New Acland Cattle Grazing Trials:

Optimising rehabilitated grazing pastures for sustainable and economically viable beef production

Annual Cattle Grazing Report

Year 4

31/10/2017

Prepared by:
Tom Newsome
Director, Outcross Pty Ltd

PO Box 1668, Armidale NSW 2350
Phone: +61 2 5777 7128.Mobile: 0409 580732
Email: tom@outcross.com.au. Web: www.outcross.com.au

TABLE OF CONTENTS

1. INTRODUCTION

The New Acland cattle grazing trial has been an ongoing research project, conducted by Outcross Pty Ltd in association with the project team since 2014. The project team consists of expertise in the following disciplines:

- Livestock: Mr Tom Newsome, Outcross Pty Ltd
- Pasture Agronomy: Mr Colin Paton, Ecorich Grazing
- Soil Science: Mr John Bennett, Mr Jochen Eberhard, Ms Alice Melland, Mr Craig Bailie, Mr Jeff Clewett, NCEA, USQ
- Veterinary Science: Dr John Armstrong

The fourth year of the five year project has recently been completed. This report contains results from the fourth year of cattle grazing.

2. METHOD

This report details the methods and results from the grazings of the trial sites conducted in 2016/2017. Three grazing periods were conducted comprising:

Grazing period	Time on feed
Spring Grazing (G13)	57 days from 17th October, 2016 to 13th December, 2016
Summer Grazing (G14)	45 days from 31 January, 2017 to 17th March, 2017
Autumn Grazing (G15)	43 days from 24 April, 2017 to 6 June, 2017
Winter Grazing (G16)	44 days from 24 July, 2017 to 7 September, 2017

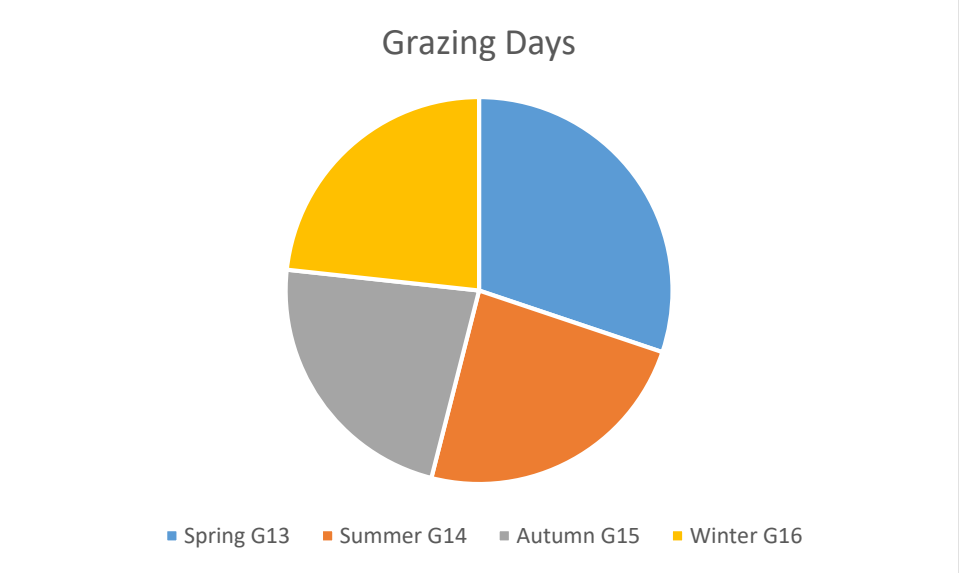

Figure 1: Days on Feed - Year 4

2.1 KEY FACTORS AFFECTING PERFORMANCE

The key factors affecting animal performance include breed, sex, age, body condition score and entry weight.

In Year 3 we elected to graze a cohort group of Angus steers. We have used the same group for Year 4, enabling the consideration of taking a cohort to a Japanese grass fed ox end market.

All other aspects of the cattle data have remained constant to ensure comparisons can be made between the years.

