ASHEEP Pasture Variety Trials 2022 Results

Report Author: Chad Hall & Rachel Minett, South Coastal Agencies *Published: 21/02/2023*

Introduction

In April 2022, South Coastal Agencies (SCA) accepted the opportunity to participate in what would be the third year of the ASHEEP Pasture Variety Trials, a Meat & Livestock Australia (MLA) Producer Demonstration Site (PDS) project. Previously managed by South East Agronomy Research (SEAR), plot-scale pasture variety trials were established in various rainfall and soil zones within the Esperance region. The objective of years one and two of the trial was to determine suitable varieties to be trialled in paddock scale grazing situations while assessing their persistence to re-establish over the coming years of the trial.

2022 being the third of the five-year trial, SCA worked with sheep and cattle producers to assess pasture performance in several different management systems, soil types, and rainfall zones. The objective was to evaluate the pasture performance and stocking rate potential as well as the cost of production in order to make an economic analysis of each situation. The areas were split into rainfall zones, high (+550mm), medium (350mm), and low (<350mm) and appropriate pasture varieties were chosen for each zone (see image 1).

Image 1: Pasture Rainfall Zones by Site

Pasture Mixes in Trial

Low Rainfall Zone (LRZ) – 350mm

- **Cascade Site 3:** Barloo and RM4 Vetch
- **Salmon Gums Site:** Leafmore Grazing Brassica

Medium Rainfall Zone (MRZ)– 450mm

- **Cascade Site 1:** Leafmore Grazing Brassica, Santorini, and Margarita Serradella
- **Cascade Site 2:** RM4 Vetch
- **Scaddan 1:** RM4 Vetch
- **Condingup Site 1:** Forester Oats, Planet Barley Sown into a Sub-Clover stand
- **Condingup Site 3:** Abundant Ryegrass, Forster Oats and Rasina Vetch

High Rainfall Zone (HRZ) – 550mm

- **Neridup Site 1:** Forester Oat, Planet Barley into a sub clover stand
- **Boyatup Site 1:** Pascal Wheat, Triticale, Illabo Wheat, Planet Barley, Abundant Ryegrass, Bartolo Bladder Clover, Paradana Balansa, Eliza Serradella and RM4 Vetch
- **Neridup Site 2:** Illabo Wheat
- **Neridup Site 3:** Planet Barley
- **Condingup Site 4:** Forester Oats and Planet Barley

2022 PROJECT PARTNERS

asheep Esperance

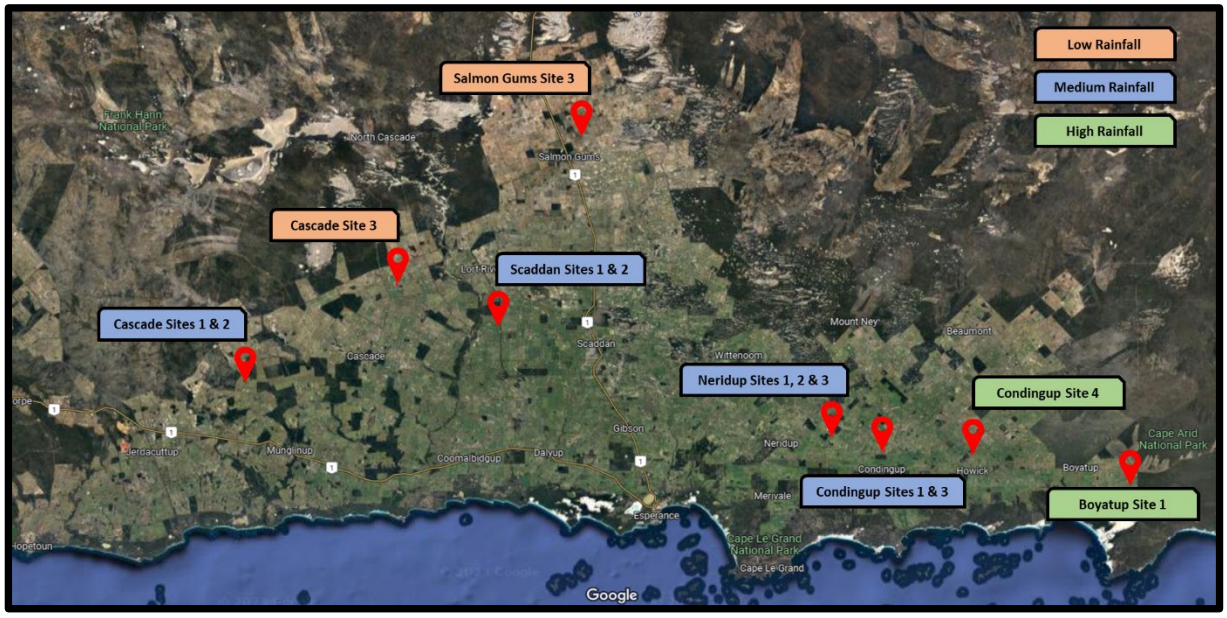
South Coastal Agencies
Esperance – Ravensthorpe – Salmon Gums

mla
MEAT & LIVESTOCK AUSTRALIA

Method

Each site had three pasture grazing cages constructed to allow the producer to graze the paddock with livestock (sheep or cattle) whilst still allowing monitoring of the pasture growth. Soil samples were collected from each paddock to develop an understanding of each site's soil constraints and limitations. On installation of the cages, visual observations were noted, such as pasture composition and establishment, as well as the presence of weeds and other notable pests (mice, diamondback moth, mites). With consistent and widespread opening rains throughout the district, it was determined that the 'break of the season' would be set for the 14th of April 2022 for all sites.

Ten weeks and sixteen weeks after the break of the season, pasture samples were taken from a quadrant and sent away for analysis. Each pasture sample was weighed to determine the wet weight and available biomass to determine kilograms of dry matter per ha (Kg/DM/Ha). The pasture cuts were conducted to simulate livestock grazing; each quadrant was cut evenly to replicate heavy stock grazing, and regrowth was monitored. The presence of weeds, insects, disease, and pasture composition was observed and noted.

