Do pasture cropping systems work out west?

G.D. Millar[A] and W.B. Badgery

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

Abstract: *Pasture Cropping and No Kill Cropping can be successful in the western areas of the Central West and Lachlan CMAs. However, unless appropriate herbicides are used, paddocks with high annual grass content are not suitable for Pasture Cropping or No Kill Cropping. Pasture Cropping systems rely on sown cereal crops to have a greater growth rate than germinating annual weeds.*

Introduction

Previous reports into Pasture Cropping systems (Millar and Badgery 2009), has concentrated on work carried out at Wellington (620 mm average annual rainfall, evenly distributed throughout the year). To see if Pasture Cropping is suitable in the drier, western areas of the Central West and Lachlan Catchment Management Authorities, trial sites were established in 2005 at Trangie (I&I NSW, Trangie Agricultural Research Centre – TARC) and Condobolin (I&I NSW , Condobolin Agricultural and Advisory Station – CARAS). In 2007, a further trial was set up on the property 'Willydah' approximately 20 km SE of Trangie. This research examined Pasture Cropping at Trangie and Condobolin and a variation of Pasture Cropping called No Kill cropping at Trangie and 'Willydah'. Badgery and Millar (2009) defined pasture cropping as winter cereal crops sown directly into dormant summer active perennial pastures after the first frost to utilise the difference in plant growth patterns. The aim of this system is primarily to produce grain rather than forage. For No Kill cropping (also known as Advanced Sowing) winter cereal crops are sown dry, before the autumn break, into perennial pastures of varying composition without the use of herbicides. The aim of this system is to provide additional winter and spring forage for grazing with grain harvested only on an opportunistic basis.

Methods

At TARC, two paddocks, 'Hoggets' and 'Vince' were selected, to which three treatments were applied from 2005 to 2007, replicated twice. The three treatments were:

1. *No Kill Crop:* Plots were dry sown in May with a disc seeder, which produced little soil disturbance. Lang wheat was sown at 40 kg/ha in 2005 and Yarran oats at 60 kg/ha in 2006 with no fertiliser. No herbicides were applied during 2005 and 2006. In 2007, the *No Kill Crop* treatment was modified to a conventional *No Till* treatment. This was achieved with a chemical fallow using glyphosate in February and April. A paraquat/diquat knockdown spray was applied in June prior to the sowing of Lang wheat at 40 kg/ha with 50 kg MAP/ha.
2. *Pasture Crop:* Plots were sown after rain in June using an air seeder fitted with Super Seeder points. Lang wheat was sown at 40 kg/ha with 40 kg MAP/ha in 2005, Yarran oats at 60 kg/ha with 40 kg MAP/ha in 2006, and Lang wheat at 40 kg/ha with 50 kg MAP/ha in 2007. Plots were sprayed with 1.5 L/ha of paraquat/diquat prior to or at sowing. Glean (chlorsulfuron) was applied at 25 g/ha in July each year.
3. *Pasture:* Plots were not treated with fertiliser or herbicide.

At CARAS, two replicates of two treatments were established:

1. *Pasture Crop:* Plots were sprayed with glyphosate (540 g/l, 0.8–1.0 l/ha) 1–2 days prior to sowing. Yarran oats (45 kg/ha) was sown on June 26, 2005 with 45 kg MAP/ha, Sunstate wheat (35 kg/ha) was sown on June 20, 2006 with 60 kg MAP/ha, and Ellison wheat (35 kg/ha) was sown on May 25, 2007 with 50 kg MAP/ha. In crop herbicides were

required in 2005 and 2006 – MCPA (0.3 l/ha), and Igran (0.5 l/ha) on August 5, 2005, and Hoegrass (1.0 l/ha) on July 25, 2006.

2. *Pasture:* Plots were not treated with fertiliser or herbicide.

In 2007, two treatments replicated three times were set up on the property 'Willydah':

No Kill Crop: Treatments were dry sown with oats at 40 kg/ha in March.

Pasture: Plots were not treated with fertiliser or herbicide.

Measurements at all sites included assessments of plant composition, green and total biomass, and ground cover.

Results

Growing season rainfall (May to October) was above average in 2005, but below average in 2006 and 2007, with total rainfall in 2006 less than half the long term mean (Table 1).

