final report

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Shorthorn Genetic Improvement Phase 2

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1. History

Durham Research and Development Pty. Ltd., was established as the research and development entity of the Shorthorn Society of Australia (Shorthorn Beef) in 2000 to conduct research programmes enhancing the value of Shorthorn genetics. Subsequently, an application was submitted to the MLA Donor Company seeking funding support from the Australian Commonwealth Government R&D through the Federal "donor company" programme.

Durham R&D leased both the 700 ha. property "Nandillyan Ponds" at Molong and the "Adair" herd of registered Shorthorns which carried significant historical data as one of the CRC1 co-operator herds and Breedplan validation herd, for the purposes of the test.

During Phase 1 of the project, 79 Angus (APR) unjoined weaner heifers were purchased from the Trangie herd in 2002 and a further 29 PTIC (APR) heifers were purchased from Trangie in 2004 to facilitate an outcome for the *second-tier objective (iv).*

The Durham application listed the following core objectives of Phase 1 of the project:

1. To organise a progeny test of young Shorthorn bulls nominated by the Shorthorn seedstock sector.

2. To submit data to Breedplan to assist in the calculation of highly accurate carcass estimated breeding values (EBV's).

3. To investigate and demonstrate further, the role of scanning and carcass measures in the identification of superior carcass sires.

4. To investigate the best system for identifying at a young age, the sires that should be submitted to progeny test.

5. To enhance the accuracy of EBV's for reproduction (eg. days to calving and calving ease) by mating as many heifers to test bulls as possible.

6. To use the progeny test outcomes generated to demonstrate the benefits of well-designed and structured breeding programs.

7. To provide a beef industry extension, learning and training facility that focuses on improving understanding of aspects of beef production, particularly related to meat quality and meat safety issues.

In addition and in accordance with the protocols of the project, three samples of DNA collected from each animal recorded in the test from 2000 to 2010 were documented and stored for future industry genomic research.

During Phase 1 of the Durham progeny test 52 Shorthorn bulls generated progeny which were measured for reproduction, growth, carcass and fertility traits. Whilst Phase 1 funding extended from 1st July, 2000 to June 30th, 2005, the recording of final carcass data from progeny was not completed until December, 2007.

The project enhanced the accuracy of Breedplan data of the candidate sires and their progeny with a significant increase in the quantity and quality of carcass data through extensive live scanning and carcass phenotypes which proved the high correlation between grader assessment of BMS and the actual IMF% as measured by chemical extraction.

The outcomes demonstrated both the value of live scanning to rank animals according to carcass composition and proved that EBV's and $Index values could be used successfully to rank sires according to the differences in expected performance of progeny for each trait and according to the difference in value of progeny as estimated in the respective indexes.

Phase 1 of the project also provided for the publication of calving-ease EBV's for the Shorthorn breed.

Outcomes of the test were disseminated to Shorthorn breeders at a number of workshops, forums and field days and through the Shorthorn Beef web site. The project itself and subsequent outcomes was circulated to the wider industry through rural publications.

Additional second-tier objectives of Phase 1 were also noted in the application:

(i) To provide post graduate opportunities.

(ii) To create the opportunity to export Australian bred and evaluated genetics to international markets.

(iii) To establish "satellite" herds on properties throughout Australia to generate additional data through the use of link sires from the core project and thereby create a "point of presence" in purebred and crossbred herds in differing climatic and production conditions.

(iv) To determine across-breed EBV's by running performance recorded Angus females together with performance recorded Shorthorns under the exact same conditions.

By completion of Phase 1 in June, 2005, the foundations had been laid to continue the research and achieve the second-tier objectives in the future.

2. Objectives

The application for Phase 2 support submitted to the MLA Donor Company which was approved, was dependent up0n achieving the following objectives to MLA's reasonable satisfaction:

The Project aimed to:

(i) Continue the core project of progeny testing through the initial breeding cycle of the program into the ongoing reproductive, growth and carcass collection phase for an additional 36 sires giving a total of 85 sires over the 10 year life of the project.

(ii) Further expand the core project to include any industry relevant areas, including structural soundness, blood measures of growth and efficiency (i.e. Insulin like Growth Factor 1(IGF-1) and flight-time recording. With the advent of new measures then these too can be examined for robustness against the objectively measured outcomes from the trial.

(iii) Include the three satellite herds based in Southern Queensland as part of the core data resource through implementation of a detailed management programme on each of the properties. The protocols for management and collection of data were designed in conjunction with AGBU.

(iv) Lease purebred, performance recorded Angus females to facilitate the implementation of multi breed EBVs. This also included the difficult-to-collect maternal traits.

(v) Continue the development of the International Shorthorn Genetic Evaluation with the ongoing joint funding of a post-graduate student.

(vi) Introduce an early weaning treatment into the project to evaluate the life-time effect on feed efficiency and all other recorded traits in the project.

(vii) Using existing material, and through the collection of additional samples from all cattle going to slaughter, test each DNA sample for gene markers to relate back to the recorded phenotypic performances. As new gene markers are released then this data set can be used to further validate results.

(viii) Provide data to validate/re-estimate Shorthorn variance component (particularly carcass traits) and validate existing indexes and assist in the development of new indexes.

(ix) In conjunction with CRC III scan, condition score and weigh females 3 times per year to contribute data to the CRCs Maternal Productivity Project.

3. Background

The lease of Nandillyan Ponds and the Adair herd from Kincardine Pty. Ltd. for a further five years was not renewed as the parties failed to reach agreement over terms and conditions of management of the project.

Subsequent to the failure of negotiations and according to the terms of the Durham-Kincardine agreement, Durham assumed ownership of 113 Shorthorn and 47 Angus cows with Spring-drop calves at foot which were relocated to a nearby vineyard at Molong. In addition to this herd, 19 Y and Z drop females were donated to the Durham Central herd by Arubial Pty Ltd and G. Morgan and Co.

Refer: ***Addendum 1. DRD Herd Inventory. 01.01.06***

The Society's Business Development Manager and director of Durham R&D was seconded to manage the project on an interim basis until appointed to the permanent position of Durham "project manager" following signing of the MDC contract in November, 2006.

With the effective loss of income from 70% of the Shorthorn cows, all 2003 and 2004 progeny and the autumn 2005 calves, a number of the original sub-projects of the Phase 2 research were re-assessed according to cost-benefit. Priority was given to a number of research subjects which were likely to have greater impact on the industry should they reach a successful outcome.
The Durham progeny test and associated research projects were also realigned to incorporate a greater focus and dependence upon the three satellite herds based in Southern Queensland.
Whilst the data generated from the satellite herds was submitted to Breedplan as performance records pertaining to the individual herds, EWA, BDB and MYM, rather than as Durham (DRD) Central herd records, the records were invaluable in enhancing accuracies of the tested sires traits and in achieving a critical number of steer and heifer progeny for each sire.
The impact of drought and a contraction of the grazing area available to the Central herd forced the directors of DRD to consider one of two options; to slaughter the breeding herd or consign the cows and calves to the Lillyvale feedlot at Condamine, Queensland, owned by Arubial Pty Ltd, a Durham satellite herd.

Fodder was impossible to procure and as dams and creeks dried, water levels became critical. The situation quickly deteriorated to a point where it was necessary to lift the score 1-2 cows and young calves within 72 hours. Despite an eighteen hour road-trip, the loss of only one cow and one calf in transit was an excellent outcome.

Confinement to a commercial feedlot for ten months made a significant impact on DRD cash flow, however disposal of the herd and winding-up the project was seen to be against the interests of the partners and industry.

It was only through the generosity of Uen and Margaretta Morgan and family at "Arubial", Condamine, who redirected resources to maintain the herd "at cost" rather than utilize the feed and pens for commercial profit, that the project continued.

The unforeseen consequence of indirect contact with foreign animals however, was exposure of the herd to BVDV with 47% of the breeding herd failing to conceive to AI in 2007.

Due to the financial inability of Durham to support the empty females for a further lengthy period on a feedlot ration, the cows were slaughtered. The cash flow was welcomed, however the Central herd struggled to contribute adequate progeny groups and the value of the satellite herds became apparent.