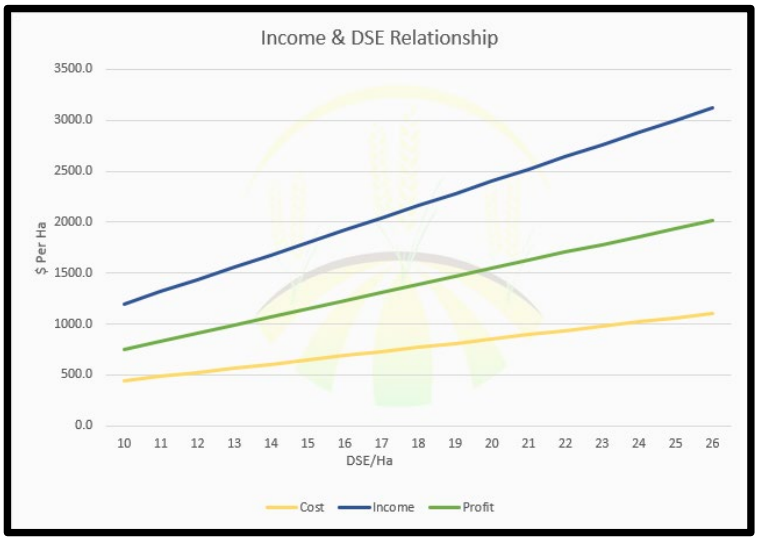


Economic Analysis

An economic analysis was conducted by comparing the number of dry stock equivalent (DSE) that a pasture could maintain over the period the samples were taken (break of the season to sixteen weeks). It is important to note that all data in this report is limited to information collected between the break of the season and sixteen weeks post-break only; this report does not consider pasture biomass or quality beyond this point. It was determined that the best way to compare pastures in differing rainfall environments was to analyse the carrying capacity as DSE per one hundred millimetres of rainfall. The grower inputs were then considered to calculate a cost per ha and a cost per DSE. The input cost per DSE is relevant as it considers carrying capacity to better analyse the direct cost of feeding a DSE. Finally, the value of nitrogen fixation through legume and rhizobia symbiosis was calculated by assuming twenty units of N is fixed per tonne of biomass produced. The value per unit of N was based on a urea price of $920/t with an analysis of 46% N, equating to $2/unit of N.

Stocking Rate Drives Profitability

When measuring the effects of stocking rate on profitability, three aspects were considered 1. Fixed costs: these are costs to the business that won't change regardless of stocking rate, for example, pasture, lease/capital costs. 2. Variable costs: The total sum of this amount will change depending on the number of livestock; examples are contract labour, animal health products and supplementary feed. 3. Sales: All income generated from the enterprise, such as wool and livestock sales. While there is a linear increase in all three aspects; cost, income, and profit, as the DSE/ha increases, the gap between each widens. This is because the costs increase at a slower rate than income and profit due to the dilution effect of the stocking rate on the fixed costs. This illustrates the importance of the stocking rate. The below chart doesn't claim to consider all the costs or income that a livestock enterprise might incur but aims to illustrate the effect that the stocking rate has on the relationship between profit and cost. The biggest limiting factor to the stocking rate is feed availability. This is why the report has measured pasture value in DSE carrying capacity. It's important to consider other factors that may limit the stocking rates' potential, such as soil fragility or pasture seed set.



Fixed Costs		Per ha ($)
Lease	$	100.00
Pasture Seeding	$	140.00
Pasture Manipulation	$	25.00
Total Fixed Costs/Ha	$	265.00

Variable Costs		Per DSE ($)
Animal Health	$	7.00
Supplementary Feeding	$	20.00
Contract Labour	$	15.00
Total Variable Costs/DSE	$	42.00

Income		Per DSE ($)
Livestock Sold	$	70.00
Wool Sold	$	50.00
Total Income/DSE	$	120.00

NRI Analysis

An NRI analysis measures feed quality to ensure that the feed is adequate for the livestock grazing a pasture. Considerations that are used in this report are that a single DSE requires 8.3 megajoules of energy (ME) and at least 9% crude protein (CP) per kilogram of dry matter consumed to maintain condition (pregnant sheep and lambs require 15% CP). All figures used in this report are based on Dry Matter measurements. A description of all measurements has been included below.

Moisture and Dry Matter (DM%) – These two figures add up to 100% and are the inverse of each other. They are the percentage of moisture removed to the percentage of DM remaining.

Crude Protein (CP%) – The most used measure of proteins available from the feed source. CP% is calculated from the nitrogen content in the plant material.

Acid Detergent Fibre (ADF) – ADF measures less digestible fibres, cellulose, and lignin. This can be used to measure digestibility or how much of the DM is useful. The higher the ADF content, the lower the digestibility.

Neutral Detergent Fibre (NDF) – NDF is a prediction of all digestible and indigestible fibre contained by the feedstuffs. This encompasses all the ADF but includes the highly digestible fibres, hemicellulose, and pectin. Feeds with NDF levels that are too high will reduce dry matter intake, and too low will reduce roughage and digestibility.

Lignin –Lignin is a component of both NDF and ADF that is entirely indigestible. It acts to bind up nutrients that would otherwise be available to the animal. Lignin aids in plant stem rigidity by binding cells to the cell wall; the plant uses this mechanism to strengthen its stem in preparation for reproduction. Abiotic stresses to the plant, such as water, heat, and nutritional stress, will cause lignin biosynthesis, which can prematurely reduce the feed quality.

Metabolizable Energy (ME) – This is the measure of ME/kg of DM and is a simple calculation of gross energy minus energy losses in faeces, urine, and gases.

Pasture Growth Rates (PGR) – PGR is the amount of feed grown per hectare per day, measured in kilograms of DM/ha/day over a set period.

Dry Stock Equivalent per Hectare (DSE/ha) – This is the amount of DSE that can be stocked per hectare based on the nutritional requirements above.

DSE/100mm Rainfall – This is used to roughly compare pastures between differing rainfall conditions by dividing the stocking rate by the rainfall for the period. Note that this method only controls one of many variables.

Total DM/Ha – All the dry matter measured over the period.

PGR AVE – The average pasture growth rate (kgDM/ha/day) over the period of measurements.

DSE/Ha 0- 16 Weeks – The amount of DSE the dry matter could feed over the measurements.

DSE/100mm 0-16 Weeks – DSE/ha 0-16 weeks divided by each hundred millimetres of rainfall over the measurement period.

Other Definitions

Growing Season Rainfall – The rainfall collected from the 1st of January to the 1st of September; this was when the final pasture samples were taken.

Dry Stock Equivalent (DSE) – One 50kg wether maintaining condition requires 1kg of dry matter containing 8.3 megajoules of metabolisable energy. This model allows for 80% pasture utilisation with 20% wastage due to trampling and fouling.

2022 Project Results

Of the twelve sites followed in 2022, the project scope allowed six sites to be selected for deeper review. We have therefore chosen two sites in each rainfall zone and given further insight into the data collected by providing agronomic commentary and performance review. The report then goes on to compare results more broadly across sites.

