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Prepared by:	**PC Smith, M Stockdale, R Dray & M Jeffery Department of Agriculture & Food, Western Australia**
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Industry initiatives to improve young breeder performance in the Pilbara and Kimberley of W.A

Abstract

Young breeder performance is high risk in herds across northern Australia. Yet limited work demonstrating improved practices exists. To address this, activities were conducted in the Pilbara and Kimberley regions of Western Australia to describe current performance, determine industry understanding and perceptions, and demonstrate means of improving performance.

The project has provided improved credibility of management systems developed to enhance overall breeder herd productivity by focussing on improving young breeder performance. In particular, the capacity to refer to locally developed information will be more acceptable to many pastoralists. In particular, it demonstrated the importance of seasonally-dependent nutrition before and during mating on first calving and return to oestrus. It also confirmed the difficulties associated with controlling time of first calving in extensive management systems.

Executive Summary

By comparison with many other areas of northern Australia, little information has been documented on any production parameters of grazing cattle in the Pilbara and Kimberley regions of WA. Cattle properties in both regions are characterised by their extensive areas, large herds and variable land systems and pasture communities. In addition, there is a highly variable climate which impacts on pasture quality and quantity throughout the year and a relative lack of infrastructure and animal control. These factors all contribute to significant opportunities to improve and stabilise individual animal and overall herd performance. But, in order to facilitate the management changes required to make the improvements, simple, practical methods of herd, pasture and diet quality assessment need to be developed.

To obtain information on these issues, a series of activities were conducted in the Pilbara and Kimberley regions of Western Australia to describe current performance of young breeders, to determine industry understanding of young breeder status (including mortalities), to demonstrate various means of improving young breeder performance and gauge the changes in industry perceptions over the course of the project. An industry group (the Pastoralist Project Management Group) provided advice and support during the development and conduct of the project in each region. Adverse seasonal conditions in the Pilbara reduced the capacity of the project to obtain all the information envisaged. However, the project, with the support of the Pastoralist Project Management Groups in both regions, was able to meet its objectives.

A survey of pastoralists provided an understanding of industry perceptions both before and after the project, and highlighted that the project increased awareness and likelihood of adoption of new techniques. But considerable scope for further uptake exists. Producer estimates of mortalities in young breeders were initially quite low (less than 10% in all cases, although estimates were higher in the Kimberley), suggesting that survey respondents felt that these classes of stock were quite capable of surviving within the current management system. These results confirm the major premise of the project that limited information exists upon which producers can make informed decisions. Comparison data (pre and post project activities) were restricted given the transience of many respondents, but this, in itself, highlighted that information products and communication strategies need to be constantly provided to industry to ensure those entering the industry have information available to them as soon as possible, rather than extension activities being predicated on a continual upskilling of a fixed group.

Recorded average weaner heifer weights were higher in Kimberley 207 kg/head (average – range 183 kg to 244 kg) than Pilbara 189 kg/head (range 143 kg to 218 kg), although growth rates were lower in the Kimberley. Growth rates of heifers for a period of up to 12 months following weaning averaged 95 kg/head (range 69 kg to 109 kg) in Kimberley as opposed to 108 kg (79 kg to 124 kg) in the Pilbara.

Conception rates in the year following weaning averaged 44% (22% to 64%) in Pilbara. Bull control proved an on-going problem, and the project demonstrated the problems experienced with keeping heifers segregated and being able to handle them as a discreet group, particularly over the wet season when infrastructure is often damaged, and the associated costs of mustering and returning stock to their paddock. It was common at all Pilbara sites that significant numbers of heifers were already lactating at the time of planned first mating. This reinforces the approach of segregating the replacement heifer group to allow management of these calves e.g. two weaning musters, supplementation, etc.

It was concluded that for these extensive situations it was better to manage calves once they were on the ground rather than spend too much effort trying to control the time of first mating by keeping bulls out. The cost of any additional mustering would need to be justified in terms of increased animal performance, improved recovery rates, pregnancy and weaning rates of the young female group. It was also difficult to limit the number of 'other cattle' entering the young breeder paddock, exacerbating the problems of handling large mobs through the yards and collecting information useful for herd management.

While knowing pregnancy status is important in young breeder management, pregnancy testing of large mobs of more than 1000 head, particularly where numbers include lactating females and 'stranger cattle', present management and welfare concerns, particularly for young calves. This situation limited data collection from the project group, but highlighted the practical problems of handling commercial scale herds in this environment.

Botulism vaccination was shown to have a significant effect on mortality (as estimated by the disappearance rate of animals between musters), suggesting that botulism was a factor in the herd in which its effect was assessed.

Although nutritional status is considered an important factor for young breeders, urea supplementation (as supplied through the stock water system) produced minimal, non-significant liveweight responses (3 kg/head in one draft and 5 kg/head in another). Supplementation also appeared to have no significant effect on conception rates of first mated heifers.

Demonstrating responses to changes in breeder management is difficult even when there is good animal control. This problem is significantly greater in extensive areas. While the PDS format appears to be appropriate to demonstrate 'practice changes' to improve reproductive performance, e.g. improving conceptions of females during their first lactation by having them in better condition at calving, producer demonstration sites are unlikely to be an effective tool to demonstrate 'system' change. Gaining adoption of new techniques may best be achieved using herd modelling as a tool, with animal performance documented to produce realistic and 'best bet' outcomes.

Contents

1 Background

A common problem facing commercial beef producers in northern Australia is getting young females rebred during their first lactation, and this is generally regarded as the biggest area of inefficiency in breeding herds. This is a problem because the requirement is to rebreed an animal that has not yet reached her mature weight, and is often faced with the task of consuming enough energy to satisfy needs for growth, lactation, and maintenance when generally grazing only poor quality forage. In most situations, the pregnancy rate of either the two or three-year old cow during their first lactation is the lowest in the herd.

Replacement females, including first lactation females, may represent up to 40% of the breeding herd. Maximising calf output of this segment of the herd so that lifetime production is not compromised is a significant challenge of herd management in northern Australia. Yet, although the importance of breeding replacement heifers to calve as early as is efficient is acknowledged, what is uncertain is the level and nature of management required to maximise their productivity. Moreover, the two-year old lactating breeder is generally the most expensive and valuable animal in the herd, because of the investment in her to date and because she has not yet returned any income to the business.

Despite young breeder performance (defined as young females remaining in the breeding herd until they wean their first calf) being specifically identified as both a high risk and a high opportunity group in breeder herds across northern Western Australia (referred to as the northern rangelands, and encompassing the Pilbara and Kimberley regions), limited work exists that demonstrates the benefits of improving their productivity. For example, supplementing weaner heifers in the Kimberley and Pilbara is not widespread, partly because of the view that the practice is not cost effective. Consequently, young breeders continue to be turned out onto poor quality pasture with little additional nutritional support, resulting in poor growth rates and low reproductive rates.

Calving before three years of age reduces the likelihood that these young breeders will re-conceive while lactating. This, and mortality rates of this group, can have a major impact on herd productivity and sale potential. Implementing specific management strategies, such as supplementation to improve wet season weight gain and minimise dry season weight loss could assist cattle to reach turn-off weights more quickly, and reduce the age at which heifers will reach sustainable reproductive potential.

Therefore, the aim of this project was to increase the awareness of cattle managers about the problems with heifer fertility in the Pilbara and Kimberley, and of practices that can be used to improve it. In particular, it aimed to assist Pilbara and Kimberley pastoralists, in conjunction with staff of the Department of Agriculture and Food Western Australia (DAFWA), to assess the current performance level of heifers and young breeding females, develop and demonstrate practical management strategies to overcome the problems identified, and increase adoption rate of those management practices demonstrated to have a positive impact. The emphasis throughout the project was on producer involvement in the development and implementation of project activities. This was to ensure that the management systems developed and demonstrated were compatible with local production constraints, and to facilitate adoption of improved systems. In response to the limited documented information available of the productivity of breeder herds in the northern Western Australian rangelands a significant part of this project was targeted at establishing benchmarks of female breeder performance.

2 Project Objectives

2.1 Project Objectives

By December 2009, the Research Organisation will have:

1. Identified (in consultation with industry), evaluated and demonstrated practical management strategies to improve the performance of heifers and young breeding females on 2 commercial properties in each of the Kimberley and Pilbara regions (total 4 sites).
2. Recorded the reproductive performance of heifers and young breeders on 8 representative stations in the Pilbara and Kimberley regions of W.A. and established benchmarks for young breeder reproductive traits on each of those stations.
3. Produced a Best Practice Manual for heifer management in northern W.A and the NT (in conjunction with DBIRD).
4. Surveyed Kimberley and Pilbara beef producer heifer management practices at the start of the project to identify barriers (real and perceived) to implementation of other known practices.
5. Surveyed Kimberley and Pilbara beef producer heifer management practices at the end of the project to document changes during the life of the project.

3 Methodology

3.1. Producer management groups.

As this project was particularly targeted at management change on pastoral leases, Pastoralist Project Management Groups (PPMGs), composed of pastoralists known to be interested in improving the management of young breeders, were established in both the Pilbara and Kimberley to assist with the management and development of the project activities and to ensure project credibility in the respective local industries. The input and support of these groups was a valuable part of the project. In addition to pastoralists co-operating with the heifer performance monitoring and demonstration site activities, a call for expressions of interest from others interested in becoming involved in the management groups was advertised in the Western Australian Northern Pastoral Memo in June 2004. The Pilbara and Kimberley NBIC and NABRC representatives were members of their respective groups.