2.2 DESCRIPTION OF CATTLE

The cattle have been sourced from a single vendor to ensure consistency of the herd. As in Year 3, Angus cattle were selected to eliminate variation in performance between breeds.

The herd used in Year 3 and 4 initially consisted of 157 head. The weight ranged from 154kg to 322kg on induction; with an average of 235kg on induction (9th December, 2015). This was lighter than the previous years.

A lighter weight on induction improves the ability to hold the cattle in the trial before they become too heavy. The average weight of cattle on exit from the trial on 7th September 2017 was 593kg. Using the same cohort group over two years allowed us to target slaughter cattle, commonly known as the Japanese Ox market.

Animals with structural or health defects were deemed unsuitable and excluded on the basis that these defects may affect growth rate.

2.3 HEALTH PROTOCOLS

As per the previous protocols, the cattle were grazed in a single cohort on unmined areas on arrival. All cattle were treated with the same treatments with the exception of animals affected by infectious bovine kerato-conjunctivitis (pink eye), which were treated individually where required.

Treatment	Issue controlled	Dosage
5 in 1 vaccine	Clostridium bacteria causing clostrial diseases including tetanus, malignant oedema, enterotoxaemia, black disease and blackleg.	2ml
Athelmentic drench	Parasitic worms	
Coopers Easy Dose	Buffalo Fly affecting performance through external irritation	10ml/100kg
Terramycin spray	Pink Eye	Spray directly at eye for 2 seconds.

Table 1: Standard health protocols

2.4 ALLOCATION TO TREATMENT GROUP

The allocation process remained the same as the previous years. All animals were monitored each time they were weighed. Animals that exhibited attributes that have a negative impact on weight gain were excluded, including unhealthy, structurally incorrect or injured animals on induction to G9. The animals were allocated to the same tag colour and grazing group in Year 3 and 4.

Eligible animals were randomly allocated to one of four treatment groups. Each group was colour coded and had sequential visual identification numbers. Each individual animal's visual identification number was linked to its National Livestock Identification System (NLIS) tag. As animals were weighed, they were allocated sequentially in order from group 1 to group 4. As all of the cattle were steers the allocation process was simpler than previous years.

Cattle that were outside the preferred weight range or surplus to requirements were defined as 'filler' cattle. Filler cattle were added into trial groups at G14 and G15 inductions, when variations to the stocking rate was required in order to attain the benchmark 10% pasture utilisation rate, as described in the pasture report. The filler group was grazed on the unmined rest paddock.

Figure 2 shows the number of head allocated to each site by grazing event. While it is preferable to use a minimum number of head (20) per site, a lower number of head for the control site was used given the reduced pasture availability from the overgrazing event.

2.5 STOCKING RATE

The stock number varied between grazing events (G13, G14, G15, G16). This depended on the stocking rates required to achieve 10% grazing utilisation of available feed consumed during each grazing event. The total number of cattle used varied from 58 to 105 head. These animals were selected from a broader group of 157 head.

2.6 WEIGHING AND DATA COLLECTION

The following actions were taken:

- All animals were weighed on a 2.5-hour dry (no water available) curfew period between the start of mustering and weighing. The typical weighing time was between 2.5 and 3 hours. Cattle were co-mingled between groups and weighed in random order.

- The scales were calibrated to minimize variation within weighing events. Scales were tared (taken back to zero) if required every 10 animals and the scale check weight was taken every 25 animals weighed.

- Data collected on individual animals was recorded using software provided by Outcross. Weighing was completed on a full weight basis less curfew as described above.

The full suite of data recorded on each animal at induction and exit of each grazing is outlined below:

- NLIS number
- Shrink adjusted weight
- Visual ID
- Average daily weight gain
- Breed
- Weight
- Sex
- Processing date
- Tag Colour
- Date and Time of weighing
- Treatment Group (Site)
- Paddock from
- Paddock to
- Fate
- Operator

2.7 KEY PERFORMANCE INDICATORS

The commercially important Key Performance Indicators (KPIs) for beef cattle production were identified by the project team and are outlined below.

