SUSTAINABLE GRAZING SYSTEMS (SGS) – DEVELOPING A NATIONAL EXPERIMENT

W. Mason[1] and M. Andrew[2]

[1] RPC Solutions, [2] AACM International

Abstract

Grazing Systems refers to the combination of pasture management, animal management, land management and whole-farm planning practices that are used to produce meat. The research component of SGS is a single, national experiment. There are six sites across the southern high rainfall zone (South West WA; Western and NE Vic; SW Slopes, Central Tablelands, and NW Slopes of NSW), all contributing to a single hypothesis. Traditionally, researchers would focus primarily on collecting data to learn as much as possible about their individual site. This process provides few insights into the principles and guidelines that might operate across the zone, and involves considerable duplication across sites. SGS has developed a new approach to make the experiment truly national, and to focus more on developing principles and guidelines from across the sites which can then be used to address real problems anywhere in the zone, whilst still providing site specific information. This paper describes the establishment phase of the SGS national experiment.

Key words Grazing systems, pastures, sustainability, perennial pastures, research management

Introduction

Sustainable Grazing Systems (SGS) is an initiative of the Meat Research Corporation and includes a range of collaborating partners. SGS is the second phase of a two phase process begun in 1993 – the first phase was TPSKP (the Temperate Pasture Sustainability Key Program). SGS focuses equally on production and sustainability issues for the beef and sheep industries in the high rainfall zone (HRZ; >600mm/yr) of southern Australia.

The perennial grass based pastures in this region have the potential to meet the demands from premium markets, but the quality of the pastures has declined over the past decade or more. Pastures have not been managed appropriately; fertiliser use has reduced; pastures have not been resown; and pastures have been over-grazed in summer and autumn, and under-grazed in spring.

SGS combines the efforts of producers, researchers and extension agents into a focussed partnership to develop, implement and manage grazing systems that are more profitable and more sustainable. There are three interacting elements within SGS: PROGRAZE[?] to provide training and skills development for producers; a network of 11 regional producer committees to manage local delivery; and a national experiment to develop the principles, tools and indicators that are needed for assessing and improving the profitability and sustainability of grazing systems.

One of the features of SGS has been the high level of producer input from planning through to regional delivery, and this aspect of the program has been reported elsewhere (Mason et al. 1997). The focus of this paper is the development and operations of a national experiment examining the hypothesis "that management practices can improve the profitability and sustainability of grazing systems in the HRZ of southern Australia", and its innovative features.

The budget (Agency plus Corporation) for the national experiment is over $10m to June 2001.

Results and discussion

Planning for the national experiment began in August 1996 with a call for expressions of interest from multidisciplinary teams who wanted to be involved in developing the processes, and conducting the experiment.

Experimental proposals were not part of the EOI, and teams were selected on the basis of the skills of members and their apparent enthusiasm to become involved in developing and implementing an integrated experiment, tempered by a need for a geographic spread of the sites.

Research teams led by Greg Lodge (NW Slopes of NSW), David Kemp (Central Tablelands of NSW), Anna Ridley/Bob White (NE Victoria), David Chapman (Western Victoria) and Paul Sanford (SW Western Australia) were selected from the EOIs, while a team led by Bill Johnston (SW Slopes of NSW) was funded independently by the Murray Darling Basin Commission to join the experiment.

Over 6 months, site teams individually and collectively designed the activities for each site. While the individual experiments at each site are quite different, the common feature is a focus on grazing management within realistic animal production systems, with plots of sufficient size to allow reasonable expression of the important processes and outcomes for both production and sustainability.

Collectively, the sites plan to explore all the major production and sustainability issues within the following objectives:

1. to demonstrate that grazing management can increase pasture productivity and longevity

2. to determine the profitability of the various grazing strategies within sustainability parameters

3. to determine the management needed to provide critical ground cover for erosion and soil health

4. to develop strategies which maximise water use and minimise rising water-tables, salinity and acidity

5. to identify strategies which optimise animal production and reduce nutrient losses, and

6. to determine the impact of grazing systems and management intensifications on biodiversity.

