ACLAND CATTLE GRAZING TRIAL:
Key Performance Indicators – Summary of Stage 2 Years 1 and 2

REPORT PREPARED FOR THE NEW HOPE GROUP AND THE ACLAND PASTORAL COMPANY

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Background

New Hope Coal is engaged in mining coal in the Surat basin region of Queensland. The New Acland mine is central to the operations of New Hope Coal in Southern Queensland. Mining is undertaken predominately through open cut techniques that require rehabilitation of land following mining to return the land to commercial production. The intention is to restore or improve the pre-mining land capability following mining through effective rehabilitation.

The focus of the Acland Pastoral Company (APC) farming area (10,000 ha) is on beef cattle production, although there are approximately 1,000 ha of land cropped each year. The pastoral business is managed by Acland Pastoral Company, a fully owned subsidiary of New Hope Coal. The basis for this project is that the project team, co-ordinated by Outcross Pty Ltd, is measuring the performance of rehabilitated land when compared with unmined land, based on commercial parameters. Given that the land is to be used predominately for beef cattle production, the team have chosen to compare the performance of a series of trial sites and control sites based on measuring commercially important key performance indicators (KPIs) for beef cattle production.

The area operated by APC is mostly productive land based on a range of soil types and quality. The enterprise chosen for the project is growing out steers and heifers to feedlot entry weight. This is consistent with common commercial land use for the area in the absence of mining.

Key performance indicators (KPI) are being recorded from both rehabilitated mining land, at various ages since rehabilitation, and unmined land. These include:

- Soil depth, structure, fertility and water holding capacities
- Pasture growth, productivity and quality (in grazing exclosures referred to as Swiftsynds, (Day and Philp, 1997))
- Pasture presentation yields before cattle graze each paddock (feed on offer)
- Pasture leaf quality at each grazing: %N; metabolisable energy (MJ/kg) and; digestibility (%)
- Cattle faecal samples for analysis by NIRS to determine diet quality
- Cattle weight gains, stocking rates, beef production per hectare and grazing days in each paddock

The project has been ongoing since October, 2011. A Stage 1 pilot trial was run from October, 2011 to May, 2012 (Outcross Pty Ltd, 2012). Stage 2 of the grazing trial began in January, 2013. This document summarises results from the trial for Stage 2 Years 1 and 2, from October 2013 until September 2015. The report should be read in conjunction with the following attached reports:

- Outcross Pty Ltd, 2014. New Hope Cattle Grazing Trial Stage 2 Report 1: Grazing Period 1 and 2. Report prepared for the New Hope Group and the Acland Pastoral Company. Armidale, Australia.
- Outcross Pty Ltd, 2015. Acland Cattle Grazing Trial Year 2: 2014-2015. Report prepared for the New Hope Group and the Acland Pastoral Company. Armidale, Australia.

Methods

Livestock

Cattle selection and allocation to trial sites: The key factors affecting animal performance include breed, sex, age, body condition score and entry weight. To remove variation in performance due to these factors, all cattle were of the same breed (Angus), were of a similar age and were sourced from only one or two vendors in each year. An equal number of heifers and steers of mid-range weight were allocated to each grazing site. Further to this, animals considered unsuitable for the trial were excluded on the basis that structural or health defects may affect growth rate. Non trial animals were also monitored as a 'filler' group. This group was monitored and grazed on unmined land when other project cattle were grazing trial sites and was used to supplement the grazing trial cohorts when stocking rates required adjustment.

Health Protocols: On arrival to APC, the cattle were grazed as a single cohort group, on previously unmined land, for a period of 2 months. Prior to and during the trial all cattle received the same treatment protocols, with the exception of animals affected by infectious bovine kerato-conjunctivitis (pink eye), which were treated individually where required.

Weighing and data collection: Three grazing periods were conducted during Year 1 and four grazing periods occurred in Year 2 (Table 1). There was no spring grazing in Year 1 because the trial had not yet begun due to adverse seasonal conditions. Cattle grazed the trial sites for 0.68 of the total grazing days (128 of 189 days) in Year 1 and 0.48 (141 of 293 days) in Year 2 with the remainder of the grazing occurring with the 'filler' group of cattle in an unmined sown pasture adjacent to the control site. All animals were weighed at induction and exit of each grazing with a 2.5 hour dry curfew period between the start of mustering and weighing. Data recorded or calculated were 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 and operator.

Faecal Near Infrared reflectance spectroscopy (NIRS): Faecal NIRS is a process which estimates the quality of feed being consumed, using faecal samples taken from animals. 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, then sundried and analysed by the Symbio Alliance laboratory.

Gross Margins: Gross margins per head for cattle grazed on each trial site during year 1 (2013-14 including G1, G2 and G3), were calculated based on the fixed costs of feeding ($337/hd), marketing ($25/hd), freight ($11/hd), levies ($5/hd) and husbandry ($9/hd), the variable costs of cattle purchase price and the income from cattle sales after backgrounding and feedlotting. Data for year 2 are not yet available.

Pastures

Trial Paddocks: there are 4 paddocks sown to pasture from 2007 to 2012. Species sown include Rhodes grass, Gatton and green panics, Bambatsi panic, Queensland bluegrass, silk sorghum, purple pigeon grass, woolly pod vetch, lucerne and some medics. The paddocks include three rehabilitated sites previously mined and one unmined site:

- **Rehab 1, 22 ha** – oldest of the mined and Rehabilitated sites, returned to pasture in 2007
- **Rehab 2, 32 ha** – a second rehabilitated site, returned to pasture in 2010
- **Rehab 3, 22 ha** – most recently rehabilitated area and returned to pasture in 2012
- **Control, 21 ha** – an unmined site, sown to a mix of pasture, with similar species and in the same year as Site 3, in 2012

Cattle and grazing system: The objective was to use young steers and heifers, approximately 300 to 400 kg average weight, to concurrently graze each paddock for short periods of each of the four annual seasons. The grazing aims to mimic a rotational grazing system and was informed by using forage budgets to determine stock numbers and the number of grazing days for each rotation, as described below.

Pasture sampling method: The Botanal Technique (Tothill JC *et al.*, 1992) was used to assess pastures in all paddocks on a grid pattern at the times shown in Table 1. Information gathered included:

- Pasture presentation yield, species composition, species frequency of occurrence
- Ground cover by the proportions of green pasture material, organic matter and rock; and
- Proportion of unpalatable pasture that stock are unlikely to consume when grazing

Forage Budgets: A set of spreadsheets were used to calculate the number of grazing days and number of stock required for the grazing period, to achieve an average pasture utilisation rate by grazing stock of 10% of the pasture on offer. Pasture average yields and proportions of unpalatable pasture were used to derive the number of grazing days and numbers of stock to graze each treatment paddock.

Grass leaf: Samples of grass leaf were collected from across each treatment paddock immediately prior to grazing for analysis to determine percent digestibility, protein and energy contents.

Swiftsynds: Ten metre by ten metre areas were fenced to exclude grazing stock so pasture primary production and quality could be determined. Grazing exclosures were located in areas considered representative of each paddock. Exclosures were subdivided into 4 sections and slashed to 2-3cm height at the end of dormant season (in about September) of each year. At each sampling time (Table 1) a single 0.5m x 0.5m quadrat of pasture was cut to ground level from each quarter, bagged and dried for 48 hours in a forced draught dehydrator oven set at 80^{o}C, and the dry weight recorded. Each bag of pasture was then sub-sampled and a bulked sample for each exclosure sent for chemical analysis to determine macro nutrient (N, P, K and S) concentrations.

Soil

The soil monitoring component of the study compared soil chemical and physical properties of the rehabilitated soils with an unmined soil recently sown to similar pasture species (the control site) and analysed the relative benefits and constraints to pasture production. Properties and profile characteristics of the control site and nearby grazed soils (benchmark

sites, BMK) were also compared to identify how representative the control site was of surrounding grazed land.

