New Acland Cattle Grazing Trial

Annual Cattle Grazing Report

Year 3

20/09/2016

Report prepared by

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Table of Contents

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:	Outcross Pty Ltd
Pasture Agronomy:	Ecorich Grazing
Soil Science:	National Centre for Engineering in Agriculture, USQ
Veterinary Science:	Dr John Armstrong

We have recently completed the 3rd year of the 5 year project. This report contains results from the 3rd year of cattle grazing.

METHOD

This report details the methods and results from the grazings of the trial sites conducted in 2015/2016. Three grazing periods were conducted comprising:

1. Spring Grazing – Not completed due to seasonal conditions.
2. Summer Grazing – 68 days from 9th December 2015 to 15th February 2016 (G9)
3. Autumn Grazing – 49 days from 8th March 2016 to 26th April 201 (G10)
4. Winter grazing – 42 Days from 29th June 2016 to 10th August 2016

Figure 2 depicts the time on feed (Days) for grazing events in the reporting period.

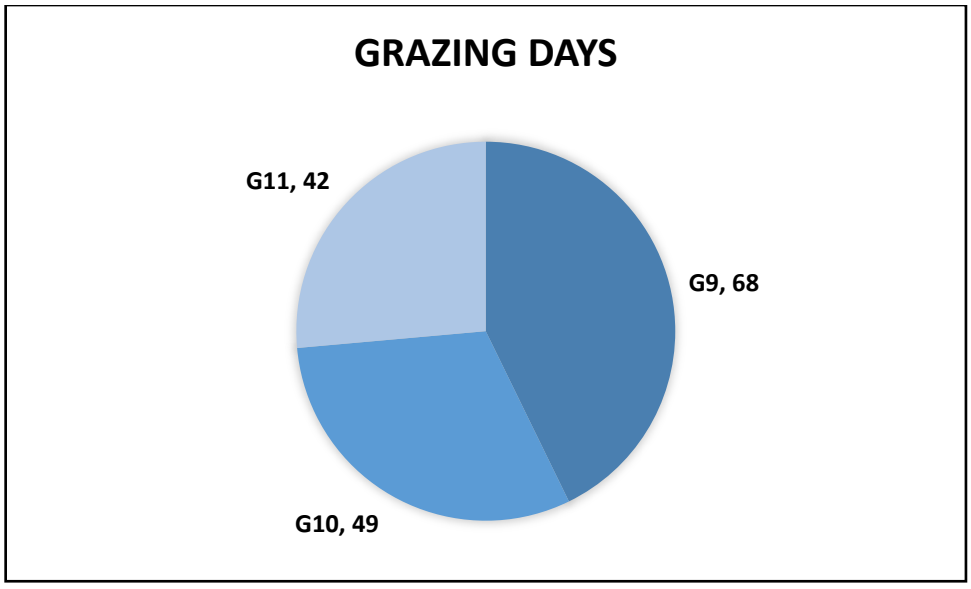

FIGURE 2: DAYS ON FEED - YEAR 3, STAGE 2

KEY FACTORS

The key factors affecting animal performance include breed, sex, age, body condition score and entry weight. In year 2, we grazed both Heifers and Steers to enable consideration of sex as an explanatory variable. In year 3 we elected to graze solely steers. All other aspects of the cattle data have remained constant to ensure comparisons can be made between the years.

DESCRIPTION OF CATTLE

The current cattle have been sourced from a single vendor. This has ensured consistency of the herd. As in the previous year Angus cattle have been selected to eliminate variation in performance between breeds.

The herd used in year 3 consisted of 157 head. The lowest weight was 154kg with the highest being 322kg. The average weight of the cattle was 235kg. This was lighter than the previous years. This decision was based on the ability to hold the cattle in the trial prior to them becoming too heavy.

Animals considered unsuitable for the trial were excluded on the basis that structural or health defects may affect growth rate.