The respective PPMGs were interested in documenting how well these new systems worked, and if they were likely to result in improved animal performance when compared with performance generated from their current management systems. The role of these groups also included ensuring that management practices to be demonstrated were likely to be practical in the extensive Pilbara and Kimberley environments, and to ensure that the project maintained a practical industry focus.

3.2. Industry survey

A survey to record background information on the pastoral industry in the northern rangelands, pastoralists' perceptions of the performance of young breeders and their attitude to change was conducted as one of the first project activities. A similar follow-up survey was completed in 2009 to provide information on industry changes and to document practice change as a result of the adoption of project recommendations.

The initial survey was conducted during the early stages of the project in 2004/05. A questionnaire was developed and around 40% of Pilbara pastoralists were surveyed in the initial survey. Survey information was collected during personal interviews and mail out questionnaires, and all participants were advised that they would again be asked to participate in a similar survey towards the end of the project in 2008/09 as part of project evaluation. A smaller proportion of Kimberley producers were surveyed in the initial survey.

A second survey to collect similar information was conducted late in 2009 at the end of the project to assess uptake of project recommendations and outcomes by industry. Due to 'natural attrition' and change of managers, only about one half of the original respondents were available for the second survey. Fewer pastoralists were surveyed in the second survey in the Pilbara compared to numbers surveyed initially; the reverse occurred in the Kimberley region.

3.3. Benchmarking current heifer and young breeder performance.

Young females were identified on four stations in the Pilbara and three stations in the Kimberley, and their performance recorded to provide base data on the reproductive performance of females in the northern rangelands. In most instances it was possible to record information until after young females had calved for the first time. The aim of this activity was to provide some real information on heifer and young breeder productivity under existing management systems. This information also provided a pseudo control group for the best bet management system adopted and being evaluated at 'project sites' in the Pilbara and Kimberley.

3.3.1. Pilbara

Mallina

This station is dominated by hills and ridges with hard spinifex grasslands, sandy plains with shrubby hard and soft spinifex grasslands and sandy surfaced alluvial plains with soft spinifex grasslands.

Weaner heifers, (average weight 208 kg, estimated age range 6 – 18 months) were identified, weighed and moved to a 'heifer paddock' in October 2003. Bulls were intentionally introduced into the heifer paddock in March 2004. Heifers were weighed and pregnancy tested in August 2004 and turned out into the Mallina breeder herd. The lactation status of these females was recorded by station staff during mustering in 2005.

Yarraloola

This is predominantly an area of hills and stony plains with hard and soft spinifex grasslands, and stony plains and alluvial plains with tussock grasslands and snakewood shrublands.

A group of 106 young weaner heifers (average weight 143 kg, estimated age range 5 – 9 months) were tagged at Yarraloola in October 2003. A further group of 56 heifers (estimated age range 18 – 24 months) were tagged in October 2004. Both groups of heifers weighed on average 261 kg in October 2004. These heifers were not intentionally mated until mid 2005 at around 2 - 3 years of age. Largely due to severe flood damage to fencing during Cyclone Monty in March 2004, some conceptions had occurred prior to intentional mating. The heifers were weighed and pregnancy tested in August 2005 before being turned out into the breeder herd.

Mandora

This is an area of sandplains with shrubby soft spinifex grasslands and coastal plains with buffel grass grasslands.

A group of 229 weaner heifers (average weight 218 kg, estimated age 6 – 18 months) were tagged and weighed at Mandora in November 2004. Bulls were introduced to the heifer paddock in early May 2005. The heifers were again weighed and pregnancy tested in August 2005. The reproductive performance of this group of females was recorded again in July 2006 and May and September 2007.

Hamersley

This is an area of hills with hard spinifex grasslands, stony plains with hard and soft spinifex grasslands and some alluvial plains with tussock grasslands and mulga shrublands.

A group of 200 heifers (estimated age 18-30 months) were tagged and pregnancy tested in October 2004 before being dispersed into the breeder herd as replacement females. These heifers were in excellent condition at that time and pregnancy testing results indicated that they had been unintentionally exposed to bulls for a considerable period. The lactation status of these females was recorded by the Hamersley team during mustering in August 2005.

3.3.2. Kimberley

Spring Creek

The Spring Creek lease is in an area of ribbon grass/ soft spinifex monsoonal pastures with some areas of black soil.

The heifer and young breeder management system in practice at the time of benchmarking included running heifers/first lactation females separately from the main breeder herd until their second calf. Mating was continuous, and limited supplements were offered to breeders, and smaller weaners were supplemented as required. In 2004 a group of 254 heifers were tagged (average weight 196 kg, estimated age 6 – 18 months) and were weighed again in 2005. Also in 2005 a further group of 250 heifers (average weight 183 kg, estimated age 6 – 18 months) were identified. However, because of management difficulties this second group was not followed through.

Ruby Plains

Ruby Plains station is in an area of low stony hills and ridges of sandstone and associated red sandy country supporting hummock grasslands of soft spinifex with stunted eucalypts and shrubs.

Good historical data already existed on the reproductive performance of many groups of breeders on Ruby Plains station. The breeder management system included control mating of all breeders, with all heifers culled if not pregnant following mating as 2 year olds. Non-pregnant 1st lactation females were given a second chance and all older dry breeders removed from the herd at weaning.

Data from the Ruby Plains herd were utilized for both the benchmarking activities and subsequently, herd data were recorded for the demonstration activities.

In May 2005, a group of 250 first lactation females, average weight 310 kg, estimated age 3 years old, were pregnancy tested and weighed prior to distribution into the breeder herd. In June 2005 a group of 250 pregnant 2 year old heifers (average weight 300 kg) were weighed. In May 2006 the lactation status and weight of this group was recorded, and in September 2006 they were pregnancy tested during their first lactation. In May 2006 a third group of approximately 300 mated 2 year old heifers were weighed and in June 2006 they were pregnancy tested and weighed again. In May 2007 these animals were weighed and their lactation status recorded. In May 2006 a forth group of

approximately 500 weaner heifers (average weigh 230 kg) were identified and, following mating, these animals were weighed and pregnancy tested in June 2007.

Yeeda / Colourstone

The area of which Yeeda station is typical is dominated by low fertility sands with soft spinifex/ribbon grass pastures. These low fertility Pindan soils cover a large area of the west, southern and central Kimberley areas. Carrying capacity is traditionally low, with poor to very poor animal production with weight gains below 100 kg per year and mustering costs high on a per beast basis due to the areas needed to run numbers.

Cattle included in the project on Yeeda station in 2005 were part of a 6 paddock rotational grazing system being established on the Pindan soil systems of the west Kimberley. The breeders were of mixed ages and previous reproductive history. Controlled mating of these breeders was used for the first time in 2006. This group was included as one of the monitoring herds with the intention of providing background information on females of different ages and to record changes in breeder performance with the introduction of controlled mating. However, little data were collected from these animals.

3.4. Project sites – evaluation of 'improved' young breeder management systems

Project sites were established on two locations in the Pilbara (Yalleen and Warrawagine stations) and Kimberley (Ruby Plains and Anna Plains stations). The role of these sites was to evaluate the practicality of 'best bet' heifer and young breeder management systems in the northern Western Australian rangelands, and to document the performance of females run under these management systems. Management practices to be included in these systems were determined in consultation with the members of the respective Pastoralist Project Management Groups and the co-operating pastoralists. Information collected from the benchmarking sites provided support for the inclusion of some practices. For example, the apparent disappearance of a significant number of heifers around the time of their first calving compared to non-calving heifers at one of the benchmarking sites supported the need for heifers to run as a separate group until they weaned their first calf.

Practices included in the management systems evaluated at these sites are documented below.

Warrawagine

This lease is dominated by ranges with hard spinifex grasslands, stony plains with hard and soft spinifex grasslands and alluvial plains with tussock grasslands.

Management system introduced and evaluated at Warrawagine station were:

- Potential replacement heifers were segregated from the breeder herd following weaning during the annual breeder muster. Replacement females were selected from these heifers after the completion of breeder mustering. In practice, the replacement female group comprised a mixture of younger weaners from the previous year and 'big weaners' from the current year. The majority of this latter group had been too small to wean the previous year. The resulting average age at first mating in March of the year following weaning was estimated to range from 18-24 months.

- These 'keeper heifers' were run in the Big Dam heifer paddock following selection in September/October 2006, and were mustered in April and September in each of the following years.
- Bulls were introduced annually in March and removed at the pregnancy testing muster, usually in September. It was apparent from subsequent lactation and pregnancy testing records that bull control was largely ineffective.
- Females were pregnancy tested annually in September. Because of the numbers involved, it was not practical to pregnancy test lactating females in the first two years of the project.
- Pregnant replacement females were run as a group until they weaned their first calf. This provided an opportunity for management intervention in the event of poor seasonal conditions or other events threatening females calving and lactating for the first time.
- A representative group of these heifers and young breeders was vaccinated with botulism vaccine each year from 2006 to 2009.

Activities began at Warrawagine station in September 2006, with the final data collection in September 2009. One group of 1500 heifers (average weight 294 kg, estimated age 12 – 18 months) was followed through for the 3 year period.

In addition to recording the reproductive performance and recovery rate of young breeders, the use of RFID and computer based book keeping (Stockbook) also provided the opportunity to evaluate disease control practices. Botulism vaccination was not currently part of the cattle management system on Warrawagine station. The effect of vaccination on recovery rates of vaccinated and unvaccinated females was recorded as part of this project.