4. Management Infrastructure

Durham Research and Development Pty Ltd, a wholly-owned subsidiary of Shorthorn Beef, is governed by a Board of Directors and functions as an independent, properly constituted company. To avoid any conflict of interest, the President of Shorthorn Beef is unable to serve as Chairman of Durham R&D Pty. Ltd. Simultaneously.
The directors of DRD were advised to declare any interest when sire nominations were considered for test and it should also be noted that former Chairman and current director of Durham, Mr. Spencer Morgan, a managing partner of a DRD satellite herd participated in all discussion and was asked for advice pertaining to the satellite herds, however Mr.Morgan disqualified himself from voting on matters pertaining to financial support of the satellite herds.

The Board of Directors appointed the Shorthorn Business Development Manager, Peter Vincent, as DRD Project Manager in 2006. The project manager reported all correspondence to the Durham Board and advised the Chairman of any necessity to convene formal DRD board meetings to consider matters of importance.

As required by the DRD-MDC-MLA agreement, the Project Manager filed quarterly milestone reports to MLA Southern Manager, Dr. Robert Banks.

A statement of monthly financial accounts was issued by the DRD Company Secretary and Treasurer, Mr. Ed Attwooll, who ensured compliance with all statutes and regulations during the course of the project.

St. Clair Livestock (Lockie and Cara Seccombe), were employed to manage the herd which was agisted on the Seccombe's property, "Tallerack" at Ebor, NSW, according to protocols stipulated by Dr. Hans Graser, Animal Breeding and Genetics Unit, UNE. The herd manager and project manager have a close working relationship which allows for any unforeseen tasks to be addressed immediately.

Lines of communication between DRD, St. Clair Livestock, MLA, AGBU, ABRI, Swift Australia and CRC Tullimba remained open and functioned efficiently at all times and any problems arising have been resolved quickly and satisfactorily.

N.B. Discussions as to project management which considered both short and long-term consequences for the outcomes were always forthright and frank and the Durham directors at all times acted transparently and ethically in governing the company's interests and that of the project partners.

The conduct of the Durham directors was acknowledged as being exemplary for the position the DRD Board adopted in protecting the interests of the partners during negotiations to ensure the project continued beyond 2005.

5. Project Design and Test Protocols

AGBU was contracted to continue supervision of Phase 2 of the project and oversee protocols ensuring standardised treatment of progeny groups according to sex to eliminate the effects of environment and management.

Sire Selection

Members of Shorthorn Beef were invited to nominate bulls registered with the Society with current Shorthorn Group BREEDPLAN EBV's of 55% minimum accuracy for growth and scrotal size and carcass EBV's (EMA) with a minimum accuracy of 30%.

No conditions or restrictions applied to age, colour, horn status or phenotype, however contributors were reminded that all progeny were to be retained and subject to public inspection. In 2006, a condition of nomination was amended to stipulate that all bulls were to be used over both heifers and cows; previously contributors had the option to nominate bulls for use "on cows only", thereby adding robustness to calving ease data.

The Durham directors retained final discretion to accept or decline a nomination, however acceptance was guided by the following parameters:

#1 IMF EBV
#2 IMF EBV
#1 RBY EBV
#1 SB3 Carcass $Index
#1 Export Maternal $Index
#2 Export Maternal $Index
#3 Export Maternal $Index
#1 Heavyweight Domestic $Index
#1 Board Discretion
#2 Board Discretion
Preference will be given to bulls which are unrelated to animals which have previously been enrolled for test.

Refer: ***Addendum 2. Phase 2 Bull Nomination for Test.***

AGBU advised that to make full use of the test, better performing bulls must be enrolled if genetic gain was to be made within the breed. Consequently, high $Index young sires were identified and the respective owners encouraged to nominate these bulls.

Following acceptance to test, if semen was not immediately available, bulls were collected and the required 200 straws were shipped to DRD.

Follow-up bulls (preferably bulls which had been accepted for test) were leased for paddock mating to generate additional progeny records for test analysis.

For the purposes of the multi-breed sub-project, AGBU selected Australian and overseas Angus sires with high-accuracy EBV's from semen donated to the project by ABS Australia.

N.B. Due to adverse circumstances previously reported there was no intake of sires in 2007, however the 2008 enrolment was expanded to allow the testing of 15 bulls which had the highest average $Index values of any annual enrolment.

Genetic linkage between DRD progeny was maintained through the duplicated use of several bulls and linkage to CRC1 and the Breedplan validation project was provided through semen made available by Balderstone Pastoral Co.

Mindful of the opportunity the ongoing breeding programme represented and the need to contribute as much phenotypic information as possible to the proposed Beef Information Nucleus, nominations were extended by the Board to 2009.

In taking this action which would extend the test beyond the period of MDC support, the directors believed that it would be impossible for DRD to ramp up a progeny test of this size in the future. With the infrastructure and genetic resources in place, the opportunity to enrol a further ten sires and provide linkage to CRC was grasped.

Female Selection

Female selection was restricted to animals within the Central test herd and maiden heifers which were contributed to the project annually by the satellite herd. The only animals removed from the Central herd during Phase 2 were:
a. females failing to conceive to a synchronised, two-shot AI programme followed by a six-week joining were culled following pregnancy diagnosis.
b. female progeny of an overseas bull known to carry a lethal recessive genetic disorder were culled prior to joining as yearlings.
c. one heifer suffering a dislocated shoulder culled prior to joining.
d. one heifer born without a tail culled prior to joining.

Joining

Sires were randomly allocated across all age groups of females such that they had equal opportunity over maiden and mature females. The joining live weight target for all maiden heifers of 32okgs was readily achieved as a result of committing heifer progeny to NFI test for 100DOF prior to mating.

Inseminations were a two-round, synchronised, observed programme.

N.B. Conception to AI in heifers conducted shortly after the first NFI test at Tullimba was lower than industry standards. As a result, following the usual 100 days of high energy feed during NFI, the group was spelled for six to eight weeks on paddock pasture before programming for AI.

There was no requirement for bulls to be collected in a licensed AI centre, however poor semen quality was evident in two consignments of imported semen and one collection of an Australian bull. Despite the requirement for certification of semen quality, assessment of the same semen varied considerably amongst licensed technicians.

It should also be noted that in three instances, a limited number of straws were forwarded in order to commence an AI programme. Following exhaustion of the stock the semen was unavailable for a number of reasons.

Calving

Central herd calving was closely supervised with all calves weighed and identified at birth. Colour and sex of the calf were noted and the dam ID's recorded with any assistance at birth recorded using BREEDPLAN calving-ease scores.

Male calves were castrated at birth in the Central herd and as a single group in each satellite herd following completion of calving. Wet females were "drifted" and supplemented if necessary.

N.B. It should be noted that significant losses occurred in observed and identified newborn calves in the Central herd as a result of feral dogs which are prevalent in the Ebor district. Similarly, during Phase 2, newborn calves died in the satellite herds from an outbreak of chronic calf scours and from dehydration and stress during several periods of extreme heat.

Weaning

Progeny were tattooed and to validate paddock records or address any loss of ear tags in calves, the animals were re-mothered prior to final weaning. Live weights, tail-hair follicles for DNA analysis and IGF1 blood blots were collected and recorded and the dams weighed.

All progeny were yard weaned and supplemented with silage or high quality hay for a period before release according to group management protocol.

Post-Weaning

(Satellite herds)
As a result of several difficult years of very low rainfall and feed growth, female progeny in the satellite herds were grown out under paddock conditions to eighteen months of age before joining in the Spring of the following year.

This policy enabled the heifers to achieve adequate live weight to conceive and rear a calf without high supplementation costs. The Autumn calving also allowed for greater input of labour as all satellite herds have commitments to on-property bull sales, silage making and grain harvest in the late Spring/early Summer.

Steer progeny in each satellite herd were backgrounded until optimum average induction weights were attained before consignment to Swift Beef City feedlot where management groups were maintained. Following mid-fed regimes of 120DOF, the steers were slaughtered and assessed for carcass traits.

(Central herd)
Progeny were managed in respective groups, receiving any health treatment/mineral or fodder supplementation as a single management group until an average target live weight of approximately 320kgs was attained when the yearlings were consigned to NFI test.