Soil pit analyses: Soil pits were dug and used to characterise the soil profile and classify the soil type at 18 benchmark sites, the experimental control (3 pits) and the rehabilitated sites (3 pits per site). The benchmark sites were chosen to represent the main soil types mapped by SKM (2013) and used for grazing within a surrounding unmined area of approximately 10000 ha. The depth and abundance of pasture roots was also assessed in the pits.

Soil chemistry: At each sampling time (Table 1), five soil cores to 1m depth were collected along transects within five subsample areas in each trial site. Subsample areas were stratified to represent the topographic and vegetative variation in the landscape. Three cores were collected at each benchmark site. Soil properties measured using methods from Rayment and Lyons (2011) were pH, electrical conductivity, soluble and exchangeable cations, plant-available phosphorus (Colwell P), KCl-extractable mineral N, potentially mineralisable N, total N and organic C.

Soil physical properties: Aggregate stability in water (Loveday and Pyle, 1973), bulk density of collected cores, and field soil water content were also measured.

Table 1. Cattle, pasture and soil sampling schedule

Trial year	**Stage 2 Year 1**				**Stage 2 Year 2**		
Grazing period	G1	G2	G3	G5	G6	G7	G8
Season	Summer 2014	Autumn 2014	Winter 2014	Spring 2014	Summer 2015	Autumn 2015	Winter 2015
Cattle entry	23-Jan 2014	16-Apr 2014	24-Jun 2014	30-Oct 2014	14-Jan 2015	14-Apr 2015	14-Jul 2015
Cattle exit	13-Mar 2014	28-May 2014	31-Jul 2014	21-Nov 2014	17-Feb 2015	2-Jun 2015	19-Aug 2015
No. grazing days	49	42	37	22	34	49	36
Faecal sampling	-	14-May 2014	8-Jul 2014	20-Nov 2014	11-Feb 2015	1-Jun 2015	18-Aug 2015
Botanal visual pasture assessments	14-Jan 2014	15-Apr 2014	19-Jun 2014	27- Oct 2014	14-Jan 2015	9-Apr 2015	22-Jun 2015
Swyftsynd exclosure sampling	17-Feb 2014	6-May 2014	-	-	17-Dec 2014	13-Apr 2015	-
Soil chemistry sampling	T1 Feb 2014	-	-	T2 Nov 2014	T3 Feb 2015	-	-

Results: KPI summary

Weather

Rainfall was below the long term average (626 mm) in both years with the total Oct-Sep rainfall being 407 mm in year 1 and 486 mm in year 2 (Figure 1).

Year 1 (2013-14) **Year 2 (2014-15)**

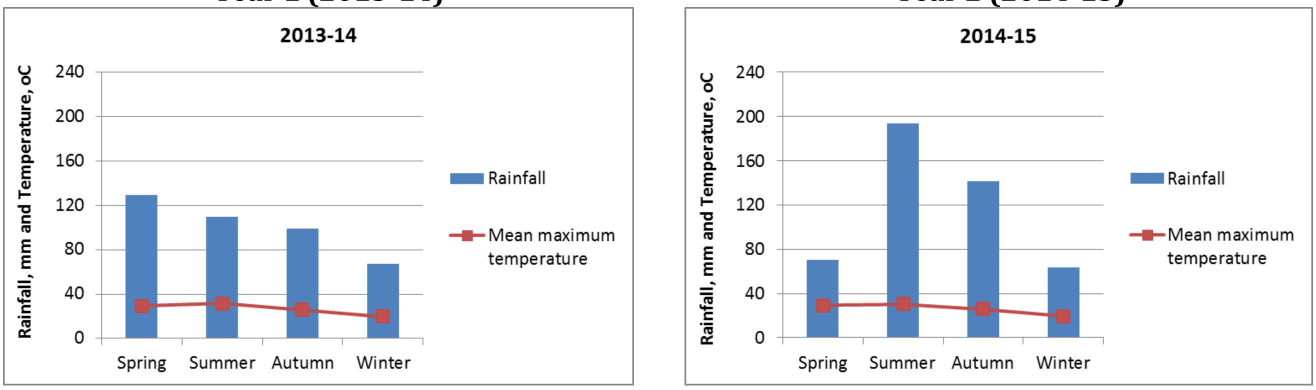


Figure 1. Seasonal rainfall and temperature recorded at nearby Oakey Airport (Source: Bureau of Meteorology)

Livestock

Gross margins in year 1 were similar between sites (Figure 2). Gross margins for Rehab 3 are not comparable with the other sites as there were no heifers maintained on the site throughout all grazing periods.

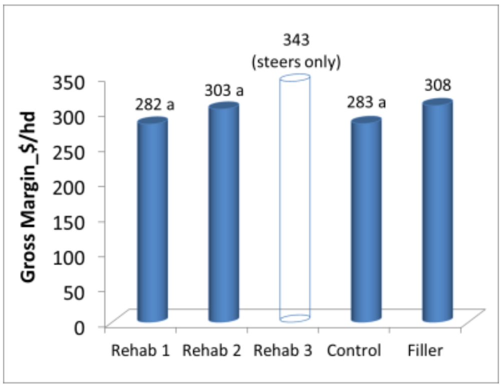


Figure 2. Gross margins for cattle grazing each site and for filler cattle in Year 1, $/head. Bars within a grazing period sharing the same letter are not significantly different (P<0.05).

Cattle grazing the control site had the highest overall annual ADG in Year 1 and those grazing Rehab 2 had the highest ADG in Year 2 (Figure 3 a,b). The ADG of cattle grazing Rehab 1 was similar or lower than the ADGs of cattle grazing other sites during trial grazing periods in both years (Figure 3 c,d). Beef production from the control site and Rehab 3, whose pastures were sown in the same year, was similar (Figure 4 a,b). Beef production was highest in Rehab 2 and lowest in Rehab 1 overall in each year, although in Year 2, production was similar or higher in Rehab 1 than in Rehab 3 or the Control in all but the first grazing (G5) (Figure 4 c,d).