At TARC, by November 2005 there was no difference between the treatments in total biomass (Fig.1). Throughout 2006, there was less total biomass on Pasture Crop up to November, when again there was no difference between treatments. There were no consistent differences in green biomass throughout the trial. In 2005 and 2006, significantly more cereal biomass was produced on Pasture Crop compared to No Kill Crop. In 2007, there was no difference between Pasture Crop and No Till in cereal biomass production.

While perennial grasses played a minor role in both sites, annual grasses were a major contributor to biomass at both sites. Annual grasses were significantly reduced by Pasture Crop in 2005 and 2006. In 2007, more annual grass biomass was present in Pasture compared to No Till and Pasture Crop. Legumes were significantly reduced by Pasture Crop in 2005 and 2006. In 2007, more legume biomass was present in Pasture compared to No Till and Pasture Crop. In 2005 and 2006, less broadleaf biomass was produced on Pasture Crop. In 2007, No Till had the least amount of broadleaf biomass, while Pasture had the greatest.

The reduction in legume and broadleaf biomass associated with the Pasture Cropping treatments could have been due in part to the post sowing application of chlorsulfuron, as it has a strong residual effect on most broadleaf plants (especially medics and clovers).

Ground cover was significantly reduced by Pasture Crop throughout the experiment. Prior to 2007, No Kill Crop did not affect ground cover, but in 2007, the No Till treatment reduced ground cover to levels similar to Pasture Crop.

At 'Willydah', the No Kill Crop treatment significantly increased total and green biomass over Pasture, due to the sown crop. Perennial and annual grasses and broadleaf biomass were not affected, but legume biomass was reduced on No Kill Crop. Ground cover was increased on No Kill Crop compared to Pasture.

For grain production at TARC, in 2005 No Kill Crop yielded less than 1 t/ha, while Pasture Crop treatments averaged 2.4 t/ha at 13.4% protein. A well grown crop would have yielded 3.2 t/ha on the 320 mm of growing season rain (Sadras and Angus 2006). In 2006, drought affected all plots and none were harvested. There was little difference between Pasture Crop and No Till cereal yield in 2007 (average yield of 0.4 t/ha).

At Condobolin, the Pasture Crop sowing treatment increased spring total and green biomass over Pasture, primarily due to the sown crop (Fig. 2). Annual grasses were not affected.

Table 1. Annual and May to October rainfall (mm) at TARC and CARAS for 2005 to 2007 and long term mean (mm).

	TARC		CARAS	
Year	May to October	Annual	May to October	Annual
2005	318	509	293	399
2006	102	207	107	178
2007	125	522	146	498
Long term mean	183	485	205	425

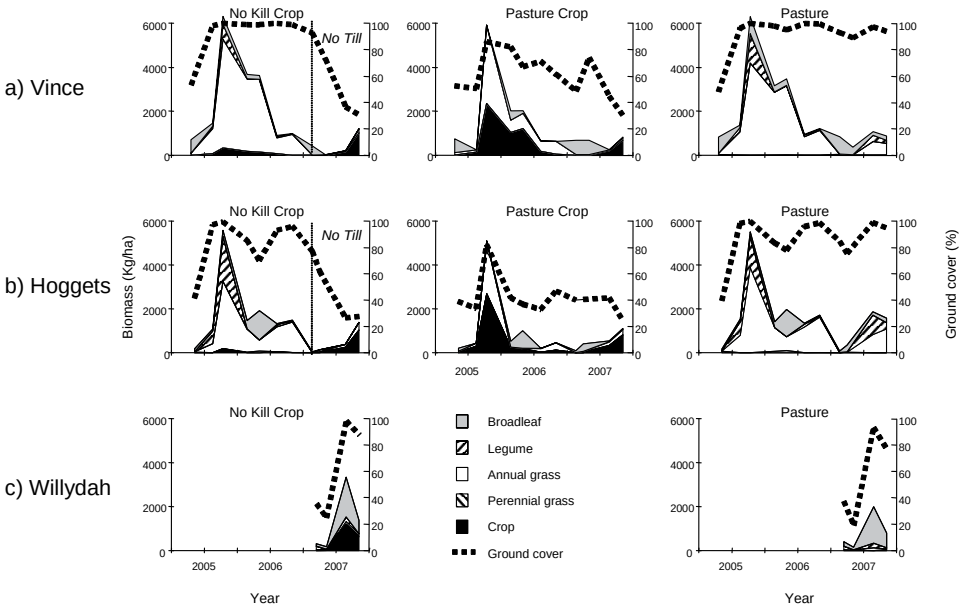

Figure 1. Total and functional group (crop, perennial grass, annual grass, legume and broadleaf species) biomass and ground cover over time for No Kill Crop, Pasture Crop and Pasture at TARC a. Vince, and b. Hoggets, and 'Willydah' c. No Kill Crop and Pasture. Note the change in No Kill Crop for Vince and Hoggets to No Till in 2007.