	Moisture	DM %	Crude Protein	ADF	NDF	Lignin	TDN	ME	DM/ha	PGR	DSE/ha	DSE/ 100mm rainfall	Total DM/Ha (Kg)	PGR AVE	DSE/Ha	DSE/ 100mm 0-16 Week
10 Week Cut	86.8	13.2	32.1	23.8	18.7	4.47	72.6	11.64	2453	40.21	32.17	10.77	11980	92.87	69.32	28.46
16 Week Cut	73.6	26.4	21.9	41.3	43.5	7.55	50.9	7.6	9527	140.10	102.64	34.35				

Cascade Site 3

Grower: Simeon Roberts

Variety: Barloo and RM4 Vetch

Rainfall Zone: LRZ

Annual Rainfall 2022: 420mm

1st Jan – 1st Sept 2022 Rainfall: 298mm

Soil PH CaCl2: 5.3

Input Costs

Seeding	Rate/Ha	$/kg	Cost/ha	Cost/DSE
RM4 Vetch Seed	12.5	$ 2.00	$ 25.00	$ 0.36
Barloo Vetch Seed	12.5	$ 2.00	$ 25.00	$ 0.36
Operating Cost	1	$ 45.00	$ 45.00	$ 0.65
			$ 95.00	$ 1.37

Spray	Rate/Ha	Cost/L	Cost/ha	Cost/DSE
Clethodim 240gai	0.3	$ 19.95	$ 5.99	$ 0.09
Targa 100gia	0.1	$ 22.40	$ 2.24	$ 0.03
Alpha Cypermethrin 100gai	0.5	$ 6.00	$ 3.00	$ 0.04
Operating Cost	1	$ 10.00	$ 10.00	$ 0.14
			$ 21.23	**$ 0.31**

Cost of Pasture Production	
Total Cost/ha	$ 116.23
Total Cost/ DSE	$ 1.68

Nitrogen Fixation

Units Fixed (N)	Unit of N ($)	N Fixed/Ha ($)	N Fixed/DSE ($)
239.6	$ 2.00	$ 479.20	$ 6.91

Excellent seasonal rainfall was experienced in North Cascade, setting these two varieties up to express their full genetic potential. Vetch has been a good fit for the Roberts' program. For some years now, RM4 has been used as a break crop and risk mitigation strategy in their canola cereal rotation. The added benefit of nitrogen fixation reduced their reliance on expensive inorganic fertilisers. While RM4 has been the mainstay variety for the area, Barloo was included in this mix for its early vigour and shorter days to grazing in an attempt to bridge the Autumn feed gap. While the Barloo did provide better early biomass, it was subjectively noted that it also elongated and turned reproductive earlier. This caused an earlier-than-anticipated botrytis infection increasing the reliance on fungicide treatments. The early maturation was also reflected in the NRI results, as MJME dropped below the required level to maintain 1 DSE, and the lignin and ADF levels increased, indicating the locking up of carbohydrates in the cell wall of the plant. While measurements weren't taken of each variety individually to objectively determine the source of the high lignin levels, this report hypothesises that the RM4 on its own would have maintained higher feed quality for longer, as is evident in other RM4 cuts within this trial. Despite the overall reduced quality, these varieties produced a massive 11,980kg of biomass per ha over these sixteen weeks. The DSE rating was adjusted for the period between the 10 and 16-week cuts from 1kg/DSE/Day to 1.092kg/DSE/Day to ensure the ME requirements were met. This level of feed

consumption is still well within the parameters of a DSE's feed consumption ability. With these adjustments considered, this pasture could maintain 69.32 DSE/ha and 28.46 DSE/100mm of rainfall. The cost to establish this pasture was $116/ha but only $1.68/DSE. However, the icing on the cake for the Roberts was the 239 units of nitrogen estimated to have been fixed, producing $479/ ha of nitrogen saving in the subsequent crops.

	Moisture	DM %	Crude Protein	ADF	NDF	Lignin	TDN	ME	DM/ha	PGR	DSE/ha	DSE/ 100mm rainfall	Total DM/Ha (Kg)	PGR AVE	DSE/Ha	DSE/ 100mm 0-16 Week
10 Week Cut	83.7	16.3	30.6	15.6	14.2	3.15	69.6	11.09	1480	24.26	19.41	4.83	2006	14.03	11.22	3.49
16 Week Cut	71.5	28.5	21.3	19.7	21.8	4.54	65.5	10.32	526	6.41	5.13	1.28				

Salmon Gums

Grower: Peter McRea

Variety: Leafmore Grazing Brassica

Rainfall Zone: LRZ

Annual Rainfall 2022: 401mm

1st Jan – 1st Sept 2022 Rainfall: 248mm

Seeding Date: 17th April

Input Costs

Seeding	Rate/Ha	$/kg	Cost/ha	Cost/DSE
Leafmore Brasica Seed Brass	1.8	$ 2.00	$ 3.60	$ 0.32
Agstar Extra	60	$ 1.40	$ 84.00	$ 7.49
UAN	60	$ 1.20	$ 72.00	$ 6.42
Operating Cost	1	$ 45.00	$ 45.00	$ 4.01
			$ 204.60	**$ 18.23**

Spray	Rate/Ha	Cost/L	Cost/ha	Cost/DSE
Treflan	2	$ 6.90	$ 13.80	$ 1.23
Paraquat	1.5	$ 6.30	$ 9.45	$ 0.84
Operating Cost	1	$ 10.00	$ 10.00	$ 0.89
			$ 33.25	**$ 2.96**

Cost of Pasture Production	
Total Cost/ha	$ 237.85
Total Cost/ DSE	$ 21.19

Salmon Gums experienced good opening rain and higher-than-average annual rainfall in 2022, providing a good opportunity for Leafmore to be assessed in the area. The dry matter measurements indicate good early growth rates with short days to grazing, although pasture growth rates slowed between the 10 and 16-week cuts. The NRI results show that the CP% and ME are higher than is required for 1 DSE. UAN was applied in August at a rate of 60L/ha to encourage biomass growth. An N-rich strip was applied at 100L/ha, but no visual difference between the two treatments could be noticed. Later in the season, diamondback moth was detected and caused some damage. However, the decision was made not to apply an insecticide as there was a lack of moisture, and the season appeared to be coming to an end. In hindsight, there was further rainfall which would have warranted an insecticide to be applied. The theoretical stocking rate over the period was 11.12 DSE/ha or 3.49 DSE/ha/100mm of rainfall. The cost of pasture production was $237.85/ha or $21.19/DSE.

	Moisture	DM %	Crude Protein	ADF	NDF	Lignin	TDN	ME	DM/ha	PGR	DSE/ha	DSE/ 100mm rainfall	Total DM/Ha (Kg)	PGR AVE	DSE/Ha	DSE/ 100mm 0-16 Week
10 Week Cut	87.4	12.6	20.2	20.3	22.6	3	70.0	11.15	2320	38.03	30.43	9.56	**3547**	**27.50**	**22.00**	**8.64**
16 Week Cut	81.4	18.6	28	31.1	30.6	5.43	62.2	9.7	1227	18.04	14.44	4.54				

Cascade Site 1

Grower: Mark and Liv Walter

Variety: Leafmore Grazing Brassica, Santorini and Margarita

Rainfall Zone: MRZ

Annual Rainfall 2022: 494mm

1st Jan – 1st Sept 2022 Rainfall: 318mm

Soil PH CaCl2: 5.3

Input Costs

Seeding	Rate/Ha	$/kg	Cost/ha	Cost/DSE
Leafmore Seed	2	$ 14.00	$ 28.00	$ 1.27
Santorini Serradella Seed	2	$ 5.00	$ 10.00	$ 0.45
Maragrita Serradella Pod	10	$ 5.10	$ 51.00	$ 2.32
Alosca Ryzobia Group G/S	5	$ 2.00	$ 10.00	$ 0.45
Operating cost	1	$ 45.00	$ 45.00	$ 2.05
			$ 144.00	**$ 6.55**

