Dual Purpose (graze & grain) Cropping : GRDC funded

Background

There have been encouraging research and broad-acre results on the mainland and locally in terms of animal weight gains and grain yield when grazing dual-purpose cereal and canola crops at appropriate crop growth stages. Having the option to graze crops during early winter allows pastures to achieve optimum density and leaf area index during the traditional winter feed gap period, which then improves management options and potential to increase overall farm carrying capacity. Given appropriate crop and grazing management, these benefits to the farming system can be achieved without greatly reducing grain yield.

The proposed research aims to demonstrate and refine the technique to suit the many mixed farmers on Kangaroo Island. Initially crop and variety selection were researched in 2007, however crop management may be targeted in the future, including time of sowing, sowing rates, N timing, grazing timing, grazing duration, weed management and associated stock benefits such as feed quality and live weight gains.

What was done

Site Selection

The research was conducted at Karatta on the property of R&A Morris. The soil type is an acid sand over clay duplex, recently clayed and limed to improve non-wetting and acidic characteristics. Soil tests reveal no obvious fertility problems in the top 10cm (41ppm P, 145ppm K, 10ppm S, pH_{CaCl2} 5.7, 1.9% OC). Lupin stubble from 2006.

Trial design

Two varieties of wheat, barley, triticale, oats and canola were selected and replicated 3 times to give 30 plots. Splitting these in half for the grazed and ungrazed treatments gave 60 x 0.05ha plots. Plot size was designed to accommodate normal broadacre machinery and to give enough grain for statistical analysis using a weigh trailer.

Variety Selection

Varieties were selected considering a combination of familiarity to local farmers, previous grazing/grain research and those specifically bred for recovery from grazing.

Canola varieties included an Imi-tolerant hybrid variety 46Y78 renowned for early vigour and a Triazine Tolerant variety ATR Thunder.

Triticale was included in the trial due to its suitability to local conditions and general shift by grain growers to produce locally consumed feed grains. Varieties Speedee and the later maturing Yukuri were selected.

Wheat varieties included the specifically bred dual-purpose wheat Wedgetail and the spring wheat Wyalkatchem, the latter showing good recovery from grazing on the mainland and a very popular local variety.

Oat varieties Possum and Wintaroo. Possum is a dwarf milling oat bred specifically for its grain production. Wintaroo is a mid-season tall oat that has good leaf production.

Barley varieties Gairdner and Cape. Cape is an old 6-row variety used as a dual-purpose variety for decades and as such has a very rank growth habit and low grain harvest index (grain to dry matter ratio).

Simulating grazing

Grazing was simulated by mowing, which became necessary given the eventual size and layout of the trial site. Mowing obviously affects the crop differently to grazing arising from:

- Lack of selectivity, sheep may initially selectively graze weeds over the crop.
- Nutrient recycling
- Prostrate crops not upset by mowing as much as erect crops (eg Cape barley very prostrate). This was even more pronounced given that the trial was seeded with press wheels and plants were growing in the bottom of the furrows.
- Less trampling with mowing.

Mowing was targeted for growth stage 30 (just prior to stem elongation) of the mid-maturing cereals and cut twice over a 10 day period. This coincided with early maturing varieties being slightly more advanced at the time of mowing and late maturing varieties being less mature. Canola was mowed at first flower, considered to be later than ideal.

Crop agronomy

- Site cultivated on April 27th to stimulate ryegrass germination with 50mm rain on 26th and 27th April
- Knockdown with Glyphosate on May 1st (+ Simazine on TT canola plots)
- Seeded 2nd May; all plots received 8:18:0:20 at 105kg/ha
- Sprayseed prior to emergence 5th May. Canola plots also received bare earth insecticide; cereal plots also received DualGold for ryegrass
- Post-emergent for canola 18th May; Intervix + Select for Imi canola, Atrazine + Select for TT canola
- Glean + Fastac over cereals for weeds and aphid deterrant 1st June
- 75kg/ha Urea over all plots on 22nd June and again July 13th. 100kg/ha SOA over canola July 5th
- Cereals mowed 28th June and again July 6th. Canola mowed 2nd August
- Locky's brew flown on Sept 5th; 7kg N, 166g Mn, 330mg Mg
- Harvest 10th December

Measurements

Sowing rates, plant densities, dry matter production at mowing, yield and oil (canola), barley head loss and yield were measured.

Possum oats were affected by copper deficiency and then bird damage prior to harvest. ATR Thunder was unable to recover from mowing sufficiently to compete with ryegrass (herbicide resistant) and plots were therefore abandoned. Hybrid canola, given its extra vigour was better able to recover from mowing and compete with weeds. Severe head loss in barley resulted from a combination of early nutrition resulting in a rank plant (susceptible to necking) and bird damage. Head loss was recorded and used in conjunction with reapt grain to calculate grain yield for barley.