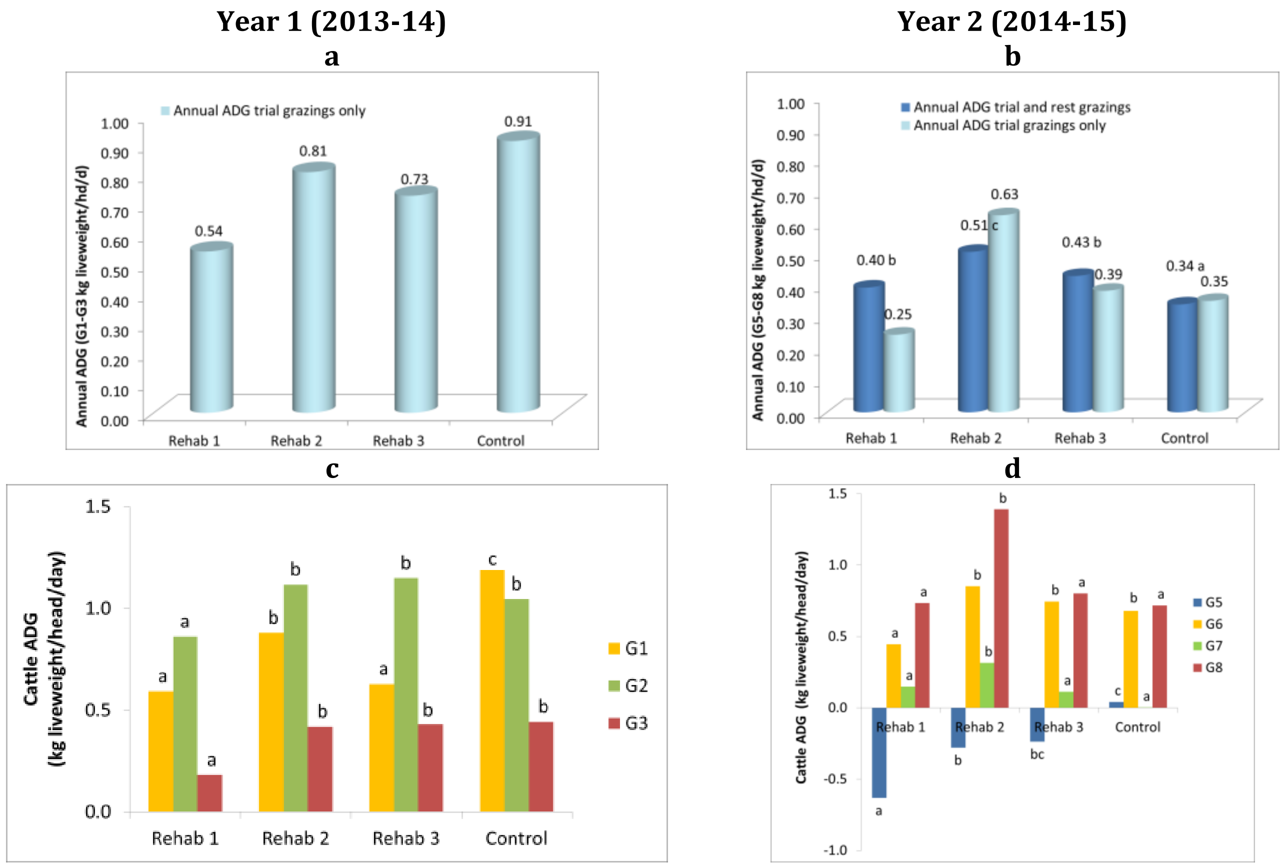


Figure 3. Average daily liveweight gain per head, kg/head/day (ADG) for annual (a and b) and grazing trial (c and d) periods. Bars within a grazing period sharing the same letter are not significantly different (P<0.05).

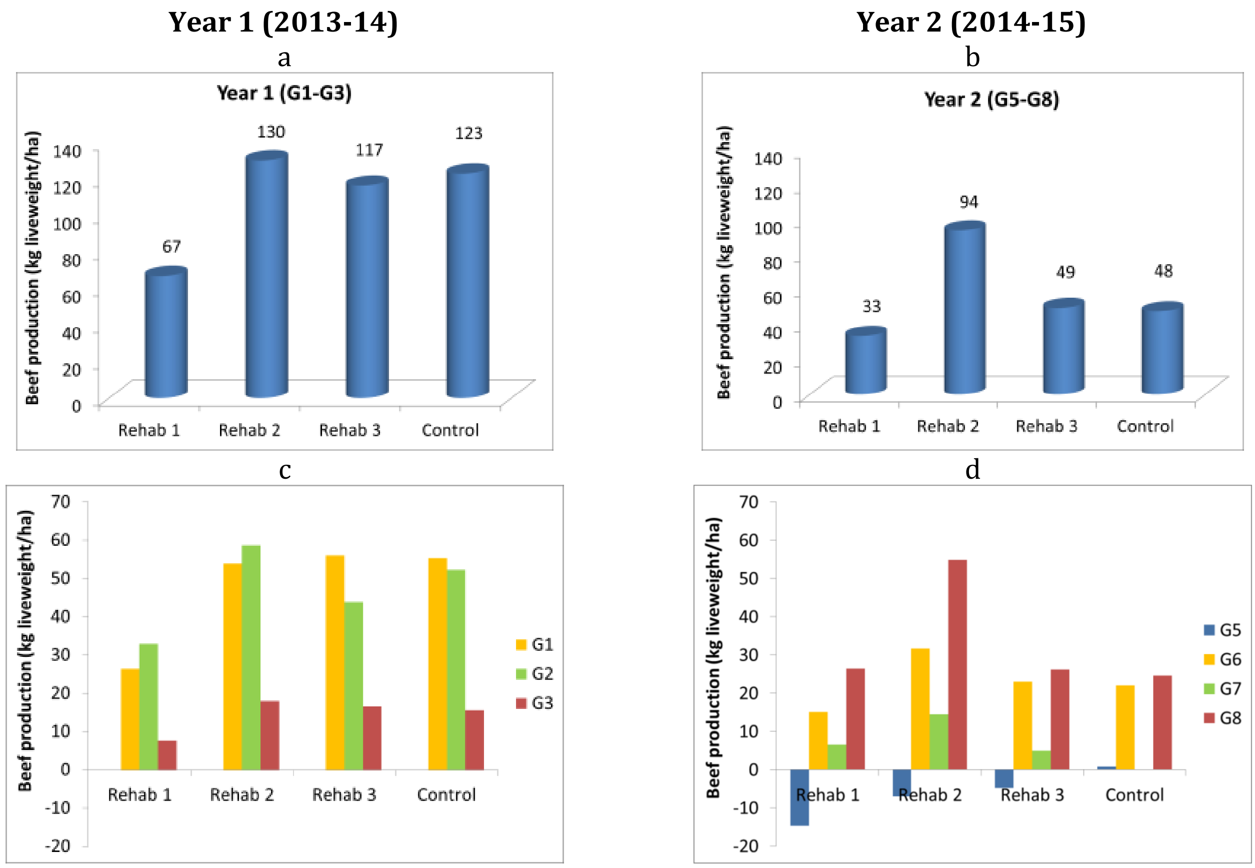


Figure 4. Beef production, kg liveweight/ha for annual (a and b) and grazing trial (c and d) periods.

The quality of the pasture consumed, based on NIRS analysis of faceal samples was generally similar or higher in Rehab 2 than in the other three sites, where consumed pasture quality was similar (Figure 5). Estimated dietary crude protein was relatively low in the control site (<8%), medium in Rehab 2 (>8%), and low-medium in Rehabs 1 and 3 (Figure 5 a,b). The N content in Rehab 3 and control site faecal samples was also relatively low (<1.3%, (Symbio Alliance, 2015)) in the autumn and winter of Year 2 (Figure 5 c,d). Digestibility was above maintenance requirement (>50%, (Symbio Alliance, 2015)) across all sites and times (Figure 5 e,f).