Spray	Rate/Ha	Cost/L	Cost/ha	Cost/DSE
Clethodim 360gai	0.3	$ 19.95	$ 5.99	$ 0.27
Factor	0.1	$ 22.40	$ 2.24	$ 0.10
Hasten	0.5	$ 6.00	$ 3.00	$ 0.14
SOA	0.5	$ 1.00	$ 0.50	$ 0.02
Operating Cost	1	$ 10.00	$ 10.00	$ 0.45
			$ 21.73	**$ 0.99**

Cost of Pasture Production	
Total Cost/ha	$ 165.73
Total Cost/ DSE	$ 7.53

The pasture NRI test results for Cascade site 1 reveal that, in this case, this pasture mix is sufficient to maintain a DSE at the expected intake of 1kg of dry matter per head per day. Crude protein is well in excess of ruminant requirements (9-15% CP/kgDM) in both the 10 and 16-week cuts. While ME declines between the 10 and 16-week cuts, it is still sufficient to support a DSE. Pasture DM/ha also decreased between the two cuts, with the lignin levels increasing, which is indicative of the Leafmore becoming reproductive. This variety would appear to be useful as an option for winter biomass production as it produces good early bulk when the season permits. However, its feed value later in the season will be determined by plant nutrition, insect control and grazing management. It was subjectively noted that the Santorini and Margarita serradellas produced less biomass, particularly early in the season. However, serradella was included for its late-season feed quality and its regenerative persistence in subsequent years. Unfortunately, the scope of the trial wasn't positioned to measure this as only a 10 and 16-week cut was allowed for. Clethodim and Factor were used to control ryegrass and volunteer cereals to prepare for a 2023 wheat crop. While the two serradella varieties nodulated well, a figure for nitrogen fixation could not be estimated for economic analysis as the biomass of Serradella could not be separated from the Leafmore to be measured on its own.

	Moisture	DM %	Crude Protein	ADF	NDF	Lignin	TDN	ME	DM/ha	PGR	DSE/ha	DSE/ 100mm rainfall	Total DM/Ha (Kg)	PGR AVE	DSE/Ha	DSE/ 100mm 0-16 Week
10 Week Cut	86.1	13.9	24.5	25.8	31.4	3.72	59.3	9.71	1367	15.88	17.93	3.33	4073	31.57	25.26	5.86
16 Week Cut	72.5	27.5	16.2	20.6	37.5	1.57	71.1	11.37	2706	39.79	31.84	5.91				

Condingup Site 3

Grower: Nick Ruddenklau

Variety: Abundant Rye Grass – Forester Oats – Rasina Vetch

Rainfall Zone: MRZ

Annual Rainfall 2022: 805mm

1st Jan – 1st Sept 2022 Rainfall: 539mm

Soil PH CaCl2: 4.9

Input Costs

Seeding	Rate/Ha	$/kg	Cost/ha	Cost/DSE
Abundant Rye Grass	10	$ 5.45	$ 54.50	$ 3.25
Forester Oats	30	$ 1.50	$ 45.00	$ 2.68
Rasina Vetch	20	$ 2.26	$ 45.20	$ 2.69
MAP Fertilizer	50	$ 1.30	$ 65.00	$ 3.87
Operating Cost	1	$ 45.00	$ 45.00	$ 2.68
			$ 254.70	**$ 15.18**

Spreading	Rate/Ha	$/kg	Cost/ha	Cost/DSE
Urea	250	0.92	$ 230.00	**$ 13.71**
Operating Cost	1	10	$ 10.00	**$ 0.60**
			$ 240.00	**$ 14.30**

Spray	Rate/Ha	Cost/L	Cost/ha	Cost/DSE
Glyphosate 450gai	1.7	$ 9.50	$ 16.15	$ 0.96
Ester 680gai	0.5	$ 8.50	$ 4.25	$ 0.25
Operating Cost	1	$ 10.00	$ 10.00	$ 0.60
			$ 30.40	**$ 1.81**

Cost of Pasture Production	
Total Cost/ha	$ 285.10
Total Cost/ DSE	$ 16.99

The Condingup 3 site, like other sites, received higher-than-average rainfall. However, most of it came later in the season, which, along with cold conditions, contributed to a slower start than some of the other trial sites. The 16-week samples had sufficient protein and energy, low lignin levels, and low ADF, confirming that this pasture is a high-quality feed source. It would have been very interesting to continue to measure biomass and NRI test this pasture beyond the 16-week mark to capture its full potential, as this is where this pasture did most of its heavy lifting. Nick reported that the paddock went on to produce 18t (wet)/ha of silage followed by another hay cut later in the season of 2.2t/ha. If hay is valued at $200/t and silage at $80/t, this paddock would have produced $1880/ha of feed. All while holding 680 maiden ewes for three and a half weeks in July, then restocking after the hay was cut (from half the paddock only) in mid-December with 1200 maidens that remain on the paddock as I write this in early February 2023. Over this period, the maidens required a flushing ration prior to joining but have not required supplementation beyond this. So, to date, this paddock has maintained 23.5 DSE/ha for 73 days while producing $1880/ha worth of feed to be used through the summer.

	Moisture	DM %	Crude Protein	ADF	NDF	Lignin	TDN	ME	DM/ha	PGR	DSE/ha	DSE/ 100mm rainfall	Total DM/Ha (Kg)	PGR AVE	DSE/Ha	DSE/ 100mm 0-16 Week
10 Week Cut	87.8	12.5	25.4	26.5	40.6	2.14	68	10.79	2053	33.66	26.92	4.42	4741	36.75	29.40	6.03
16 Week Cut	86	14	25.8	24.1	35.3	1.04	70.2	11.2	2688	39.53	31.62	5.19				

Boyatup Site 1

Grower: Ryan Willing

Variety: Pascal Wheat – Triticale – Illabo Wheat – Planet Barley – Abundant Ryegrass – Baldder Clover – Balansa Clover – Eliza Seradella – RM4 Vetch

Rainfall Zone: HRZ

Annual Rainfall 2022: 908mm

1st Jan – 1st Sept 2022 Rainfall: 609mm

Soil PH CaCl2: 5.6

Input Costs

Seeding	Rate/Ha	$/kg	Cost/ha	Cost/DSE
Pascal Wheat	20	$ 0.35	$ 7.00	$ 0.24
Triticale	20	$ 1.50	$ 30.00	$ 1.02
Illabo Wheat	20	$ 0.35	$ 7.00	$ 0.24
Planet Barley	20	$ 0.35	$ 7.00	$ 0.24
Abundant Ryegrass	8	$ 4.10	$ 32.80	$ 1.12
Bartolo Bladder Clover	2.5	$ 6.00	$ 15.00	$ 0.51
Paradana Balansa Clover	0.3	$ 6.00	$ 1.80	$ 0.06
Eliza Serradella	10	$ 2.60	$ 26.00	$ 0.88
RM4 Vetch	10	$ 2.00	$ 20.00	$ 0.68
MAP Fertiliser	70	$ 1.20	$ 84.00	$ 2.86
Peat Inoculant	0.4	$ 40.00	$ 16.00	$ 0.54
Operating Cost	1	$ 45.00	$ 45.00	$ 1.53
			$ 291.60	**$ 9.92**

