry task in a satisfactory manner. This matter is regarded as highly important by the cattle industry. A level of assurance is sought commensurate with the degree of immediate welfare risk to the animal. Formal assessment of ability is not required.

Cattle in Australia are managed in environments that vary from extensive rangelands to intensively managed systems. In all cases the persons in charge of cattle are responsible for the welfare of the animals under their control. In achieving improved welfare outcomes envisaged by the standards, it is important that people responsible for animals have the necessary knowledge, experience and skills to undertake the various procedures and meet the requirements of the standards, in a manner that minimises the risk to cattle welfare. The relevant principles are:

- The undertaking of any husbandry procedures required for planned herd management in a manner that reduces the impact of these procedures and minimises risks to cattle welfare.
- Handling facilities, equipment and procedures that minimise stress to the cattle
- minimising the risk of pain, injury or disease
- Assessing the need to undertake any husbandry procedures that may result in significant short-term pain against alternative strategies for the long-term welfare of the cattle

Considerations include:

- Reducing the impact of mustering, handling and restraint
- Carrying out the procedures at the earliest practical age
- Knowledge of the appropriate age/size considerations for selection of method
- Ensuring that facilities and equipment are suitable
- Applying the method skilfully
- Applying other basic principles such as vaccinating cows and calves to protect against tetanus and other clostridial diseases
- Avoiding wet weather
- Maintaining clean hygienic practices
- Allowing the unweaned calves to mother up as soon as possible
- Releasing the cattle from the yards and onto feed and water as soon as possible
- Conducting regular post-spaying inspections.

The most important elements to be considered are:

- Knowledge of the appropriate age/size considerations for selection of method
- Demonstrated manual skill
- Appropriate hygiene
- Appropriate instruments.

AGE

Compared to other similar husbandry procedures, upper age limits are not appropriate for spaying in order to optimise animal welfare, except in very old and infirm cows. Per-rectal or per-vaginal approaches physically require a reasonably mature animal and even in the flank approach, small ovary size can be a limitation. These size considerations dictate that spaying is most common in animals over 12 months of age. Older multi-parous cows appear generally to be at greater risk from spaying due to the ovarian blood supply being better developed with the risk of post-operative haemorrhage. The only practical distinction is really size-related and is between very young heifers and well-grown heifers. Health considerations apply to all candidates for spaying with cattle in very poor condition not recommended for the procedure.

REVIEW OF NATIONAL POLICIES AND POSITIONS

Cattle spaying discussion paper public consultation version 1.3.13

The **Cattle MCOP** 5.5 states in part that: *“Surgical spaying is a routine and important husbandry practice in many extensive range operations. In less extensive production systems, separation of male and female cattle is recommended. Spaying should be undertaken in dry weather and conducted by a skilled operator using hygienic materials and technique. Adequate restraint is essential and spayed females should be returned to clean surroundings as soon as possible. Post-operative inspections should be conducted. The Willis dropped ovary technique is the preferred method. Where other surgical techniques are used, they should be carried out by a veterinarian or lay operator trained and competent in the procedure, using appropriate analgesia.”*

The cattle MCOP does not in effect create a standard, despite the reference to other legislation in various states. Existing regulations do not mandate the age at which veterinary intervention or the application of analgesia is required for spaying. It is apparent that a standard for the provision of effective analgesia for cattle spaying does not exist in all states and Territories.

The **Australian Veterinary Association (AVA)** 8.3 Cattle spaying Policy

“Cattle can be spayed by veterinarians using the Willis spay technique until suitable alternatives are developed.

The surgical flank spaying of cattle may only be performed by veterinarians with the use of appropriate anaesthesia and analgesia.

Animals must be assessed by the veterinarian to be sufficiently healthy to undergo the procedure. Animals showing signs of disease, weakness or emaciation should not be spayed by any technique.”

RSPCA Australia 2008 relevant policy is as follows:

4.6 Invasive animal husbandry procedures

“4.6.1 RSPCA Australia is opposed to any invasive animal husbandry procedure for which there is no established need, which only benefit the human handler of the animals concerned, or that is performed to overcome the adverse effects upon animals of the production system they are in.

4.6.2 If an invasive procedure is to be performed, it must be undertaken at the earliest age possible, be performed by an accredited operator and be accompanied by appropriate pain-relieving and / or pain-preventing products.”

The revised RSPCA Australia Position paper B4 Invasive farm animal husbandry procedures) states:

11 Spaying of cattle

Cattle spaying is performed to avoid unwanted pregnancy of animals, often in extensive pastoral areas where females cannot be segregated from males.