Yalleen

This is predominantly an area of hills and ranges with hard spinifex grasslands and minor alluvial plains with tussock grasslands.

Management of heifers and young breeders at Yalleen station included mustering twice a year, keeping heifers segregated from the breeder herd, until mated following selection as suitable herd replacements in the year following weaning. Heifers were pregnancy tested five months after the commencement of mating, and pregnant heifers turned out into the breeder herd. Empty heifers were sold. This project site was seen as a good opportunity to evaluate and document the performance of heifers and young breeders under an existing young breeder management system which included twice-yearly mustering.

No 5 weaner heifers were initially identified in June 2005. These heifers were run on better country to ensure reasonable growth and development prior to mating early in 2006. Heifers were pregnancy tested following mating, and pregnant heifers turned into the breeder herd.

The lactation status of identified heifers and pregnancy status of dry heifers was recorded at each of the two breeder musters each year. It was intended to pregnancy test all identified females during the second round muster the year after they were turned out into the breeder herd to provide information of conception rates of females during first lactation. Unfortunately, because of seasonal conditions and other management factors, only limited conception information was recorded from

lactating females. At the time of data collection, it was 'normal' management practice to pregnancy test all dry females.

This system was repeated with another group of heifers (average weight 280 kg, estimated age 2 years old) in the second year (2006) of the demonstration. This group was dispersed following pregnancy testing due to very poor seasonal conditions experienced at Yalleen station at that time.

Anna Plains

Marine plain and couch/buffel grass pastures dominate the vegetation of this West Kimberley lease.

The aim of the Anna Plains project site included increasing the percentage of heifers reaching mating weights of 280-300 kg by 15 months of age through the use of urea supplement supplied through a water medicator. Two year groups of Brahman cross heifers were used in the trials. The first group was identified in August 2006, and supplemented until December 2006. The second lot was identified in July 2007 and supplemented until January 2008.

Each year group of Brahman cross heifers was allocated on the basis of liveweight into four weight groups containing 15 animals within two treatment groups (± urea supplement), with two replicates for each treatment. All heifers within a treatment replicate grazed together, with a total of 60 animals in each paddock. Two groups were provided urea through a water medicator between August 2006 and December 2006, while the remaining two groups were grazed on pastures without supplements. In January 2007, all these heifers were moved to a common paddock and bulls were added to the group at a rate of 4%. The heifers were pregnancy tested in April 2007.

All animals were watered through troughs, with no natural free water available in the paddocks. Urea content of the water in the fed groups was adjusted weekly based on weekly water intakes and set to deliver 10, 20, 30 and 60 g of urea per head per day for weeks 1-2, 3-5, 6 and 7-9 of the trial respectively. Heifers were mated in January 2007.

A second age group of heifers was introduced into the project in August 2007 when four weight groups of Brahman cross heifers were allocated to similar supplementation treatments from August 2007 until January 2008. As with the previous age group, these heifers were mated as a group to 4% bulls from January 2008. All heifers were pregnancy tested in late June when they returned to their treatment paddocks until mating in January 2009.

Ruby Plains

Ruby Plains station in the southern East Kimberley was involved in the young breeder project from May 2005. Data from the Ruby Plains herd were utilized for both the benchmarking activities and subsequently, herd data were recorded for the demonstration activities.

All breeders on Ruby Plains were controlled mated with heifers being exposed to bulls for 2-3 months (3-4 cycles) and mature breeders for 2-3 months (3-4 cycles). Breeders were run as four age cohorts, weaners, maiden heifers, 1st calf heifers and mature cows.

A draft of 550 No 6 weaner heifers was identified and separated into 3 liveweight groups, with the aim of increasing the number of heifers reaching a start of mating weigh of 280 kg by February 2008. The light group averaged 194 kg in September 2007, the middle 251 kg and the heavy group 291 kg. The lightweight group and the heavy group were not supplemented. The mid weight group were fed a high protein meal dry lick from September to December 2007 (78 days). All animals were weighed and pregnancy tested in June 2008.

4. Results and Discussion

4.1. Management Groups

The Pastoralist Project Management Groups (PPMG) were a key part of developing the credibility of project activities with the industry in their regions and they provided practical input and industry support, particularly in the early stages of project activities. Combining the knowledge and experience of pastoralists with the experience and R&D knowledge from other areas of northern Australia ensured the management systems developed and demonstrated had practical application in the northern rangelands. While membership of these groups declined over time, the active support of the remaining members continued to provide a valuable conduit for information to pastoralists of the activities at the demonstration sites and support during presentations at industry meetings.

4.2. Industry Survey

In order to identify the status of the production system at the start of the project, and the changes that may have occurred during the project, surveys of Pilbara and Kimberley producers were conducted to:

1. Identify the extent to which producers were initially aware of the real reproduction indices of their herds.
2. Identify barriers (real and perceived) to implementation of other known practices at the start of the project.
3. Identify heifer management practices and reproductive performance at the end of the project.

Producer estimates of calving percentages compared with data obtained from the sites at which benchmark data were collected varied between Kimberley and Pilbara producers (Tables 1 & 2).

Expectations of reproductive performance among Pilbara producers were initially high for first calf heifers compared with collected data, but were more realistic in the 2007/08 survey. A similar trend was noted amongst Kimberley producers for first calf heifers, although reproduction estimates for maiden heifers were below those figures recorded at the benchmark sites.

Statistical analysis (Chi square) of these data [grouped across maiden and first calf heifers] suggested that, apart from survey estimates in the Kimberley in 2007/08, the estimated percentages for weaning rates determined in the survey were significantly different ($P<0.01$) from the values recorded for the benchmark surveys. This suggests that producers had an incorrect understanding of the actual performance of their stock. Certainly the survey, covering a larger number of producers than those involved in the benchmarking exercise, would have included data from a wider range of production systems.

Table 1. Producer estimates of reproductive data and those data recorded at benchmarking sites, Pilbara.

Pilbara Estimated weaning % - survey			Recorded %
	2003/04 (n=20)	2007/08 (n=14)	
Maiden heifers	61	41	64
1st calf heifers	67	54	48
Breeders	71	73	
Old cows	67	68	

Table 2. Producer estimates of reproductive data and those data recorded at benchmarking sites, Kimberley.

Kimberley Estimated weaning % - survey			Recorded %
	2003/04 (n=8)	2007/08 (n=18)	
Maiden heifers	41	57	68
1st calf heifers	58	45	48
Breeders	69	60	
Old cows	68	48	

The comparisons of the industry profile in 2004/05 and 2008/09 in both the Pilbara and Kimberley suggested a variable response to the project in terms of modification of industry practice. However, nine of the twenty one managers interviewed during the 2004/05 survey in the Pilbara had moved from the area in the period before the 2008/09 survey was conducted. Similar transience was noted in the Kimberley. In all, ten Pilbara pastoralists and four Kimberley pastoralists participated in both surveys (Tables 3 & 4). These latter data provide a more realistic comparison of change over time.

Information indicates that while management system changes occurred in both regions, there is still considerable opportunity for further change.

Survey data regarding producer awareness of practices to improve young female productivity were variable (Table 5) although generally appeared to be slightly higher in the Kimberley than in the Pilbara.

Survey respondents were also asked if they had adopted any of these strategies since 2004/05 (Table 6). Responses suggested significant uptake of some strategies (for example, running heifers as a separate group or providing heifers with a higher nutritional system) while others had a limited uptake. Of interest, while the actual uptake of practices varied between the Kimberley and Pilbara regions, the relative uptake of most practices was quite similar. Reasons for not adopting many of these management practices revolved around cost of providing infrastructure to improve cattle control coupled with concerns over the cost/benefit of some of the practices.

Table 3. Management changes 2003/04 – 2007/08 by pastoralists participating in both surveys, Pilbara

Practice	% Adopt 2003/04	% Adopt 2007/08
Campylobacter (Vibrio) vaccination of heifers	0	10
Campylobacter (Vibrio) vaccination of bulls	20	30
Heifers 1st mated 250/300Kg weight range	43	66
Segregate until wean 1st calf	0	50
Bulls <3 years old mated to heifers	50	80
Select heifers on pregnancy test	30	20

Table 4. Management changes 2003/04 – 2007/08 by pastoralists participating in both surveys, Kimberley.

Practice	% Adopt 2003/04	% Adopt 2007/08
Campylobacter (Vibrio) vaccination of heifers	0	100
Campylobacter (Vibrio) vaccination of bulls	50	100
Heifers 1st mated 250/300Kg weight range	58	80
Segregate until wean 1st calf	33	50
Bulls <3years old mated to heifers	75	100
Select heifers on pregnancy test	0	100

Because of varying perceptions on the "fate" of females in the herd (mortality, sales etc), survey respondents were also questioned on various indices of female sales and mortality. These data (averaged over 2007 and 2008) were collected for the Kimberley and Pilbara and suggest substantial differences in the estimates of female mortality between the two regions (Table 7). Averaged across leases that responded to the survey, respondents estimated that, averaged over 2007 and 2008, 41% of total sales were of females in the Pilbara (803 females of 1942 total sales), while the corresponding figures in Kimberley were 30% (461 of 1552 sold were females). Estimated mortality was much higher in the Kimberley than the Pilbara, although in both cases there is an inconsistency between the estimated female sales and the estimated female mortality (Table 7).

Table 5. Producer perceptions of the importance of improved management practices to improve heifer productivity.

