final report

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Improving the reproduction efficiency of bulls - feasibility study

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FOR PUBLIC RELEASE

PROJECT SUMMARY

Project Title - Improving the reproductive efficiency of bulls - a feasibility study

Project No. - DAQ 087

Research Organisations and Locations -

DPI (ARI), UQ (Pinjarra Hills), CSIRO (Rockhampton), JCU (Townsville), NTDPIF (Berrimah)

Commencement - July 1992

Completion - April 1993

Project Investigators -

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Objective -

The project identified gaps in research knowledge that limit the ability to select more fertile bulls for herds in northern Australia. In addition the project assessed the feasibility of making significant gains in these identified areas.

Results and Conclusions -

A 2 day workshop in Rockhampton in September 1992 addressed issues such as bull examination, managerial aspects influencing bull fertility, disease and genetic effects. Recommendations from the workshop placed a higher emphasis on disseminating technology that is known rather than additional research. The major recommendations for technology transfer were publication of the workshop proceedings as a technical bulletin, update skills of practitioners and continued funding for existing projects (BGIP and PDS). The priority recommendations for future research were evaluation of assessment methods of bull fertility under multiple-sire mating using DNA fingerprinting; quantifying the value of improving female fertility through selection on male characteristics and evaluating disease effects on bull fertility using new technologies and including some fundamental research on disease effects.

A workshop proceedings has been published and is titled 'Bull Fertility' - Proceedings of a workshop held at Rockhampton, 8-9 September 1992 (R G Holroyd - editor), DPI Conference and Workshop Series, QC93008, Brisbane.

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PART 2 - EXECUTIVE SUMMARY

PROJECT DAQ 087 - Improving the reproductive efficiency of bulls - a feasibility study

Background and Industry context:

The study was undertaken as bull costs are a significant component in the economics of a breeding enterprise. The cost of capital tied up in bulls can be substantial and can be reduced if non-working bulls can be identified and sold.

The hypothesis is that bulls contribute more than given credit for in the differential diagnosis of causes of lowered branding rates in northern Australian beef herds. Our estimates from limited data with *Bos indicus* cattle, is that 20-25% of bulls mated in multiple sire herds do not contribute to any of the following year's progeny. This could be due to a combination of structural defects, inability to serve, testicular or reproductive tract abnormalities or social dominance.

Evidence from some *Bos taurus* herds would suggest that the average working life of a bull is 2.5 to 3 years. Earlier studies by P.W. Ladds from James Cook University confirm this for *Bos indicus* bulls with an increasing prevalence of testicular and reproductive tract abnormalities in slaughter bulls greater than 5 years of age. However the 1990 North Australia Beef Producer Survey indicated that the majority of herd bulls were kept in excess of this age and that selection of breeding stock, particularly superior bull selection was one of the consistently identified issues important for improving profitability over the next 5 - 10 years. It would seem that there could be considerable wastage of effort in identifying genetically superior sires if our estimates are correct of up to 25% of bulls being non contributors of progeny.

Project Objectives:

The project sought seed funding to allow scientists from a number of organisations and locations to meet, review and discuss existing knowledge on bull fertility and if considered necessary, to develop a co-ordinated research program whose progressive outcome will be the means of improving the efficiency of bull reproduction performance in tropical Australia by 1999.

The objectives of the project were by March 1993:

(i) to identify gaps in research knowledge that limit the ability to select more fertile bulls for herds in northern Australia;

(ii) to assess the feasibility of making significant gains in these identified areas;

(iii) depending upon the outcome of (i) and (ii):

  (a) make recommendations to the NAP2 Management Committee for technology transfer of existing knowledge on the subject;

(b) to identify research needs and develop strategies for commencement in July 1993 that will progressively address bull reproduction efficiency.

Brief Methodology:

A two day workshop with 35 attendees was held at Rockhampton 8-9 September 1992. Participants were representatives of research, extension, practitioner and producer interests mainly from Queensland with delegates also from Northern Territory and Western Australia.

Papers were presented on topics such as:

- an overview of physiology and endocrinology of male reproduction
- bull examination and its contribution to herd fertility outcome
- managerial aspects from weaning to first mating that influence bull fertility
- management of mated bulls
- pathological abnormalities
- impact of disease on fertility
- genetic relationships - heritabilities and male/female correlations
- genotype effects
- selection strategies for replacement bulls

Two working parties were convened at the workshop. The first addressed education/extension activities, the second dealt with future research priorities.

A workshop proceedings containing all papers and working party recommendations was published in April 1993. These proceedings have been distributed to workshop participants, DPI, NTDPIF and WADA field staff and various scientific libraries.