KPI	Rationale
Average Daily Weight Gain (ADG)	ADG is commonly used in the beef industry to measure the performance of individual cattle and to compare the performance of pasture sites. ADG is a measure of production per animal and is calculated by dividing the weight gained on feed by the number of grazing days.
Beef production measured by kilograms of beef produced per hectare (KgBeef/Ha)	KgBeef/Ha is particularly useful for calculating the annual beef production from a site. This measurement combines ADG with stocking rate to measure total production per hectare of land grazed.
Faecal Near Infrared Reflectance Spectroscopy (NIRS)	Faecal NIRS is a process which estimates the quality of feed being consumed, from faecal samples taken from animals. The use of NIRS enables us to further inform the cattle performance results by showing the quality of what is actually consumed. This differs from the potential diet quality that is measured from the green leaf pasture samples collected in each site prior to grazing. NIRS faecal samples were taken at the mid-point of each grazing period, to ensure samples were taken when feed was not limited. Following collection Faecal NIRS samples were kept cool until the samples could be dried. Samples were sundried to remove all moisture in the samples prior to packing for delivery to the Symbio Alliance laboratory for analysis.

3. RESULTS AND DISCUSSION

We report all results in reference to the 4 trial sites and will provide individual results in the form (rehab 1, rehab 2, rehab 3, control).

The results for Year 4 were significantly impacted by a single event where the control paddock was severely grazed in September, 2016. This event occurred during a rest period prior to the spring graze (G13).

The stocking rate provides an indication of pasture production. It is calculated based on pasture quality and quantity measurements made by the Agronomist using the Swiftsynd and Botanal processes.

Rehab 2 again had the highest stocking rate for all grazing periods. This site has consistently had the highest stocking rates for the project. The remaining sites had relatively similar stocking rates.

Figure 2 shows the number of head and stocking rate for cattle grazing in Year 4 of the trial.

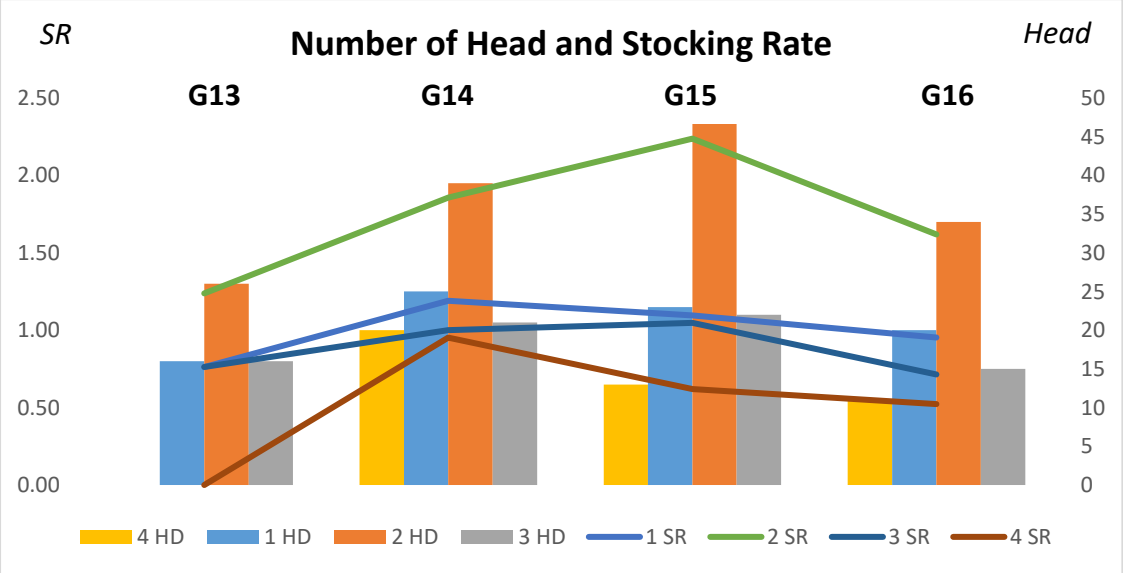

Figure 2: Number of head and stocking rate - Year 4

3.1 KPI 1- AVERAGE DAILY GAIN

Table 2 below shows the average daily gain (ADG) results and beef production for each of the grazing's conducted in 2016.