11.1 In extensive pastoral areas, spaying is often performed using the Willis dropped ovary technique, which involves cutting the ovaries away from their attachments in the abdomen and allowing them to drop within the cow’s body cavity where they remain. The technique requires entry through the vagina (per-vaginal method) and involves a high level of skill.

11.2 RSPCA Australia advocates the development of inexpensive and easily applied hormonal implants to control pregnancy of animals in extensive pastoral areas.

11.3 It is unacceptable to use flank spaying or webbing (removal of the fallopian tubes) as a method to control pregnancy.

11.4 Where spaying is deemed necessary, the procedure must only be performed by a veterinary surgeon (trained in the technique) or a competent operator experienced in the technique (see 2.4). Spaying must be performed using appropriate restraint (see 2.6), pre- and post-operative pain relief and aseptic technique.

11.5 Post-operative monitoring and care must be implemented for a period of at least two weeks after the operation to minimise the possibility of complications.”

REVIEW OF INTERNATIONAL POLICIES AND POSITIONS

This section is included to provide a brief international context, while acknowledging that Australia's cattle production systems may vary from production systems, cattle breeds and climatic conditions in other countries. The spaying procedure is known to be performed on cattle in other countries but cattle spaying is not well referenced in published animal welfare policies and regulations.

The **New Zealand** Painful Husbandry Procedures Code (2005) states that: “*Spaying (removal of the ovaries) of female cattle, sheep, goats or pigs is rarely undertaken for husbandry reasons in New Zealand. Furthermore, it is considered a significant surgical procedure to be performed by a veterinarian or under veterinary supervision.*”

In the **United Kingdom** spaying of cattle was considered to be an acceptable mutilation when carried out for therapeutic reasons until 2007. The spaying of cattle is no longer a permitted procedure and has been removed from the Principal Regulations to the Mutilations Act. A number of procedures for the control of animal reproduction and identification have been added to the Principal Regulations; namely, ovum transfer, laparoscopic insemination, etc.

In the **USA** there are no identifiable policies but Dr Temple Grandin states: “Spaying Heifers - Anaesthetics are required for flank spaying of heifers. Other less invasive methods of spaying which do not require a flank incision are recommended. “

A noted author, Dr Daryl Meyers stated in 2005 “Once very common but now rarely used in the U.S., flank spaying involves an incision being made in the heifer's left flank, through which the ovaries are removed. This procedure is much more labour intensive and costly than modern vaginal methods now used.” Other reviews are available: Weddle-Schott L and Meyer D. and Minnesota Beef Extension update.

Canada does not appear to have any policy but the beef cattle industry is known to follow similar practices to the USA.

DEFINITIONS

<p>accreditation</p>	<p>To certify as meeting official requirements (Macquarie Dictionary). Accreditation is recognised when a person is assessed against the requirements of a unit of competency. In the case of the development of the spaying unit of competency; the National Skills Standards Council (NSSC) endorsement will be required. Industry accreditation schemes may use this approach or create their own assessment methodology.</p> <p>Agrifood Skills Australia is an Industry Skills Council (ISC) which is responsible for developing Training Packages in accordance with the standards for Training Package development, as set by the NSSC. ISCs are required to submit Training Packages and a case for endorsement to the NSSC for assessment against the standards. The relevant package for spaying is the Agriculture, Horticulture and Conservation Land Management Training Package. http://www.agrifoodskills.net.au/?page=AHC10.</p>
<p>direct supervision</p>	<p>A person (the supervised person) is acting under the direct <i>supervision</i> of another person (the supervisor) if the supervisor:</p> <p>(a) provides instructions and guidance to the supervised person in relation to the subject activity; and</p> <p>(b) oversees and evaluates the performance of the activity by the supervised person; and</p> <p>(c) is contactable by the supervised person; and</p> <p>(d) is supervising the person in accordance with paragraphs (a), (b) and (c) above; and</p> <p>(e) is on the same premises as the supervised person while the subject activity is being undertaken; and</p> <p>(f) is able to immediately render assistance to the supervised person, if required, at any time during which the subject activity is being undertaken.</p>
<p>dropped ovary technique (DOT)</p>	<p>A technique for spaying cattle that involves dropping ovaries into the abdomen by using a prescribed instrument to:</p> <p>(a) enter the abdomen by piercing the wall of the vagina with the instrument's spearhead; and</p> <p>(b) place each ovary, by rectal manipulation, in the oval hole in the instrument's spearhead; and</p> <p>(c) sever the ovaries with the sharp edge of the slit in the instrument's spearhead by retracting the instrument.</p>
<p>flank approach</p>	<p>The incision of the skin and tissue layers on the left side of the cow to gain</p>

	access to the abdominal cavity.
pain relief	The administration of drugs that reduce the intensity and duration of a pain response.
spaying	The removal of the ovaries by excision, or disruption of the function of the ovaries by removal of part of the fallopian tubes. Note: <i>immuno-spaying is not included in this definition and is not considered a welfare concern.</i>
webbing	Spaying by removing a short length of the fallopian tubes. The ovaries are not affected. Existing pregnancy is usually maintained.