HEALTH PROTOCOLS

As per the previous protocols upon arrival the cattle were grazed in a single cohort on unmined areas. 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. Table 1 lists the treatment protocols all trial cattle received:

TABLE 1: ANIMAL HEALTH TREATMENTS

Date	Treatment	Issue Controlled	Dosage
	5 in 1 Vaccine	Clostridium bacteria causing clostrial diseases tetanus, malignant oedema, enterotoxaemia, black disease and blackleg	2ml
	Anthelmentic Drench	Parasitic worms	
	Coopers Easy Dose	Buffalo Fly affecting performance through external irritation	10ml /100kg
	Terramycin spray	Broad spectrum antibiotic for control of pink eye	Spray directly at eye for 2 seconds

ALLOCATION TO TREATMENT GROUP

The allocation process remained the same as the previous years. All animals were monitored each time they were weighed and any animals that exhibited attributes that

have a negative impact on weight gain were excluded. This included unhealthy, structurally incorrect or injured animals on induction to G9.

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.

Cattle that were outside the preferred weight range or surplus to requirements were defined as 'filler' cattle. The filler group was grazed on the unmined rest paddock. Filler cattle were added into trial groups at G10 and G11 inductions, when variations to the stocking rate was required in order to attain the benchmark 10% pasture utilisation rate, described in the pasture report attached as **Appendix C**. Table 2 shows the number of head allocated to each site by grazing event. We used a minimum number of head (20) per site.

STOCKING RATE

The stock number varied between grazings (G9, G10, G11), depending on the required stocking rates to achieve 10% grazing utilisation. Therefore 10% of available feed was consumed during each grazing event. The total number of cattle used varied from 99 to 157 head. These animals were selected from a broader group of 157 head.

TABLE 2: NUMBER HEAD AND STOCKING RATE BY SITE AND GRAZING

		G9		G10		G11	
Site	**Area**	**Number Head**	**Stocking Rate / Ha**	**Number Head**	**Stocking Rate / Ha**	**Number Head**	**Stocking Rate / Ha**
Rehab 1	22	23	1.05	32	1.45	21	0.95
Rehab 2	32	46	1.44	63	1.97	38	1.19
Rehab 3	22	25	1.14	35	1.59	20	0.91
Rehab 4	21	20	0.95	27	1.29	20	0.95
Total		114		157		99	

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 the *BeefLink* software provided by Outcross. Weighing was completed on a full weight basis less curfew as described above. The following list displays the full suite of data recorded on each animal at induction and exit of each grazing.

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

KEY PERFORMANCE INDICATORS (KPIS)

The commercially important Key Performance Indicators for beef cattle production, as identified by the project team, to be measured in the grazing trial are:

1. 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.

2. 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.

RESULTS AND DISCUSSION

The stocking rate provides an indication of pasture production as it is calculated based on pasture quality and quantity measurements as assessed 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.

TABLE 3: STOCKING RATE AND NUMBER OF HEAD BY SITE

		G9		G10		G11	
Site	**Area**	**Number Head**	**Stocking Rate / Ha**	**Number Head**	**Stocking Rate / Ha**	**Number Head**	**Stocking Rate / Ha**
Rehab 1	22	23	1.05	32	1.45	21	0.95
Rehab 2	32	46	1.44	63	1.97	38	1.19
Rehab 3	22	25	1.14	35	1.59	20	0.91
Control	21	20	0.95	27	1.29	20	0.95
Total		114		157		99	