Net Feed Intake
The time of induction to Tullimba was largely determined by the induction specification of 450-500kgs for steers at Swift Caroona, therefore the average target weight for progeny entering Tullimba was 320kgs.

Following 30 days of bunker training, heifers and steers were penned according to sex and weight for a test period of 70 days, during which weekly weights were recorded.

The 100 DOF not only yielded NFI data and greater accuracy of scans owing to expression of subcutaneous and intramuscular fat which would not have been possible on grass at Ebor but also ensured the heifers exceeded critical joining weights comfortably without heavy paddock supplementation through Winter. In addition, the steer progeny effectively underwent a long-fed regime rather than a standard 120 DOF.
At completion of NFI test, final weight and hip-height were collected and all progeny were scanned to measure EMA, IMF, Rump and Rib fats. Ultrasound scanning was undertaken using a Pye machine prior to 2009, when both Pye and CAP software were used.

Post-NFI Test

Heifer progeny were returned to the Central herd in preparation for AI and the steers consigned to Swift Caroona feedlot for an additional 120 DOF prior to slaughter at Swift Beef City. Target live weight for induction to Caroona was a group average of 480kgs.

At kill, a 12-hour curfew live weight, dentition and hot carcass weight were recorded to calculate dressing percentage and P8 rump fat was measured. Durham ID, Swift ID and NLIS tags were correlated and further DNA was collected as “insurance” against lost tags.

Following overnight chilling, carcases were measured for cold weight, fat colour, meat colour, BMS and EMA and a lean meat yield was subsequently estimated. Carcass weights averaged approximately 385kgs at 17 months of age.

Following correlation of Swift grader assessment of marble score and UNE chemical extraction of intra-muscular fat, AGBU advised that the significant cost of UNE chemical analysis could be avoided as the chiller assessment was extremely accurate, based on the chemical extraction results. Intramuscular fat was then recorded as an Ausmeat marble score.

N.B. Variations to the original design which stipulated different feeding regimes, carcass weight and age at slaughter for domestic and export market specifications were necessary due to virtual elimination of the long-fed Japanese export market as a result of extreme feed costs brought about by extended drought.

The simultaneous global financial crisis forced exporters to reduce inputs (DOF) and importers to seek cheaper product.

Rather than target either a (i) domestic supermarket or (ii) B3 heavy export market, the Durham progeny were fed according to an amended mid-fed regime for heavy B2 carcases destined for Japan on the advice of Swift Australia.

However, following 100 DOF at Tullimba and a further 120 DOF at Swift Caroona, the steer progeny were effectively “long-fed” prior to kill and chiller assessment.

6. Genetic Resources

Sires:

The four cohorts of Shorthorn bulls used to join the registered Shorthorn females in Phase 2 were comprised of:
42 Australian Shorthorn bulls (inc.7 sires providing linkage)
6 overseas Shorthorn bulls (USA, Can, NZ)
1 benchmark Shorthorn sire (1982 drop)
1 benchmark Shorthorn CRC1 sire (1988 drop)

(a) 48 "current" (alive and in-service) Shorthorn sires were accepted for test in 2005, 2006, 2008 and 2009.
(b) 1 (1982 drop) sire and 1 (1988 drop) sire with high-accuracy EBV's were used to benchmark SSA genetic progress since 1985.
(c) The (1988 drop) sire was also used in CRC1 and Breedplan validation. The bull provides linkage between DRD and Beef CRC1 in addition to benchmarking Shorthorn phenotype as a current trait leader for IMF.
(d) 42 of the 48 current bulls were bred and owned in Australia.
(e) 44 of the 48 bulls are analysed in the Shorthorn trans-Tasman Breedplan Group report.
(f) Ages of the current sires ranged from 15 months to 7 years of age at time of acceptance.
(g) The Australian bulls were sourced from the five mainland states:
NSW 19
SA 9
QLD 8
WA 4
VIC 2
(h) The 48 current Australian bulls were bred in 24 herds and were nominated or jointly-nominated by 25 contributors who owned or jointly-owned the sires at time of nomination.
(i) 7 of the 48 bulls were used in more than one year as link sires.
(j) 6 of the 48 current bulls were bred from 4 herds overseas:
New Zealand 2
United States 3
Canada 1

Refer: ***Addendum 3. Phase 2 Sires Enrolled for Test***

Females
At commencement of Phase 2 the DRD Central Herd consisted of 113 Shorthorn cows and calves transferred from the "Adair" herd, 19 Shorthorn females donated by Arubial Pty Ltd and G.Morgan and Co. and 46 Angus (APR) cows and calves originally purchased as heifers from the NSW DPI Trangie herd.

All females were registered and recorded with Group Breedplan. At 30th June, 2010, the Central female breeding herd ranged from 2 to 9 years of age.

The events of 2005 - 2006 reduced the Central herd to a breeding resource of limited value and without the 400-600 females contributed to test annually from the satellite herds, the project would have been terminated.

7. Project Objectives and Outcomes

(i) Continue the core project of progeny testing through the initial breeding cycle of the program into the ongoing reproductive, growth and carcass collection phase for an additional 36 sires giving a total of 85 sires over the 10 year life of the project.

From 30th June, 2005 to 18th December, 2007 the collection of data continued for Y, Z and A-drop progeny produced from Phase 1 with the final A progeny carcass and daughter reproduction records collected in December, 2007.

The Spring-drop Shorthorn and Angus steers generated in Phase 1 were consigned to AMH Beef City for long-feeding to meet the heavy B3 export market specifications. A final live weight was recorded and multiple chiller measurements of carcass traits were recorded by AMH graders and DRD personnel.

The Y Autumn-drop Shorthorn steers consigned to Tullimba for NFI prior to kill and chiller assessment at AMH Dinmore as short-fed, domestic steers was the final group of animals prepared to target the domestic market due to the reduction in progeny being generated from the depleted Central herd.

Dependent upon group size and sire representation, females were inducted to Tullimba for NFI test prior to joining. All heifers were scanned at exit and returned to Ebor for a cooling period prior to random insemination to the annual enrolment of DRD sires at approximately 15 months of age.

An additional 48 Shorthorn sires were enrolled during Phase 2, during which, progeny sired by 20 enrolled bulls from years 2003 and 2004 completed growth, carcass and reproductive testing. A total of 97 Australian and foreign Shorthorn sires were accepted for progeny testing in the nine enrolments.

Refer: ***Addendum 4. Phase 2 Sire Record. Progeny-Herds-Index***

(ii) Further expand the core project to include any industry relevant areas, including (a)structural soundness, (b)blood measures of growth and efficiency (i.e. Insulin like Growth Factor 1(IGF-1) and (c)flight-time recording. With the advent of new measures then these too can be examined for robustness against the objectively measured outcomes from the trial.

(a) Development of trial structural soundness EBV's data was not pursued as a result of the reallocation of funds to agistment in order to keep the project alive in 2005-2006. The DRD Board examined the aims and objectives of the project aims and redirected funds to objectives of higher priority for both the breed and industry according to practical application and return on investment.

Refer: Item 8.1. *Expansion of Original Project (Aims and Outcomes)*

(b) Phenotypic blood blots were collected and submitted for analysis according to AGBU protocols. Whilst initial results showed a moderately positive IGF1 and NFI correlation, other factors such as age of animal and time of collection in relation to weaning appear to influence any association to the point where several group phenotype showed a very strong negative correlation between IGF1 and NFI.

The collection of blood blots from 2010 progeny will continue for the purposes of expanding the base of phenotype data.

Refer: Item 8.2. *Expansion of Original Project (Aims and Outcomes)*

(c) Crush and yard testing of docility proved to be of limited value due to the narrow spread of phenotype evident in the docility of groups which had been previously handled extensively in AI programmes.

Refer: Item 8.3. *Expansion of Original Project (Aims and Outcomes)*

(iii) Include the three satellite herds based in Southern Queensland as part of the core data resource through implementation of a detailed management programme on each of the properties. The protocols for management and collection of data were designed in conjunction with AGBU.

