Pasture cropping checklist

G.D. Millar and W.B. Badgery

Industry & Investment NSW, Orange Agricultural Institute, Orange NSW 2800
geoffrey.millar@industry.nsw.gov.au

Introduction

Since its conception in the 1990's in central NSW, Pasture Cropping has evolved into various forms as it has been used and adapted by farmers. To avoid confusion amongst the different adaptations we have defined the three major forms of pasture cropping systems (Badgery & Millar 2009) as:

Pasture cropping (PC) – winter cereal crops are sown into summer active (C_4) perennial pasture (such as Redgrass or Warrego grass), usually after the first frost. This activity is done primarily for grain production with weed control when required.

Perennial intercropping (PI) – similar approach to pasture cropping but pastures are predominately temperate, such as lucerne in a degraded/weedy form.

Advanced sowing/no kill cropping (AS) – dry sowing of winter cereal with a disc seeder into pastures of varying types, before autumn rain and with no herbicide. This activity is done to improve feed quantity and quality.

To help determine whether these pasture cropping systems offer appropriate options for farmers, NSW Industry and Investment researchers have developed a checklist for Pasture Cropping systems. This checklist includes rainfall distribution, pasture species present, paddock history and management objectives. While pasture cropping systems are promoted as low input, low risk farming systems, producers need to be aware that the following checklist needs to be addressed before embarking on a successful pasture cropping system.

Seasonal rainfall distribution

Pasture cropping systems were developed in central NSW where monthly rainfall distribution is even. These systems utilize rain as it falls, so if summer fallows are required for winter cereal crop production, then crop production is likely to fail more regularly and pasture cropping systems will not perform as well as conventional cropping systems. However, if the soil has a low moisture holding capacity (for example sandy soils), pasture cropping systems may be appropriate as conventional cropping with a fallow period is unlikely to store much moisture.

Pasture species present

PC utilizes the complementary growth patterns of a summer growing pasture with a winter growing cereal, minimizing the competition between the pasture and the crop. Summer active or C_4 pastures are predominately native pastures, and include Redgrass (*Bothriochloa macra*), Warrego grass (*Paspalidium jubliflorum*), Kangaroo grass (*Themeda australis)* and Windmill grasses (*Chloris* spp.and *Enteropogon acicularis*), or the sown subtropical exotic grasses Gatton panic (*Panicum maximum*), and Rhodes grass (*Chloris gayana*).

PI involves sowing a winter active cereal into a C_3 or temperate pasture such as the introduced lucerne and phalaris, or native Wallaby grass (*Austrodanthonia* spp*)*. These species compete with the sown crop for both nutrients and soil moisture when the crop is actively growing. The more degraded the temperate pasture (such as low plant density or low biomass), the less competition there will be between the cereal and the pasture, and PI may be successful. However, as the temperate pasture becomes more degraded, weed control becomes increasingly important.

Because AS is essentially dry-sowing an annual grass into a pasture, if the selected paddock has a high annual grass content, then AS will not

be successful because of the competition from the already present annual grasses. If there are no annual species present, AS may provide additional feed providing rainfall is effective post-sowing.

Paddock history

Fertilizer input history and overall soil fertility play important roles in the economic success of pasture cropping systems. On paddocks with high input history and good soil fertility, pasture cropping systems can be profitable with low inputs. However, repeated low input cropping runs the risk of "mining" the soil resources, with the continued success of such systems in subsequent years unknown.

On paddocks with low input history, as is often the case with native pastures, cereal performance is closely related to soil nitrogen. The majority of N used in crop growth is from N mineralized from previous plant and crop residues, which occurs at the greatest rate over summer. Summer active grasses will use nitrogen that mineralizes over this period, and even with increased fertilizer levels there is often not sufficient soil N for optimum crop growth. The end result is decreased crop yields in pasture cropping systems compared to conventional crops.

Management objectives

Management objectives (production and Natural Resource Management – NRM elements) need to be clearly defined to help decide when pasture cropping systems are more appropriate than conventional cropping or other pasture management techniques. In some situations profit and NRM objectives may be complementary, but in others there may be trade-offs between short-term profitability and longer-term NRM objectives that are difficult to economically quantify.

If economic grain production is an objective, appropriate nutrition and weed control are essential, especially as degraded pastures often have a large weed population. Because of the lack of a planned summer fallow, opportunity grain production is an option, and may be more suited to a grazier wanting to do some cropping, than a for a full-time grain producer. Because of the lack of a planned summer fallow in PC and PI, the decision to plant a crop or not can be made quite late in the "sowing window", without the economic costs of fallow preparation and loss of usable forage. However, this is not the case for AS, as the cereal is dry-sown before the autumn break.

If increasing the amount of forage available with minimal soil and ground cover disturbance is a management objective, then pasture cropping systems may provide an option. However, if the pasture already has a dominant annual grass population, pasture cropping systems will not be successful. Research has shown no detrimental effects of pasture cropping systems on Redgrass pasture and lucerne production, but to be economically successful, this forage needs to be efficiently utilized. By retaining the perennial species in the pasture, the NRM benefits associated with these perennials (erosion, acidity, salinity and biodiversity) are maintained.

Concluding comments

Do pasture cropping systems have a role in regenerating pastures? The research evidence to date is inconclusive, but there have been no negative effects on C4 perennial grass recruitment. However, appropriate grazing management has been shown to be effective in rejuvenating perennial pastures.

How often should I pasture crop? Continual low input pasture cropping will lead to "mining" of the soil resources. While research has shown that continuous PC or PI can be successful, continual cropping does run the risk of cereal-borne diseases affecting grain yields. Farmers who wish to undertake pasture cropping systems on their farms need to evaluate where the activity should take place as part of a long-term farm plan and paddock rotation.

The following table summarises the suitability of a paddock to pasture cropping systems.

References

Badgery, WB & Millar, GD 2009 Pasture cropping. Primefact 875, New South Wales Department of Primary Industry, Orange.

Item	Pasture cropping systems		
	Suitable	**Conditional**	**Unsuitable**
Seasonal rainfall distribution	Profitable crop can be grown without a summer fallow		Summer fallow is essential for a cereal crop
Dominant pasture species	C4, summer active species	C3 perennials – success depends on amount of C3 in pasture	Annual grasses
Paddock history (fertility)	High fertilizer history – low input suitable	Low fertilizer history – high inputs required	Low fertilizer history with minimal inputs at sowing
Management objectives	Cropping 1 year in 5, or opportunistic	Cropping for 2 or more successive years	Continuous cropping
	Maintain ground cover in 1 year cropping activity	Grain production – depends on weed control and fertility	
	Low risk – flexible decision making (except for Advanced Sowing).	Increase forage production – depends on Dominant pasture species and available livestock	
	Retain perennial species in 1 year cropping activity. (C4 and lucerne)	Regenerate pastures? – may create niches for increased perennial grass recruitment	