Integrating livestock and subsequent crop enterprises

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Abstract: *Farming grazier or grazing farmer? This is the ultimate question which determines the balance of enterprises to be conducted. There are no 'free' stubbles to be grazed at the end of a crop, nor are there 'free' grazing opportunities during the winter period. Each activity has its benefits and costs, with issues such as compaction, soil structural decline, water infiltration, water use efficiency, early grazing opportunities and risk management being some of the more critical ones. Extensive data collected from commercial paddocks, combined with real life grazing data, enable the validation of decisions farmers, or graziers, make.*

Introduction

Broadacre agriculture in the Central West region of NSW has, like many regions, been a significant challenge over the last ten years. Most of that period has experienced drought conditions, with dry autumns, late cropping starts, and failed springs. Associated with this have been significant one-off rainfall events, many outside the cool growing season. Cropping yields and returns have been disappointing, costs have been rising and, in the livestock industry, keeping feed up to stock has been a monotonous struggle. Whilst the livestock prices may have improved somewhat, many businesses have chosen to reduce numbers, or completely destock, in order to manage the drought conditions.

Being able to integrate cropping enterprises within a business is a juggling act. Leading farmers have, recognised that managing resources and ensuring the timeliness of activities cannot be compromised, irrespective of enterprise. Often the compromise resulting from one decision has a positive outcome on another, thereby complicating the decision-making process.

Grazing in the cropping enterprise – grazing stubbles

Grazing stubble comes at a cost to crop performance (Gardner & Elliott 2005). This cost needs to be weighed up against potential livestock returns. AGnVET Services developed its proactive agronomy service program BettaCrop® in 2001. Since then, during the 2001–2009 seasons, AGnVET agronomists have collected data from over 10,000 paddocks in central and southern NSW (the current program has approximately 120 growers and some 1200 paddocks). Among many parameters, plant available water (PAW) at establishment, soil conditions at sowing, crop yields, and grazing data from the previous crop stubble have been recorded. This data has enabled many different analyses to be conducted, in particular, the effect of grazing on the cropping enterprise, and the resulting yield, water use efficiency (WUE) and profit.

The BettaCrop® database, when comparing wheat crops that followed grazed and ungrazed stubbles, reports grazing stubble alone decreases yield by 260 kg/ha. There are various physical factors that may be causing this, some of which are: poorer establishment due to 'hair pinning'; increased surface compaction; deeper soil structure decline; decreased organic matter; and increased evaporation. The data analysis also found that grazing stubbles reduced the water available to the subsequent crop by 15 mm.

Extending this to yield, this amounts to 225 kg of grain (at 15 kg grain/mm). Factors involved in this reduced water availability include reduced infiltration rate and increased run off, both leading to poorer fallow efficiency. Added to the above figure, the total potential loss from grazing amounts to 485 kg out of a total average yield over all paddocks of 2.4 t/ha. This is supported by Kirkegaard & Hunt (2010) who found grazing stubble can negatively influence fallow efficiency by reducing soil porosity and infiltration rates, and increasing soil strength and bulk density. Modelling of these effects indicates yield reductions of up to 10%, which is comparable, although obviously less than, that found by the eight years of actual paddock data in the BettaCrop® program.

It is important to note some of the benefits the cropping enterprise can obtain from retained stubble, as crop residues can improve fallow efficiency in several ways. Firstly, its presence minimizes the physical impact of raindrops on the surface soil, meaning that soil surface structural integrity and, consequently, infiltration rates are maintained, resulting in less run-off. Stubble also slows down the flow of water on the soil surface, allowing more time for infiltration, and can slow soil evaporation between rainfall events. (Kirkegaard & Hunt 2010). The deeper penetration of water from rainfall afforded by increased infiltration also better protects stored moisture from the forces of evaporation. Packer (2010) also demonstrated the benefits of retained stubble with a simple rainfall simulator. The key findings were that, in a cultivated plot, it took only 2–6 minutes to seal the soil surface and 4–7 minutes for run-off to commence, compared to a stubble plot of 4 t/ha, where there was no impact on surface soil and run-off did not commence until after significant rain. The measured difference in total infiltration of the rain applied between the two treatments was 24% (13 mm). The stubble plot retained 89% (46.9 mm) of water applied, whereas the cultivated plot retained only 65% (34 mm).