The original satellite herd proposal, which foreshadowed the establishment of such herds in all states, was amended as a result of limited cash flow to service the herds and the difficulty of managing such a large number of AI programmes to generate progeny at an acceptable cost.

The attempt to create a national stage for the Durham project had the potential to diminish the value of the entire project through an inability to control protocol compliance and collection of quality data.

It was decided to focus on three of the largest herds in the Shorthorn breed, all in close proximity to one another and within comfortable travel time of the Central herd and administrative base of Durham R&D.

The three satellite herds ranged in size from 200 to 1,500 registered, performance-recorded breeding females and presented a unique opportunity to enhance the quality and expand the quantity of data immeasurably.

With the loss of the majority of the Durham female genetic resource due to events and circumstances occurring in 2005 and 2006 which were beyond the control of Durham management, the value of the satellite herds in providing sire progeny groups for test comparative performance soon became apparent.

Prior to the partners of the three satellite herds committing to participation in Phase 2 of the project, a meeting was convened at which AGBU tabled a list of responsibilities, a calendar of activities and emphasized the importance of maintaining management control according to the protocols of the progeny test at all times..

Following the briefing, G.Morgan and Co, (The Grove), Woolalla Pastoral (Woolcott) and Arubial Pty.Ltd. (Arubial) agreed to commit a number of registered, Breedplan recorded females to an annual insemination programme, using each Durham sire in accordance with AGBU protocols.

Conditions of enrolment of sires did not initially allow for the registration of female progeny in the name of the satellite herds if a semen share was not owned in the sire or the owner of the sire did not consent to the registration of heifers. In accordance with protocols, all male progeny were castrated, therefore the herds were unable to salvage male progeny for their own use or to sell as breeding sires.

The three members devoted significant resources to insemination programmes, monitoring of calving heifers, weighing calves at birth and data recording and reporting according to management protocols and reporting.

(iv) Lease purebred, performance recorded Angus females to facilitate the implementation of multi breed EBVs. This also included the difficult-to-collect maternal traits.

Following the failure to secure a renewal of the Nandillyan Ponds property and control of the majority of the Adair herd and the prolonged drought, cash reserves did not allow for the purchase of APR females to expand the Central herd Angus animals.

Whilst leasing breeding females was considered, discussions with individual Angus breeders indicated that the costs involved were beyond DRD capacity unless cows of considerable age or structural concerns were to be leased. Concerns were also raised as to the liability of DRD if biosecurity was breached and active APR females could not be returned to the lessor.

Phase 2 continued to generate multi-breed comparative data for the life of the project, albeit with diminished numbers of Angus females.

(v) Continue the development of the International Shorthorn Genetic Evaluation with the ongoing joint funding of a post-graduate student.

A global Shorthorn genetic evaluation feasibility study, seed-funded by several contributing members of the World Shorthorn Council, was completed by AGBU in November, 2007, however not as part of the post-graduate project. The final report is included as an addendum for interest only.

Refer: ***Addendum 5. Shorthorn Global Breedplan Evaluation.***

The post-graduate project was amended to a four year master's thesis, "Estimation of breeding values for animals selectively slaughtered" which was completed by Chris Worsnop in March, 2008.

Refer: ***Addendum 6. Durham post-graduate thesis (abstract).***

(vi) Introduce an early weaning treatment into the project to evaluate the life-time effect on feed efficiency and all other recorded traits in the project.

A trial to determine the effects of early-weaning on growth, carcass, docility and fertility traits was undertaken in 2007, utilising 145 steer and heifer progeny sired by the 2006 DRD sires fromThe Grove satellite herd heifers.

The trial was supported by AGBU, Beef CRC Tullimba, Elders Livestock Management Services and Swift Australia. Feed supplements were supplied by ELMS and fed as directed to validate claims to the effect that early weaning and supplementation with ELMS product increased feed conversion efficiency.

No live weight s were recorded for all cows at the time of early-weaning and conventional weaning of progeny, therefore an analysis was unable to be made as to any advantage in live weight gain and conception in dams of the early-weaned cow herd.

Refer: ***Addendum 7. Effects of early weaning on growth, feed efficiency and carcase traits in Shorthorn cattle.***

(vii) Using existing material, and through the collection of additional samples from all cattle going to slaughter, test each DNA sample for gene markers to relate back to the recorded phenotypic performances. As new gene markers are released then this data set can be used to further validate results.

At least three samples of tail-hair follicles have been collected from all progeny born or introduced into Durham Central herd for the purposes of genotyping. In addition, follicles were collected again from heifers at completion of NFI and steers slaughtered for carcass data were also collected at time of slaughter to ensure records and data was correlated with NLIS correctly. The samples are stored in three separate locations to ensure security and back-up.

All sires used in the project were genotyped by Pfizer and UQ upon acceptance for test. Further genotyping is currently being undertaken by PAG (Aust), PAG (US) and UQ on behalf of CRC for all Shorthorn sires with DNA available and which have carcass (EMA) accuracy of 70%>. A total of 206 eligible sires were listed for genotyping.

Refer: ***Addendum 8. Candidate Genotyping Sires. Carcass EBV Acc.70%+***

The Durham data was used in the SmartGene report to industry which attempted to validate commercial markers released by Pfizer Animal Genetics and has been made available to all industry organisations to utilize for similar purposes.

Currently the CRC is genotyping all available Durham animals with performance data using the 50K chip.

Refer: ***Addendum 9. AGBU Final SmartGene Report***

(viii) Provide data to validate/re-estimate Shorthorn variance component (particularly carcass traits) and validate existing indexes and assist in the development of new indexes.

AGBU commenced a validation and re-estimation of Shorthorn genetic parameters however this awaits completion as additional carcass data is being submitted to Breedplan. These results are now expected by early 2011.

Durham data, particularly the growth and significant carcass data collected during the project, was used by AGBU in an amendment of the SB Export Maternal index and development of a single Heavy Domestic index to replace two domestic indexes.

Refer: ***Addendum 10. Shorthorn $Index Revision***

Refer: ***Addendum 11. Top 100 Published Sires, New Export Maternal Index***

(ix) In conjunction with CRC III scan, condition score and weigh females 3 times per year to contribute data to the CRCs Maternal Productivity Project.

Prior to commencement of the CRCIII Maternal Productivity Project, an offer was extended to the project manager to utilize the DRD Central herd for data collection. Due to its own funding restriction the CRC concentrated on two breeds only, Angus and Hereford, which had large numbers of co-operating breeders. As no reply was received from CRC, it was assumed that the DRD herd was not required for the purposes of the project.

8. Expansion of Original Project (Aims and Outcomes)

1. Develop structural soundness EBVs for Shorthorns

The industry is pursuing the development of EBVs for structural soundness traits. These are subjectively scored and require a measure that has adequate repeatability so that the differences reflected are those of the animal (sire) and not of the assessor.

Structural soundness is considered as being critical in feedlots targeting the long-term feeding market and the establishment of an EBV is important to all associated with this section of the industry.

This project allows for:
(i) confirmation of such a system in an operation where the validity of the measures can be assessed.
(ii) contribution towards the development of a Structural Soundness EBV for a number of commercially desirable traits. This will be done with Shorthorn and Angus cattle and will have significance across all breeds of cattle.
(iii) calculation of repeatability across years on females. Females will be scored at least three times to examine the effect of age.

The seed stock industry has pursued development of EBVs for structural soundness traits with varying degrees of success and whilst the Angus society has implemented trial structural soundness traits for five measurements of feet and hocks, the EBV's have not met with universal acceptance and are not widely accepted or utilised.

(i) There was a disparity in the subjective assessments of the two assessors which did not give rise to confidence in the only subjective system considered for implementation in Breedplan.

(ii) Whilst Breedplan maintains that consistency of an accredited assessor's subjective judgment is the key driver to acceptance of the EBV's, individual assessors are not responsible for more than a small percentage of a breed's sale catalogues in any given year.

(iii) The cost-benefit of such a programme was not immediately apparent to either the Durham project which was proceeding on the basis of limited cash flow or the broader industry which was and is expressing doubts as to the value of such an EBV.

(iv) The number of progeny generated per-sire within the depleted Central herd provided limitations as to the robustness of any analysis of data.