ADG	Spring	Summer	Autumn	Winter
Site	**G13**	**G14**	**G15**	**G16**
Rehab 1	1.04	1.07	1.01	0.73
Rehab 2	1.15	0.85	1.19	1.14
Rehab 3	1.04	0.91	1.26	0.72
Control		0.50	1.48	0.58

Table 2: Average Daily Gain by grazing event

The Average Daily Gain is shown further in the figure below:

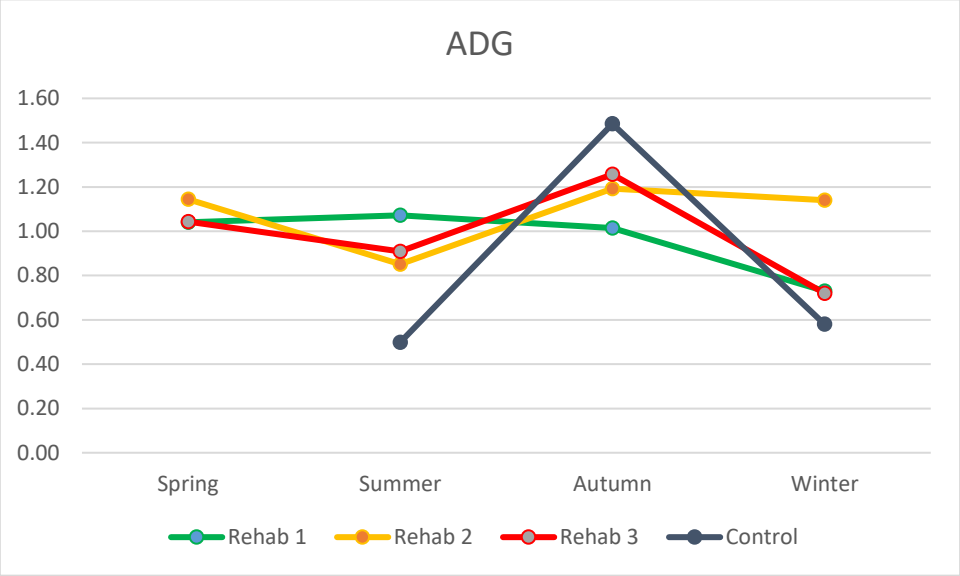

Figure 3: Average Daily Gain

The above information demonstrates the season variability of the ADG. The highest weight gain in Year 4 was achieved in the autumn graze, following a good seasonal break. This is different to the previous year where the summer grazing had the highest performance. The winter graze has consistently shown the lower quality feed, due to frost, temperature and lower feed quality. This would typically be managed in a commercial enterprise through supplementation of feed with a urea based lick.

Whilst the seasonal variance is to be expected the variance between the sites is relatively small. The exception to this is the control that had a lower than expected daily gain in the summer graze and higher than expected performance in the autumn grazing event.

3.2 KPI 2 - TOTAL BEEF PRODUCTION

Figure 4 shows beef production per hectare for each site per grazing period.