Valuing dry matter production

There are numerous ways to place a dollar value on the dry matter consumed by stock. One way is to value the dry matter directly based on hay prices. For example, hay at $250/t gives a return of $250/ha with 1000kg/ha dry matter removed. Alternatively, the value of grazing can be assessed via meat/wool gains (i.e. value added produce). Using this method, the dollar value is dictated by the value of the product grown (meat vs wool) and the efficiency in which the dry matter is converted into that product eg for meat; wethers vs prime lambs.

Results

Variety	Plants per m^2	D Matter (kg/ha)	Grain yld (t/ha) *LSD 5%=0.5t/ha*		Economics		
			Grazed	Ungrazed	$loss.gain/ha grain[#]	$value/ha as hay[#]	Total $ gain/ha
46Y78 canola	65	2220*	1.6	2.0	-$200	$555	$355
ATR Thunder	55	1502*	Not reapt	Not reapt			
Possum oats	191	1338^	0.87	0.47	+$100	$334.5	$434.5
Wintaroo oats	162	953^	1.79	2.31[@]	-$130	$238	$108
Cape barley	162	918^	3.34	2.92	+$105	$230	$335
Gairdner barley	146	1241^	3.34	3.56	-$55	$310	$255
Speedee triticale	137	1492^	2.39	3.07[@]	-$170	$373	$203
Yukuri triticale	200	1087^	2.79	3.07	-$70	$272	$202
Wedgetail wheat	109	748^	3.04	3.02	+$5	$187	$192
Wyalkatchem wheat	127	1026^	3.33	3.33	$0	$257	$257

* Measured 92 days post sowing (9/7/07), LSD 5%=393kg
^Measured 68 days post sowing (2/8/07), LSD 5%=287kg
[#] Hay at $250/t, grain at $250/t, canola at $500/t
[@] Incurred statistically significant yield loss from mowing

Weight gains of 300g/hd/day have been measured in lambs grazing cereals on the mainland. This gives a total weight gain of 4.2kg/head for a 2 week grazing period (1.9kg of carcass at 45% dressed weight). Stocking rates of 35.7 sheep/ha (aiming to remove 1000kg/ha DM in 2 weeks with 2kg/hd/day consumption) gives a return of $217/ha ($3.20/kg for lamb). Furthermore, there must be value in allowing pastures to reach optimum density and leaf area whilst the crop is being grazed.

Discussion and future directions

2007 results showed some varieties to experience no significant yield penalty when mowed at growth stage 30 given appropriate crop management. The very early maturing triticale variety Speedee had approached growth stage 32 at the time of mowing and therefore suffered a greater yield penalty from mowing than other varieties such as the later maturing Gairdner, Yukuri, Wedgetail and Wyalkatchem.

Note the dry matter results for all varieties were taken on the same day so early maturing varieties are likely to have developed more dry matter simply due to being more physiologically advanced.

Canola mowing was conducted later than ideal and therefore the yield penalty was quite pronounced. As with the cereals, crop maturity was delayed in the mowed plots, ie., flowering 7-10 days later which forced grain fill further into a period of drought stress during late October. The later maturity also exposed the mowed plots to greater caterpillar damage, particularly plutella or diamond back moth.

Future research may involve refining the management of crops to be grazed, ie., time of sowing, sowing rates, N timing (canopy management), timing and duration of grazing, animal growth rates.

Stocking rates and duration of grazing

Current thinking is to introduce stock once plants are well anchored (any time from 3 leaf) and up until GS30 (stem elongation) before the growing point becomes susceptible to grazing. Duration of grazing will depend upon stocking rates. A pick grazing where sheep are lightly stocked could continue for up to 4-6 weeks. High stocking rates could be used for shorter periods for example: with sheep removing 2kg/head/day, a 2 week grazing period with 1000kg/ha dry matter available could be achieved with a stocking rate of 35.7 sheep/ha.

Funding/Sponsors

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- Nufarm (Russell Meade) Intervix herbicide
- R&A Morris: property
- Pat Crowther: aerial application of foliar fertiliser
- P Lock: foliar fertiliser

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Take home message

- 2007 results showed two varieties experienced statistically significant yield penalty from mowing when medium maturing varieties were mowed at growth stage 30 (given appropriate crop management)
- Early sowing thought to be very critical to minimizing yield penalty from grazing - to be researched
- Crop management will be different for both graze/grain versus pure grain crops - to be researched
- Grazing crops gives pastures a chance to establish and grow at optimal growth rates during winter
- Sheep can be used to selectively graze weeds - to be researched