While it is possible to quantify the crop 'costs' in terms of yield loss due to grazing, the much harder question is quantifying the gains in the livestock enterprise, and these are rarely monitored when stubble is grazed. Just having a paddock with reasonable groundcover to put stock on post harvest has been a blessing of recent years. In many cases, the plain reality is that 'there is more in the stubble than what they were on'. Stubbles vary in quality and so does the animal performance on them. The absence of this performance data makes it difficult to objectively comment on the benefits to the grazing enterprise of this stubble, and to the business as a whole, and each situation will be different. However, what is the price of not having to trail feed sheep in the summer heat?

Farming in a grazing enterprise – the role of grazing cereals

For those predominately east of the Newell Highway, this is probably a far easier option than for those to the west. That said, there is good data available to say it is still quite achievable in both regions. The area of farms sown to grazing cereals has expanded in recent years, and grazing canola is also seen as an alternative. It must be noted however, that a 'cropping' rotation in the eastern regions of NSW probably consists of four crops per cycle or less, with the main aim being to get the paddocks back to a strong pasture base, which hopefully lasts for eight or more years. There are many ways to examine the grazing cereals; is it a crop that provides some grazing, or is it a paddock of feed that, if the season is favorable, the grain is a bonus? Either way, the huge benefit of these options depends on careful management – by spreading the "harvest" periods (grazing and grain), both cash flow timing and total revenue are improved.

A rare event in recent years, has been a "full" profile at planting. Kirkegaard & Hunt (2010) modelled fallow rainfall and plant available water (PAW) at sowing at Bogan Gate NSW, using 120 years worth of rainfall data (Figure 1). PAW is directly related to the soil type, and each soil has its own PAW capacity (PAWC) as illustrated for this Bogan Gate soil. Fallow efficiency increases with rainfall, to a point beyond which PAWC is maximised, and additional water is draining or running off – i.e. the 'bucket' is full. As mentioned, this has been very rare, but it does provide an opportunity, with grazing cereals, to maximise the capacity of a crop to utilise as much water as possible.

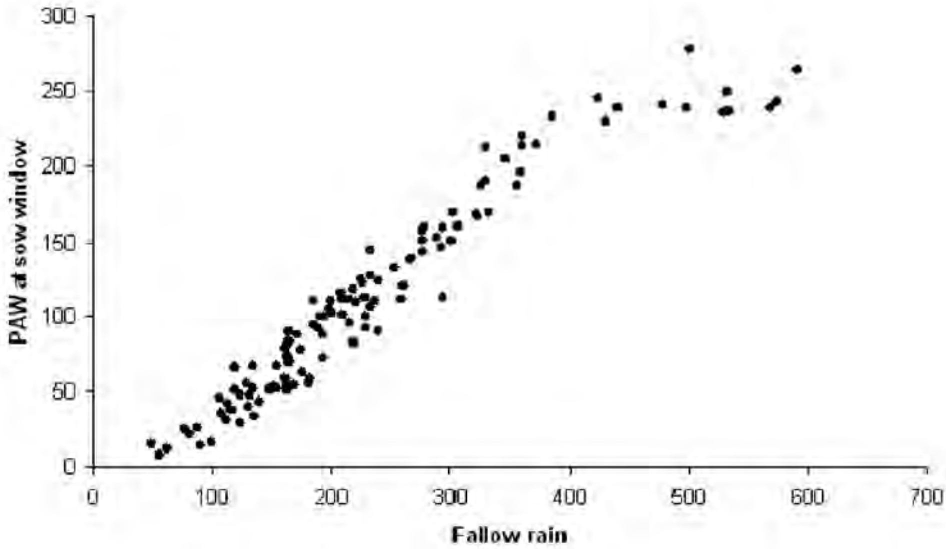

Figure 1: Plant available water (mm) at the sowing window for one location at Bogan Gate, NSW (120 years data)