Year 1 (2013-14) **Year 2 (2014-15)**

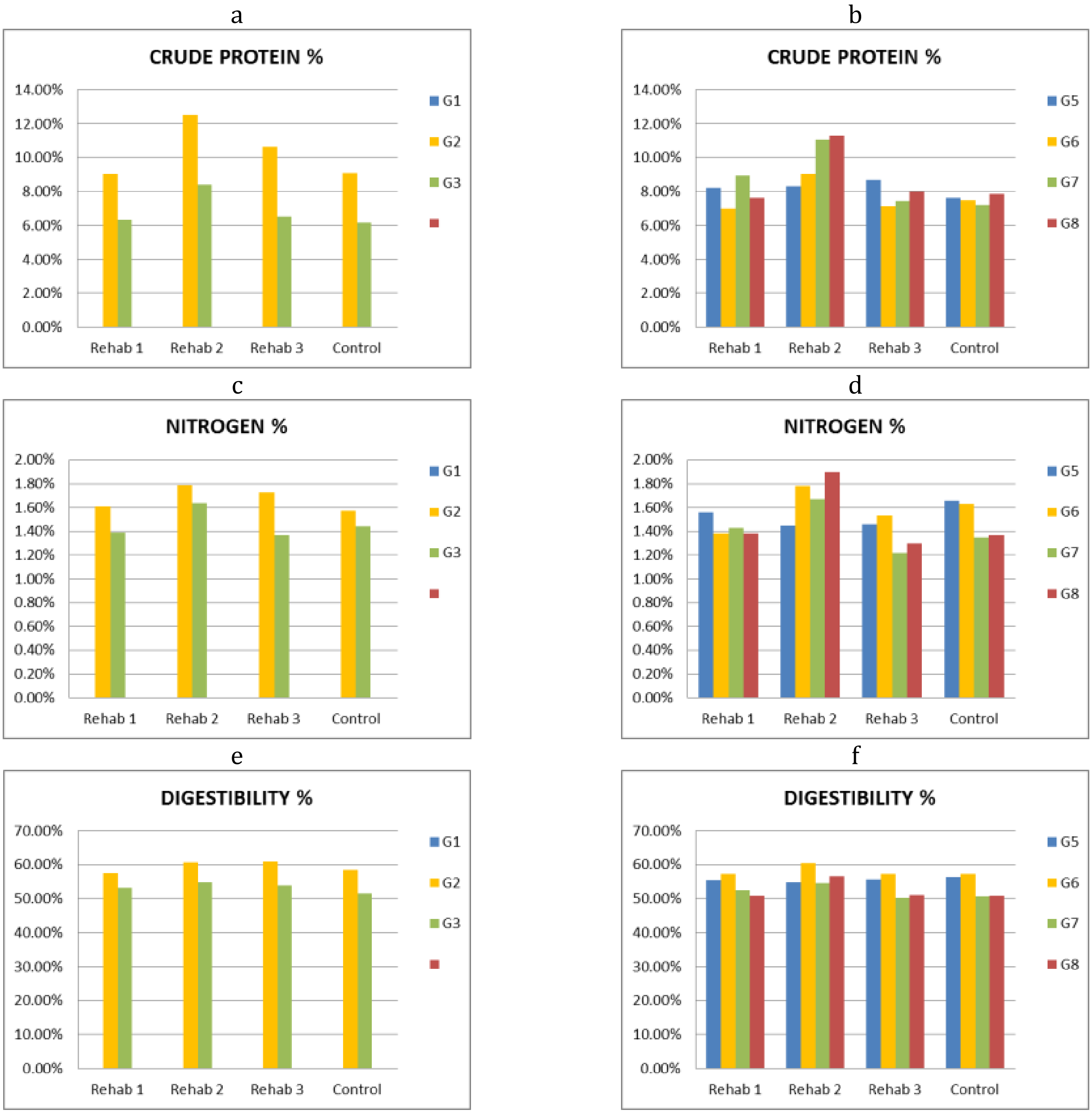


Figure 5. Quality of consumed pasture based on faecal NIRS analysis; (a & b) crude protein (%), (c & d) nitrogen (%) and (e & f) digestibility (%), for each grazing trial period. Samples were not collected during G1.

Pasture

The quantity of primary production, based on the ungrazed exclosure pasture yields, were similar or higher in Rehab 2 than the other sites in both years (Figure 6). Total nitrogen uptake followed a similar pattern with the pasture quality being higher in Rehab 1 and Rehab 2, and lower in Control and R3, reflecting the soil mineral N trends (Figure 6). Similar to the ungrazed pasture assessments, the quantity of grazed pasture on offer based on Botanal assessments was similar or higher in Rehab 2 than the other sites (Figure 7). Pasture yield related to soil properties more than to the age of the pasture.

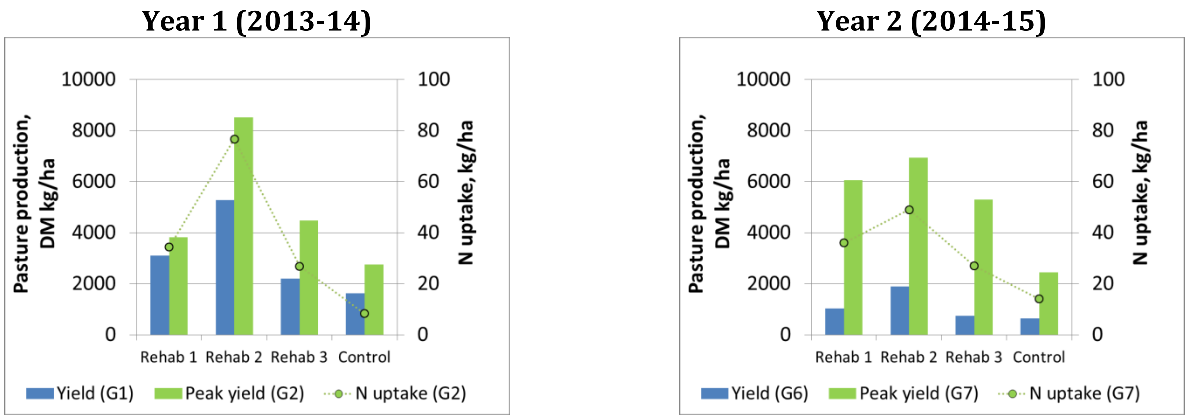


Figure 6. Peak ungrazed cumulative pasture yield (dry matter kg/ha) measured in autumn (G2, G7) and initial yields measured in summer (G1, G6) in Swyftsynd exclosures at each site and year , and total nitrogen uptake (kg/ha) at peak yield.

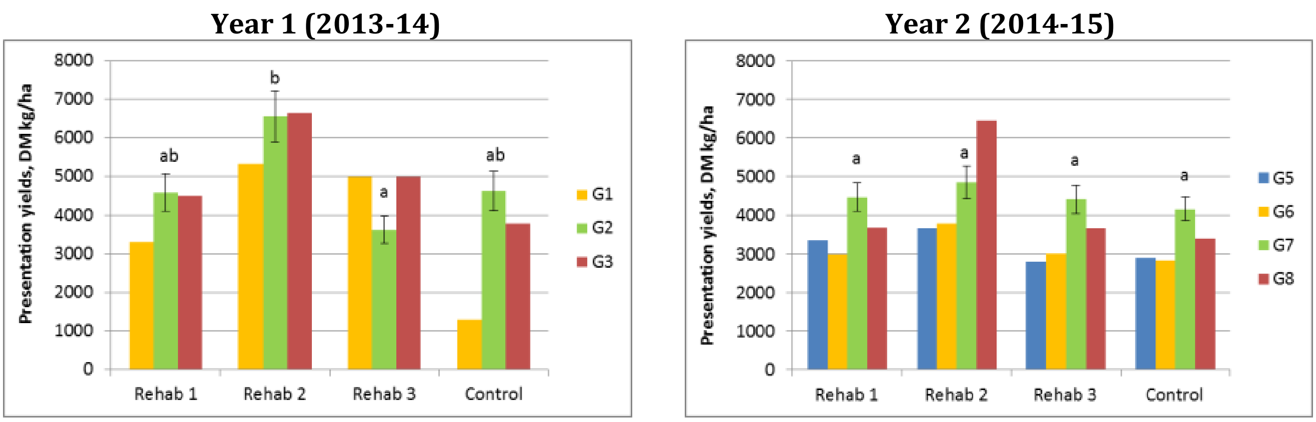


Figure 7. Quantity of grazed feed on offer (dry matter kg/ha) prior to each grazing period based on Botanal assessments. Bars within a grazing period and year sharing the same letter are not significantly different (P<0.05).

There was no marked change in the species composition across different aged pastures or between years (Figure 8). Rehab 2 had a higher proportion of Panic grass species (*Panicum spp.*) than the other sites. Pasture quality in terms of crude protein, metabolisable energy and digestibility was higher in most seasons in Rehab 2 (Figure 9). Frosts occur more often at the control site than at the rehabilitated sites, which likely reduced protein and digestibility in G8 in the control. The percentage of green pasture biomass was highest in the control in Year 1 and highest in Rehab 2 in Year 2 (Figure 10). Total groundcover was above 60% at all sites during autumn and was considered adequate for minimising erosion and enhancing weed control (Hannan, 1995).