KPI 1- AVERAGE DAILY GAIN

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

TABLE 4: AVERAGE DAILY GAIN (ADG) AND STOCKING RATE FOR EACH GRAZING PERIOD

	ADG		
	G9	**G10**	**G11**
1	0.83	0.14	-0.11
2	0.80	0.59	0.11
3	0.64	0.25	0.03
4	0.70	0.24	-0.16

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

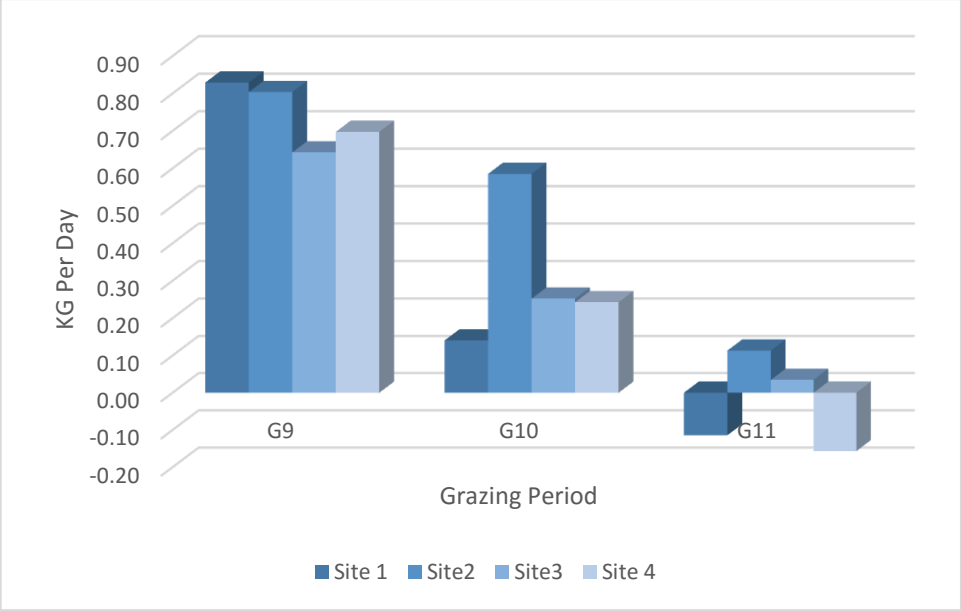

FIGURE 4: AVERAGE DAILY GAIN

The above information demonstrates the season variability of the ADG. The highest weight gain is during the summer graze. This is expected due to the composition of the pasture and the local climate. The winter graze has consistently shown the lower quality feed, due to frost, temperature and lower feed quality. This would typically be managed through supplementation of feed with a urea based lick in a commercial enterprise.

Whilst the seasonal variance is to be expected the variance between the sites is relatively small. The exception to this is G10 where Rehab 2 performed well above the other sites. This can be explained through a combination of feed quality and quantity.

Both Rehab 1 and 4 show the greatest variability between the seasons whilst remaining very similar in results in individual grazing's. This demonstrates that the rehabilitated and unmined areas are acting in a similar manner.

KPI 2 - TOTAL BEEF PRODUCTION

Figure 5 shows beef production per hectare for each site per grazing period.

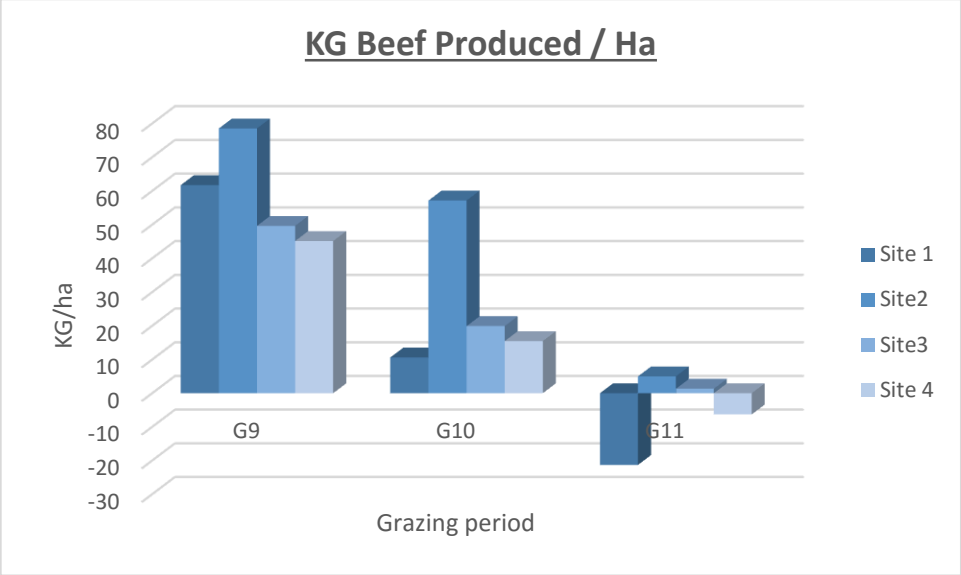

FIGURE 5: BEEF PRODUCTION PER GRAZING (KG BEEF/HA)

Figure 6 demonstrates the combined information for the three grazing periods. Rehab 2 continues to show the highest rates of KG /Ha producing 141kg/ha. Rehab 1 site was the poorest performing site based on this information with a production of comparable to Site 4(Control), producing 51 and 54kg beef/ Ha respectively.