The optimum time to plant grazing crops east of the Newell Highway ranges from mid-late February through to April. Managing this 'water bucket' from a grazing perspective is a win – win situation. The early growth can be grazed as intended, and the water used in this early dry matter production is replenished by rain that falls through mid-late autumn and early winter. This prevents any unfortunate run-off or leaching losses, and produces dollars through the grazing enterprise. Early-sown crops also potentially develop deeper root zones that better prepare them for the task in spring of extracting moisture from more of the profile and turning it into more grain.

A real-life example

James Hart, managing a commercial operation at Cumnock for the past 11 years, has long been an advocate of grazing cereals in his business. In 2009, James made a concerted effort to quantify the production achieved from his cereals, and has kindly allowed the use of his data in this paper.

Cumnock lies approximately half way between Dubbo and Orange, to the west of the Mitchell Highway. At 600 metres above sea level, the 'non seasonal' rainfall pattern totals 600 mm/year. James pays significant attention to his planning, and the fallow period prior to the grazing cereal is priority number one – water storage. Planting of wheat usually commences in mid March, closely followed by barley. In this example, the wheat variety was the winter type Marombi, and the barley variety was the main season spring type Gairdner.

Grazing performance outcomes

There were eight grazing cereal paddocks in total in 2009, encompassing 191 ha. Five were barley (129 ha) and three wheat (62 ha). Grazing is principally steers but, when push came to shove, in order to get enough grazing pressure applied, all resources were used, including cows, ewes, and hoggets. Grazing commenced on 4th May (i.e. 50 days after sowing), and stock were rotated to other paddocks to leave approximately 1200–1500 kg/ha green dry matter. Tables 1 and 2 are a summary of the eight individual paddocks combined, to be crop specific for performance interest. The starting steers were purchased at approx 250 kg just prior to the crops being ready for their first grazing. The grazing time in total on winter cereals was 127 days, with a resulting sell weight, straight off the crop onto the truck of approximately 475 kg (a gain of 225 kg/head). In simplifying the total gross margins, James equated the total grazing returns based on the steers measured performance, being an average daily weight gain of 1.7 kg per head at a sell price of $1.80 per kg. There were a number of assumptions made: urea at $600/t (urea rate varies from 50–100 kg/ha), harvest at $16/t, and freight to the 'on farm' storage at $5/t, all of which are then attributable to the cropping enterprise. The wheat paddocks all received 100 kg/ha urea, as they had a longer cropping history compared to the barley paddocks.

The ability to manage risk in the grazing cereals is clearly demonstrated in Table 1. By allocating all the establishment costs of a grazing cereal (Table 2) to the grazing enterprise, careful management can return positive gross margins by the end of August or early September. At this point, whatever the season delivers from here on is another opportunity. Depending on the seasonal outlook, the current soil moisture status and knowledge of the soil nitrogen levels, James would make a 'cropping' decision. Topdressing of nitrogen, the need for a late season broadleaf spray, potential stripe rust issues and other pending harvest costs (Table 2) are all costs attributed to the cropping or harvest returns. Whilst the yields are lower than the expected conventional wheat-only yields for the district, the total paddock gross margins are far better.