Main results and conclusions and likely industry impact:

The project identified that considerable technical information was available on bull fertility but this was not being used widely. The effective dissemination of our present knowledge should have a greater priority for improving overall herd fertility in northern herds with a lesser emphasis on research.

Recommendations of the working party on education/extension activities were:

- the workshop proceedings will enhance the available bulletin and brochures and there is no need for a specific bulletin or series of brochures to be written on bull fertility.

- updating the skills of practitioners on bull fertility should be continued to be addressed by the AVA and its special interest group (Australian Association of Cattle Veterinarians) plus support from the two University Post Graduate Committees in Veterinary Science.

- continued funding for extension on bull fertility in Queensland should be channelled through the existing projects, Beef Genetic Improvement and Producer Demonstration Sites to emphasise the place of bull fertility in whole property management.

- technology and extension material developed and being used in Queensland be made available and assistance be provided for its implementation in the Northern Territory and the northern part of Western Australia.

- stud breeders, livestock selling groups, breed societies and industry associations should be closely involved with provision of objective data on fertility and suitability of bulls offered for sale to commercial producers.

The working party recommended that research priorities in bull fertility should be:

- Evaluation of methods of assessment of bull fertility under a multiple-sire mating situation using DNA fingerprinting. Assessments of serving ability, serving capacity, physical soundness and semen quality parameters would all be evaluated.

- Quantify the value of improving female fertility through selection on male characteristics.

- Evaluation of disease effects on bull fertility using new technologies and including some fundamental research on disease effects.

- Research into how to educate practitioners and breeders to existing knowledge on physical soundness, relocation and nutrition.

The project will impact on the industry in three areas -

- a greater awareness by all facets of the beef industry of the impact of bull subfertility on reduced branding rates.

- improved quality of advice to industry that this will result in better value for money when purchasing bulls.

- improved techniques of assessing the value of different premating measurements when examining bulls.

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PART 3 - FINAL REPORT

PROJECT DAQ 087 - Improving the reproductive efficiency of bulls - a feasibility study

Background and Industry Context:

The study was undertaken as bull costs are a significant component in the economics of a breeding enterprise. The cost of capital tied up in bulls can be substantial and can be reduced if non-working bulls can be identified and sold.

The hypothesis is that bulls contribute more than given credit for in the differential diagnosis of causes of lowered branding rates in northern Australian beef herds. Our estimates from limited data with *Bos indicus* cattle, is that 20-25% of bulls mated in multiple sire herds do not contribute to any of the following year's progeny. This could be due to a combination of structural defects, inability to serve, testicular or reproductive tract abnormalities or social dominance.

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Project Objectives:

The project sought seed funding to allow scientists from a number of organisations and locations to meet, review and discuss existing knowledge on bull fertility and if considered necessary, to develop a co-ordinated research program whose progressive outcome will be means of improving the efficiency of bull reproduction performance in tropical Australia by 1999.

The objectives of the project were by March 1993:

(i) to identify gaps in research knowledge that limit the ability to select more fertile bulls for herds in northern Australia;

(ii) to assess the feasibility of making significant gains in these identified areas;

(iii) depending upon the outcome of (i) and (ii):

(a) make recommendations to the NAP2 Management Committee for technology transfer of existing knowledge on the subject;

(b) to identify research needs and develop strategies for commencement in July 1993 that will progressively address bull reproduction efficiency.

Methodology:

A workshop steering committee was convened in July 1992. This committee was chaired by R Holroyd with K Entwistle, P O'Rourke and J Vercoe as members. The role of this committee was to determine the workshop scope, topic areas, invited speakers and participants.

A two day workshop with 35 attendees was held at CSIRO, Rockhampton on 8-9 September 1992. Attendees were representatives of research, extension, practitioner and producer interest mainly from Queensland with delegates from Northern Territory and Western Australia (see page 107 of Workshop Proceedings for list of participants).

Each author was asked to review the relevant literature as well as present up to date reports on appropriate research activities. Papers were presented on the following topics:

- an overview of physiology and endocrinology of male reproduction
- bull examination and its contribution to herd fertility outcome
- managerial aspects from weaning to first mating that influence bull fertility
- management of mated bulls
- pathological abnormalities
- impact of disease on fertility
- genetic relationships - heritabilities and male/female correlations
- genotype effects
- selection strategies for replacement bulls

Papers were presented mainly on the first day with group discussion and a plenary session identifying issues occupying most of the second day.

Two working parties were set up by the end of the workshop. The first addressed education/extension activities whilst the second assessed future research priorities. Both of these working parties met several times between September and November and developed recommendations based on a summation of the group discussions and plenary sessions.