This results need to be read in conjunction with the stocking rate's, pasture quality and NIRS information.

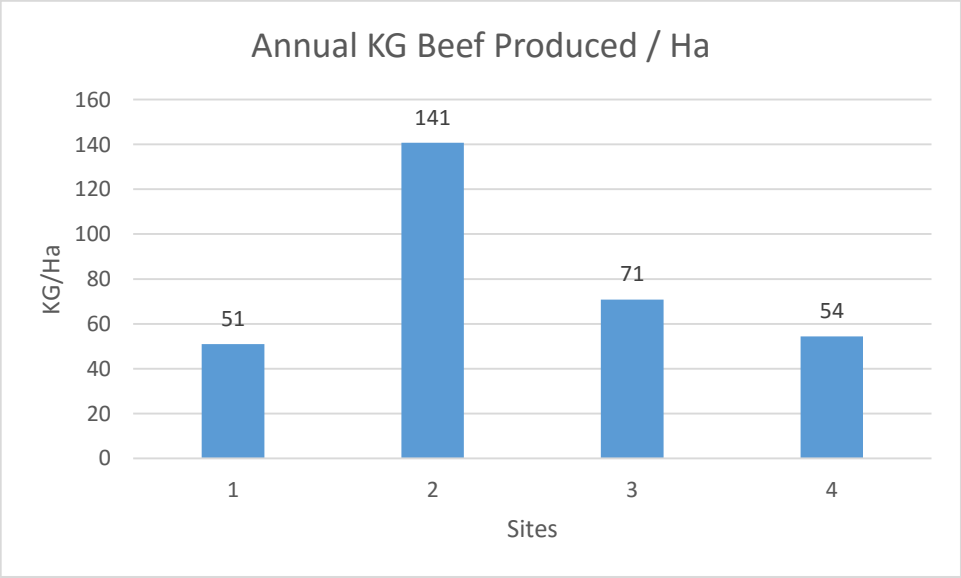

FIGURE 6: TOTAL BEEF PRODUCTION PER GRAZING (KG BEEF/HA)

FAECAL NEAR INFRARED REFLECTANCE SPECTROSCOPY (NIRS)

Table 5 provides the results from the NIRS testing performed during each of the grazing periods. This information shows that all sites are producing pasture that is capable of supporting weight gain.

These results also demonstrated that with the introduction of supplement the production rate would increase on each site. Full commentary is available in the Appendices of this document.

TABLE 5: NIRS INFORMATION

	Forage crude protein %	Forage Digestibility %	Faecal Nitrogen%	Metabolizable energy intake MJ/100 kg LWT	ASH % faeces	Diet Non-grass %	P % by Wet Chem.	DMD:CP ratio	P:N ratio
	G9								
Site1	8.21	55.52	1.56	16.35	19.62	8.32	0.39	6.76	0.30
Site2	8.30	54.91	1.45	16.44	19.76	13.54	0.37	6.61	0.28
Site3	8.69	55.63	1.46	16.78	19.30	6.74	0.25	6.40	0.18
Site4	7.62	56.31	1.66	16.41	19.73	0.88	0.23	7.39	0.19
	G10								
Site1	7.00	57.32	1.38	16.25	20.06	0.66	0.67	8.19	0.60
Site2	9.02	60.52	1.78	18.76	15.91	7.29	0.59	6.71	0.41
Site3	7.13	57.22	1.53	16.61	19.21	0.94	0.45	8.02	0.40
Site4	7.50	57.33	1.63	16.95	18.76	2.55	0.38	7.65	0.32
	G11								
Site1	9.02	57.43	1.61	17.18	23.20	0.00	not analysed	6.37	n/a
Site2	12.51	60.82	1.79	19.93	26.54	12.50	0.83	4.86	0.42
Site3	10.63	61.04	1.73	19.65	26.89	0.96	0.68	5.74	0.40
Site4	9.09	58.53	1.57	17.64	22.26	0.00	0.36	6.44	0.25

GRAZING 9 (G9) (SUMMER)

The summer grazing period was very successful on all sites. This was due to good rainfall producing high quality feed. The stocking rates were lower than G10 indicating the pasture was in an early growth stage. This results in high quality feed but lower quantity.