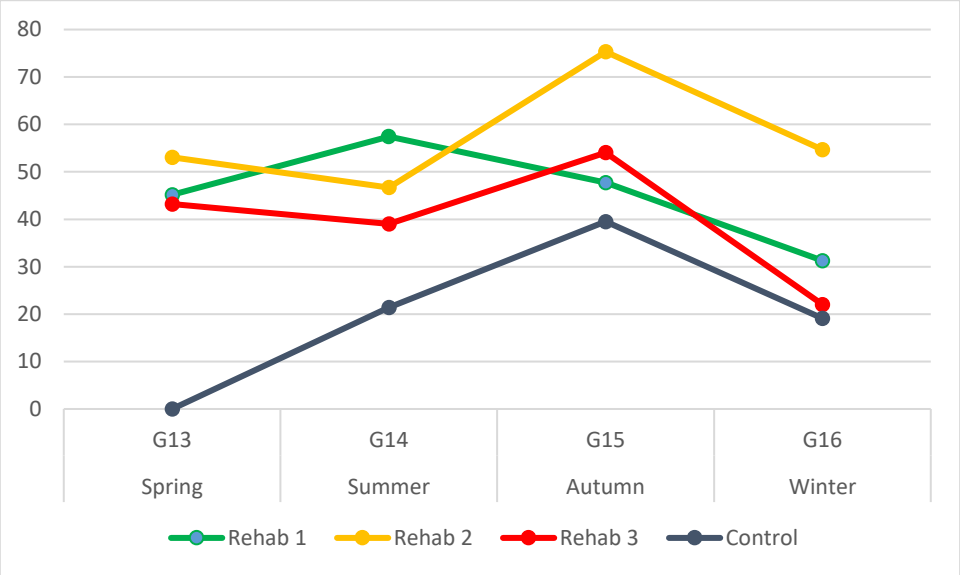

Figure 4: Beef production per grazing (KG Beef / Ha)

Figure 5 demonstrates the combined information for the three grazing periods. Rehab 2 continues to show the highest rates of KG /Ha producing 230kg/ha, up from 140Kg in Year 3. The control site was the poorest performing site with a production of 80kg beef/ Ha, up from 54 Kg in Year 3. The improved overall performance reflects better seasonal conditions in year 4.

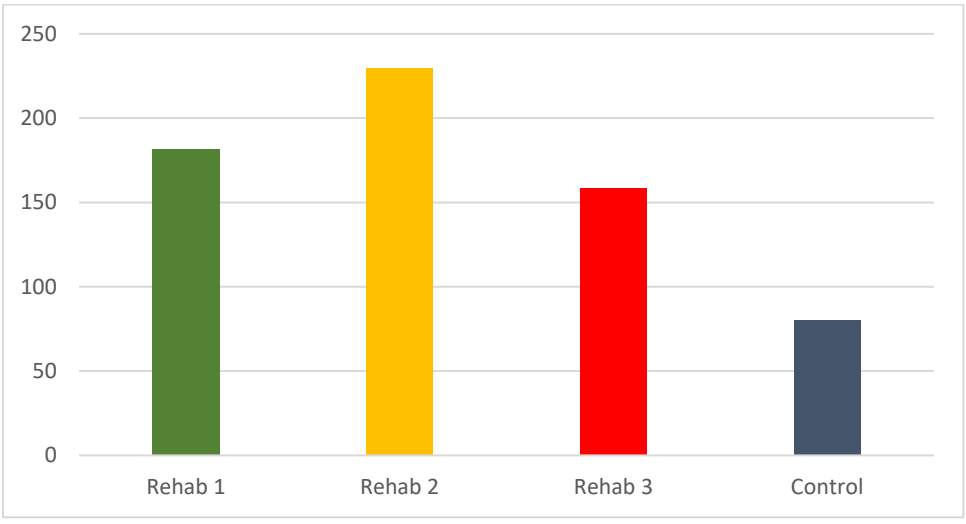

Figure 5: Total Annual Beef Production (KG Beef / Ha)

3.3 GRAZING 13 (G13) (SPRING)

The spring, 2016 grazing period produced good results for the 3 rehabilitated sites monitored. The completion of a spring graze was positive, given that the spring graze had not been achieved consistently in the first three years of the trial. The control was not grazed due to the overgrazing incident in September. The rehab sites had ample feed available for G13, with pasture yield estimates of 4417, 5663 and 3718 kg DM / Ha for rehab 1,2 and 3 respectively.

