Sheep CRC Conference Proceedings

Document ID:	SheepCRC_22A_24
Title:	Getting the sex you want
Author:	de Graaf, S.P.; Evans, G.; Maxwell, W.M.C.; O'Brien, J.K.
Key words:	sheep; sperm; sexing

This paper was presented at the Sheep CRC Conference 'Wool Meets Meat' held in Orange, NSW in 2006. The paper should be cited as:

de Graaf, S.P.; Evans, G.; Maxwell, W.M.C.; O'Brien, J.K. (2006) *Getting the sex you want* in 'Wool Meets Meat' (Editors P. Cronje, D. Maxwell) Sheep CRC pp 258

Getting the sex you want

S.P. de Graaf, G. Evans, W.M.C. Maxwell and J.K. O'Brien

Australian Sheep Industry CRC
Centre for Advanced Technologies in Animal Genetics and Reproduction, Faculty of Veterinary Science, The University of Sydney, NSW, 2006, Australia

History is littered with a myriad of techniques designed to preselect the sex of a baby, none of which achieving success until the development of modern flow cytometry, a technique that allows the accurate identification and sorting of biological cells. A modified flow cytometer is able to sort spermatozoa into two categories (those bearing an X chromosome and those bearing a Y chromosome) based on their difference in DNA content, enabling the use of X sperm or Y sperm to produce either female or male offspring, respectively. The interest of future parents in this capability is obvious, but the use of this technology extends far beyond that of family planning. Namely, the potential benefit that sex-preselection would have for agriculture in terms of improving breeding efficiency, production, and ultimately, profit. In the case of the Australian sheep industry the benefits of sex-preselection would be primarily noticed at the stud level. For example, stud producers who derive the majority of their income stream from the sale of high quality rams could increase their profit by producing a higher percentage of rams per lamb drop. Conversely, for graziers moving into the newer meat breeds the ability to produce predominantly ewes in a lamb drop would be of most benefit, as it would rapidly increase the number of breeding females in a flock, accelerating flock growth well beyond that which could be achieved with a 50:50 sex ratio. In this circumstance, sex-preselection, particularly when coupled with multiple ovulation and embryo transfer (MOET), would decrease the early costs of flock establishment by minimising the number of breeding ewes initially required. However, these exciting benefits of sex-preselection will remain on the horizon until research and development takes place to refine the technique, produce more lambs on the ground and increase our understanding of sex-sorted sperm function. With this in mind the current research program involving The University of Sydney, XY Inc., and The Australian Sheep Industry CRC was initiated, resulting in a number of important milestones in the field of sex-preselection research and ultimately drawing us closer to the point of a commercially acceptable product. Initial progress was made refining the sex-sorting technique by modifying the sperm freezing method and improving quality assurance. This effectively doubled the post-freeze viability of sex-sorted ram sperm. These advances warranted a fertility trial in early 2005, which produced ~100 pre-sexed lambs at an accuracy of almost 95%. This trial demonstrated that at the selected AI dose, sex-sorted ram sperm were equally as fertile as non-sorted ram sperm. Consequently, under commercial conditions breeders should have no concerns about the fertility or accuracy of the sex-preselection procedure. Concerns regarding transport of sperm to a sex-sorting facility (an important consideration if the animals are remote from this location) were also addressed by producing the world's first animals in September 2005 from sperm that had been frozen, then thawed and sex-sorted, then re-frozen before final thawing at artificial insemination. Further work was conducted to integrate sex-sorting into other breeding technologies, namely MOET. The subsequent field trials saw the first pre-sexed MOET lambs produced anywhere in the world in November 2005. Prior to completion of this project it is hoped that in vitro studies of sex-sorted sperm function and investigation of various beneficial additives such as seminal plasma or cholesterol will allow us to reduce the number of sperm used per insemination, and thereby reduce the price premium of a sex-sorted AI dose. Culmination of these advances will hopefully propel this technology to commercial use in the Australian sheep industry and allow producers to profit from the benefits that sex-preselection technology can offer.