Year 1 (2013-14) **Year 2 (2014-15)**

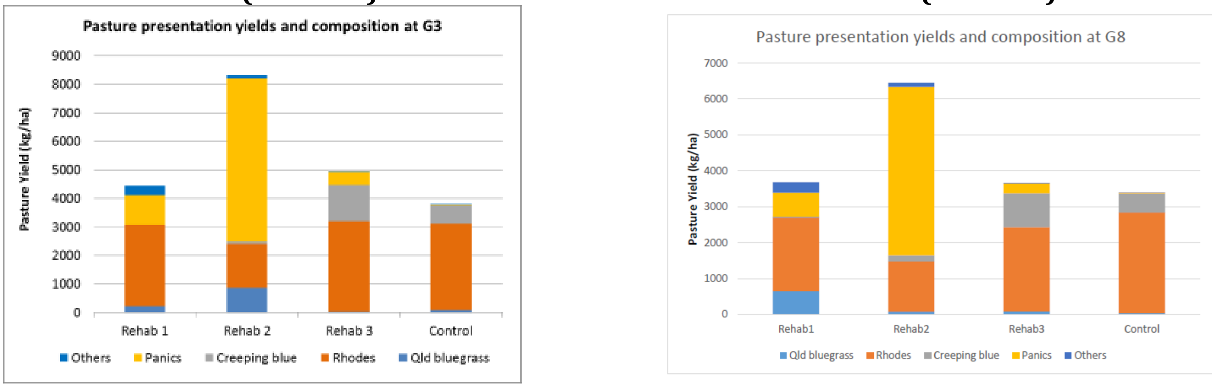


Figure 8. Species composition of pasture swards at each site measured in winter each year

Year 1 (2013-14) **Year 2 (2014-15)**

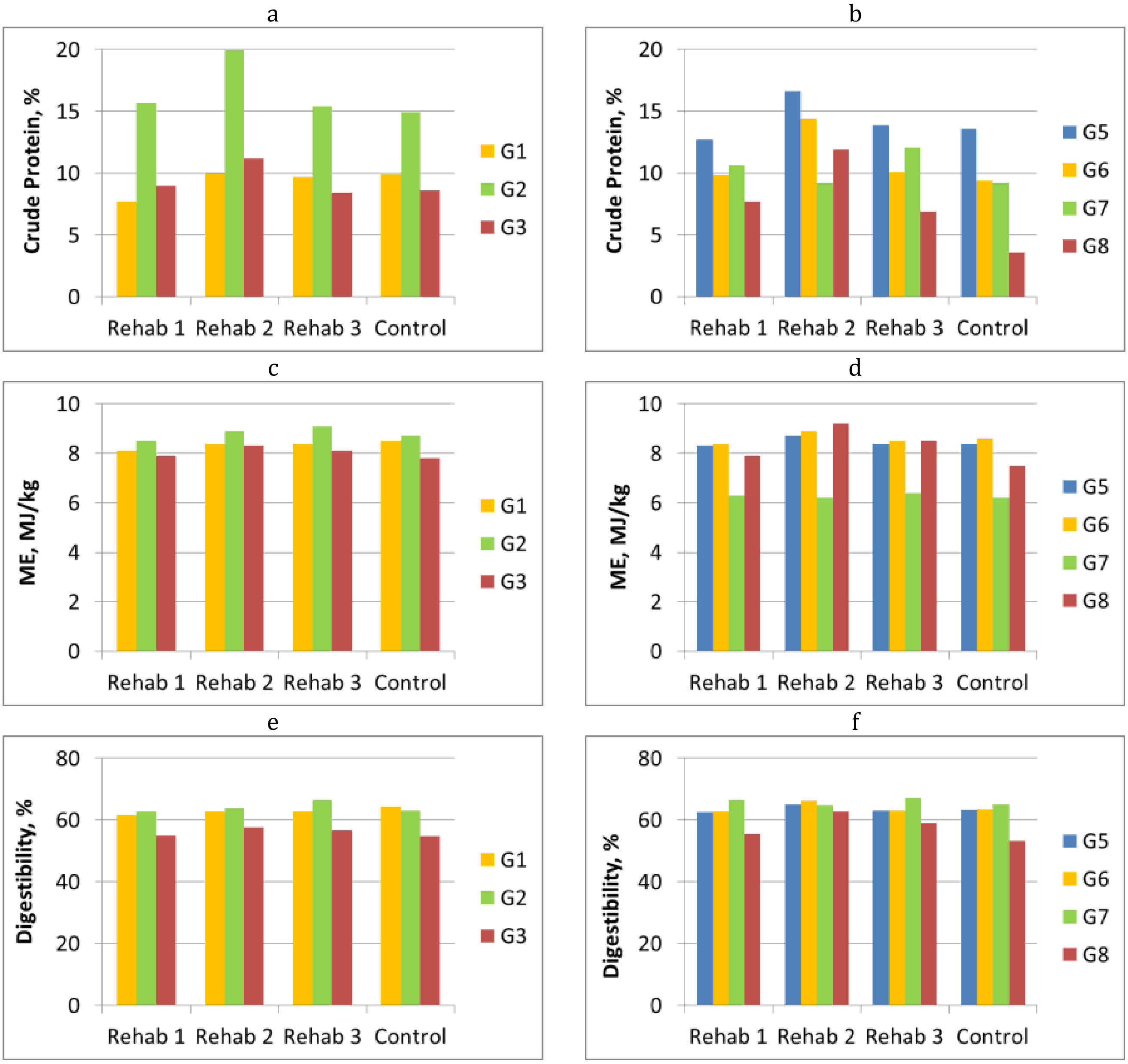


Figure 9. Quality of feed on offer based on leaf analysis for (a & b) crude protein (%), (c & d) metabolisable energy (MJ/kg), and (e & f) digestibility (%) for each grazing trial period.