The grazing period was 68 days. This was the longest grazing period for the year. This represents a typical summer grazing system. The variance of ADG between all of the sites was minimal (0.13 KG) and the Kg/Ha varied by 33 Kg/Ha Rehab 2 produced the highest Kg/Ha however Rehab 1 produced the highest ADG of 0.83 Kg/Day.

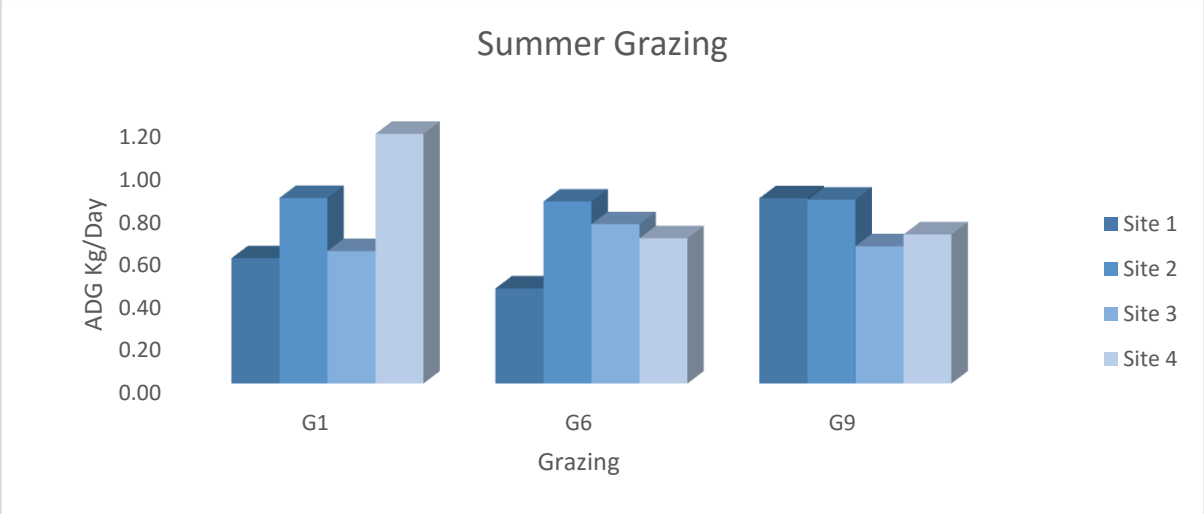

FIGURE 6: SUMMER ADG COMPARISON

GRAZING 10 (G10) (AUTUMN)

The ADG for G10 was lower than the previous grazing however the stocking rate was higher across all sites. This reflects the growth stage of the pasture This result was also affect by the short break between the grazing periods. This grazing period was also shorter than the previous at 49 days.

The highest performing site was Rehab 2. This site produced the highest Kg/Ha (57 Kg), highest ADG (0.59 Kg/Day) whilst having the highest stocking rate of 1.97 Beast/Ha. There was minimal difference between the remaining sites.

This grazing period also showed the greatest variance between the periods for both ADG (0.47 Kg/Day) and beef produced (47 kg/ha).