Spray	Rate/Ha	Cost/L	Cost/ha	Cost/DSE
Glyphosate 450gai	1.7	$ 9.50	$ 16.15	$ 0.55
Alpher Cypermethrin	0.1	$ 7.00	$ 0.70	$ 0.02
Outright Adjuvant	0.8	$ 6.95	$ 5.56	$ 0.19
Paraquat 360gai	0.28	$ 7.40	$ 2.07	$ 0.07
Glyphosate 450gai	0.5	$ 9.50	$ 4.75	$ 0.16
Wetter 1000	0.24		$ -	$ -
Operating Cost	3	$ 10.00	$ 30.00	$ 1.02
			$ 59.23	**$ 2.01**

Spread	Rate/Ha	Cost/kg	Cost/ha	Cost/DSE
NS61	80	1.1	$ 88.00	$ 2.99
Operating Cost	1	5	$ 5.00	$ 0.17
			$ 93.00	**$ 3.16**

Cost of Pasture Production	
Total Cost/ha	$ 443.83
Total Cost/ DSE	$ 15.10

The Boyatup site was sprayed with Glyphosate and Outright adjuvant, then dry-sown right before a heavier-than-expected rainfall event (150mm) that caused the widespread seed to burst and capeweed germination. Ryan saw this as an opportunity to control the capeweed and salvage his pasture for the year. Another pass of glyphosate and wetter was applied, followed by Paraquat and Alpha-Cypermethrin. Then the above seed mix was planted into moisture. This mix has been useful for Ryan in the past, noting that his stocking rates on biodiverse pastures like these have been greatly improved. Unfortunately, 2022 continued to be a very wet year for this site, causing the legumes to struggle and the ryegrass to dominate. While some could see this as disappointing, it also illustrates the strength of biodiversity in risk mitigation, particularly in high-rainfall areas. When weather conditions allow, Ryan considers the mix a two-year investment. He explains that the normal rotation would be two years in pasture followed by canola, cereal, then back to pasture, expecting that the pasture following the crop usually requires half the legume rate as the seed bank builds up. Despite the unusually wet season, this pasture performed well, and its stocking rate assisted in diluting the costs associated with reseeding. Unfortunately, no nitrogen fixation could be assumed because of poor legume germination. The quality of this pasture is evident from the NRI results, which show consistency between the 10 and 16-week cuts. In fact, the ME increased slightly while the Lignin and

NDF decreased slightly, which is the opposite of what you would expect to see. This could be because the Abundant Ryegrass became dominant, and other shorter seasoned varieties were diluted. The pasture growth rate over the period is considered high for this time of year, averaging 36.75kg/ha/day.

	Moisture	DM %	Crude Protein	ADF	NDF	Lignin	TDN	ME	DM/ha	PGR	DSE/ha	DSE/ 100mm rainfall	Total DM/Ha (Kg)	PGR AVE	DSE/Ha	DSE/ 100mm 0-16 Week
10 Week Cut	84.2	15.8	34.6	23.4	34.1	2.51	69.7	11.11	1427	23.39	18.71	3.47	6258	48.51	38.81	9.00
16 Week Cut	75.6	24.4	22.1	27.7	49.3	2.71	67.8	10.75	4831	71.04	56.84	10.54				

Neridup Site 3

Grower: Ryan Willing

Variety: Planet Barley

Rainfall Zone: HRZ

Annual Rainfall 2022: 805mm

1st Jan – 1st Sept 2022 Rainfall: 539mm

Soil PH CaCl2: 4.8

Input Costs

Seeding	Rate/Ha	$/kg	Cost/ha	Cost/DSE
Planet Barley	100	$ 0.35	$ 35.00	$ 0.90
MAP Fertilier	75	$ 1.20	$ 90.00	$ 2.32
NS 6:1	75	$ 0.78	$ 58.50	$ 1.51
Operating Cost	1	$ 45.00	$ 45.00	$ 1.16
			$ 228.50	**$ 5.89**

Pre Emergent Spray	Rate/Ha	Cost/L	Cost/ha	Cost/DSE
Trifluralin	2	$ 6.30	$ 12.60	$ 0.32
Boxer Gold	2.5	$ 10.60	$ 26.50	$ 0.68
Operating Cost	1	$ 10.00	$ 10.00	$ 0.26
			$ 49.10	**$ 1.27**

Urea Spreading 1	Rate/Ha	$/kg	**Cost/ha**	**Cost/DSE**
Urea	75	0.92	$ 69.00	**$ 1.78**
Operating Cost	1	10	$ 10.00	**$ 0.26**
			$ 79.00	**$ 2.04**

Broad Leaf Selective 1	Rate/Ha	Cost/L	Cost/ha	Cost/DSE
Jaguar	1	$ 13.50	$ 13.50	$ 0.35
Operating Cost	1	$ 10.00	$ 10.00	$ 0.26
			$ 23.50	**$ 0.61**

Broadleaf Selective 2	Rate/Ha	Cost/L	Cost/ha	Cost/DSE
Bronco	1	$ 9.50	$ 9.50	$ 0.24
Operating Cost	1	$ 10.00	$ 10.00	$ 0.26
			$ 19.50	**$ 0.50**

Urea Spreading 2	Rate/Ha	$/kg	**Cost/ha**	**Cost/DSE**
Urea	75	0.92	$ 69.00	**$ 1.78**
Operating Cost	1	10	$ 10.00	**$ 0.26**
			$ 79.00	**$ 2.04**

Pre Emergent Spray	Rate/Ha	Cost/L	Cost/ha	Cost/DSE
Top Notch Fungiced	0.4	$ 56.00	$ 22.40	$ 0.58
Transform	0.05	$ 365.00	$ 18.25	$ 0.47
Wetter 1000	0.24	$ 3.95	$ 0.95	$ 0.02
Operating Cost	1	$ 10.00	$ 10.00	$ 0.26
			$ 51.60	**$ 1.33**

Total Cost/ha	$ 530.20
Total Cost/ DSE	$ 13.66

Planet barley was used in this case for its early feed value to harvest the grain at the end of the season. While this variety is known for its high grain yield potential, its propensity to grow a lot of early biomasses creates opportunities for mix enterprise farmers to defer pasture grazing through crop grazing. The farm on which this was planted had serradella-dominant pastures that needed time to build an adequate feed wedge before stocking. Toward the end of the season, it was evident that a

lot of ryegrass was presumably stirred up by the grazing process. Ryan was able to get some late control on this by well-timed desiccation. The NRI result confirms that the feed quality is sufficient to maintain the body condition of a DSE at the expected daily intake of 1kg per DSE, and the DM was adequate to stock from early in the season. While this economic model looks at the grazing scenario only and attributes all costs to the DSE, it's interesting to note that this crop grew a 3.3 t barley crop while providing a solution to the autumn feed gap.