The grazing period was 57 days. This was the longest grazing period for the year, indicating the good spring season. The variance of ADG between all of the sites was minimal (1.04, 1.15 and 1.04 kg per day for rehab 1,2,3)) and the Kg/Ha varied by 10 Kg/Ha with Rehab 2 produced the highest beef production of 53kg beef/Ha compared with 45 and 43 Kg for rehab 1 and 2 respectively.

3.4 GRAZING 14 (G14) (SUMMER)

The summer, 2017 grazing period was the first grazing that the control was included in Year 4. The control did not recover as well as hoped and carrying capacity remained low throughout the year. The number of head by site (25, 39, 21, 20) provided a stocking rate by site (1.19, 1.86, 1.00, 0.96), indicating that rehab 2 has the highest stocking rate, which is a result of the highest pasture yields.

Performance in terms of average daily weight gain showed that the rehab 1 had the highest ADG and the control had the lowest (1.07, 0.85, 0.91, 0.50).

Subsequently, rehab 1 also had the highest beef production (57, 47, 39, 21) kg beef produced / Ha during the summer graze. Rehab 3 had a lower ranking for beef production due to a lower stocking rate than rehab 2.

3.5 GRAZING 15 (G15) (AUTUMN)

The autumn grazing benefitted from good seasonal conditions. As a result, the stocking rate of 105 head was equal to the number of head used in the summer graze. Significantly higher ADG performance (1.01, 1.19, 1.26, 1.48) led to the highest overall beef production (48, 75, 54, 40) kg DM / Ha, that was achieved in Year 4. The control site was the highest performer in terms of average daily gain, but low relative stocking rate (1.10, 2.24, 1.05, 0.62) reduced the beef production for the control site in the Autumn graze. The higher stocking rate for Rehab 2, increased overall beef production for the autumn graze.

3.6 GRAZING 16 (G16) (WINTER)

The ADG (0.73, 1.14, 0.72, 0.58) performance of rehab 2 was significantly higher than the other sites, with the control site having the lowest ADG. The control has consistently performed poorly in the winter graze as frost becomes a significant factor affecting performance at lower altitude.

The highest ADG, coupled with the highest stocking rate per hectare (0.95, 1.62, 0.71, 0.52) result in rehab 2 producing significantly higher beef per hectare (31, 55, 22, 19) for the winter grazing period.

3.7 OVERALL

The trial had the benefit of generally good seasonal conditions. Subsequently we were able to achieve a graze in each season of the year, with the exception of the spring graze for the control site. Overall beef production increased from 330 kg beef in Year 3, to 650 kg beef / Ha in Year 4.

- Rehab 1 had the highest increase in production with a three-fold increase to 181 kg from 64 kg.
- Rehab 2 was the highest performing site with 230 kg beef produced per Ha, up from 141 kg in Year 3.
- Rehab 3 increased beef production to 158 kg beef produced from 71 kg in Year 3.
- The control had the lowest annual beef production of 80 kg beef produced per Ha. This was an improvement from 54 kg beef produced in Year 3.

3.8 COMPARISON TO PREVIOUS YEARS

The below graphs demonstrate the variability within each season.