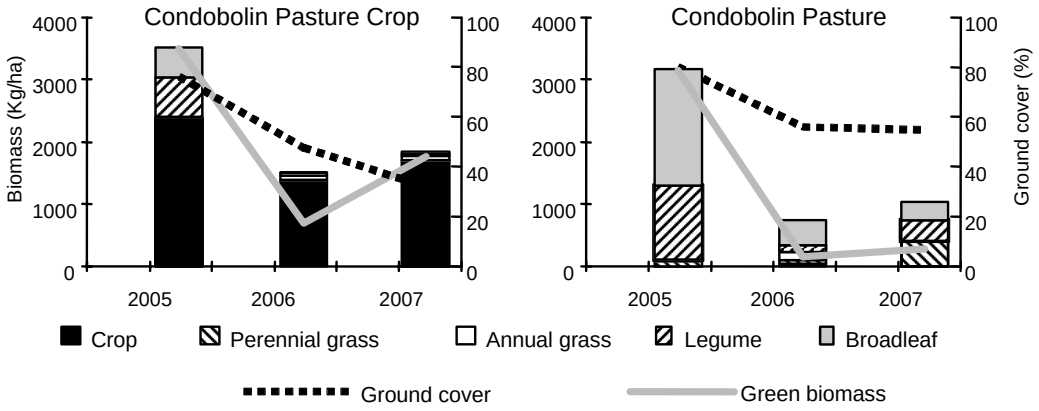

Figure 2. Total, green and functional group (crop, perennial grass, annual grass, legume and broadleaf species) biomass, and ground cover measured in spring over time for Pasture Crop and Pasture at CARAS.

However, perennial grass, legume and broadleaf biomass were reduced in Pasture Crop. Ground cover was reduced by Pasture Crop compared to Pasture.

A harvestable crop was grown in 2005 and the average yield was 1.2 t/ha of oats. A well grown crop would have yielded 2.9 t/ha on the 290 mm of growing season rain (Sadras and Angus 2006). However, because of dry conditions, all plots were grazed in 2006 and 2007.

Discussion

This research work has shown that cereals can be grown successfully in perennial pastures for either grain and/or forage in drier conditions in the western areas of the Central West Catchment Management Authority (Trangie – 485 mm AAR) and Lachlan Catchment Management Authority (Condobolin – 425 mm AAR), providing paddock conditions are suitable. In annual grass dominated pastures at TARC,

Pasture Crop did not produce any extra biomass compared to Pasture, whereas at CARAS where there was minimal annual grass, pasture cropping increased spring biomass. No Kill Cropping in annual grass dominated pastures at TARC resulted in very poor cereal production, but at 'Willydah', where there was minimal annual grass, No Kill Cropping produced more biomass than pasture. As Pasture Cropping or No Kill Cropping without herbicide relies on the cereal having a greater growth rate than germinating annual weeds, paddocks with high annual grass content are not suitable unless an annual grass herbicide is applied.

At TARC, No Kill Cropping and Pasture Cropping did not produce more biomass than Pasture during the dry year of 2006. The flexibility of Pasture Cropping in commercial practice would have meant that the crop would not have been sown in 2006, whereas because the cereal is dry sown early for No Kill Cropping, it would have been sown. Whether the system is profitable in the long-term is determined by the number of years a profitable crop or forage can be grown, which is largely determined by rainfall. This can be somewhat negated by the decision making process in Pasture Cropping about whether to crop or not, but is not the case for No Kill Cropping.

As reported for Wellington (Millar and Badgery 2008) ground cover will be decreased by Pasture Cropping compared to Pasture, due to soil disturbance by tynes at sowing, as compared to No Kill Cropping which maintained ground cover with little soil disturbance.

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