Table 1. A brief description of each site in the national experiment

NW Slopes of NSW	3 sites (2 native and 1 improved), focussed on ground cover, runoff, soil and nutrient loss, water infiltration, soil microbial activity and carbon cycling, and how these interact with productivity and profitability
Central T'lands of NSW	A native pasture site with a range of strategies, from low to high input (physical as well as managerial) to allow assessment of the productivity, profitability and sustainability of each option, and the impact on biodiversity
SW Slopes of NSW	A core site at Wagga, with a range of satellite sites in NSW, Vic and SA to determine the extent to which native grass pastures in the MDB can be managed for improved profitability and sustainability
NE Victoria	2 sites, each with three unreplicated catchments (5-10 ha) to focus on catchment scale water and nutrient movement. Pastures at each site are: 1 typical, "annual"; 2 and 3 improved perennial (high vs. medium input)
W Victoria	A single site to optimise water use and animal production by managing interactions between grazing management, nutrient use, green leaf production, water use and animal

	nutritional requirements
SW of WA	3 sites at Albany and Esperance strongly focussed on the role of perennial pastures to increase profits and water use. The biggest sustainability issue is dryland salinity, so a major focus on trees in grazing systems

In the process of designing, planning and implementing the individual sites, the collective research team has implemented three innovative steps: the creation of theme teams to manage the cross-site integration; undertaking a comprehensive, pre-experimental modelling exercise to "test" the likely impact of treatments before they were implemented; and the development of a database system to both manage the huge data sets at each site and provide a mechanism for the theme teams to operate across sites. The remainder of this paper describes and discussing these three innovations.

Themes

There are seven "Themes" running across the national experiment. These are:-

1. Animal performance and productivity	5. Nutrient use and losses
2. Pasture production, composition and quality	6. Biodiversity and nature conservation.
3. Soil structure, biology and loss	6. Economics
4. Water use, deep drainage and runoff	Modelling is not a theme; it operates across all themes

There is a team (drawn from the site teams) for each theme, with the initial roles of:

• establishing a cross-site network of technical specialists

• specifying the experimental protocols so that sites collecting the same information, use the same methods and the same recording system to facilitate cross-site analyses and modelling

• specifying the minimum data sets that must be collected at all sites (including those without a major interest in a given theme) to enable modelling to be used for filling in the gaps at those sites

• agreeing on individual site specialisation.

As the experiments develop, each theme team have the responsibility for reporting annually on progress within their theme, and then for developing the principles, guidelines and indicators - and in some cases a suite of useable computer models - for delivery to PROGRAZE and the regional producer network for delivery or local demonstration. Theme teams and the associated modelling support are budgeted independently from the site/experimental budgets.

Every site must collect the agreed minimum data set for every theme – sites add to the minimum for those themes where the site team has a higher level of experience and/or interest and/or theme responsibility, as shown in Table 2.

Table 2. The matrix of sites and themes for the national experiment

?	Themes						
Sites	Animal	Pasture	Soil	Water	Nutrient	Biodiversity	Economic
NW Slopes	x[1]	xx	xxx[2]	xxx	x	xx	x
Central T'lands	xxx	xxx	xx	xx	x	xxx[2]	xxx
SW Slopes	x	xx	x	xxx	xx	x	x
NE Victoria	x	x	x	xxx[2]	xxx	x	x
Western Vic	xxx[2]	xxx	x	xx	xx[2]	x	xxx
WA	xxx	xxx[2]	x	xxx	x	x	xxx

[1] x, xx and xxx indicate a low, medium or high input to the theme at that site. x represents the minimum data set.

[2] Location of the leader of the theme team

The site teams meet in February to report on the previous growth season, and the theme teams have until June to integrate the site information into theme progress reports.

Pre-experimental modelling

This study (Bond et al. 1997) challenged both modellers - to link production and water models -, and researchers - to quantify realistic scenarios. This significantly advanced both the way large-scale land management research is planned, and the links between modellers and researchers. The study showed that perennial pastures in winter rainfall areas (Vic and SW, WA) use a lot more water than annuals, roughly halving deep drainage (ca. 200 v. 120 mm/yr) and runoff. However, these perennial pastures cannot control rising groundwater and salinity in the long-term. To be sustainable, well managed perennial-grass based systems must be combined with trees or other deep-rooted species.