(v) As the cost associated with assessors travelling to the Satellite herds at Condamine was prohibitive, no assessment of structure was undertaken in the three herds.

2. Evaluate insulin-like growth factor–1 (IGF-1) as an indirect measure of Nett Feed Intake and all other traits

The cost of generating the efficiency measures of nett feed intake is extremely high making it, in most cases, out of reach for widespread evaluation (i.e., it is unlikely that large numbers of bulls will be evaluated).

However as the Durham Project has already generated nett feed intake figures this data together with those generated by blood testing for IGF-1 provides valuable support information for the Animal Genetics and Breeding Unit.

Provided additional financial resources are made available or cost savings can be made within the project, NFI testing of steers from the Central Test Herd will continue to provide data for the AGBU IGF1-NFI analysis.

Initial IGF1-NFI data showed strong correlations between IGF1 and conversion efficiency of feed to live weight. However, the correlation varied significantly depending upon the age of animal at collection, time of collection pre-weaning and post-weaning and several other factors.

Consequently, despite the significant cost of NFI testing, it is necessary to continue the collection of further phenotype-genotype data to define the parameters under which the correlations may prove to be positive or disprove the initial data which showed so much promise.

It should be noted that the Phase 2 application contained no expenditure item for net feed intake testing of progeny. Consequently, when the DRD Board considered NFI testing to be of paramount importance to both the Shorthorn breed and industry, funding was sourced from savings made within individual expenditure item budgets and sale of live stock from the DRD Central herd.

614 Shorthorn and Angus progeny of both sexes entered CRC Tullimba for NFI during Phase 2 of the progeny test, comprised of 145 Shorthorn yearlings bred from The Grove satellite herd which underwent NFI as part of the early-weaning trial, 373 Shorthorn and 96 Angus yearlings bred in the Central herd.

These 145 animals have two IGF1 records, one taken at early weaning age and one at standard weaning age. While no difference between IGF1 was observed at early weaning age, the difference in IGF1 at standard weaning age was significantly different between early and normally weaned calves. Further analysis of this data is pending.

A significant amount of NFI data has yet to be submitted for analysis, including results from the

E progeny due to complete test on October 5th.

At completion of Phase 2, the cost of testing amounted to in excess of $350,000, however the commitment to NFI provides the breed with a trial NFI EBV and industry with invaluable data for use in the validation phase of marker commercialization.

All data harvested during the life of the Durham project is to be contributed to the national Beef Information Nucleus and utilized to understand and harness bovine genomics.

Refer: ***Addendum 12. Shorthorn trial NFI EBV's.***

3. Measure genetic differences in temperament by using the flight-time recording system

Temperament is an inherited trait and has particular relevance to human and animal safety as well as the economic effects on feedlot performance and meat quality. AGBU organised for Ruddweigh Cattle Equipment, to develop a flight time recorder to measure and therefore assess the differences in temperament between animals and presumably then develop an EBV for temperament.

It has been demonstrated in Bos Indicus cattle that flight time and other measures of temperament such as yard scores are heritable and genetically correlated to shear force tests (tenderness).

The Durham R&D herds are an important resource for the foundation work to generate an industry measure of genetic parameters for flight time in Bos Taurus cattle. All progeny are measured for flight-time twice to ascertain environmental effect and measure repeatability.

Several groups of Durham progeny bred in the Central and Satellite herds were flight-time measured and yard scored for docility according to Breedplan guidelines, however the raw data was not submitted due to the lack of spread in the scores recorded for progeny measured both at weaning and as yearlings.

These conflicts with outcomes from Phase 1 data extracted from the Central herd, however herd management and different techniques in handling the animals played a major role in docility scoring.

The extended AI programmes involving twice-daily yarding and drafting of cows and very young calves over a period of several weeks educated progeny to an extent that docility scoring of the Durham progeny was of no value to the development of docility or tenderness (based on docility scores) EBV's for the Shorthorn breed.

Poor temperament was evident in two progeny groups of animals consigned to Tullimba from short-term agistment . NFI was increased in these two groups. This behavior reflected the habits of animals which had been worked in the yards with dogs.

4. Demonstration of the value of EBV's

Despite escalated adoption of EBVs in the national Shorthorn herd there remains significant scepticism regarding their value in the selection of sires that produce superior progeny.

Results from Durham and the satellite herds are being used to demonstrate the value of EBVs as a selection tool.

The strict management protocol and recording practices of the Durham herds make it an ideal model for promotion of the underlying genetic principles. In many on-farm situations the comparison between sires of different genetic merit become confounded with management and mate allocation practices (e.g., some sires are not mated to heifers).

The Durham project with its extensive data recording including direct carcass data is an ideal vehicle for the extension of the genetic principles and benefits will flow much wider than just the Shorthorn breed. This validation will be extended to highlight the value of selection indexes as well as the individual traits.

Information generated to date from the Durham R&D Program has already been used in the "Proof of Profit" story and by MLA in their "Tips and Tools" handouts , the Feedback Magazine and will be used in future CD Rom presentations. The Breedleader course uses Durham as an example of genetic progress.

Durham R&D provides proof of increased profitability as a result of genetic selection and will be an important resource in the upcoming MLA review of industry and commercial investment in beef cattle genetic programmes.

Expansion of the Durham core herds to what will be perceived as a more "commercial" base will assist in a better understanding of EBV's as a key to optimizing profitability and accelerate producer's uptake of technology

The value of EBV's and $Indexes is now well understood by Australian seed stock and commercial Shorthorn breeders. So too is the danger of single trait selection of animals for the purposes of maximizing performance in the belief that it maximises profitability.

In 2008, Shorthorn Beef conducted a successful "Breedleader" workshop in Armidale for a "leadership group" of 25 breeders owning high profile Shorthorn herds which were eligible to receive a TakeStock analysis.

The workshop, organized by SB Technical Extension Specialist Bob Freer, was conducted to encourage "breed leaders" to assume a leadership role in disseminating knowledge within the Society as why and how Breedplan should be used to increase the value of Shorthorn seed stock.

BreedLeader™ Program - Shorthorn Leadership Group

Provided in Collaboration with Southern Beef Technology Services

Day 1	**Key aspects of product & herd improvement**
1.45 pm	**Course overview**
2.00 pm	**1.What influences genetic improvement?**
3.00 pm	**2. Understanding the effects of a single gene**
4.00 pm	**3. Are you recording the right information for genetic improvement?**
5.00 pm	**4. TakeStock herd reports. TakeStock - case study + detailed outline**
6.30pm	**Close day 1 - Hand out individual herds' Takestock reports**
Day 2	**Fine-tuning for the future: your breed - your herd**
8.30 am	**5. Selection Indexes - Are you using the correct $Index?**
9.30 am	**6. Group and Herd Sessions - clarify future goals for your herd.**
10.45 am	**7. Proof of Profit - EBVs and Indexes that work: case studies**
11.45 pm	**8. DNA Tests - opportunities and challenges for the individual herd**
1.30 pm	**9. DNA Tests - implications for the Shorthorn breed**
2.15 pm	**10. Genetic Technologies for the Breed**
3.15pm	**11. Genetics of the Future for the Shorthorn Breed**

SBTS co-coordinator Christian Duff was requested to submit a technical article for each of the three Shorthorn Beef magazines published each year during Phase 2, with editorial related to the Durham project and outcomes. Two of the articles, including a summary of trans-Tasman Shorthorn performance recording trends, were also published in the UK World Shorthorn Conference magazine.

It is obvious that Shorthorn breeders now seek optimum performance to maximize profitability through the widespread use of $Indexes pertinent to specific markets when selecting seed stock. Unlike five years ago, there is little or no discussion as to the validity or otherwise of indexes between seed stock breeders.

Refer: ***Addendum 13. Shorthorn Pedigree and Performance Submission***

Next to structural soundness and fertility, the $ value of a sire for a respective index is the foremost selection tool used when purchasing sires. Once the highest indexing bulls are identified, buyers scrutinize individual EBV's, particularly birth weight and calving ease to ensure management problems are not outweighed by performance. The primary consideration other than these traits appears to be carcass EBV's.