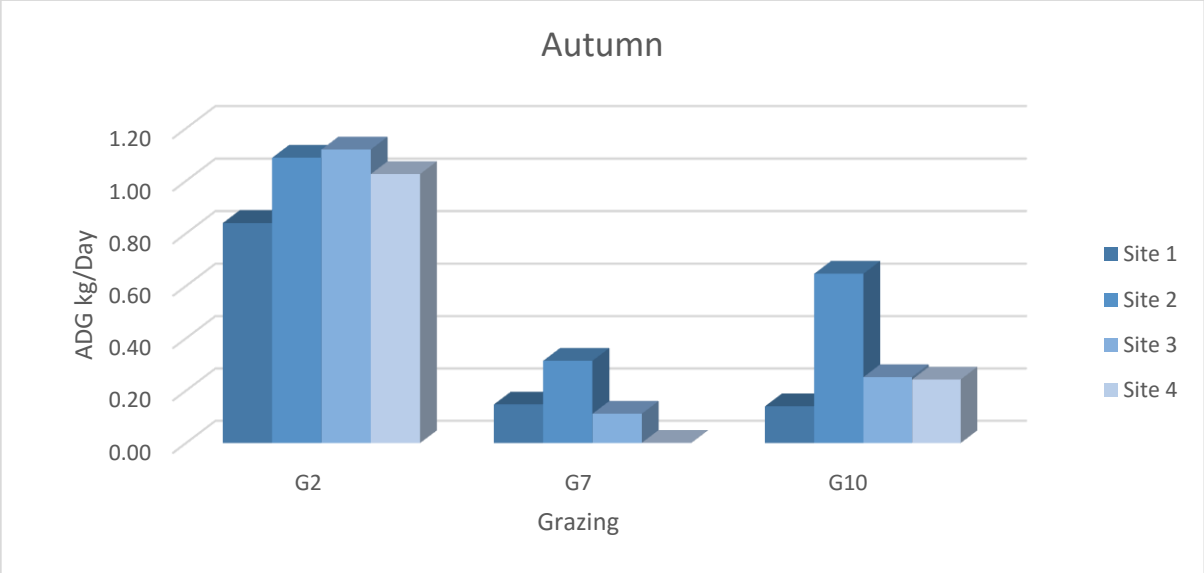

FIGURE 7: AUTUMN ADG COMPARISON

GRAZING 11 (G11) (WINTER)

The winter grazing resulting in Rehab 2 and 3 having small weight gains 0.11 Kg/Day and 0.03 Kg/day respectively. Sites 1 and 4 had negative weight gains of -0.11 kg/Day and -0.16 Kg/day respectively. This shows a variance of 0.31 Kg/day for the ADG.

The variance between the beef produced per Ha was lower between the sites at 13 kg/Ha. This was due to the stocking rates

A negative weight gain during this period can be attributed to the seasonal conditions.

