

The value proposition for remotely sensed estimates of feed on offer and pasture growth rate

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Introduction

The contribution to whole-farm profit from sheep production within a mixed farming system will be affected by improvements in productivity and real farm-gate prices for wool and meat. A key to improving productivity of sheep producers is increasing the utilisation of pastures from current low levels. Michael *et al.* (1997) estimated that, in many years, the utilisation of pastures by sheep is between 20% and 30% of what is grown. Economic analyses undertaken using a farming system model demonstrate the opportunity to double farm profit by increasing utilisation (J. Young, pers. com.). The analyses show that, for every 10% increase in utilisation, profit increases by \$20/ha/year up to a maximum utilisation of around 55%.

Considerable investment has been made in training programs designed to provide producers with the skills and tools to improve pasture utilisation. Since 1994, over 10,000 producers have undertaken such programs as PROGRAZE (NSW Agriculture, 1994) and Woolpro. A subsequent course called PROGRAZE Plus (NSW Agriculture, 1998) was developed at the request of producers to integrate the skills and concepts learnt from PROGRAZE into a whole-farm context. PRO Plus (McPhee *et al.*, 2000), a whole-farm feed budgeting decision-support system, was subsequently developed to assist in the management of producer-developed grazing plans. The program predicts the pasture biomass available at the end of each month for individual paddocks based on past pasture growth rates (PGR; measured in kg DM/ha/d), number of animals, intake, and a grazing plan in which producers allocate mobs weekly to paddocks.

It is our experience in Western Australia that very few producers have used the specific skills and tools to assist in the development of individual grazing plans. Sneddon *et al.* (2000) concluded that the slow adoption of pasture management techniques could be attributed to the lack of producer confidence in quantifying pasture biomass and the lack of time available to assess pastures across the whole farm.

In 2000, a Precision Sheep Production Group was established with the aim of managing feed intake of flocks over winter and spring to achieve outcomes measured in terms of mean fibre diameter and staple strength and budgeted-for at least 6 months in advance.

House *et al.* (2002) reported on three separate case studies from this group in which visual estimates of

feed on offer (FOO¹) and retrospective estimates of PGR, along with a 'measure as you grow' approach, were used to manage wool production from both young sheep and adult wethers. The producers were from the Kojonup region of Western Australia; and each nominated the fibre diameter, staple length, and staple strength that they wanted their flock to achieve at shearing in 12 months' time.

In all three cases, they were able to meet their objective of a reduction in fibre diameter and an increase in clean wool production per hectare while at least maintaining the staple strength in their flocks, by restricting the intake of green feed during winter and spring. A range of tactics was used to manage the supply and resultant intake of green feed during winter and spring; and in these three cases, it proved to be more profitable than their current grazing management by \$16.30, \$8.93, or \$2.63/head. The increase in profit per head translated to an increase in profit per hectare ranging from \$112 to \$288.

The producers all concluded that their ability to visually estimate FOO was subject to large errors and highly dependent on the monthly calibration exercise organised by the Department of Agriculture. They said that it was highly unlikely that they would be willing to invest the time required to do the calibration themselves if this service was not available. The producers also recognised that extra income could be earned from the surplus land that becomes available as a result of stocking sheep more heavily over smaller areas. They acknowledged that the key to maximising profit is to do something productive with this surplus land (e.g., cut silage or plant more lucerne or summer crops).

CSIRO Livestock Industries in collaboration with the Western Australian Departments of Agriculture and of Land Administration have developed a way of measuring both the biomass and growth rate of annual pastures using satellite images (Henry *et al.*, 2002). Our vision is to provide cheap, reliable, timely, and accurate satellite-based pasture information to producers at the paddock level.

This paper reports on the value to producers in Western Australia of satellite-based FOO and PGR delivered at the paddock level via a website (www.spatial.agric.wa.gov.au/foo) and e-mail.

¹ FOO is the amount or mass of pasture, expressed in kilograms of dry matter per hectare (kg DM/ha), in front of the animal as it grazes.

Precision Sheep producer case studies

In 2001, additional Precision Sheep Production Groups were set up to pilot test the delivery of satellite-based FOO and PGR for paddocks on individual farms in Western Australia. The producers within these groups were delivered predictions of PGR weekly and FOO monthly for each of the paddocks on their farm, from August to September in 2001 and from May to October in 2002. Case studies were undertaken both in 2001 and 2002 to assess the value of remotely sensed pasture measurements to individual producers.

Case study 1: management of wool production to forward contract and budget for silage production

Richard Coole farms 5,500 ha spread over six farms between Frankland and Boyup Brook, approximately 400 km south of Perth. Approximately 40% of the arable area is planted to crops, and he runs 35,400 dry sheep equivalents (DSE) at a winter-grazed stocking rate of 12.9 DSE/ha with an average annual rainfall of 600 to 700 mm. In 2001, Richard used satellite-sourced estimates of FOO and PGR to both manage wool production and increase pasture utilisation on his farm. In concert with the satellite-based pasture technology, he used the 'measure as you grow' approach to manage the wool production in two- and four-tooth dry ewes to a predetermined fibre diameter, staple length, and staple strength by restricting their intake in winter and spring. Because he was so confident that he had the tools available that would allow him to hit his target, he made the decision to forward sell 300 bales (a third of his clip) of 18- to 19-micron wool with a staple strength of around 30 N/ktex.

Through a combination of technologies, he was able to meet his forward contracts and realise a profit of \$50,000 over what he would have achieved if he had sold his wool into the spot market. The profit achieved through the forward selling of his wool does not take into account the extra profit achieved, over and above his current grazing management, through the management of wool production during winter and spring. The surplus land that became available as a result of the more intensive grazing of dry ewes provided him with the option of fodder conservation. He used the weekly PGR and monthly FOO predictions to develop feed budgets for his livestock and to provide him with the information on how much land he should lock up for silage production. He valued the 1,500 tonnes of silage produced from the surplus land at \$150,000 (i.e., \$100/tonne).