The majority of Shorthorn seed stock breeders are conscious of the annual genetic gain which they must attain to remain profitable and understand how EBV's and $Indexes can be used successfully to increase herd profitability.

The value of EBV's was clearly demonstrated by the Turanville Shorthorn seed stock operation at Scone, NSW, which markets 20-30 registered, performance recorded bulls bred specifically for the domestic market every year.

In 2006, managing partner Doug Robertson identified and purchased Kevlyn Downs Zulu, the highest value 2004-drop bull for the Heavy Domestic Index.

Within three years, Kevlyn Downs Zulu genetics had elevated the Turanville herd from a ranking of #28 in the breed to #2 for the Heavy Domestic Index. The Shorthorn annual average rate of gain for the HDI is $1.31. The Turanville herd gains an estimated $3.62 pa.

Refer: ***Addendum 14(a) & 14(b). Demonstrating the Value of EBV's. Turanville.***

$Indexes have established a conduit from the seed stock industry to the commercial beef production industry which is imparting a commercial focus on breeding goals and selection criteria employed in the seed stock sector. The monetary unit of value expressed in Breedplan $Indexes is the key to a beef breeder's comprehension and use of indexes.

Refer: ***Addendum 15. Shorthorn Genetic Trends. EBV's.***

Refer: ***Addendum 16(a) & 16(b). Shorthorn Index & EBV Genetic Gain***

Further evidence of the value of $Indexes in the eyes of both vendors and buyers, is obvious in a raw analysis of the annual multi-vendor, National Shorthorn Sale results for the years 2006-2010

A significant premium existed for bulls presented with above-average values for the Heavy Domestic and Export Maternal $Indexes and a better clearance of lots is evident in the category of higher value indexes.

National	2006	
Shorthorn Sale	Ave.Price	Clearance
Above Ave. $Indexes	$6,438	79%
Below Ave. $Indexes	$5,263	63%
National	2007	
Shorthorn Sale	Ave.Price	Clearance
Above Ave. $Indexes	$5,292	96%
Below Ave. $Indexes	$4,810	74%
National	2008	
Shorthorn Sale	Ave.Price	Clearance
Above Ave. $Indexes	$5,795	88%
Below Ave. $Indexes	$4,797	68%
National	2009	
Shorthorn Sale	Ave.Price	Clearance
Above Ave. $Indexes	$5,443	86%
Below Ave. $Indexes	$4,833	95%
National	2010	
Shorthorn Sale	Ave.Price	Clearance
Above Ave. $Indexes	$5,225	88%
Below Ave. $Indexes	$4,166	83%

5. Multi-Breed EBVs

The inability to compare EBVs across breeds has created a major hurdle to expansion of beef breeds with a low (or recently established) performance base. It is inevitable that the comparison of the EBVs between breeds occurs, but it is both false and misleading.

In the early nineties the Shorthorn Society of Australia decided to reset the base for all traits at the average of 1987 drop animals. The original base for Shorthorns (like most other breeds) was the late 1970's and was based on the first 200 records. Other breeds have a much earlier base and due to genetic progress over time they are perceived to have a much greater magnitude of their EBV values.

As a starting point to develop across-breed EBVs, in 2002, 70 Angus pedigreed and performance recorded heifers were purchased from the NSW Agriculture's Trangie Research Station. A further 30 heifers were purchased from the same herd in 2004 to supplement the programme.

They are running as part of the DRD Central Test Herd (with comparable Shorthorn females) so as to commence gathering the necessary data to evaluate the relativity of an Angus EBV with a Shorthorn EBV.

The project continues to gather data from the reproductive, growth, carcass and fertility phases and will allow development of the Angus/Shorthorn multi-breed EBV's, including the first benchmarked carcass traits.

Dr Hans Graser and Dr David Johnston from the AGBU govern the protocol associated with management and data collection for the multi-breed project and analysis of the data will commence at a time of their determination.

It is proposed that these two female groups, and their purebred progeny, representing Shorthorn and Angus will provide a pure basis for further multi breed EBVs.

They are to be made available for future industry research to provide performance and phenotypic information to determine and then measure differences in areas such as structural soundness, coat and hair type and to provide an ongoing resource to collect information on new traits not previously collected.

The Angus and Shorthorn breeding females and progeny continued to co-exist in the same management groups throughout Phase 2 of the project and a further 96 Angus progeny have or are currently being tested for the reproduction , growth, NFI, carcass and fertility traits. A total of 220 Angus progeny have been recorded to date during the life of the Durham project.

After some delay due to internal discussions, Angus Australia has enrolled a Durham Angus herd (Prefix AUD) in the AA register, transferred the original Trangie females which were

purchased to AUD and has accepted all data recorded from the Angus cows and progeny for analysis in Angus Group Breedplan.

Once all data is submitted, AGBU will attempt to undertake a Shorthorn-Angus multibreed analysis.

As a consequence of acceptance and analysis of the AUD Angus data, AA will receive significant data from the Durham Angus kills to enhance carcass EBV's of sires which otherwise are dependent upon live scan records.

Whilst several breed societies regard the generation of multi-breed EBV's as unimportant for obvious reasons, there is no doubt that despite breed-specific branded product, the beef breeding sector is moving rapidly from a focus on breed-environment compatibility to one of market-environment profitability.

Consequently, the need for development of multi-breed EBV's is urgent and once released, it is likely that $Indexes will be used extensively as a primary selection tool by commercial breeders. Further refinement of the indexes to include environmental tolerance as an element of genotype would be advantageous.

Senior livestock managers of Australia's largest processor and exporter of beef, Swift Australia, have accommodated the protocols of feeding and managing the Durham progeny groups according to AGBU requests throughout the life of the project.

AMH and Swift have allowed Durham personnel free-reign to assess and measure traits of any live animals or carcases in lairage, on the kill floor and in the chillers and have readily accommodated every request from Durham in order to facilitate successful data collection from each kill. In return, AMH and Swift management has received a summary of all raw data as soon as each progeny group's data has been collated according to sire.

N.B. *Swift management has consistently indicated that there is little difference between the live weight gain of Angus and Shorthorn steers in Swift feedlots for 150-220 DOF and in respect of carcass traits.*

To verify the accuracy of the statement, the project manager enquired as to the availability of historic phenotype data which would be of great benefit to ascertain whether the propensity for the Shorthorn to marble was diminishing as was the popular belief which was reinforced by the genetic trend for the trait.

Swift consented to the request and Durham commissioned a report of comparative data collected by AMH and Swift over the last decade from the New Zealand IP company Abacus, which manages the processor's data base.

It should be noted that the report was made available on the condition that the data should be regarded as "for eyes-only" and is to remain confidential. The addendum is restricted to MDC and MLA senior management.

Refer: ***Addendum 17. Swift SH&AA Feedlot and Carcass Performance 2000-09***

6. Incorporation of DNA Gene Markers in EBV's

Durham Stage II will provide a valuable resource to test and validate existing markers and to work alongside industry to develop new markers given the large number of well identified phenotypes. The data collected from this project has phenotypic measurements on more than 12 traits, together with full pedigree records and has carcass data collected from animals that are all slaughtered on the same day, not serially slaughtered as is mostly the case.

Genetic Solutions is supporting this project through DNA testing of all Durham progeny for both existing and yet to be identified markers. AGBU, Genetic Solutions and Durham are collaborating to incorporate these outcomes into strengthening Breedplan EBV's.

Further recording and analysis of DNA/phenotype is to be undertaken with sub-projects associated with (a) immunity levels in new-born calves in relation to calf scours (b) the incidence of pink-eye and (c) the relevance of "coat type" to growth, fatness and mature weight in Shorthorn cattle.

The development of EBV(m) is ongoing and Durham has and will continue to provide data to facilitate development of the EBV's which is likely to be selective due to the numerical dominance of 5-6 breeds in a population of some 30 breeds within Australia.

The variation in location and effect of markers from one breed to another means that individual breeds will be obliged to engage in genomics research at one level or another to ensure that their particular breed is not isolated in the discovery and development of effective gene markers to harness the power of genomics.