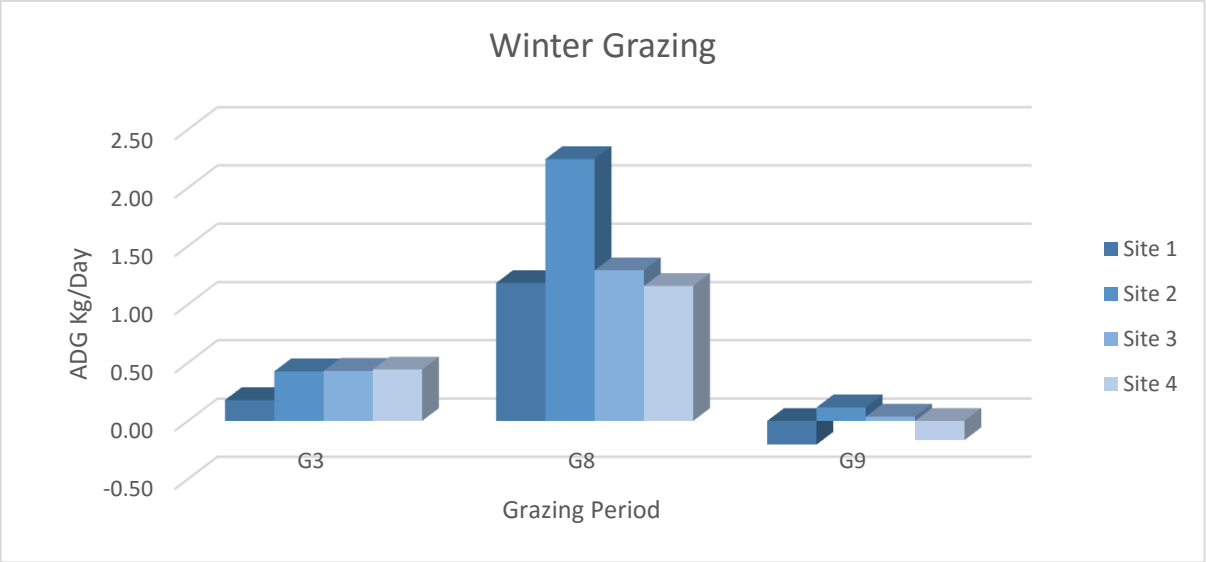

FIGURE 8: WINTER ADG COMPARISON

OVERALL

Seasonal conditions have had the greatest impact on the grazing's this year. The late break to the season resulted in a spring 2015 grazing not being conducted. This did result in a very good summer grazing.

The data collected contains to show a strong coloration between the rehabilitated areas and the unmined areas.

COMPARISON TO PREVIOUS YEAR

The below graphs demonstrate the variability within each season.

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, coupled with particularly dry spring seasons during the trial period.

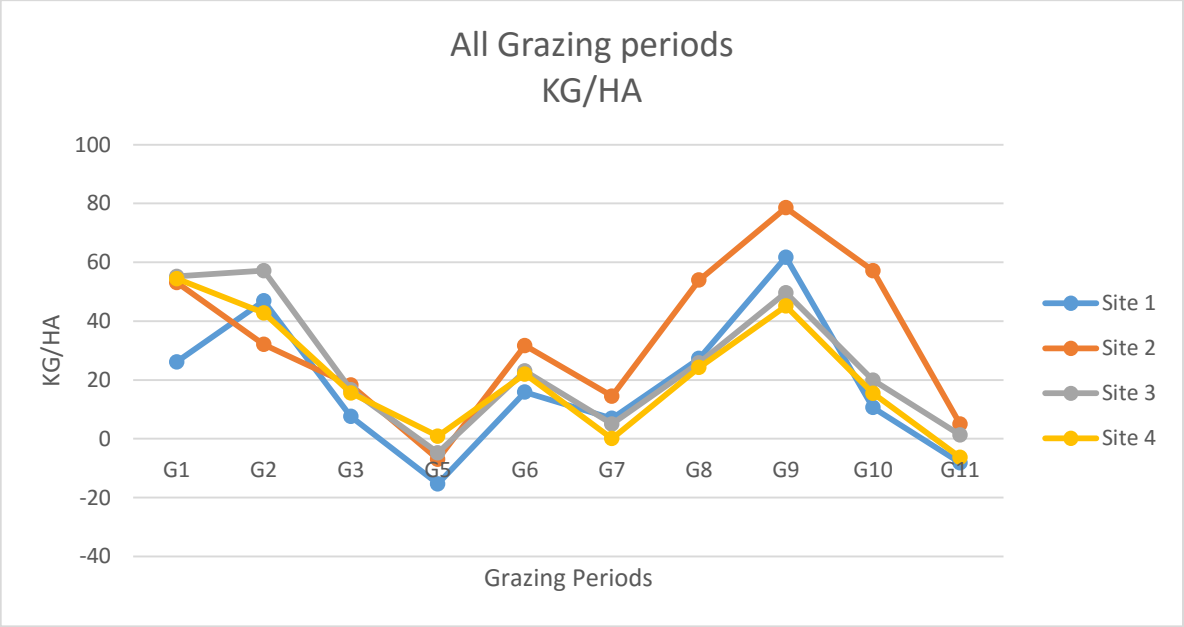

FIGURE 8: All grazing KG/HA

The above table shows all of the grazing periods. Rehab 2 has consistently been the highest performing site in relation to Kg/Ha. There is also a strong correlation to the control site and Rehab 3. This is to be expected as a result of the age of the pasture.

The information demonstrated above shows that rehabilitated land has the same characteristics as unmined land.

CONCLUSIONS

Year 3 results have added significantly to the overall results for to date. The following significant conclusions can be made.

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