A workshop proceedings containing all papers and working party recommendations was published by April 1993. One hundred and fifty of these proceedings were printed and copies distributed to workshop participants plus DPI field staff (30) and DPI libraries. The balance will be sent to various scientific libraries or advertised for distribution through the newsletter of the Australian Association of Cattle Veterinarians. Should there be greater demand, additional copies will be printed through DPI publishing services and will be a saleable publication.

Results and Discussion:

A workshop proceedings has been produced and has been distributed to advisers to the beef industry.

The recommendations of both working parties were contained in the workshop proceedings.

The working party recommended that research priorities in bull fertility should be:

1. Evaluation of methods of assessment of bull fertility under a multiple-sire mating situation using DNA fingerprinting. Assessments of serving ability, serving capacity, physical soundness and semen quality parameters would all be evaluated.

2. Quantify the value of improving female fertility through selection on male characteristics.

3. Evaluation of disease effects on bull fertility using new technologies and including some fundamental research on disease effects.

4. Research into how to educate practitioners and breeders to use existing knowledge on physical soundness, relocation and nutrition.

The workshop identified that considerable technical information was available on bull fertility but this was not being used adequately. While some areas for future and further research were indicated, the main task was to effectively disseminate what we now know. Higher adoption rates would then lead to either higher bull fertility or, more probably, greater efficiency and lower costs in the use of bulls. This working group aimed to develop a plan based on education and extension strategies to further this process.

There are three components to a potential education and extension program:

- a technical bulletin or series of information brochures
- technical update or refresher workshops for veterinary practitioners and consultants
- extension programs for producers.

Technical bulletin:

Recommendation. There is adequate written material available at a range of technical levels, so that there is no need for a specific bulletin or series of brochures to be written on bull fertility.

The technical papers from the workshop will be compiled into one set of reference documents. Although these would not be considered as an adequate technical bulletin on their own, they will make a valuable contribution to the available material. Comprehensive lecture notes have been written to accompany short courses. Examples include Buying Better Bulls (3B Days) conducted within the Queensland Beef Genetic Improvement Project, Beef Cattle Practice by the Post-graduate Veterinary Science Committee, Bull Fertility Performance and Health at the Burdekin Agricultural College, and Bull Soundness Examination Workshop at Goondiwindi.

The proceedings should certainly be circulated to the participants from the Rockhampton workshop. Apart from this, existing literature and that to be produced in association with future courses on aspects of bull fertility will be adequate. There is no further need for specific bulletins or brochures.

Refresher for practitioners:

Recommendation. Updating the skills of practitioners should be addressed by the profession through the Australian Veterinary Association and particularly the Australian Association of Cattle Veterinarians with technical support from University Post-graduate Veterinary Science Committees.

Short courses on aspects of bull fertility have been held in 1986 and 1990 and a further one is planned for July 1993 in Townsville. These courses certainly attract the main practitioners in bull fertility but not necessarily those with smaller or mixed practices or those with part time involvement. Seminars and half-day workshops, as recently conducted in southern Queensland, fill a useful role here. Certainly those practitioners who participate benefit from this refresher training. The challenge is to get greater involvement so that the benefits from well informed and skilled practitioners flows throughout the cattle industry.

Geographically distributed workshops on topical issues and covering practical skills will be most appealing to practitioners. A whole property approach to veterinary advice will incorporate bull testing for fertility. In this way practitioners can incorporate extension information and awareness as part of their advice.

Extension for producers:

Recommendation. Continued funding for extension on bull fertility in Queensland should be channelled through the existing projects, Beef Genetic Improvement and Producer Demonstration Sites to emphasise the place of bull fertility in whole property management.

Clearly the previously outlined sections would have both direct and indirect impact on producers and the industry. The series of workshops on Buying Better Bulls has been widespread in both volume and impact for both the stud and commercial components of the industry. With Producer Demonstration Sites there is increasing producer interest in Breedplan and the place of bull fertility in breeder and whole property performance. Given that the infrastructure and momentum are in place for these projects, appropriate topics and locations can be readily included in extension activity.

Recommendation. Technology and extension material developed and being used in Queensland be made available and assistance be provided for its implementation in the Northern Territory and the northern part of Western Australia.

In comparison with Queensland the other parts of northern Australia lag with adoption of screening and selection for bull fertility. Both extension officers and producers in these areas would be keen to improve bull fertility. Funding from MRC for a series of short workshops led by the Queensland team could introduce the concepts in Breeding Better Bulls in the Kimberley and Northern Territory. Smaller numbers of people and more extensive conditions would indicate the benefits of using the existing Queensland expertise and infrastructure. Producers are aware of bull fertility but need more practical information.

Recommendation. Stud breeders, livestock selling groups, breed societies and industry associations should be closely involved with provision of objective data on fertility and suitability of bulls offered for sale to commercial producers.