Mature weight is rigorously recorded in the central and satellite herds and coat scores have been undertaken in the Spring of every year, however no records have been maintained on viral infections such as "pink eye" and no calf scours have been recorded in the central herd.

7. Data Source for CRC Maternal Productivity Project

The Durham herds provide an ideal source of data from repeated scanning and measuring of cows 3 times per year for all-age females. This data will be made available to the CRCIII for the Maternal Productivity Project.

Durham Research and Development continued to encourage further use of the herds to facilitate additional R&D programmes and works closely with AGBU to evaluate ideas for incorporation within this significant project.

As previously reported, the CRC limited the scope of the project to two British breeds and whilst Shorthorn is not involved, the outcomes will be pertinent to the breed due to its phenotypic similarity to Angus and Hereford. Should any DRD data be required for the maternal productivity project it will be made available.

4. Target Outcomes

a. *Target:*
Develop multi-breed EBVs. The ongoing data collection from the existing Angus and Shorthorn herds will provide unique, highly robust data including birth weight, growth, fertility, feed efficiency and carcase values. Significant improvements realized for generating multi-breed EBVs, the impact of early weaning on later expression of genes for feed efficiency and other key traits.

Outcome:
Development is ongoing for multi-breed EBV's and whilst the trial indicated that early weaning had little or no effect on feed efficiency, growth and carcass traits, further research on calves weaned at lighter weights is required to draw absolute conclusions as to any effect.

b. *Target:*
The development of across-breed EBVs for Shorthorn and Angus so that meaningful comparisons can be made between these breeds.

Outcome:
Development is ongoing.

c. *Target:*
Validation of gene markers for all traits measured in the project.

Outcome:
Validation of commercial gene markers was achieved and is ongoing as a joint project with Beef CRC.

d. *Target:*
Evaluation of IGF – 1 (Insulin-Like Growth Factor 1) as an indirect measure of Net Feed Intake. Expanded industry capacity to use DNA and IGF-1 markers from PSHIP.193 validation.

Outcome:
Results have varied significantly depending on protocols used for time of collection in relation to time of weaning and age of animals. The evaluation is ongoing.

e. *Target:*
New knowledge of the genetic relationships between temperament and the production traits.

Outcome:
Not achieved due to lack of data.

f. *Target:*
Generate an industry measure (through flight time recording) of temperament.

Outcome:
Not commenced due to lack of data.

g. Target:
Capacity to deliver EBVs for several additional traits for Shorthorns.

Outcome:
Shorthorn NFI EBV delivered. Data base being collected for Days-to-Calving.

h. Target:
Final report describing achievement of objectives based on datasets developed to June 30 2010. This will not include performance data from progeny of 2008 sires, that will be available by March 2012.

Outcome:
The final report is delivered without full data sets to June 30, 2010. Additional information is currently being submitted to Breedplan for analysis and afull data set for all animals and traits will be presented immediately the analysis is complete.

i. Target:
Project proposal for the funding of the period 1 July 2010 to 30 June 2012 to complete analysis of the Phase 1 and 2 program.

Outcome:
Proposal for funding from 1 July 2010 to 30 June 2012 to finalise the Durham project delivered.

Extension

Contributors of sires to the progeny test received collated raw data as it became available in a format comparing "their" sire's progeny to the average for the group for the particular trait which was measured. The information was provided with a warning that the raw data should not be published for the purposes of promotion as it was misleading.

Refer: ***Addendums 18(a)(b)(c). Sire Contributor Feedback Extracts***

Extension of the project and outcomes to members was undertaken through the Shorthorn web site which contained a specific Durham R&D tab listing annual sire enrolments hot linked to Breedplan Internet Solutions and in print media through the quarterly Member Newsletter and the three issues pa. of the Shorthorn Beef magazine.

Refer: ***Addendum 19. Durham R&D Web Page***

Refer: ***Addendums 20(a)(b)(c). Shorthorn Publication Extracts***

The SB magazine is also direct mailed to another 5,080 recipients, including 84 international subscribers, 96 NZ subscribers, 5,080 Aust. beef breeders, agricultural schools, feedlots, processors, S&S agents, state Ag.Depts, beef industry organizations and R&D administrations.

Extensive use was made of CRC Bulletin editorial reprinted in the SB magazine to link the Durham project to industry R&D and reinforce messages concerning the importance of correct selection of genotype to create an optimum phenotype in a herd and the consequential "proof of profit".

In 2007, a series of industry symposia was conducted at Orange NSW, Albury NSW and at Naracoorte SA. The DRD project outcomes were used as examples of "proof of profit" realized by astute selection of genetics in breeding programmes.

Refer: ***Addendum 21. The Power of Genetic Selection***

Prior to the forums in Albury and Naracoorte the Project Manager and Technical Extension Specialist met with SB members to hear and address any concerns.

"Durham project - the benefits of this project to the breed in general, and members specifically, is not well understood. Criticism of the project at member meetings did not stand up to informed debate.
That industry recognizes this program to be a vital part of the future of the breed at a greater level than do most Shorthorn breeders identifies a clear problem in communication, and an opportunity to create a greater return on R&D investment.
This program could be enhanced by schemes to ensure that members better understand the benefits of the project to their enterprise, that more high performing young bulls are tested and that these bulls are made available widely throughout the industry".
Bob Freer, Technical extension Specialist.

In 2008, a Breedplan technical workshop was also conducted in Westbury, Tasmania, for 13 Shorthorn Beef members where data from Durham Phase1 of the project was used by the SB Technical Extension Specialist, Bob Freer, to demonstrate the value of EBV's and indexes.

In March, 2010, DRD conducted a technical symposium in Armidale at which AGBU presented a report on the early-weaning project and SBTS presented an update on data collection for days-to-calving and mature cow weights.

Closer to your Client days featured outcomes of the Durham project in the programmes to demonstrate the application of EBV's. The six Shorthorn herds in SA, NSW and Qld which conducted the client days facilitated by SBTS had all contributed sires to the Durham test.

N.B. *Despite editorial pertaining to the methodology, purpose and outcomes of the project to date published on the SB web site, in SB member newsletters and SB magazines since commencement of the project, many members had a limited understanding of the fundamentals of research and regarded the project as a promotional programme to publicise the advantages of Shorthorn genetics*.
Extension of outcomes likely to bring change was often frustrated by a small number of breeders apparently fearful that change would diminish their influence.

Numerous editorial pieces specific to the Durham project or relating to the application of outcomes of the project to the Shorthorn breed were published in respective Rural Press journals during Phase 2.

Refer: ***Addendums 21(a)(b)(c). Print Media Editorial Extracts***

Global extension of the project and outcomes was undertaken through the SB magazine to a limited number of breeders subscribing to the publication in Canada, USA, UK and to all NZ Shorthorn society members.

A Durham R&D report was delivered to the World Shorthorn Conference held in the U.K. in

July, 2010 by the project manager who reported that Australian genetics, specifically bulls tested through DRD were the focus of numerous enquiries and discussion and a large number of leading herds visited throughout the UK displayed progeny by Durham sires.

Refer: ***Addendum 23. DRD Presentation WSC 2010***

The project manager also delivered a presentation detailing the structure, function and capability of Breedplan and the delivery of the most accurate estimated genetic value of any software programme throughout the world.

Refer: ***Addendum 24. Breedplan Presentation WSC 2010***

Dissemination and Uptake of Durham Outcomes

Prior to January, 2008, the registration of progeny by Shorthorn AI sires was limited by society regulation to 25 calves p.a. for each of the maximum eight shares owned in a sire and held limited appeal due to higher society fees and extensive documentation.

In 2008, a number of regulations relating to artificially bred calves were removed to facilitate the wider use and availability of superior bulls, particularly numerically small herds for which securing a share in a bull for limited use was an expensive exercise.

To expedite the use of sires identified as being superior through progeny test, a catalogue of DRD bulls which either had semen available for sale or were available for semen collection was compiled and disseminated in electronic format on the Durham web page and as a hard copy catalogue in 2006.

DRD facilitated contact between the persons making enquiry and the owners of sires but did not act as agent for the sale of semen. The catalogue was updated in 2007 and again in 2009.