On the NW Slopes of NSW deep drainage under perennial pastures was much smaller (5-25 mm/yr) than from the other two, winter rainfall sites. This difference reflected the evapotranspiration pattern of the region, with most rain falling in summer, when evaporative demand is high, providing little opportunity for soil saturation and drainage below the root zone. Maintenance of ground cover was likely to be important in this environment for reducing the runoff and erosion from intense summer storms, and for reducing evaporation from bare soil to maximise transpiration.

Well managed, perennial-grass based pastoral systems appeared to be sustainable in this environment, at least as far as the water balance was concerned.

The analysis emphasised the importance of different sustainability issues at the different sites and identified research goals for consideration by the various research teams.

• The grazing treatments evaluated for perennials at the Western Victoria site appeared unlikely to result in significant water balance differences. A clear issue which emerged here was the importance of persistence of the desirable perennial species.

• The introduction of kikuyu and fescue pastures at the South Western WA site appeared promising, improving both the economic returns, and the sustainability of the system. Alley farming projects at the site also appeared well directed as the pasture system alone was not capable of controlling deep drainage.

• The NW Slopes site reflected the climatic differences between southern Australia and northern NSW. The northern NSW summer-rainfall-dominant climate appears more conducive to supporting pasture systems which are sustainable in terms of water balance, with the management of surface vegetation cover being particularly important to manage erosion, runoff and evaporation.

Databases for the national experiment

The concept behind the theme teams in SGS was to shift the focus of the national experiment away from data analysis and reporting at individual sites, and towards interpretation across sites to facilitate the development of principles. These principles will then be made available (through PROGRAZE and the Regional Producer Network) as guidelines, indicators and/or best management practices for producers to customise for their individual circumstances and properties.

The mechanism for the theme teams to integrate data across sites is through relational databases specifically developed for each site.

Through the University of New England, SGS has developed a series of relational databases – one for each site in the national experiment. For an individual site the database provides:

• an extremely efficient data storage system: where all data from every aspect of the site, over the life of the experiment can be stored – data can be entered directly or through the importation of Excel spreadsheet or ASCII files from field data collection systems

• improved quality of data stored: a quality assurance system scans all data as it is entered so that even very large data sets such as weather records can be trusted

• enhanced ability to understand linkages between different data sets and improved data access which facilitates understanding of complex data-sets without having to develop tables of means for the variables of interest

• detailed interrogation tools to allow easy development of complex queries so data can be readily accessed for writing reports, graphing results, obtaining subsets of data for statistical analysis, etc.

• data in a form whereby related data sets can be gathered for modelling purposes: GrassGro, for example, can generate many different output graphs and the database allows data sets to be put in a form which can be compared with those model outputs.

For the theme teams, the common database structures will facilitate the analyses of theme data from across all sites to give full effect to this "national" experiment.

In other words, the databases for each site are extremely useful, and likely to become standard operating procedure for all future, large scale experiments. Just as importantly, for the SGS sites, is the fact that all the development and the training of site teams in the use of their individualised database was provided by one person to ensure compatibility across sites. This will give the theme teams an extremely powerful mechanism to examine issues across all sites.

Conclusions

SGS has provided a new model for the collective development of large research programs, and for integrating research across geographical and organisational boundaries. In addition, the research is closely linked with the industry as it feeds directly into local testing and demonstration through the regional producer network, and into producer training through PROGRAZE.

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References

1. Bond, W.J., Cresswell, H.P., Simpson, R.J., Paydar, Z., Clark, S.G., Moore, A.D., Alcock, D.J., Donnelly, J.R., Freer, M., Keating, B.A., Huth, N.I., and Snow, V.O. 1997. CSIRO Land and Water, Consultancy report No 97-31 available from http://www.cbr.soils.csiro.ua/research/pre-exp/

2. Mason, W.K., Kay, G., and Lodge, G. 1997. *Proc XXVIII Int. Grasslands Congress*. Saskatoon. Vol 2, Session 24, p 13-14.