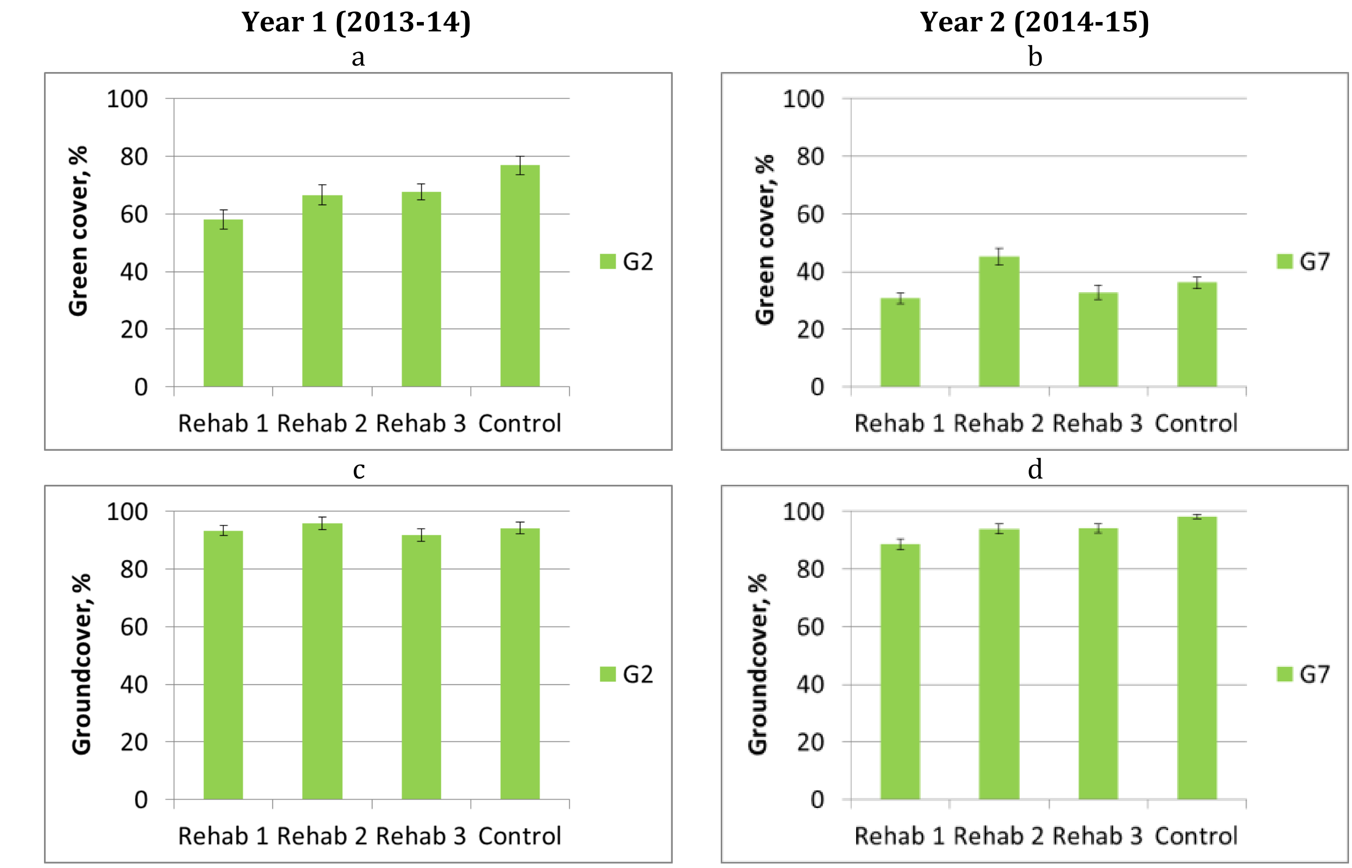


Figure 10. Percentage of green (a & b) and total (c & d) groundcover at each site during autumn in each year. Error bars are standard errors.

Soil

Key performance indicators for soil properties include nutrient supply, nutrient cycling potential, water supply, and soil structure and structural stability. In terms of nutrient supply, total N in the topsoil (0-10 cm) was less limiting in Rehab 2 than in the other sites (Figure 11 a,b). The total potentially plant-available mineral N content to 60 cm (nitrate plus ammonium plus potentially mineralisable nitrogen) was similar in Rehab 1 and Rehab 2 and lower but similar in Rehab 3 and the control site (Figure 11 c,d). Levels in the BMK sites were intermediate to these pairs of sites. Plant-available P (Colwell P) was high and non-limiting for pasture legume growth in Rehab 1, Rehab 2 and the BMK sites and was potentially limiting for legume growth in the control and Rehab 3 (potential legume limitation) sites (Figure 11 e,f).

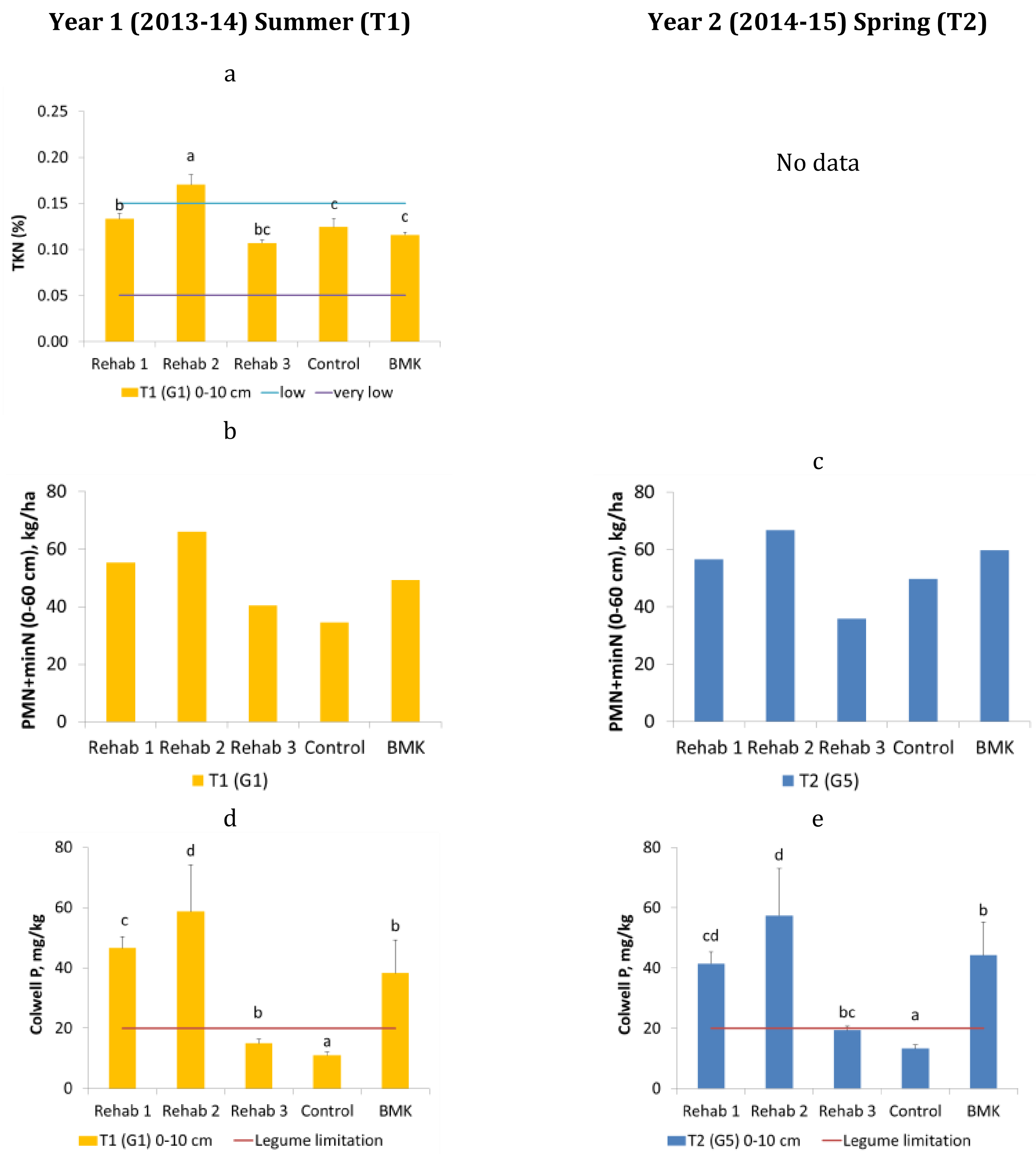


Figure 11. Nutrient supply indicators of (a) topsoil total nitrogen (%), (b & c) potentially plant-available nitrogen (mineral nitrogen plus potentially mineralisable nitrogen) 0-60 cm (kg/ha) and (d & e) topsoil plant-available phosphorus (Colwell P, mg/kg). Bars within a grazing period sharing the same letter are not significantly different (P<0.05).

The nutrient cycling potential, as indicated by the topsoil organic C content was higher in Rehab 2 than in Rehab 3 but was similar across all other sites, including the benchmark sites (Figure 12a). The organic C to total N ratio (C:N <25) suggested net mineralisation of soil organic N would occur at all sites (Figure 12b). Soil depth is an indicator of the potential to supply water and nutrients to the pasture root system. The soil depth in the rehabilitated sites was shallower than in the control site but was within the range across the benchmark sites (Figure 13). Pasture roots in the rehabilitated sites extended into the inter-burden layer (Figure 13), mainly through fissures (Figure 14a). The density of roots appeared non-limiting in the topsoil of all sites but was possibly limiting in the subsoil of the rehabilitated pastures where there was usually an abrupt reduction in root density at the inter-burden interface (Figure 14b). The maximum rooting depth was shallower (1.10 m) in the rehabilitated pastures than in the control (1.57) site and similar to the mean of the benchmark sites (1.12m excluding a very shallow outlier of 0.15m). Potential limitations to soil water storage, inferred by the plant available water storage capacity, are under investigation.