Management practice	Important - Pilbara	Important - Kimberly
Heifers separate from breeders	77	80
Bull control	38	73
Improve joining weights with supplements	23	53
Improve joining weights with better paddocks	77	73
Time of year weaning occurs	42	73
Early weaning from heifers	43	73
Pregnancy testing of heifers	35	66
Selection for fertility	70	64
Bull fertility testing	58	67

Moreover, estimates of mortalities in young breeders (Table 7) were quite low (less than 10% in all cases), suggesting respondents felt that these classes of stock were quite capable of surviving within the current management system.

Overall, survey response data suggest some increased awareness and adoption of new techniques, but considerable scope for further uptake. Comparison data are restricted given the transience of many respondents, but this, in itself, highlights a major issue. Information products and communication strategies would need to be constant to ensure that those entering the industry had information available to them as soon as possible, rather than extension activities being predicated on a continual upskilling of a fixed group.

Table 6. Percentage adoption of young breeder management strategies since 2004/05, Pilbara and Kimberley regions.

Adopted strategies since 2004/2005		
	Pilbara Yes %	**Kimberley Yes %**
Run heifers separate to breeders	57	33
Bull control	21	6
Improve joining weights with supplements	21	44
Improve joining weights with better paddocks	57	39
Vaccinate against disease (Botulism, Vibrio)	29	33
Time of year weaning occurs	7	6
Early weaning from heifers	14	17
Mating heifers as yearlings	7	6
Pregnancy test heifers	36	28
Bull fertility test	7	6
Bull percentage	43	22
Age of bulls – for heifer mating	43	28
Selection for fertility	29	17

Table 7. Estimated female sales and female mortality, Kimberley and Pilbara regions, 2007/2008.

	Average estimated mortality (%)			
	Kimberley		**Pilbara**	
Class of Female	**2007**	**2008**	**2007**	**2008**
Weaner heifers	4	4	4	2
Maiden heifers	7	7	5	5
1st calf heifers	7	8	4	9
Breeders	4	4	5	6
Old cows	25	25	8	8

4.3. Benchmarking Current Heifer and Yearling Performance

4.3.1. Pilbara benchmarking sites

4.3.1.1. Mandora

At the Mandora station site, heifers were first identified as weaners in November 2004 (Table 8). The heifers were run as a group and recovery at mustering was excellent. In comparison to other sites, the 'disappearance' of heifers from this site was minimal, with only 6 animals missing for the last two consecutive years of benchmarking, and no animals missing for all three musters following weaning.

Heifers were first intentionally mated as nominal two year olds. With the exception of one lactating heifer in the group, the first conceptions appear to have occurred when bulls were introduced to the herd in May 2005.

After the May 2007, muster, the young breeders were dispersed into the rest of the breeder herd. In September 2007 a portion of the heifers were mustered and lactation and pregnancy status recorded. All females, both lactating and dry, were pregnancy tested. The high pregnancy rate in September 2007 (86%) can be attributed to the good condition of the lactating females with many not being detectably pregnant (NDP) at the time of the May 2007 pregnancy test. This highlights the limitation of pregnancy testing too early in the year. The relatively small trial group at the Mandora site has allowed all of the heifers to be pregnancy tested at each muster.

Table 8. Summary of Mandora station information collected 2004 –2007.

	Nov 2004	Aug 2005	July 2006	May 2007	Sept 2007
Number recorded	229	225	205	214	128
Av. Live Wt. (kg)	218	297	382		
Av. Live Wt Pregnant (kg)		328	397		
Av. Live Wt Empty (kg)		290	351		
Pregnant (%)		20	64	49	86
Lactating (%)		0.5	37	75	22
Condition Score – dry (1-9)			6.1	6.6	5.6
Condition Score – lactating (1-9)			4.6	5.0	4.7
Pregnancy/Lactation failure		-	16	12	-

4.3.1.2. Hamersley

The aim of the Hamersley station activity was to record the recovery rate and lactation status of females in years following first joining. Collection of this information provided a background to the productivity of *Bos taurus* females in the Pilbara, since all other monitoring herds had a significant infusion of *Bos indicus*. The Hamersley group also included a number of *B. indicus* infused females of the same age as the *B. taurus* females. While the numbers were small, it was interesting that *B. indicus* heifers recorded similar pregnancy rates to the *B. taurus* heifers at the initial observation.

Data for the Hamersley site are presented in Table 9. A group of 200 heifers were identified and pregnancy tested at Hamersley in October 2004 and turned out into the breeder herd. Sixty percent of these heifers were pregnant to calve during the failed 2004/05 summer growing season. Non-appearance rates at muster were twice as high in the pregnant group (18%) compared with the non-pregnant group (9%). While all of these heifers may not necessarily have died, this does suggest far higher mortality rates in young pregnant females. The overall 'disappearance rate' of 15% for this group compares with 3% to 6% at other sites over the same period.

There was a complete failure of the 2004/05 summer growing season, and the recovery rate of the 200 heifers identified and pregnancy tested at Hamersley in October 2004 and subsequently mustered again during August 2005 and July 2006, has demonstrated the potential effect of heifers calving for the first time during a time of poor nutrition. These heifers became widely dispersed in the breeder herd by the time they were mustered again in August 2005.

Twenty-one percent of the heifers pregnant to calve from February to April of the failed 2004/05 growing season were not mustered since that time (Table 9). Overall, 18% of the heifers tested pregnant in October 2004 compared to 9% of heifers empty at that time were not mustered again.

It is believed that some management intervention to improve this recovery rate may have been possible had these heifers been run as a group during their first calving and until they weaned their first calf.

Eighteen of the 119 heifers tested pregnant in October 2004 were recorded as dry in August 2005. At 15%, this is within the range of losses from confirmed pregnant to weaning recorded from other areas of northern Australia in heifers pregnant for the first time (Schatz and Hearnden, 2008).

The findings form this site support the recommendation of segregating heifers as a group, at least until they wean their first calf. Adoption of this practice provides the opportunity for management intervention for events such as failed growing seasons – not uncommon in the unreliable Pilbara climate.

4.3.1.3. Yarraloola

Second round weaner heifers were individually identified on Yarraloola station in 2003 to document performance under the current management system. Observations concluded during the 2006 mustering season. As the original group were dispersed in the general breeder herd following pregnancy testing in August 2005, it was not possible to record further detailed information for the group. Pregnancy status of dry cows, lactation status and liveweight information was recorded from 46 of the original group of heifers during mustering in August 2006 (Table 10).

Table 9. Hamersley – recovery rate of pregnant and empty heifers 2004 – 2006.

	October 2004	August 2005	Heifers missing Aug 2005	July 2006	Heifers missing 2 consecutive musters - July 2006
Pregnant to calve Nov 2004 – Jan 2005	32/119	23	9/32 (28%)	28	5/32 (16%)
Pregnant to calve Feb – Apr 2005	71/119	45	26/71 (37%)	54	15/71 (21%)
Pregnant to calve May – July 2005	16/119	13	3/16 (19%)	14	2/16 (13%)
Total pregnant (%)	119/200 (60%)	81	38/119 (32%)	92	22/119 (18%)
No. Empty (%)	81	66	15/81 (19%)	72	7/81(9%)
No. Wet (%)	0	94 (60%)		86 (65%)	
No. Dry	0	53		46	
Pregnancy failures (%)		18/119 (15%)	-	-	
Mustered		147		132	
Originals not recovered			53/200 (27%)		29/200 (15%)

Yarraloola station experienced serious flooding in March 2004 and failure of the 2004/2005 summer growing season. Despite these adverse seasonal conditions, only 4% of the heifers originally identified were not mustered in August 2005.

Recorded pregnancy rates in August 2005 demonstrated the limited effectiveness of bull control and heifer segregation, as 22% of the group were either pregnant or lactating as 2 year olds. The mean conception date of the pregnant heifers recorded in August 2005 was April – to commence calving around January 2006.

4.3.1.4. Mallina

Data collection began at Mallina station in 2003, when weaner heifers were identified and weighed. Further data were collected in 2004 when pregnancy and lactation status. Lactation status only was recorded by station staff during mustering in 2005 (Table 11).

Around 30 of the 250 Mallina females originally identified in October 2003 were not mustered in June 2005. This equated to a disappearance rate of around 6% a year. Of those cattle mustered,

64% of the young females conceived in the year following weaning, with 66% of conceptions during March – May 2004. Calves over around 120 kg were weaned at the June 2005 muster.

Table 10. Yarraloola site - summary of information collected October 2003-August 2006.

	Oct 2003	Oct 2004	Oct 2004	Aug 2005	Aug 2006
Number recorded	106	92 original	56 additions	143	46
Av. Live weight (kg)	143	261	261	345*	407
Wt Change (kg)		118		84	
Av. Live weight – Pregnant (kg)				350	447
Av. Live weight – Empty (kg)				345	
Av. Live weight – Wet (kg)				281	377
Av. Live weight – Dry (kg)				343	453
Pregnant (%)				15	75*
Lactating (%)				7	54
Condition Score – Wet (%)				5.2	
Condition Score – Dry (%)				6.6	

* Dry heifers only

The pregnancy/calf loss of 16% from confirmed pregnant to weaning was within the 'normal' range of up to 20% loss believed to be often experienced by young breeders in northern Australia (Schatz and Hearnden, 2008). However, the season at Mallina station in the areas where these heifers were running received useful storm rains during the first half of 2005, and the average condition of lactating heifers on 27/6/05 of 4.1 (1 – 9 scale) was considered to be satisfactory.