REFERENCES

Abortion definition: <http://www.partners-in-reproduction.com/reproduction-cattle/abortion.asp#definition> Accessed on 2/3/09.

Animal Welfare (Painful Husbandry Procedures) Code of Welfare Report, 2005, New Zealand. Accessed on 3/3/09at: <http://www.biosecurity.govt.nz/animal-welfare/codes/painful-husbandry/index.htm>.

Australian Veterinary Association, 2012, Policy 8.3 Cattle spaying, accessed on 5.1.13 at: <http://www.ava.com.au/policy/83-cattle-spaying>

Cattlenetwork USA *Cattle Update: Spaying Heifers as a Management Tool* Minnesota Beef Extension http://www.cattlenetwork.com/Cow_Calf_Content.asp?contentid=222975 Accessed on 29/4/09.

de Witte K, Jubb T and Letchford P, *The dropped Ovary Technique for Spaying Cattle – a Training Manual*. 2006 Australian Cattle Veterinarians of the Australian Veterinary Association, Queensland.

Grandin, T. Accessed on 19/3/09 at: <http://www.grandin.com/cattle.welfare.ccp.html>.

Jeffery, M, Loxton, I, Van Der Mark, S, James, T, Shorthose, R, Bell, K and D'Occhio, M (1997): *Liveweight gains, and carcass and meat characteristics of entire, surgically spayed or immunologically spayed beef heifers*, *Aust. Jnl Experimental Agriculture* 37(7) 719 – 726.

Jubb TF, Bolam M, Letchford P and Fordyce G (1997) *Evaluation of the Willis spay instrument*, Project NAP3.102, A Report to the Meat Research Corporation.

Jubb TF, de Witte KW and Smith GI, *The Use of the Willis Dropped Ovary Technique in Extensive Beef Herds in Northern Australia*. 1998. Proceedings of the XXI World Association of Biuiatrics Conference, Sydney.

Meyers, D. Accessed on 19/3/09 at: http://beefmagazine.com/mag/beef_spaying_pays/.

Model Code of Practice for the Welfare of Animals – Cattle, second edition, PISC Report 85, 2004, CSIRO Publishing. Accessed on 2/3/09 at: <http://www.publish.csiro.au/>.

Cattle spaying discussion paper public consultation version 1.3.13

Petherick JC, McCosker K, Mayer DG, Letchford P and McGowan M *Preliminary investigation of some physiological responses of Bos indicus heifers to surgical spaying* AVJ_89 131-137, 2011.

RSPCA Australia policies (2008) RSPCA Australia Inc, Australia. Accessed on 3/3/09 are available at <http://kb.rspca.org.au/78/>.

RSPCA B2, Farm Animal Position Papers 2006 edition, 2.1 Surgical animal husbandry techniques, pp 59 – 60. Accessed on 3/3/09 at: http://www.rspcavic.org/about_us/images/Policy/2006_RSPCA_B7.pdf. RSPCA Australia position papers are now available at <http://kb.rspca.org.au/files/2/>.

Rupp GP and Henderson ED (1995) *Compend Contin Ed Vet Sci*, Food Animal Supp, August: S42-S47.

Stafford KJ, Mellor DJ, Todd SE, Bruce RA, and Ward RN 'Effects of local anaesthesia or local anaesthesia plus a non-steroidal anti-inflammatory drug on the acute cortisole response of calves to five different methods of castration' *Research in Veterinary Science* 2002, 73 61-70.

Stafford KJ, Mellor DJ, Todd SE, Ward RN and McMeekan CM 'The effect of different combinations of lignocaine, ketoprofen, xylazine and tolazoline on the acute cortisol response to dehorning in calves.' *New Zealand Veterinary Journal* 51(5) 219-226, 2003.

Weddle-Schott L & Meyer D. *Spaying Heifers as a Management Tool*. University of Minnesota Beef Centre <http://www.extension.umn.edu/beef/components/pdfs/05-20-08-Schott.pdf> Accessed on 29/4/09.