Project Summary

Low Rainfall Zone (MRZ) ~ 350 Average Annual Rainfall

	Grower	Location	Pasture variety	Moisture	DM %	Crude Protein	ADF	NDF	Lignin	TDN	ME	DM/ha	PGR	DSE/ha	DSE/ 100mm rainfall	Total DM/Ha (Kg)	PGR AVE	DSE/Ha	DSE/ 100mm 0-16 Week
10 Week Cut	Roberts	Cascade Site 3	Barloo & RM4 vetch	86.8	13.2	32.1	23.8	18.7	4.47	72.6	11.64	2453	40.21	32.17	10.77	11980	92.87	69.32	28.46
16 Week Cut	Roberts	Cascade Site 3	Barloo & RM4 vetch	73.6	26.4	21.9	41.3	43.5	7.55	50.9	7.6	9527	140.10	102.64	34.35				
10 Week Cut	McCrea	Salmon Gums	Leafmore Grazing Brasica	83.7	16.3	30.6	15.6	14.2	3.15	69.6	11.09	1480	24.26	19.41	4.83	2006	14.03	11.22	3.49
16 Week Cut	McCrea	Salmon Gums	Leafmore Grazing Brasica	71.5	28.5	21.3	19.7	21.8	4.54	65.5	10.32	526	6.41	5.13	1.28				

Medium Rainfall Zone (MRZ) ~ 450mm Average Annual Rainfall

	Grower	Location	Pasture variety	Moisture	DM %	Crude Protein	ADF	NDF	Lignin	TDN	ME	DM/ha	PGR	DSE/ha	DSE/ 100mm rainfall	Total DM/Ha (Kg)	PGR AVE	DSE/Ha	DSE/ 100mm 0-16 Week
10 Week Cut	Walters	Cascade Site 1	Leafmore	87.4	12.6	20.2	20.3	22.6	3	70.0	11.15	2320	38.03	30.43	9.56	**3547**	**27.50**	**22.00**	**8.64**
16 Week Cut	Walters	Cascade Site 1	Leafmore	81.4	18.6	28	31.1	30.6	5.43	62.2	9.7	1227	18.04	14.44	4.54				
10 Week Cut	Walters	Cascade Site 2	RM4 Vetch	87.0	13.0	30.8	18.9	12.6	3.86	73.9	11.89	1026	16.82	13.46	4.23	5850	45.35	36.28	14.25
16 Week Cut	Walters	Cascade Site 2	RM4 Vetch	86.6	13.4	35.3	27.6	26.5	3.85	66	10.42	4824	70.94	56.75	17.84				
10 Week Cut	Epasco	Condingup 1	Oats, Barley, sub clover	86	14.2	30.1	23.8	26.1	3.22	70.6	11.26	3366	55.18	44.14	8.19	4693	36.38	29.10	6.75
16 Week Cut	Epasco	Condingup 1	Oats, Barley, sub clover	83.8	16	28.3	24.8	42.8	1.74	69.2	11.01	1327	19.51	15.61	2.90				
10 Week Cut	Epasco	Condingup Site 3	Pasture Mix 1*	86.1	13.9	24.5	25.8	31.4	3.72	59.3	9.71	1367	15.88	17.93	3.33	4073	31.57	25.26	5.86
16 Week Cut	Epasco	Condingup Site 3	Pasture Mix 1*	72.5	27.5	16.2	20.6	37.5	1.57	71.1	11.37	2706	39.79	31.84	5.91				
10 Week Cut	Wattledale	Scaddan Site 1	RM4 Vetch	79.2	20.8	34.1	20.4	21.2	2.97	73.1	11.74	500	8.20	6.56	1.68	2514	19.49	15.59	4.99
16 Week Cut	Wattledale	Scaddan Site 1	RM4 Vetch	67.9	32.1	16.1	29.2	33.9	4.36	59.6	9.21	2014	29.62	23.69	6.07				

* Pasture Mix 1 consists of: Abundant Ryegrass, Forrester Oats & Rasina Vetch

High Rainfall Zone (HRZ) ~ 550mm Average Annual Rainfall

	Grower	Location	Pasture variety	Moisture	DM %	Crude Protein	ADF	NDF	Lignin	TDN	ME	DM/ha	PGR	DSE/ha	DSE/ 100mm rainfall	Total DM/Ha (Kg)	PGR AVE	DSE/Ha	DSE/ 100mm 0-16 Week
10 Week Cut	Epasco	Condingup Site 4	Oats, Barley	***Insufficient biomass to measure***												1248	9.67	7.74	1.79
16 Week Cut	Epasco	Condingup Site 4	Oats, Barley	86	14	24.5	25.8	31.4	3.72	59.3	9.17	1248	9.67	7.74	1.44				
10 Week Cut	Epasco	Neridup Site 1	Planet Barley & Forester Oats	***Insufficient biomass to measure***												640	4.96	3.97	1.24
16 Week Cut	Epasco	Neridup Site 1	Planet Barley & Forester Oats	86.1	13.9	18.7	24.8	36.5	7.71	69.3	11.03	640	9.41	7.53	1.89				
10 Week Cut	Willing	Neridup Site 2	Illabo Wheat	86.9	13.1	31.4	21.6	34	2.21	73.1	11.73	996	16.33	13.06	2.42	4098	31.77	25.41	5.89
16 Week Cut	Willing	Neridup Site 2	Illabo Wheat	86	14	24.5	26.6	47.2	2.36	68.6	10.89	3102	45.62	36.49	6.77				
10 Week Cut	Willing	Neridup Site 3	Planet Barley	84.2	15.8	34.6	23.4	34.1	2.51	69.7	11.11	1427	23.39	18.71	3.47	6258	48.51	38.81	9.00
16 Week Cut	Willing	Neridup Site 3	Planet barley	75.6	24.4	22.1	27.7	49.3	2.71	67.8	10.75	4831	71.04	56.84	10.54				
10 Week Cut	Willing	Boyatup Site 1	Pasture Mix 2**	87.8	12.5	25.4	26.5	40.6	2.14	68	10.79	2053	33.66	26.92	4.42	4741	36.75	29.40	6.03
16 Week Cut	Willing	Boyatup Site 1	Pasture Mix 2**	86	14	25.8	24.1	35.3	1.04	70.2	11.2	2688	39.53	31.62	5.19				

** Pasture Mix 2 consists of: Pascal Wheat, Triticale, Illabo wheat, Planet barley, Abundant ryegrass, Bladder clover, Balansa clover, Eliza Seradella, RM4 vetch