He also claimed that the provision of remotely sensed PGR and FOO resulted in a labour saving by eliminating 1 day/week of the time needed to monitor pastures during the growing season. This saving in labour for a skilled person was valued at around \$3,900 per year (\$30,000 annual salary). In addition, the technology was used in the management of his five remote properties and resulted in a further labour

saving to the enterprise. The technology provided him with additional time to spend on making strategic and tactical management decisions on his farm.

Case study 2: use of historical knowledge of PGR to test the feasibility of a radical change in grazing management

Brad Wooldridge farms 502 ha at Arthur River, approximately 250 km south of Perth. Approximately 60% of the arable area is planted to crops, and he has traditionally run 2,645 DSE at a winter-grazed stocking rate of 12.2 DSE/ha with an average annual rainfall of 500 mm. In 2002, Brad used satellite-sourced estimates of past PGR information to make a major stocking rate and grazing management decision for his farm. His aim was to increase his stocking rate to 14 DSE to increase pasture utilisation by better matching his total animal requirements to total pasture production and therefore stocking for an 'average year' rather than the more conservative approach he had taken previously.

At the break of season in April, he was running 12 DSE/winter-grazed ha, with both his ewe and wether hoggets agisted on stubbles in the wheatbelt. Following the return of the ewe hoggets in early May, the stocking rate had increased to 14 DSE/winter-grazed ha, his target for the year. By the end of May, the season had not broken where he had the wether hoggets agisted, so they returned, increasing his overall stocking rate to 18 DSE/ha. He had to decide whether the current stocking rate was going to be sustainable over the growing season or whether he would need to sell surplus stock and when they should be sold.

Feed budgets were undertaken using historical information and previous satellite-based information on PGR, along with a pasture allowance per DSE (Grimm, 1998). The conclusion was that the 18 DSE/ha was probably sustainable but would need the weekly satellite-based PGR information to monitor the situation. The decision was also made to use the satellite-based FOO and PGR information to help rotationally graze his reproducing ewes to optimise the production of both the animals and the pastures.

He recognised that the satellite-based pasture information was a key tool used in the strategic and tactical decision-making processes on his farm. The ewe flock quickly adapted to the rotation so long as they were only moved directly from one paddock to another, that is, transferred through a single gate between adjoining paddocks, when the residual FOO reached 500 to 800 kg/ha. Over lambing, ewes and lambs that stayed behind were picked up in the next move with little or no effect on lamb survival. There was a 5-day cold period in July when the PGR slowed dramatically and the rotation became very tight. However, the increase in stocking rate was sustainable; and the ewes produced finer and stronger wool than normal, resulting in a 150% increase in the profit of his livestock enterprise. He thought that other important spin-offs of the technology include its ability to identify low-performing paddocks and areas within

paddocks. By addressing the issue of poor paddock performance, producers will be in a better position to sustain higher stocking rates on their farms in the future.

Precision Sheep producer surveys

At the end of the 2002 growing season, 63 of the producers from the Precision Sheep Production Groups were surveyed to explore the value of the remotely sensed pasture technology to their farming enterprise (J. Sneddon, pers. com.). Eighty-two percent of the producers interviewed felt that the satellite-based FOO and PGR information increased their confidence in making pasture and stock management decisions. Sixty-one percent of the producers felt that the FOO and PGR information helped them to better manage risk, and over 50% felt that the technology contributed to an increase in both the profitability of their wool enterprise and the farm business (58% and 59%, respectively). When asked to quantify the potential value of the FOO and PGR technology to their farming enterprise, the majority of the producers declined. This is not surprising, considering the difficulty of quantifying the value to a farming enterprise of an increase in confidence and a reduction in risk. However, one of the producers indicated that it would have increased his revenue by \$20,000 to \$30,000 through stock management decisions, while another participant quantified the increase in confidence in stock and pasture management decisions at \$250/winter-grazed ha, as the information helped him to increase the stocking rate of his wool enterprise.

In 2003, a value proposition will be undertaken to gain a clear understanding of the usefulness of the FOO and PGR information delivered, to determine how it was used in making management decisions on farm, and to quantify the resultant increase in profit that was achieved through its use. Cooperating producers will be asked to collect specific information associated with the use of the technology to enable the conduct of a 'with and without' economic analysis to determine the value of technology to their farming business. In addition, whole-farm economic modelling will be undertaken to investigate the potential opportunities that the FOO and PGR information will offer producers in maximising profit on their farm.

Conclusion

Our vision is to provide cost-effective, reliable, timely, and accurate satellite-based FOO and PGR that will enable producers to substantially increase the productivity and profitability of their farming enterprise. We know, from validation studies undertaken in 2002, that satellite-based FOO and PGR explained 97% and 66% of the variance in ground measurements, respectively (Kelly *et al.*, 2003). Also, through the availability of new remotely sensed data, there will be the opportunity to improve the precision of the predicted PGR information and to address limitations in predicting FOO due to cloud cover. We

think the benefits of the technology will be realised through both the reduction in enterprise costs and the increased value of enterprise outputs. Market research (Sneddon and Mazzarol, 2002) has shown that producers whose enterprises are highly sensitive to external forces were more likely to respond by adopting innovative grazing management to maximise pasture utilisation (as these technologies have the potential to reduce perceived production and environmental risk). However, we also recognise that, in the absence of financial pressure, many producers operating at lower pasture utilisation rates, and hence with opportunities in their pasture system, will be slower to adopt these practices. These producers will require greater levels of training and support for them to see the benefits of the satellite-based FOO and PGR technology.

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