Table 11. Mallina Heifer Observation - October 2003 – July 2005

	October 2003	August 2004	June 2005
Number recorded	250	159	196
Av. Live weight (kg)	208	332	
Av. Live weight (kg) – Pregnant		346	
Av. Live weight (kg) - Empty		308	
Pregnant %		64	
Lactating %			62
Condition Score – lactating			4.1
Condition Score – dry	5.1	6.5	6.1
Pregnant/calf loss* %			16

*****Females tested pregnant 25.8.2004 not lactating on 27.6.2005.

4.3.2. Kimberley benchmarking sites

Information collected from three Kimberley herds and supported by historical records provided a useful understanding of current productivity as well as providing a basis for evaluating the role of improved management of heifers and young breeders.

4.3.2.1. Ruby Plains

Good historical data exists on the reproductive performance of many groups of breeders on Ruby Plains station. The aim of this project activity was to assist the management of the property in identifying where further gains could be made within different groups of breeders.

General principles of selection were that all two year old heifers that failed to conceive were culled. Non-pregnant first calf females were given a second chance; all older, dry breeders were removed from the herd at weaning.

All breeders on Ruby Plains were controlled mated with heifers being exposed to bulls for 3-4 months (4-5 cycles) and mature breeders for 2-3 months (3-4 cycles). Breeders were run as 4 age cohorts; weaners, maiden heifers, 1st calf females and mature cows.

Heifer calves from maiden breeders were identified each year with a notch out of the station ear tag to allow an evaluation of current selection practices of replacement breeders. With the emphasis being placed on reproductive performance, and the known relationships between weight at joining and conception rates and lower growth rates of calves from younger breeders, this allowed the manager to see if calves from the younger breeders were being discriminated against.

Table 12. Ruby Plains young breeder information

Group		No.	Date	Weight (kg)	Condition score
A	**No 2 1st Lactation Females (Wet)**	250	May 2005		
	Pregnant		10%	336	2.8
	Empty		90%	315	2.4
B	**No. 3 1st Lactation Females (Wet)**	173	May 2006		
	Pregnant		86%	291	3.9
	Empty		14%	272	3.7
B	**No. 3 1st Mating**	250	June 2005		
	Pregnant		81%	307	4.8
	Empty		19%	287	4.9
C	**No. 4 1st Mating**	480	May 2006	294	5.2
	Pregnant		51%*	326	5.0
	Empty		49%	286	4.7
D	**No. 5 1st Mating**	486	June 2007		
	Pregnant		43%*	301	5.0
	Empty		57%	302	4.7

Note: 18% of the tested pregnant No. 3 females failed to wean a calf, representing pregnancy/lactation failure.

* Mating period reduced to 2 – 3 months.

4.3.2.2. Yeeda / Colourstone

Cattle used in the project on Yeeda station were part of a 6 paddock rotational grazing system set up on the Pindan soil systems of the west Kimberley. Breeders were of mixed ages and previous reproductive history. Controlled mating of these breeders had been used for the first time in 2006.

The Colourstone area on Yeeda station was established with the aim of increasing animal performance and reducing mustering costs through implementation of a rotational grazing system using high numbers of cattle moving through small paddocks. Maiden and first calf heifers with some older cows were introduced into the paddocks in 2004 and 2005 and grazed until December 2006,

when all animals were removed from the paddocks due to limited feed. Results are shown in Table 13.

Table 13. Body condition scores, liveweight (kg) and pregnancy rates of maiden and first-calf heifers, Yeeda / Colourstone rotational grazing system.

June 2006	Dry empty	Dry pregnant	Wet[2]
Number	64	228	224
Average condition score[1]	3.8	4.1	2.2
Min. weight (kg)	-	195	183
Max. weight (kg)	-	410	338
Average weight (kg)	-	277	245
Pregnancy % dry cows	78		

[1] Body condition score based on 9 point scale 1-9 where 1=emaciated; 4=forward store; 9=obese
[2] Wet cows not pregnancy tested

These results demonstrated the impact of lactation on body condition score and body weight. Pregnancy diagnosis was not carried out on the wet cows on the assumption of their being empty because of low body condition due to lactation stresses. The concern with this practice is that if weaning is delayed and pregnancy testing is carried out 5-6 months after calving, the relationship between body condition at time of pregnancy diagnosis and conception may be poor, especially in cows with older calves at foot. Failure with this practice is shown in meat works figures, with up to 60% of cows slaughtered being pregnant, despite having low carcase weights and poor carcase fat cover.

4.3.2.3. Spring Creek

Project work on Spring Creek station began in 2004 and ceased in 2005 due to problems of keeping the heifers together over the wet season and the costs associated with mustering and returning them to their paddock. This situation highlights the problems many properties in northern Australia face in managing breeders as discrete groups and undertaking practices such as controlled mating programs.

On Spring Creek station heifers were run separately from the main breeder herd until their second calf. Mating was continuous. Limited supplements were offered to breeders, although some supplementation of the weaners did occur.

High fencing maintenance due to wet season fence damage made keeping these groups together and data collection difficult. Moreover, feral bull problems were seen as a major issue in not adopting controlled mating.

Data were collected from Spring Creek station in 2004 and 2005 (Table 14).

Table 14. Liveweights, body condition scores and weight range of 2004 and 2005 drop weaner and maiden heifers, Spring Creek station.

	2004 drop		2005 drop
	2004 (n=254)	2005 (n=234)	2005 (n=250)
Wt range (kg)	137 – 311	205 – 379	126 – 257
Average wt (kg)	196	275	183
Average Condition Score	5.2	4.7	4.1
% heifers <150kg	2%		8%
150 – 200 kg	58%		69%
201 – 250 kg	38%		22%
> 250kg	2%		1%
200 – 250kg		21%	
251 – 300 kg		60%	
301 – 350 kg		18%	
> 350 kg		1%	

[1] Body condition score based on 9 point scale 1-9 where 1=emaciated; 4=forward store; 9=obese

These results show the challenges producers face in getting heifers to mating weights below two years of age and the impact of poor wet seasons on growth rates and body condition. Results also show the potential losses of cattle between weaning and first mating, with 20 of the 254 2004 drop animals unaccounted for. It is unclear if these heifers were missing due to simply being missed during the mustering program or if they had died during the year. No reproductive data were available from these heifers.

4.4. Demonstration sites

4.4.1. Warrawagine

The inclusion of the Warrawagine site in the Pilbara provided a unique opportunity to observe the effect of a young breeder management system on large numbers of females over an extended period. Around 1500 replacement females were mated for the first time in 2006, and all were identified with rumen bolus RFID.

The average rainfall received in the 2006/07 summer was supplemented with useful winter rainfall in June. This out of season rainfall event provided an improvement in feed quality and boosted the animals' body condition. Conditions in October 2007 during mustering were very hot and dry, and this continued with little or no useful rain received until early March 2008.

The females were first intentionally mated in March 2007. A summary of the information collected for these females for musters since initial selection in September 2006 is shown in Table 15.

Table 15. Warrawagine - summary of information recorded for heifers first mated in 2007

	Sep-06	May-07	Sep-07	May-08	Oct-08	Sep-09
Number recorded	1524	1410	1330	1048	1061	677
Av. Live Weight	294kg		328kg	369kg	323kg	352kg
Lactating (%)		22%	24%	66%	59%	61%
Dry (%)			76%	34%	41%	39%
Dry - Pregnant (%)			89%		79%	93%
Dry - Empty (%)			11%		21%	7%
Preg/Lactation Failure (%)				9.4%		
Condition Score - Dry (1-9)		5.3	5.6	6.5	5.2	6.5
Condition Score - Lact (1-9)		4.1	4.7	4.9	4.0	4.7

Numbers recorded at successive musters declined over time (Table 15). This was caused by both disappearance and deliberate removal of some cattle from the paddock in September 2007 and again in October 2008. The 22% of females lactating in May 2007 demonstrates the difficulty of controlling time of calving for young females. Pregnancy rates of dry females were satisfactory, although the 21% of females dry and empty in October 2008 was of concern. Few of the dry empty females identified during these activities were actually culled.

The pregnancy, lactation status, weight and condition score of a group of 698 heifers dry in May 2007 and present al all subsequent musters is summarised in Table 16.

Table 16. Lactation and pregnancy status of Warrawagine heifers recorded as dry in May 2007 recorded in each of the three subsequent years. Average weight and body condition score (1-9) is shown for each of the three groups (n = 698).

	Sep-07			Oct-08			Sep-09		
	%	Wt (kg)	CS	%	Wt (kg)	CS	%	Wt (kg)	CS
Wet	25.5	316.9	4.7	57.2	305.0	4.0	59.3	325.2	4.1
Dry Pregnant	51.1	345.9	5.8	32.7	354.3	5.3	37.7	393.9	6.1
Dry Empty	23.4	314.5	5.4	10.2	330.3	5.0	2.9	367.8	5.8

In October 2008 a sample of lactating heifers were pregnancy tested. Pregnancy testing the whole trial group had proven difficult for several reasons including the number of animals in the mob (up to 2000 head), the hot seasonal conditions and the presence of numerous small calves creating serious potential animal welfare issues. Table 17 summarises the information recorded from a group of 95 lactating first calf cows from the group of 698 pregnancy tested in October 2008 and 412 head lactating in September 2009. The average weight and body condition score of wet pregnant females was higher than that of the empty animals on both occasions.

Table 17: Pregnancy status, average weight and condition score for 95 wet Warrawagine young breeders in October 2008 and 412 wet breeders in September 2009.