Each of these groups has a vested interest in the performance of the bulls they sell or deal with. Supply of good quality bulls will enhance their reputation and, hence, business opportunities. Extension activities aimed at these groups are likely to have most impact and should be encouraged. These groups could also be interested in sponsoring or participating in upgrading skills within their industry.

Success in achieving objectives:

The project successfully addressed the first objective of identifying gaps in research knowledge that limit the ability to select more fertile bulls for herds in northern Australia. The workshop identified that considerable technical information was available on bull fertility but this was not being used widely. The effective dissemination of our present knowledge should have a greater priority for improving overall bull fertility in northern herds with a lesser emphasis on research. However there are a number of research issues that should continue to be addressed.

The second objective of assessing the feasibility of making gains in these identified areas were addressed. The recommendations of the working party on education/extension activities have been mostly addressed.

- The papers and recommendations from the workshop have been published and distributed not only to identified interested parties but also to technical libraries so that the information can be accessed in literature searches.

- The refresher for practitioners continues to be addressed by both the Australian Veterinary Association through special interest groups (eg Australian Association of Cattle Veterinarians) and conferences, as well as the various post-graduate committees, eg Vet Update 93 at James Cook University in July 1993 contains a component of bull fertility.

- This project has reinforced continued funding for extension on bull fertility in Queensland through DPI's continued support for the Beef Genetic Improvement project as well as elements in the Producer Demonstration Site project.

- Provision of technology and extension material for implementation of a similar bull fertility evaluation program in NT and WA is less clear. The attending delegates at the workshop are aware of the recommendation plus a number of the workshop proceedings have been distributed to both the NT and WA Departments.

- Stud breeders, livestock selling groups, breed societies and industry associations are all part of the target audience of the Beef Genetic Improvement project. The workshop proceedings will provide a sound technological reference for people who conduct workshops or field days.

In the research area, it will be feasible to make gains in a number of areas:

- DNA finger printing through the Agricultural Biotechnology Centre at University of Queensland, will allow a more meaningful assessment of pre-mating measurements such as scrotal circumference, semen quality and serving capacity tests in multiple sire herds. This test is most probably more reliable and quicker than blood typing but the cost per sample

of $20 - $25 may be an initial barrier until throughput volume should diminish the cost. It needs to be clarified that pre-mating examinations do contribute to improved branding rates and the need to use fewer bulls. Several groups are assessing this issue but none is receiving MRC funding.

- Improving female fertility through selection on male characteristics can only continue providing funds still are available to such places as Belmont, Swan's Lagoon and the Beef Genetic Improvement project. It will be feasible to collect this information as a consequence of ongoing long-term breeding programs.

- P W Ladd's paper in this workshop proceedings highlights the advances that can be made using newer diagnostic technologies for improving the assessment of bull disease effects on herd fertility.

The third objective of making recommendations to the NAP2 Management Committee on both technology transfer of existing knowledge and identifying research needs and developing strategies that will address these needs have been met. These are embraced in the recommendations of both working parties.

Intellectual Property arising from the project:

All intellectual property is contained in the workshop proceedings which has been widely distributed to advisers to industry.

Progress in, or recommendations for, commercial exploitation of the results of the project:

Should there be a demand, a second printing of the workshop proceedings will be made on a cost-recovery basis.

Impact on meat and livestock industry - present and within 5 years:

The project will impact in three areas:

- a greater awareness by all facets of the industry of the impact of bull subfertility on reducing branding rates

- improved quality of advice to industry that will result in better value for money when purchasing bulls

- improved techniques of assessing the value of different premating measurements when examining bulls.

Total funding and MRC contributions:

MRC - $22,228 of which the final payment of $5,128 is contingent upon the receipt and acceptance of the final report by the MRC.

DPI, CSIRO, JCU, UQ, NTDPIF - estimated support is $200,000 based on salaries, infrastructure

and support staff.

Conclusions and recommendations:

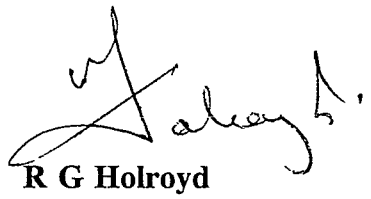
The major emphasis in research in bull fertility in northern Australia should be in the technology transfer of current knowledge rather than in research per se. This emphasis should be applicable for the next three years. However, there are a number of research areas worthy of support and these have been identified and prioritised in the workshop proceedings. The workshop proceedings will provide a sound assessment base for the evaluation of any proposed research projects in bull fertility.

Media coverage:

One broadcast was made on the ABC Rural Hour by R Holroyd during the workshop. An article appeared in the newsletter of the AACV outlining the workshop program and recommendations.

Acknowledgments:

The project members wish to thank the MRC for their financial support and on-going interest in this project.



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