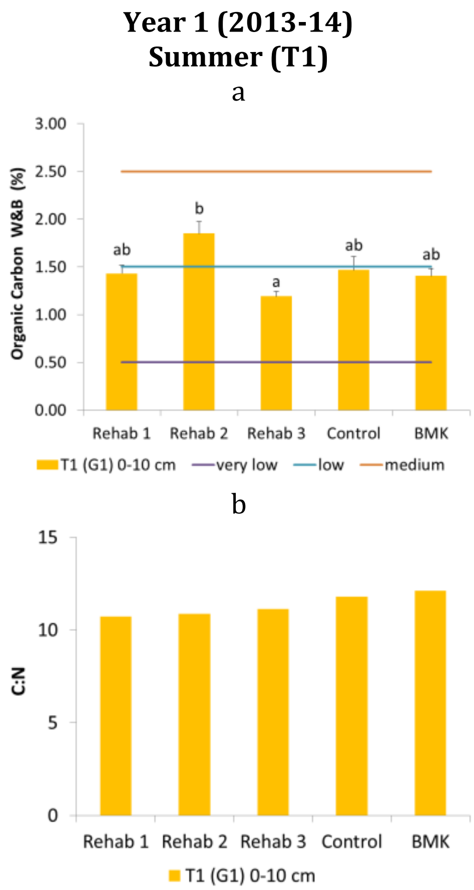


Figure 12. Nutrient cycling indicators of (a) topsoil organic carbon (%), and (b) the topsoil organic C to total N ratio measured in summer in Year 1. Bars sharing the same letter are not significantly different (P<0.05).

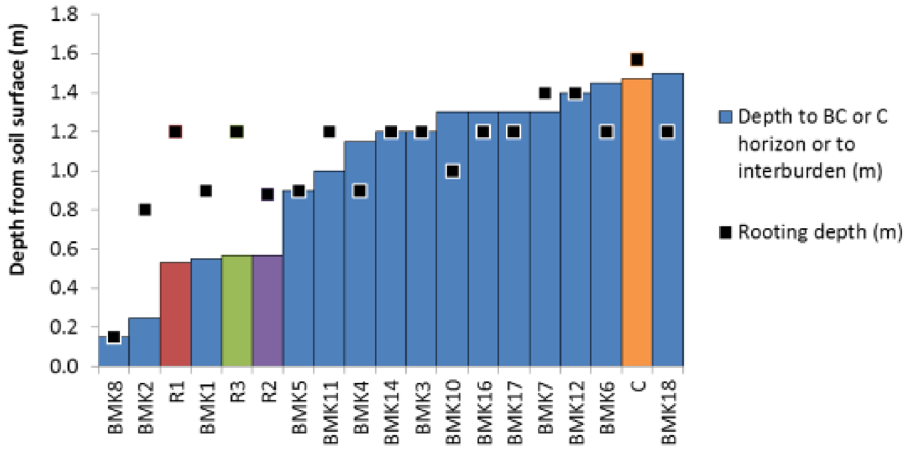


Figure 13. Average soil depth (bars) and rooting depth (square symbols) across benchmark (BMK) and treatment sites.

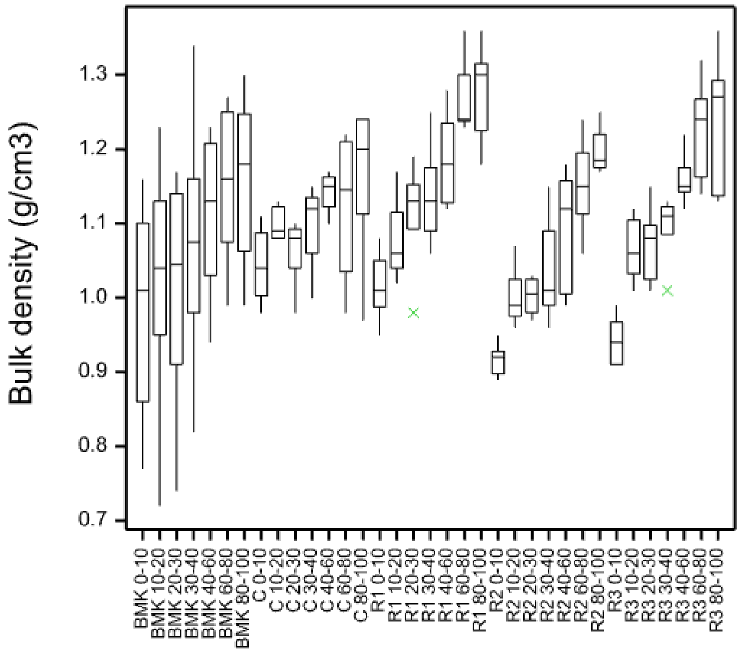
Figure 14. Photos from a soil pit in Rehab 2 showing (a) roots channelling into fractured siltstone within the interburden, and (b) an abrupt reduction in roots between soil and interburden depths

Other indicators of the soil's potential to support pasture production include the structure, bulk density, aggregate stability and salinity. The topsoil in the rehabilitated sites was less well structured than in the control site but had generally similar or better surface condition (i.e. more mulch and less crusting, which can improve rainfall entry, Table 2). The A Horizon of the rehabilitated sites shows encouraging signs of soil evolution, with darkening of the soil layer consistent with significant organic matter breakdown, as well as weak structural development to 0.35m. The bulk density was considered non-limiting for pasture production at all sites and soil depths measured (Figure 15a) and was lowest (i.e. best) in Rehab 2. Aggregate stability was considered non-limiting except for the Rehab 1 subsoil (Figure 15b). Salinity was low and non-limiting to 60 cm depth across sites (Figure 16).

Table 2. Soil type and structure

Site	Soil type	Surface condition	Surface structure (0-10 cm)	Subsoil structure (40 cm)
Rehab 1, 2, 3	Spolic Anthroposol	Hardsetting or Mulch or cracking	Massive - weak	Massive - weak-moderate
Control	Dermosol	Crust or Hard setting	Granular - Massive - Weak - moderate	Moderate - strong

a



b

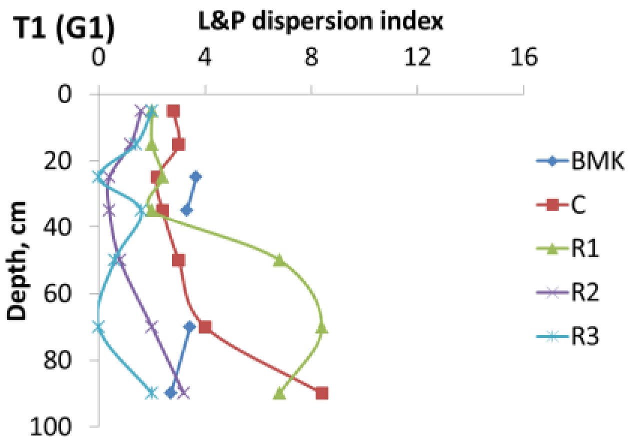


Figure 15. Soil (a) bulk density (g/cm3) distributions and (b) aggregate stability across sites and depths. Aggregate stability was measured using the Loveday and Pyle dispersion index where higher values indicate less soil aggregate stability in water.