	% Pregnant	Av. Weight (kg)	Condition Score (1-9)	% Pregnant	Av. Weight (kg)	Condition Score (1-9)
Wet Pregnant	39%	357	4.4	15%	341	4.5
Wet Empty	61%	283	3.6	85%	323	4.1

Botulism Vaccination Trial

At the beginning of the project, vaccinating for botulism was not standard practice at Warrawagine station. A trial was established to assess effectiveness of vaccinating for the toxin. In September 2006, two thirds of the trial animals were vaccinated with Pfizer Longrange, the other third remaining unvaccinated as a control. Trial animals were identified with RFID tags and were flagged on the computer system hooked up to a tag reader. The vaccinated group of animals were re-vaccinated at the second round of mustering in September or October in 2007, 2008 and 2009.

Due to the extensive nature of Warrawagine station and the large numbers of cattle, it was impossible to confirm the death of many of the trial animals. Instead, the measure of the effectiveness of the vaccine was the presence or absence of animals for more than three consecutive musters, with animals missing three or more musters considered to have died. After the first two years, some animals were dispersed throughout the breeding herd, although the computer system allowed these animals to be tracked. The computer recorded the last date that an animal's tag was scanned, and therefore it could be determined how many mustering rounds an animal had missed. It is conceivable that animals may have been 'missing' for several years then reappear. Both vaccinated and control animals had the same opportunities to disappear and then reappear. However, there is also a high probability that the majority died. Animals were not confirmed dead unless the carcass was sighted.

Results indicated that 7% fewer animals from the botulism treatment group were missing for three or more musters compared with the control group (Table 18). Botulism vaccination had no apparent effect on the numbers sold or confirmed as dead and deleted from the computer herd recording system.

Table 18. Percentage of animals missing three or more musters, confirmed dead or sold, Warrawagine station, 2006-2009.

Treatment	Initial Number	Missed 3 or more musters	Confirmed dead or sold
Botulism	1039	7%	7%
Control	486	14%	8%
Total	1525	158	108

If the 7% reductions in mortalities can be attributed to the use of botulism vaccine, the benefits of vaccinating are substantial. If the cost of botulism vaccine is $2 per head per year and the value of a heifer is placed at $500 per head, then over the three year period the return from each dollar spent on vaccine would be almost six dollars (Table 19). This is a significant saving and a large enough return to justify the expense of vaccination.

Table 19. Calculated return from botulism vaccination over a three year period assuming a reduction of 7% mortality.

Treatment	Treatment Number	Moralities		Value of dead animals @ $400/hd	Cost of vaccination @ $1/hd pa	Benefit of Vaccination	Cost Benefit Ratio
Not Vaccinated	1500	15%	225	$90,000	$0		0
Vaccinated	1500	8%	120	$48,000	$4,500	$37,500	8.33

4.4.2. Yalleen

A group of 168 heifers (average weight 303 kg) were weaned during 2004 and were identified with NLIS tags at Yalleen station in August 2005 to initiate this demonstration.

Seasonal conditions experienced at Yalleen during 2007 resulted in limited information being collected. Information was collected from the breeders first mated in 2005 during mustering in June 2007. As this group was dispersed in the breeder herd information was recorded by the co-operator as they were mustered. As practice is to routinely pregnancy test only dry cows, no information on reconception of lactating females was collected.

A summary of the information collected for the period August 2005 to June 2007 is presented in Table 20.

Table 20. Lactation and pregnancy records, Yalleen 2005 - 2007

	Aug-05	Jun-06	Oct-06	June-07
Number recorded	168	84	132	75
Av. Live Weight (kg)	303			
Lactating (%)		40	58	59
Dry (%)		60	42	41
Dry - Pregnant (%)		85		95
Dry - Empty (%)		15		5
Pregnancy/Lactation Failure (%)			8	
Condition Score - Dry (1-9)	5.8	7.8	6.3	7.2
Condition Score - Lactating (1-9)		5.9	5.7	5.2

Pregnancy testing only the dry females, while reducing the percentage of sub-fertile females, does not assist in the identification of the more fertile females that conceive during lactation.

Little information was collected from the heifer group first mated in 2006 during the year. This group was relocated as part of the dry season management plan adopted for 2007 and early 2008.

4.4.3. Anna Plains

The aim of this work was to increase the percentage of heifers reaching a mating weight of 280-300 kg by 15 months through the use of urea supplement, and to determine the effect of supplementing the same cows in the dry season post calving on their subsequent fertility. Heifers were allocated on the basis of liveweight into four weight groups containing 15 animals within two treatment groups (± urea supplement), with two replicates for each treatment. All heifers within a treatment replicate grazed together, with a total of 60 animals in each paddock.

For Draft 1, the weight range of heifers was 151 to 280 kg, average 218 kg.

For the first draft, within both the supplemented and non-supplemented groups, lighter heifers gained more weight than heavier heifers (Table 21). Supplementation increased weight gains by approximately 10 kg for each of the weight groups. Pregnancy rates and body condition scores generally increased as liveweight increased, but there was little relationship between body condition and subsequent pregnancy rates.

Intakes of water during the experimental period ranged between 25 and 51 l/hd/day to average 39 l/hd/day, increasing as weather became hotter.

This work was repeated in 2007/2008 using similar heifers. The work began earlier in the season to allow heifers a greater time on the supplement at the higher levels.

For the second draft, initial liveweights of the heifer groups ranged from 198 to 260 kg, averaging 236 kg.

Liveweight and condition score information for the four groups within each treatment for the second draft are shown in Table 22.

During the feeding period, the level of urea in the water and subsequent urea intake increased as the trial proceeded. Heifers consumed up to 30 g urea/hd/day from 2/8/07-19/9; 30-50 g urea/hd/day from 20 September to 10 November; and above 50 g urea/hd/day from 11 November to 21 January 2008. Water consumption averaged 29 l/hd/day over the full trial period, with a minimum intake of 24.5 litres and maximum intake of 40.7 l/hd/day. Water intake increased as ambient temperature and the size of the animal increased.

Results indicate a relatively good weight gain of all heifers during the trial period, with a small advantage to all weight groups as a result of the feeding. At time of mating, 72% of the control heifers were below the target 280 kg liveweight for joining, compared to 59% of the fed heifers.

Overall weight change was around 10 kg/head higher and mean pregnancy rates higher in the Control (non-supplemented) animals in Group 1 compared with the Fed (supplemented) animals. However, statistical analysis of the data indicated that supplementation had no significant effect on

either overall weight change or pregnancy status (as recorded in April 2007). For the second draft, overall weight gain (as recorded in January 2008) was slightly higher in the Fed group (33 kg/head versus 28 kg/head), but again analysis did not indicate a significant effect of the supplement.

Table 21. Liveweight and condition score changes and subsequent pregnancy rates at 6 weeks post mating of maiden heifers on Anna Plains station with or without urea fed through a water medicator

Groups	August 2006		December 2006			April 2007			
	Weight (kg)	Score [1]	Weight (kg)	Weight Change (kg)	Score	Weight (kg)	Overall Weight Change (kg)	Score	Preg (%)
Control	218.0	3.9	226.7	8.6	4.2	268.4	50.4	4.0	27.0
Fed	216.5	4.0	228.0	11.5	4.0	277.7	61.1	4.1	23.7

[1] Body condition score based on 9 point scale 1-9 where 1=emaciated; 4=forward store; 9=obese

Table 22. Weights, condition scores and weight changes of urea-fed and control heifers, Anna Plains

Group	23/7/07		30/1/08		
	Weight (kg)	Condition Score*	Weight (kg)	Condition score	Weight Change (kg)
Control	235	4.6	263	4.3	28
Fed	234	4.8	268	4.5	33

* Condition score based on 9 point system (1-emaciated, 9-obese)

4.4.4. Ruby Plains

Ruby Plains in the southern East Kimberley was involved in the young breeder project since May 2005. All breeders on Ruby Plains were controlled mated, with heifers being exposed to bulls for 3-4 months (4-5 cycles) and mature breeders for 2-3 months (3-4 cycles). Breeders were run as 4 age cohorts; weaners, maiden heifers, 1st calf heifers and mature cows.

Demonstration project activity at Ruby Plains was the weighing of 550 weaner (No. 6) heifers. These heifers were separated into three weight groups, with the aim being to increase the number of heifers at a mating weight of 280 kg by February 2008 by the strategic use of supplements.

The light weight group received no supplement as they were unlikely to attain target mating weight, and the heavy group received no supplement as it was assumed they would have little difficulty meeting target mating weight. The mid-weight group were fed a high protein meal dry lick from September 2007 to December 2007 (78 days) with the aim of increasing their chance of achieving target mating weight.

There was little difference in the liveweight performance of the fed and unfed heavy group during the feeding period to the start of the wet season (Table 23). Within the fed group, 61 heifers reached 280 kg liveweight at the end of the feeding program (start of the wet season). However, it is unlikely any benefit in terms of liveweight was gained from the feeding given the high growth rates experienced in the "heavy" group during the same period.

Table 23. Liveweight, condition score and pregnancy status of supplemented and non-supplemented heifers, Ruby Plains station.

Group	Number	Weight 24/9/07 (kg)	c/score	Weight 11/12/07 (kg)	Weight 01/06/08 (kg)	c/score	Weight change (kg)	Pregnancy (%) June 2008
Light	200	194	3.5	-	291	4.8	97	54*
Fed	200	249	4.6	274	351	5.2	102	90
Heavy	149	291	5.1	312	389	5.4	98	98

* Only 11 head tested.