Discussion and conclusions

There is strong interest in grazing crops, and there is no reason why James results cannot be replicated. Even at lower production potential, a grazing crop scenario should be gross margin positive by the end of grazing. James attributes the difference between species, to be paddock selection based. The wheat was sown into older cropping country, which had had canola previously, and visually showed nitrogen deficiency early on, which significantly impacted on dry matter production. Another factor in the differences between species is that the final paddock gross margins can swing significantly on the 'bonus' grain yield, quality and price. That said, James' move to use barley was based on the increasing occurrence of wheat stripe rust. His management of the two species would change if both crops were sown again in the same season.

Table 1: Average grazing days per paddock and grazing and crop gross margins

Species	Ave no. Grazing Days per paddock (of 127 days total)	Grazing Gross Margin	Cropping Gross Margin	Total Gross Margin	Gross Margin/ mm PAW rainfall*
Barley	75	$492.46	$248.72	$741.18	$2.17
Wheat	81	$381.43	$277.40	$658.83	$1.93

*Growing season rainfall (PAW) for 2009 was calculated as 'probe' measurement at establishment plus April to November – totaling 341 mm. Grain yields for the barley averaged 2.2 t/ha and the wheat averaged 2.3 t/ha.

Table 2: Grazing and cropping costs allocated to each enterprise

Establishment costs* per ha		Grain Recovery costs per ha	
Spray 1	$17.50	Urea	$30–$60^
Spray 2	$25	Spreading	$7
Seed	$11	Spray	$8
Fertiliser	$150	Harvest	$36
Sowing	$35	Fuel	$12
Rum	$35	Freight	$13
		Rust spray	$9
Total	**$273.50**		$115–145

*Assumptions made are seed at $200/t, fertiliser at $1500/t, and all establishment costs are allocated against the grazing enterprise.

He felt that there appeared to be some grazing adjustment time by the animals when they went from wheat back onto barley, which did not seem as evident when the reverse occurred. In future, James would try to manage stock to be crop specific, and develop rotations around each species. It must be noted, that Gairdner barley is not recognised as a grazing variety, and this may explain the animals' adjustment time. Barley also comes with its share of management and disease issues, and all grazing phases need to be matched with crop physiology and development if risks are to be adequately managed.

One area that is not well understood in this system is the potential damage grazing during late autumn and winter has on soil structure. Compaction is obviously one concern, as this can be a period of wetter and colder conditions, with increased soil bulk density a potential outcome. However, the grazing crop phase should be placed in context; a typical perennial pasture rotation may incur a grazing cereal in as few as 1 year in 8, leaving the biological processes during the pasture phase time to repair the soil. Lighter soil types are generally more resilient to grazing damage and, in the presence of increased levels of soil organic matter afforded by the pasture phase and stubble retention, they are capable of suffering less long term damage compared to clays and clay loams.

These systems are profitable with significantly less risk. In James' case, the average gross margin return from the grazing cereals was $2.05/mm of total PAW. By comparison, gross margin returns of wheat only paddocks in the 2009 BettaCrop® database of greater than $1.00/mm of total PAW were limited to the top 25% of paddocks, with only 5 wheat paddocks out of the 186 in the data set for the same region returning more than $2.00/mm of total PAW. In 2008, with 302 wheat only paddocks in the data set, the return of the top 25% of wheat paddocks was at least $1.20/mm of total PAW, with only 8 paddocks returning greater than $2.00/mm of total PAW. Sadly, the bottom 25% of wheat paddocks in the same data set of 2009 had losses of greater than $0.10/mm of total PAW, and in 2008 the losses were greater than $0.20/mm of total PAW. Thus, the obvious key benefit of the grazing cereals is the risk management factor, and that a positive return is most likely regardless of the need for grain recovery.

However, the large gains that are achievable do not come by luck. Summer rain will happen, and to take full advantage of it, one needs to be planned and organized. Much work has been done acknowledging that summer weeds are the biggest water users, and to have a 'full bucket' ready to sow into by early March requires careful attention. To do this properly, is not for the faint hearted. It isn't beyond reach, but one just needs to be committed to the cropping and grazing management skill set required.

Acknowlegement

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