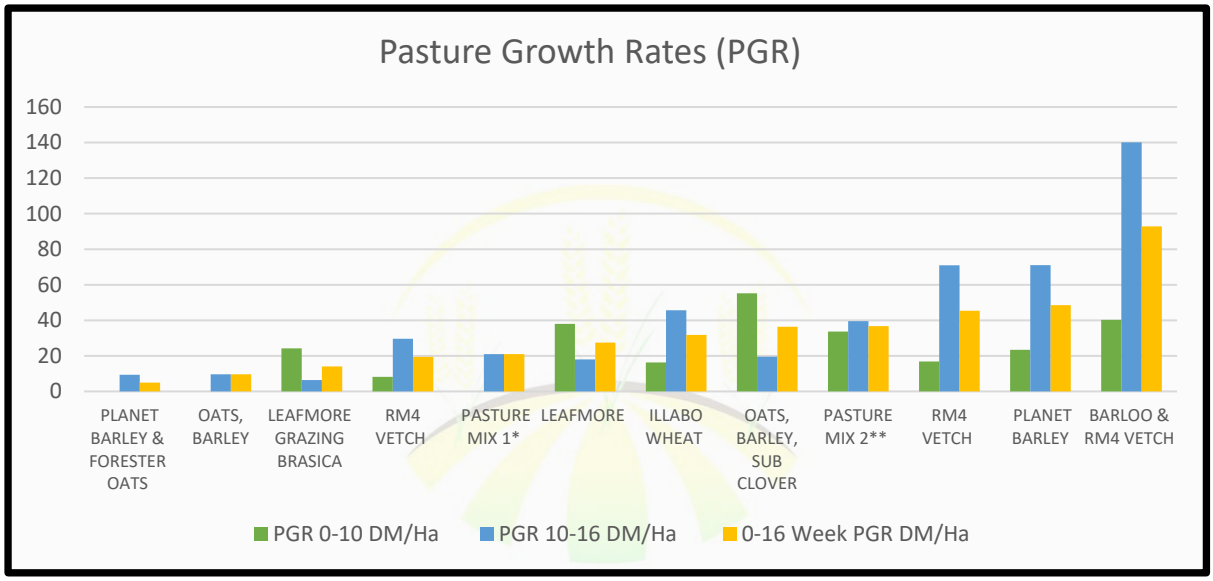
Overall, given that it was a very challenging year for growers in the Esperance region, most sites were successful. The standout variety for biomass was vetch which performed well in all three rainfall zones, producing 11,080kg of DM/ha in the Cascade RM4 and Barloo vetch mix. At the same time, it produced an estimated 239 units of N. Pasture quality was suitable; however, in the aforementioned Cascade site, the consumption rate had to be adjusted to ensure that the minimum energy requirements were met. This was due to the high levels of lignin and NDF that were produced, presumably caused by the early senescence of the Barloo vetch in the mix. In this case, caution should be taken when grazing heavily pregnant or lactating livestock to ensure that energy requirements are met within their consumption limitations. RM4 vetch samples that were collected from other sites showed a consistency of quality between the 10 and 16-week cuts with improved growth rates beyond the 10-week mark. Vetches fit well in the medium to high rainfall zones with tolerance to moderate soil acidity and alkalinity (pH CaCl 5-9). Acidic soils will reduce vetch's root development, nodulation, and overall biomass production. Vetch offers some good in crop grass control options; however, broadleaf control is limited mainly to grazing management. This trial reaffirms the fit for using vetch varieties in a cropping rotation, both as a break crop and to improve overall soil fertility and N fixation. It important to note that woolly pod vetches such as RM4 can cause secondary photosensitisation if grazed when flowering or during seed set. Livestock should be removed from the paddock immediately if photosensitisation is noticed and the vet should be contacted for advice. A well-timed pasture top application can be used to stop seed-set, control other weeds for the following season and lock in feed quality by hay freezing the pasture prior to the biosynthesis of lignin.

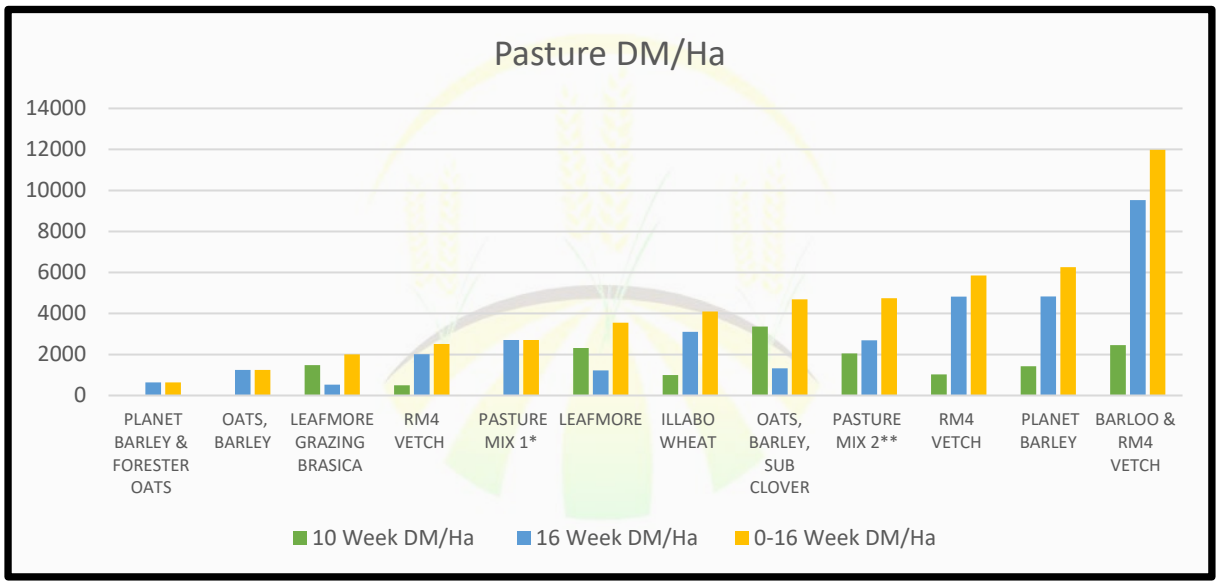
Cereal crops are a good fit to defer the grazing of pasture paddocks. Grazing pastures too early will directly affect the paddock's stocking rate potential and the pasture's ability to set seed for subsequent years. Worse yet, pasture grazed too early can cause plants to be uprooted or defoliated, stopping or inhibiting the plant's development. The Agricultural Department of WA recommends a pasture wedge of at least 1000kg DM/ha before autumn/winter grazing, with the optimum amount being 1400kg DM/ha (DPIRD 2020). The saying goes, "grass grows grass", meaning that the higher the DM/ha, the higher the leaf material, and therefore the faster the pasture growth (DPIRD 2020). This is obviously most applicable to pastures that are in a vegetative state but an important rule of thumb when deciding to stock a paddock. This is where crop grazing early seeded cash crops (cereals or canola) can be very useful. As noted in the 10-week NRI results, both the Planet barley and the Illabo wheat have sufficient ME and CP% with low ADF, NDF and lignin levels, indicating the suitability of crop grazing over this period. However, looking at the 16-week NRI measurements, the NDF increased quickly while the ADF had a slower rise, and lignin remained low. This suggests that the hemicellulose and pectin levels are increasing and is what is known as the "hardening" of the feed. Hemicellulose and pectin (good fibre fractions) slow the rate of passage,