4.5. General Discussion

Low carrying capacity – extensive herd management systems.

Many cattle enterprises in northern Australia are operated on large areas (400,000ha+) carrying low stocking rates. A common feature of these enterprises is that areas of productive country; watercourse frontages, run on areas, small areas of better soils, etc are often widely scattered over the whole station and interspersed with areas of unproductive or very low carrying capacity country.

This makes traditional fencing wisdom of fencing for improved cattle control to provide management opportunities to improve animal performance cost prohibitive and often impractical. Due to the mixture of good and poor country overall carrying capacity is low so large areas need to be fenced to hold significant cattle numbers. This presents two immediate problems:

1. The length and cost of fencing required to enclose these large areas
2. The longer the fence the more opportunity there is for fence failure; damage from feral horses and camels, fire, creek crossings, etc. This limits the effectiveness of the fence to provide control of the animals intended to be contained and excluded.

This research has indicated that bull control is a problem, particularly when attempting to manage the time of first conception of heifers in these large paddocks. This work also demonstrated that losses of young breeders around the time of calving can be significant. Eighteen percent of heifers

calving for the first time during a failed growing season at one site were missing for the following 3 years and were presumed dead. Pastoralists generally agree that 'heifers calving for the first time' are high risk animals.

Traditional management systems from areas where better cattle control is practical include; segregating heifers from the main breeder herd and controlling at least the time of their first mating (often at 2 years of age) to calve at a time of the year when good nutrition from pasture is imminent, controlling the length of the mating period, pregnancy testing and culling empty heifers, and possibly other practises. All these practises are aimed at optimising the performance of these young breeders. Segregation from the main herd provides the opportunity to manage nutritional issues should they arise and ensures that the condition and wellbeing of the group as a whole is highly visible. While a few heifers "doing it a bit tough" may be camouflaged among a mob of breeders that are "doing allright" a whole paddock of heifers "doing it tough" is highly visible to a manager.

The challenge to improve the productivity of heifers and young breeders in extensive management systems with low carrying capacity is to investigate opportunities to incorporate management practises that have proved successful in more intensive systems into practical systems for extensive areas.

As it has proved largely impossible to adequately control bulls and mickies in these extensive management systems, controlling the time of first mating of heifers is likely to remain a 'hit and miss' practise for many pastoralists. If the time of calving can not be controlled by managing bulls the females need to be managed to optimise their opportunity to rear and wean their first calf and conceive again during their first lactation. This cannot be achieved if the heifers and young breeders are dispersed in the general breeder herd.

Management system requirements

There will be many combinations of management practises that might be included in improved management systems for heifers and young breeders to meet individual situations. However, the minimum requirement is that heifers and young breeders are segregated from the breeder herd until they wean their first calf. Project experience confirmed that distributing heifers pregnant to calve at a desirable time into the breeder herd does not always produce good results.

- Allow preferential management of heifers and young breeders
- Provide opportunity to manage as a separate group to balance of the breeder herd
- Ability to successfully wean calves at least twice each year
- Allow selection pressure for fertility in heifers – preg test by August/September each year
- Opportunity to control time of calving by identifying 'out of season calvers.
- Opportunity to provide more targeted management by drafting into calving groups
- Opportunity for strategic supplementation to improve body condition (P during the growing season) and maintain body condition during the dry to ensure young breeders calve in better body condition
    - improve opportunity to conceive while lactating
    - improve survival
    - improve the cost benefit of supplementation

Management system

1. Potential heifer replacements should be selected late in the year of weaning or early the following year. In practise larger heifers are often selected and this is often a reflection of age rather than growth potential. Retain more heifers than required as replacements and make final selection on pregnancy test result the following year. If there is no immediate market for the rejects they should be spayed for future sale with their empty mates the following year.
2. Turn selected heifers into a heifer paddock. While it is preferable to run heifers and females calving for the first time as separate groups this may not be possible in practise and 2 age groups may need to be run together.
3. If groups are run together, planned matings will be underway when the next year of heifers is introduced and some conceptions of these heifers are likely as they reach puberty. While this is not really desirable it is preferable that they have the opportunity to mate to selected rather than random bulls. The whole aim of the segregation system is to improve management opportunities for these unplanned pregnancies.
4. Bulls may be removed from the heifer paddock groups at the relevant time for the area to possibly reduce the incidence of out of season calves. Project experience indicates that this may be futile in many extensive situations.
5. All females should be pregnancy tested and dry 2 year old empty females (identified by year number at least) should be considered for sale.

5. Success in Achieving Objectives - Section

5.4. Success in Achieving Objectives

5.4.1. Objective 1.

Identified (in consultation with industry), evaluated and demonstrated practical management strategies to improve the performance of heifers and young breeding females on 2 commercial properties in each of the Kimberley and Pilbara regions (total 4 sites).

This objective was addressed in the Pilbara at two sites –Yalleen and Warrawagine stations, and in the Kimberley at Ruby Plains and Anna Plains stations. Yalleen and Ruby Plains were aimed at evaluating what was believed to be 'good practice' (not necessarily 'best practice') for the respective areas of the Pilbara and Kimberley. The respective Pastoralist Project Management Groups (PPMG) were interested in documenting how well these systems worked and were likely to result in improved animal performance when compared to performance generated from their management systems. Warrawagine was aimed at demonstrating/evaluating a young breeder management system and Anna Plains was basically a well designed supplementation 'trial' aimed at increasing the number of heifers reaching puberty (mating weight) as yearlings, and thus increasing their reproductive performance.

Yalleen

The 'practical management strategy demonstrated and evaluated' at Yalleen station was in effect the management system employed at Yalleen which mainly revolved around mustering breeders twice each year which is considered 'best practice' in most of northern Australia – (2005 survey indicated that 65% of Pilbara enterprises only mustered breeders once each year).

The Yalleen 'system' was discussed and approved by the Pilbara PPMG as well worth trying to document. There was a lot of interest in the group about the value of mustering breeders twice a year.

Information was collected at this site from two separate groups of heifers; # 4s and # 5s. This information indicated that:

- Up to 92% (92% one draft; 72% other draft) of heifers first mated in the year following weaning were either pregnant or lactating some 12 months after the commencement of mating.
- 84% of heifers mated were recovered at mustering the following year.
- End of mating liveweight (24 – 30 months of age) of pregnant and empty heifers was 380 and 346 kg respectively (#5 heifers)

The Yalleen site did not produce all the information envisaged due to adverse seasonal conditions of flooding one year and no rain the next. The dry seasonal conditions coupled with

the effects of wildfires the previous year led to a serious reduction in herd numbers at Yalleen and the dispersal of the young breeder project groups.

Warrawagine

The management strategy demonstrated/evaluated at Warrawagine station included:

- Running replacement females in a heifer paddock until they weaned their first calf.
- Demonstrating the effectiveness of Botulism vaccination in reducing 'disappearance rate' of animals.
- Mustering the replacement female group twice a year.
- Culling on pregnancy test – at least on paper.
- Individual animal identification and automatic recording system.

A summary of the findings from this site include:

- Due to ongoing problems with bull control it was concluded that it was better to manage the calves once they were on the ground rather than spend too much effort trying to control the time of first mating by keeping bulls out of the paddock.
- Running the females as a separate group provided the opportunity to manage according to prevailing seasonal and animal conditions.
- The cost of mustering this group at Warrawagine averaged around $15 a head for each muster.
- The cost of additional mustering needs to be justified in terms of increased animal performance, improved recovery rates, and pregnancy and weaning rates of this young female group.
- Pregnancy testing of large mobs of more than 1000 (which included numbers of lactating females and 'stranger cattle') presented management and welfare concerns particularly for young calves and limited data collection from the project group.
- It proved difficult to limit the number of 'other cattle' getting into the Big Dam paddock. This exacerbated the problems of handling large mobs through the yards and collecting information from the project animals.
- In common with all Pilbara sites significant numbers (22% of group at Warrawagine) were already lactating at the time of planned first mating. This reinforces the approach of segregating the replacement heifer group to allow management of these calves e.g. two weaning musters, supplementation, etc.
- 78% of heifers (average end of mating liveweight 348 kg) conceived at first mating in the year following weaning. Liveweight of empty heifers was 302 kg. Given the once a year mustering regime the age of these 'yearling heifers' at the time of pregnancy testing was probably 24 to 30 months.

Anna Plains

The aim of the site at Anna Plains station was to evaluate/demonstrate the potential role of urea supplements, fed through water medication, to improve liveweight and subsequent mating outcomes of heifers mated as yearlings.

A trial was conducted comparing animal performance of different weight groups of animals with and without urea supplementation late in the year. Liveweights were recorded and pregnancy testing of one group conducted. Liveweight changes only were recorded from a second draft of trial animals.

- Urea intakes of up 60 g/day was successfully fed to heifers using water medication
- Water intakes ranged from 25 – 51 (Av 39 L/day for 228 kg heifers) for draft 1 and 25 – 41 L/day (Av 29 L/day for 266 kg heifers) draft 2.
- Water intakes increased with day temperature.
- Urea supplementation produced minimal, non-significant liveweight responses (3 kg/head in Draft 1 and 5 kg/head in Draft 2).
- Supplementation did not result in higher conception rates.
- Unsupplemented animals recorded small liveweight gains during the spring and early summer on the Anna coastal plains.