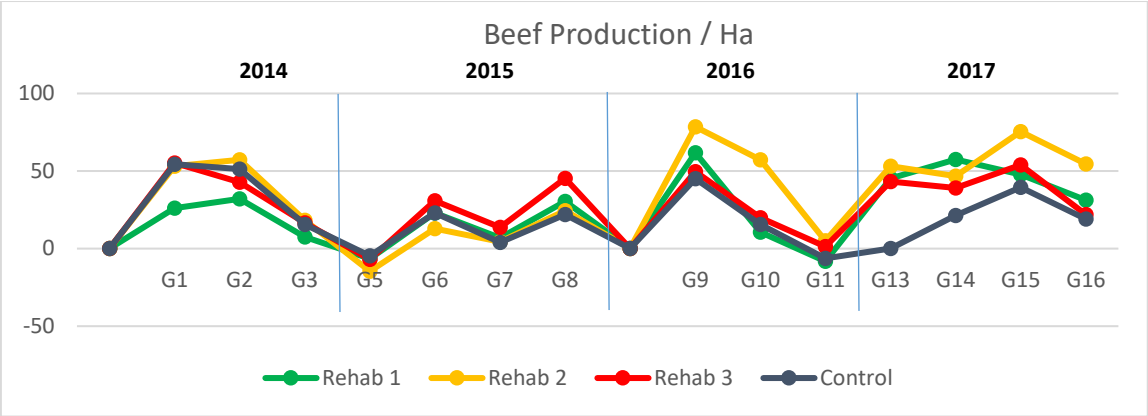

Figure 7: Comparison of beef production over seasons

The improved seasonal conditions observed in 2016 and 2017 is shown in the figure 7, through increased beef production between G9 and G16. An additional graze was achieved in year four, coupled with positive weight gain across seasons.

Spring has proved to be a difficult time of the year with which to achieve a positive outcome. This is primarily due to the summer dominant rainfall in the Acland area, along with particularly dry spring seasons during the trial period. There were 2 season grazes that were not attempted and a further spring graze (G5) that had a negative weight gain.

The above tables show all of the grazing periods. Rehab 2 has consistently been the highest performing site in relation to beef production (Kg/Ha). All rehab sites were significantly more productive in year 4, compared to previous years.

The average beef production per site is shown in figure 8 below. The control is the lowest performer due to the overgrazing in year 4.

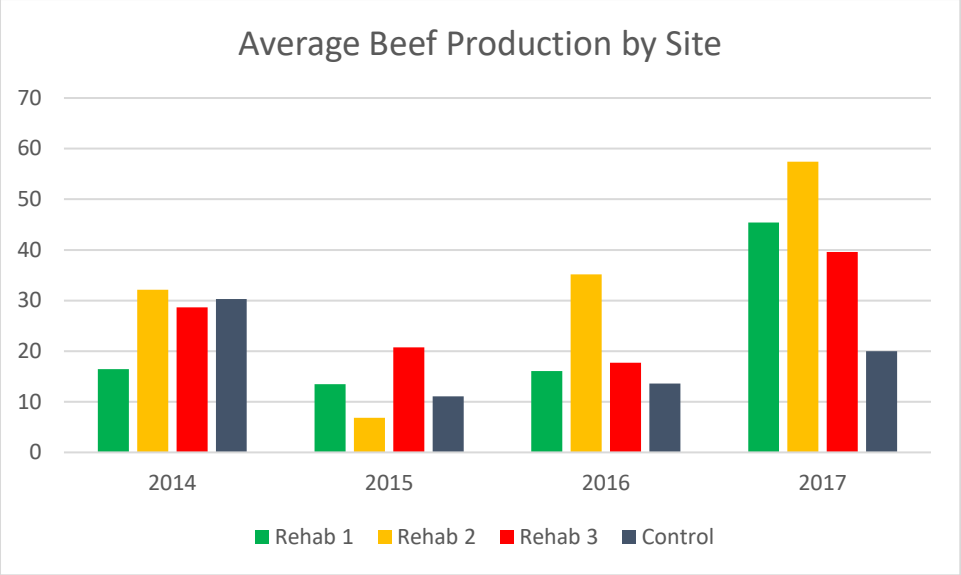

Figure 8: Average beef production by site per year

1. CONCLUSIONS

The project team has now compiled and analysed data over four years of the main project.

In doing so we have provided data to inform effects of mining on livestock production, pasture productivity, meat quality, eating quality, contaminants, soil chemical analysis and physical attributes.

Our conclusions that we made in year 3 have been further ratified, including:

1. Rehabilitated mined land can perform in a comparable way to unmined land with respect to the key performance indicators measured.

2. Rehabilitated land can exceed the productivity levels of unmined land.

3. The productivity of the rehabilitated sites is sustainable for four years.

4. Performance of rehabilitated grazing land varies significantly within season and between years, which is consistent with variation observed in the broader industry.