Refer: ***Addendum 25. Durham Genetics Catalogue***

Increased and widespread demand for progeny-tested Shorthorn genetics throughout Australia and overseas has become obvious during Phase 2 of the project. To June 30th 2020,

5529 progeny sired by DRD bulls were registered and despite the extraordinarily high cost of qualifying semen for export, semen from 11 Australian DRD sires and 3 sons of DRD sires has been sold to overseas herds.

Refer: ***Addendum 4. Phase 2 Sire Record***

To encourage members owning small herds to utilise Durham genetics, the DRD board initiated a programme to distribute semen free-of-charge to herds with less than 30 females on inventory. The uptake of semen made available by the owners of the bulls was well received with 17 herds accepting the conditional offer.

Refer: ***Addendum 26. DRD Semen Distribution Programme***

A significant achievemant of the project is that male Shorthorn calves born in 2009 bear higher accuracy EBV's than their Angus counterparts. Shorthorn breeders are acutely aware of the value of Breedplan, not only when searching for herd sires or the introduction of superior genetics through AI but also when assessing the objective value of animals within their own herds.

Through the Durham progeny test, the Shorthorn breed now has more carcass data published than any other breed in Australia. The attention which Shorthorn breeders are devoting to carcass EBV's when selecting sire genetics is quite extraordinary and doubtless a reflection of the Shorthorn genetics of the past which necessitated change within the breed.

Through the project, perceptions as to the value of an individual animal, progeny of individual sires and entire herds have been proven as false and equally, the real value of several sires and their progeny has been enhanced considerably.

Commercial and seed stock breeders are now less likely to be restricted by a sense of loyalty to a particular source of breeding stock when selecting genetics. A greater understanding of Breedplan data, particularly indexes, coupled with tangible "proof of profit" is encouraging beef breeders to broaden their search for the genetics they determine most suitable for their operations, irrespective as to the breed.

Significance of the Durham Project

The DRD project is significant both nationally and internationally for two achievements:

(i) establishing a bank of data which will remain a valuable asset to the Australian beef industry as the application of genomic research and development revolutionises beef production.
(ii) bringing about change in a traditionally conservative industry with regard to the use of objective measurement in estimating the genetic value of a live animal.

In the process of these physical and philosophical achievements a large amount of data has been recorded, analysed and the outcomes published for the benefit of the beef industry.

However, success or failure of the project will be measured according to both the utilisation of the data bank by commercial companies and organisations in discovery and development of genomics and the degree to which Shorthorn breeders take up and apply project outcomes

and breeding principles to enhance the value of their own herds and that of the Shorthorn breed generally.

Within eighteen months Shorthorn breeders will have a full suite of Shorthorn EBV's and Indexes of very high accuracy for each of the 103 bulls progeny tested in the Durham project. In addition, the data generated from Angus progeny as part of the multi-breed project will add value to the 59 Angus AI sires.

Refer: ***Addendum 27. DRD Sires Indexes, EBV's and Accuracies. 30.06.10***

Within the beef industry scepticism remains but the general understanding and use of Breedplan has increased through demonstration to the point where a pro-active group of breeders intends to create a performance-focused affiliation of herds required to meet thresholds in the recording, production and description of beef cattle seed stock.

It is unlikely that a project of this magnitude will be undertaken in the near future by an Australian breed association which is regarded as being a service organisation rather than commercially focused and driven by profitability.

If that is accepted as a valid assumption, breeders of beef cattle in Australia will shift from a state of independence to one of dependence and as a matter of urgency need to address the authenticity of products purporting to describe the influence and value of genotypes of beef cattle animal.

In January 2011 Hans Graser (AGBU) was contract to perform an analysis of the Australian Shorthorn Breedplan output with and without the inclusion of the Durham generated data.

Refer: ***Addendum 28. Report on Comparison of Australian Shorthorn evaluation with and without Durham Data. Has Graser. Jan '11.***

The above report has summarised the significance of the Durham generated data in relation to the substancial increase in acuaracy of the breeds reported Breedplan figours. This is especially relevan to carcase traits and net feed efficiency. The Durham project's contribution to this increase in accuracy across the Shorthorn breed has enable both seedstock and commercial breeders to select genetics with a much greater degree of reliability and therefore ensure more rapid genetic gain.

Shorthorn Beef members were asked to complete a survey in December 2010 asking them various questions in relation to the Durham project. The survey and summarised results (over 20% responded) can be found attached.

Refer: ***Addendum 29. Shorthorn Beef member survey.***

The survey results were very encouraging for the success achieved by both Phase 1 and 2 of the Durham project. Over 30% of all Shorthorn Beef members were satisfied with the outcome and information flow; and had then used this information to make geneteic selection and progress in their own herds.

The respondants were also ademant that further and ongoing research is essential for the development of the Shorthorn breed and genetic gain in the commercial sector. 86% of

Shorthorn Beef members indicated that they would support and encourage further research by DRD.

Testimonial (1)

"The value of the Durham project to our Shorthorn and KD Composite seed stock herds is of immense value because it increases the accuracy of our own data. Along with all other Shorthorn Breedplan traits, two of our stud sires have been measured for NFI and carcase data which is of far greater value than live scanning in published EBV's.
We opted to change our choice of sire for an ET programme recently as a result of amendment to EMA EBV's of a very influential bull, knowing that the shift in figures was based on phenotypic measurement. With the Durham central and the satellite herds using these sires, the linkage it will provide with the Shorthorn populations is very empowering to Kevlyn Downs knowing that the protocols for recording Durham progeny are equal to our own. We can use Durham sires in AI & ET programmes with confidence if the EBV's fit our programme."
Kevin and Lyn Johnson,
"Kevlyn Downs",
Keith,
South Australia.

Testimonial (2)

"The Durham project has been invaluable to our herd and indirectly our clients as it has increased the accuracies on our Sires performance and therefore the performance of bulls purchased at our sale. The Durham project has supplied information that we have not been in a position too such as carcase data. I feel the program is now positioned to really excel and provide more conclusive outcomes to producers, as to date it is the usual process in Research whereby data needs further validation before final results can be released such as NFI.
An example of Research being released before validation was the original Gene markers and Genetic Solutions- Weebollabolla spent an enormous amount funding that research. It has been said that many R&D projects have information that is lost and never reached to those that require that information- I fear that may occur if funding does not continue for Durham. Genetics is a long term partnership. Now is the time to further invest in the cattle industry for when the industry improves and we as producers are able to capitalize on markets through better performance on grass and/or grain and better carcase traits in the chiller room. Durham is leading the way for other breeds to benefit in setting up parameters and what has worked and what did not.
I feel with Peter Vincent's experience and commitment now that he has less distractions from day to day breed society operations (ie website, magazine, administration, people management and not too mention politics) his whole focus can now be directed towards the real area which agriculture will bring returns- Research and Development"
Jen Munro,
"Weebollabolla",
Moree, NSW.

Testimonial (3)

"*The Durham project data that has been made available to us as producers is very valuable to our herd management. It has enabled us to monitor the value of particular sire-lines and relate that information back to our own programme when selecting future genetics.*

When selecting bulls we try to look for sires with a good balance of EBV's with preference given to those bulls with higher accuracies. Breedplan data, if collected correctly, has a major influence on our selection of bulls to increase the efficiency of our herd. The Durham project has not only been of great importance to the Shorthorn breed but the cattle industry as a whole."
Marc Ross,
Manager,
Lanstal Pty Ltd.,
Pinjarra, W.A.

Testimonial (4)

“ The Durham project has been invaluable for genetic improvement in our herd. We have been able to select AI sires with higher accuracies due to their use in the progeny test; in particular for the carcase and calving ease traits which are crucial for our herd profitability.

I choose to exhibit in the Sydney Royal Easter Show carcass competition to benchmark the herd for both myself and my clients. My decision to purchase the highest ranked Domestic $Index Shorthorn bull of 2006 was validated when progeny of the bull won the 2009 Champion and reserve-Champion middleweight carcass awards.”

Doug Robertson,
“Turanville”,
Scone, NSW.

SHORTHORN GENETIC IMPROVEMENT PHASE 2
P.PSH.0193

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