Ruby Plains

The practical management strategy evaluated/demonstrated at Ruby Plains station was their current management system. All breeders on Ruby Plains were control mated, with heifers exposed to bulls for 3-4 months (4-5 cycles) in the year following weaning. Heifers which failed to conceive were culled. Females which failed to conceive during their first lactation were given a second chance. Breeders were run as four age cohorts; weaners, maiden heifers, 1st calf heifers and mature cows.

The mating outcomes of 4 age groups of heifers mated for the first time was recorded. Conception rates of 2 age groups of females during their first lactation were also recorded.

- Conception rates of first mated heifers were highly variable over the four years of observation (ranging from 44% - 92%).
- Growth from weaning to first growing season likely to be major contributing cause – Growth from weaning to mating # 5 heifers was 69 kg and conception 44% compared to # 6 heifers which gained 103 kg and recorded a pregnancy rate of 92%.
- Seasonal mating provided good mating outcomes in good seasonal conditions
- Conception rates of females during their first lactation ranged from 10% for # 2 females to 86% # 3 females, indicating the major impact of seasonal conditions on response to management.

5.4.2. Project objective 2.

Record the reproductive performance of heifers and young breeders on 8 representative stations in the Pilbara and Kimberley regions of Western Australia, and established benchmarks for young breeder reproductive traits on each of those stations.

This work was conducted on four stations in the Pilbara and three in the Kimberley.

Pilbara

Weaner heifers were tagged on Mallina, Mandora and Yarraloola stations. Liveweight, conception rates from first mating and, in the case of the Mandora station, conception rates as females during first lactation were recorded to establish benchmarks of animal performance. Additionally, yearling heifers were identified at Hamersley station when they were being let go into the breeding herd as replacements. Around 60% of these heifers were already pregnant, and the recovery rate of animals in different time of calving groups was recorded over the next three years.

In general terms,

- Weaner heifer weights averaged 189 kg (143 kg – 218 kg);
- Growth rates of heifers for a period of up to 12 months from late (October/November) in the year of weaning averaged 108 kg (79 kg – 124 kg);
- Conception rates in the year following weaning averaged 44% (22% to 64%), an indication of puberty as bull control was not always effective;
- Heifers that conceived were heavier at pregnancy testing than empty heifers, 337 kg compared to 301 kg for empty heifers;
- Conception rates of females during their first lactation averaged 48%
- Calf loss from confirmed pregnancy ranged from 16% to 22% for females pregnant for the first time;
- 'Missing' rates (animals missing at two consecutive musters) ranged from 2% to 18% for animals involved in the benchmarking study.
- Missing rates of females calving during the failed 2004/05 growing season were 18% compared to 9% for heifers not calving at that time. These animals missed three consecutive annual musters.
- The losses recorded at the Hamersley site where heifers were dispersed in the breeder herd with no opportunity to segregate them for more appropriate management during this extended dry period were significant. This highlighted the need for a 'heifer paddock' as part of the 'improved young breeder management system' to be demonstrated in the Pilbara.

Kimberley

Sites initially established at Yeeda/Colourstone and Spring Creek stations provided some useful information, while Ruby Plains station generally provided longer term and more detailed information.

Information on representative liveweights of different mixed age females, liveweight changes of young females and conception rate information was collected from these sites and suggested:

- Weaner heifer weights averaged 207 kg (183 kg – 244 kg);
- Growth rates of heifers for a period of up to 12 months following weaning averaged 95 kg (69 kg – 109 kg);
- Pregnancy rates of heifers mated for the first time averaged 68% (43% - 93%);
- Conception rates of females during their first lactation ranged from 10% - 86% (two years' data only);
- Problems were experienced with keeping heifers segregated and being able to handle them as a discreet group. Spring Creek station East Kimberley began the project in 2004 and withdrew in 2005 due to problems of keeping the heifers together over the wet season and associated costs of mustering and returning them to their paddock.

5.4.3. Project objective 3

Produce a Best Practice Manual for heifer management in northern W.A and the NT (in conjunction with DBIRD).

This objective is on-going in association with Tim Schatz of NT as an independent document. Relevant sections from Western Australia have been completed and provided to Schatz.

5.4.4. Project objective 4 & 5

Survey Kimberley and Pilbara beef producer heifer management practices at the start of the project to identify barriers (real and perceived) to implementation of other known practices.

Survey Kimberley and Pilbara beef producer heifer management practices at the end of the project to document changes during the life of the project.

Success in achieving these Objectives was affected by the transience of the managers in both regions. For example, nine of the 21 managers initially interviewed in the Pilbara had left the region by the time of the second survey. Comparison data are therefore restricted, but this in itself highlights that information products and communication strategies must be on-going to ensure those entering the industry have information available to them as soon as possible, rather than extension activities being predicated on a continual upskilling of a fixed group.

However, the results from both surveys suggested that there had been some increased awareness of management options as a consequence of the project, and some adoption of new techniques (or at least willingness for uptake), but considerable scope for further uptake.

6. Impact on Meat and Livestock Industry – now & in five years time - Section

6.1. Impact on Meat and Livestock Industry – now & in five years time

The impact of this project can be seen through its delivery of:

- An improved credibility of management systems developed to enhance the productivity of breeder herds by focussing on improving the performance of a segment of the herd (young breeders). In particular, the capacity to refer to locally developed information instead of information "from the east" will be more acceptable to many pastoralists.
- Systems demonstrated as practical at Ruby Plains and Warrawagine stations, in particular that the segregation of heifers and young breeders from main breeder herd, provided opportunities for management inputs that were not practical for main breeder herd.
- The producer survey indicated that managers were aware of the importance of improving heifer mating weights by using supplements and/or better grazing management to improve heifer and young breeder body condition and reproductive performance.
- The project increased pastoralist knowledge of the importance of the contribution of young breeders to overall breeder herd performance.
- The project results suggest that pastoralists will develop and maintain better records of heifer performance, and also achieved wider industry recognition of the value of developing and maintaining animal records so managers have a better idea of what is really happening in their herds.

However, there are restrictions to the implementation of project findings. These include:

1. There is still insufficient conclusive local 'trial' or 'research' information (with and without improved management practices) that documents the actual responses to improved young breeder management. The project 'demonstrated' that 'better' systems were practical and produced outcomes, but did not quantify how much these systems improved productivity in these herds.
2. Information gathered during the project suggested some pastoralists were not prepared to change current management practices.
3. The cost and availability of suitable supplements and/or providing a better paddock for heifers and young breeders will continue to restrict the implementation of project findings. These restrictions will add to the difficulty of attaining recognition by pastoralists of cost/benefit of additional management inputs to realise improved performance of the young female portion of breeder herds. This will be a paradigm change for many, and will not be easy.
4. The long term nature of 'change' makes changes to young breeder management difficult to demonstrate in a typical PDS format. Changes induced by management actions can be easily masked by something as simple as a storm a few weeks prior to data collection across one treatment paddock.

7. Conclusions and Recommendations - Section

7.1. Conclusions and Recommendations

This project has been able to document current practice and productive indices, shed some light on the restrictions that reduce producers' capacity to achieve better reproductive performance in young breeders, and demonstrate the impact of improved management practices. It established some significant benchmarks for the performance of heifers and young females in the Pilbara and Kimberley regions of Western Australia, providing information not previously available for these herds, and while apparently documented by at least some of the corporate-owned leases in the Kimberley region, not generally publicly available.

The producer survey conducted at the beginning and end of the project provided an insight into managers' perceptions of herd performance and the importance of a number of management practices that might be used to improve young breeder performance.

In particular, this project:

1. Demonstrated the clear vulnerability of young breeders to poor nutrition during calving in this region of northern Australia;
2. Documented that effective bull control is difficult in extensive management systems, with many females presumably conceiving soon after reaching puberty rather than as a result of planned matings;
3. Identified that It is difficult/impractical to control bulls as a means of controlling the time of first calving. Management should be focussed on developing management systems that allow preferential management of females calving 'out of season';
4. Identified the need for registration of alternative implant based medication to control onset of puberty, a technology identified but currently expensive and not registered for cattle;
5. Concluded that the limited information collected on reproductive performance of females during their first lactation demonstrated the importance of good nutrition (seasons) before and during mating. For example, conception rates ranged from 9% to 86% in consecutive years (one poor season followed by one good season) on the same station for the same class of females;
6. Demonstrated the positive response to botulism vaccination.

Recommendations

1. As identified above, demonstrating responses to management changes of females is difficult even when there is good animal control. This problem is significantly greater in extensive areas. While the PDS format may be appropriate to demonstrate the effect of 'practice changes' to improve reproductive performance, e.g. improving conceptions of females during their first lactation by having them in better condition at calving, PDS are unlikely to be an effective tool to demonstrate 'system' change.
2. Given this thought, gaining adoption may best be achieved using herd modelling as a tool with animal performance documented during the project to produce realistic and 'best bet' outcomes.

3. This project has clearly identified the problems associated with conducting research with breeders in extensive areas. It is unclear if 'more research' is likely to be an attractive (or effective) option for future work.
4. There is an ongoing need to extrapolate R&D from other areas of northern Australia into appropriate practical systems in the northern rangelands.
5. Encouraging pastoralists (probably sons and daughters) to spend time with selected producers in other areas of northern Australia known to be managing productive breeder herds could be advantageous.

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Administrative Report Details

The Administrative report is only of interest to MLA staff, and should therefore be a separate report that may be placed on the project file. It should include:

- a financial report detailing total funds and assets provided by MLA for the purposes of the project
- total funds and other contributions supplied by the researcher (and others) to the project
- any project intellectual property
- commercial exploitation of the project - report on progress, if any.