Year 1 (2013-14) Summer (T1) **Year 2 (2014-15) Summer (T3)**

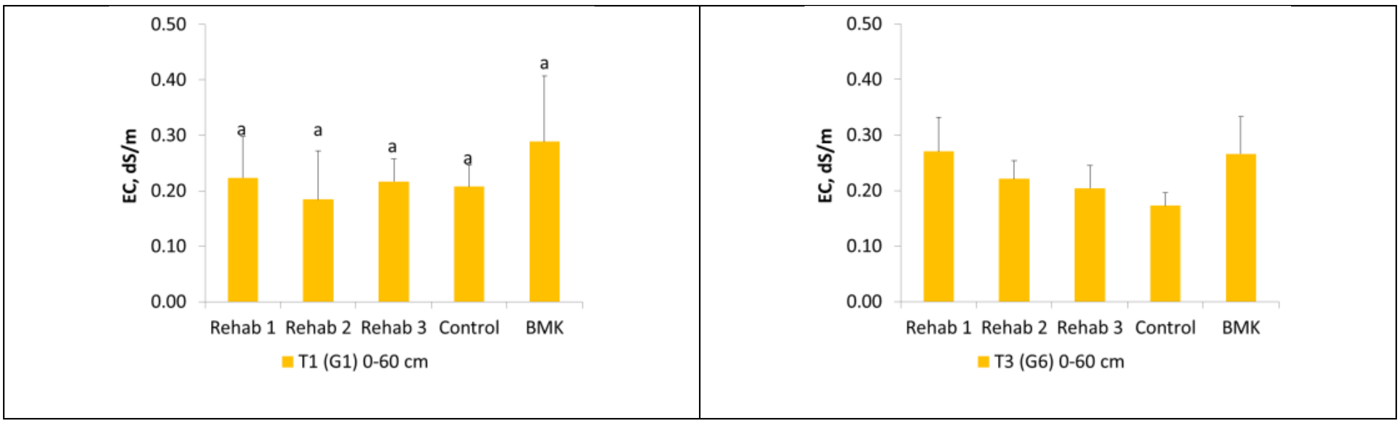


Figure 16. Soil electrical Conductivity to 60 cm (dS/m) across sites in summer. Bars sharing the same letter are not significantly different (P<0.05).

Discussion

Control vs Benchmark sites

Australian Soil Classifications (Isbell, 2002) for the soil at the benchmark sites were predominantly Dermosols and Vertosols with one Chromosol identified. The control site was a Brown Dermosol and the rehabilitated pits were classified as Spolic Anthroposols, meaning anthropogenic soil constructed using mining spoil. The control site was comparable with the benchmark (BMK) sites in both years for all soil parameters measured except for Colwell P and potentially mineralisable N, for which the mean levels were significantly lower in the control site but were within the benchmark range (Figure 11). The control site is representative of previously cropped grazing soils for these parameters.

Rehabilitated vs Control sites

Results to date indicate that two of the three rehabilitated sites are at least as productive as the unmined Control site in terms of cattle production (Figure 3 and Figure 4). Across sites and years the average annual ADGs were 0.25-0.93 kg/head/day, which compare both well and poorly with a benchmark performance for young cattle grazing subtropical pastures on the southern downs area of 0.6 kg/head/day. Stocking rates were 0.91-1.25 head/ha (Table 3, equivalent to about 0.7-0.9 adult equivalents/ha) which is comparable with expectations for the land resource area of about 1 adult equivalent/ha (Harris *et al.*, 1999), accounting for the drier than average years. Grazing period beef production was 33-130 kg liveweight/ha/yr. In year 1 gross margins per head were not significantly different between Rehabilitated and Control sites (trial mean $293 ± 79.4/hd, Figure 2).

Table 3. Stocking rates (head/ha) during each grazing period

Site	G1	G2	G3	G5	G6	G7	G8
Rehab 1	0.91	0.91	1.14	1.05	1.00	0.91	1.00
Rehab 2	1.25	1.25	1.16	1.13	1.09	0.94	1.09
Rehab 3	1.82*	0.91	1.05	0.91	0.91	0.91	0.91
Control	0.95	1.19	0.95	0.95	0.95	0.95	0.95

*unintentional overstocking

The oldest rehabilitated site, Rehab 1, supported similar or lower ADGs and produced less beef in both years than the other three sites. The poor performance of Rehab 1 compared with Rehab 2, despite having similar soil nutrient supply potential (Figure 11), was attributed to higher uptake of plant-available soil N by the Rehab 2 pastures. The reasons for higher uptake of soil mineral N in Rehab 2 are not clear but were not attributed to the higher proportion of Panic grass (*Panicum spp.*) in this site (Figure 8) because the other sown tropical pastures (mainly Rhodes grass) were also expected to respond to plant-available soil N (Robbins and Bushell, 1985). Higher N uptake enabled the Rehab 2 pasture to grow better than in Rehab 1 when rainfall was available. For example, high growth (Figure 7), and associated cattle weight gain (Figure 3d), occurred during the winter 2015 grazing (G8) in Rehab 2, presumably in response to the heavy rainfall (130 mm) during May 2015 and enhanced by the higher cumulative uptake of N during the preceding grazings (Figure 6).

Rehab 2, the second oldest rehabilitated site, has consistently displayed the highest productive capacity, in terms of pasture productivity and quality (Figure 6 and Figure 9), soil mineral N and Colwell P (Figure 11), cattle weight gains (Figure 3) and beef production per

hectare (Figure 4) relative to the other rehabilitated sites and the control site. In year 1 the unmined control had the highest ADG but Rehab 2 had a similarly high production per hectare due to a higher stocking rate, as a consequence of higher pasture presentation yields (Figure 7).

Better performance from Rehab 2 than Rehab 3 was broadly consistent with soil total and plant-available N and P content (Figure 11) and was not directly related to the age of the sown pasture. If soil from all the rehabilitated sites had the same pre-rehabilitation source and management history then a reduction in production and mineral N content with pasture age might have been expected due to depletion of a post-disturbance flush of soil mineral N (Peck et al., 2011). More information on the initial fertility of soil used to rehabilitate Rehab 2 compared with the other sites, and the climate and management of the soil during stockpiling, land-forming and rehabilitation may help to explain the differences in soil capacity.

Year 1 vs Year 2

Production from all sites was higher in year 1 due to the high accumulated biomass available at the start of the trial (Figure 7). Inter-annual variations occurred highlighting the importance of a long term dataset.

In year 1 treatments were comparable for pasture quality and growth rates but were difficult to compare for cattle performance and pasture yields because; the initial pasture biomass differed markedly between sites (1300 – 5325 kg DM /ha, Figure 7), cattle that always remained in the Rehab 3 cohort were all steers (ie heifers shifted between the Rehab 3 and filler cohorts) and Rehab 3 was unintentionally overgrazed during G1. In year 2 these shortcomings were mitigated by ensuring similar pasture biomass across sites at the start of grazing G5 (range 2786-3650 kg DM /ha, Figure 7), more balanced heifer and steer numbers, and no overgrazing.

In year 2, peak yields (based on grazing exclosure data) were low in the Control (2680 kg DM/ha, Figure 6), relative to the presentation yields measured at the same time in the remainder of the grazed paddock (4163 kg DM/ha from 50 observations, Figure 7). The variation in yield within the paddock was large and the difference therefore reflects the difficulty in locating the grazing exclosure in a representative area.

Conclusion

Over two years, a grazing trial included three (2013-14) or four (2014-15) periods of grazing of three post-mine rehabilitated pastures and one unmined control pasture. Two of the three rehabilitated sites were at least as productive in terms of cattle production as the unmined control site. The short term results suggest the rehabilitated sown pastures are able to support financially viable commercial cattle production and no significant limitations to pasture production were identified in the measured soil properties. The long term sustainability and viability of the cattle grazing system requires further investigation through modelling and measurement over longer time frames.

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