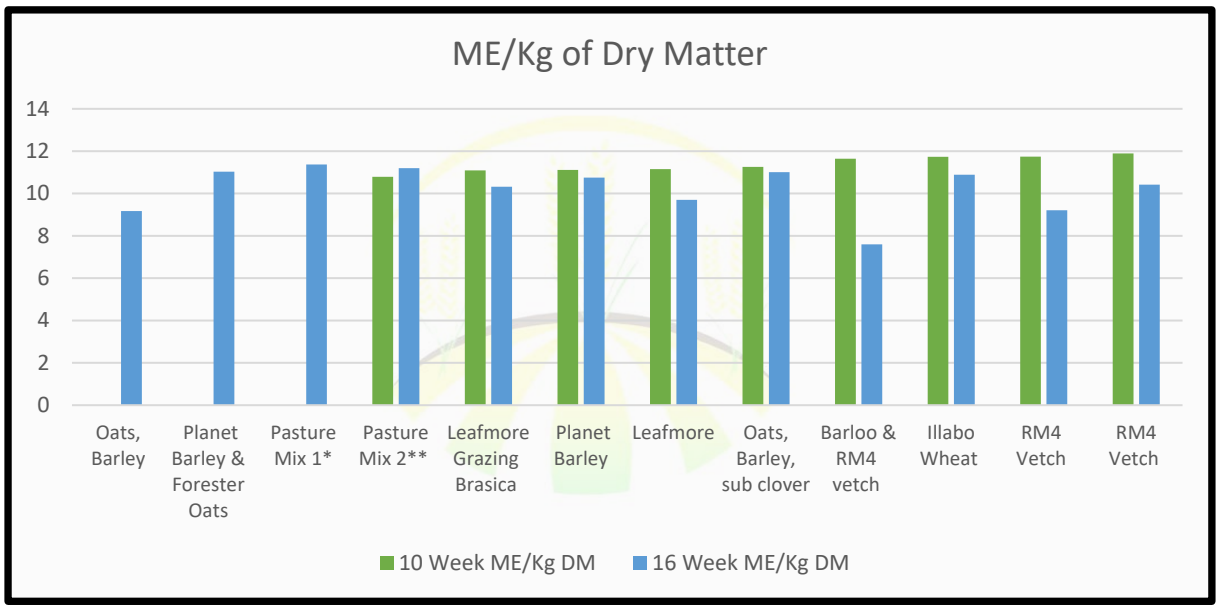
allowing the rumen time to extract nutrition from the green feed more efficiently. When crop grazing, you must consider the class of stock being grazed. A cereal crop like these two will be high in potassium and sodium, which will cause a tie-up of the calcium and magnesium that are already in low supply from the plant. This is a problem for pregnant livestock, causing hypocalcaemia or hypomagnesaemia, especially twin-bearing ewes. A calcium and magnesium lick could be introduced to ensure adequate mineral levels are maintained. Another key consideration for dual purpose crops is minimising the effect of grazing on grain yield. The timing that livestock are introduced and removed is essential to a successful dual-purpose crop. Livestock should not be introduced before the crop has suitable root anchorage to ensure that the plant isn't uprooted in the process of grazing. As a rule of thumb, a simple 'twist and pull' test can be used to assess plant anchorage. If the leaf breaks off and the plant remains anchored, stock may be introduced. However, if the plant is uprooted stock should not be introduced at that point. In considering when to remove livestock from the paddock there are two main considerations. 1. The growth stage: livestock should be removed when cereals reach stem elongation (GS30) or canola is beginning bud emergence (DPIRD, 2017). 2. Residual biomass and season length: it's important to ensure that suitable biomass remains to allow the crop to recover in time for grain production. Studies have shown that spring canola with 1.5t of DM/ha at stem elongation had a grain yield potential of 2.5-3.5t/ha and wheat with 0.5t of DM/ha at GS30 had a grain yield potential of 4-5t/ha (GRDC, 2019).

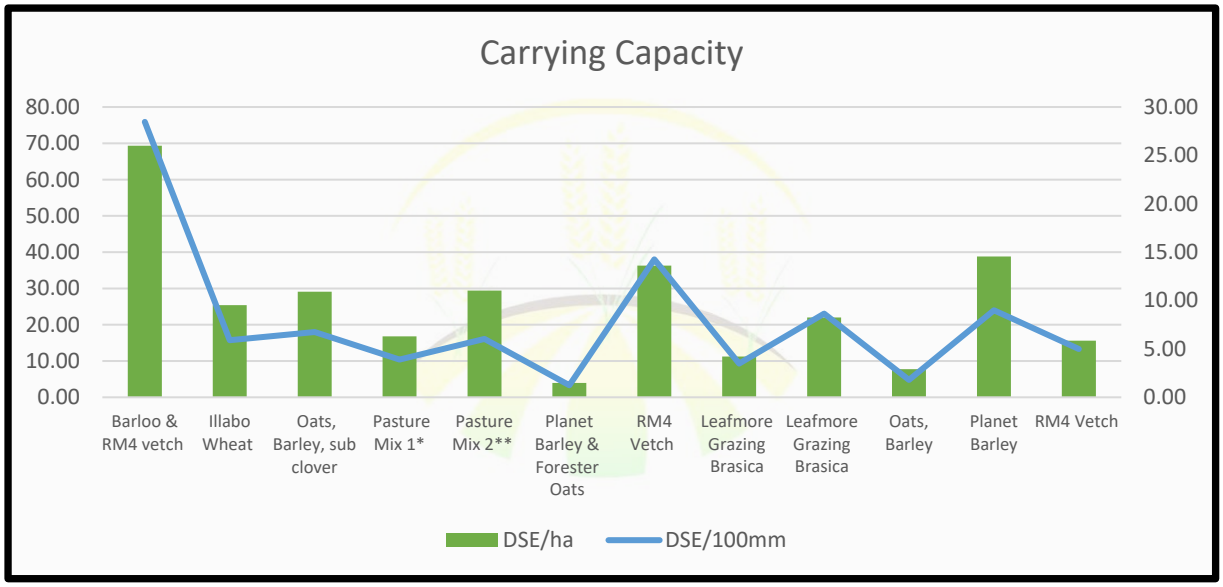
Through this trial, two Leafmore pastures were observed, one as a monoculture in an LRZ zone and the other with Santorini and Margarita serradellas in an MRZ. In both cases, the Leafmore produced good early feed, then appeared to run out of puff. Being a forage rape, Leafmore is hungry for nutrition, which would have been a limiting factor later in the season. Forage brassicas are also quite susceptible to insects such as aphids later in the season, making it wise to budget for an insecticide if you plan to see it through to the end of the season. Leafmore will be susceptible to many of the same diseases as canola, so it should be followed by a cereal crop when returning into the cropping rotation to ensure an adequate break in soil pathogens. This variety could be used alongside vetch to fill the autumn and winter feed gap created by vetch's propensity for delayed growth in cold conditions. Leafmore grown as a monoculture has the potential to produce a lot of biomasses. However, it requires a full nutritional package and a good insecticide program. An agronomist can assist in formulating the correct input package by considering soil constraints, seasonal potential and other potential limitations. Interestingly, Peter mentioned at the end of January, that his Leafmore was still green on his Salmon Gums site.

Pasture mixes that include several varieties are a great option for long-term pastures; they allow for biodiversity in the greater ecological system and provide a great risk mitigation strategy for the grower. By planning a diverse pasture mix, varieties will thrive in soil types and environments that suit them. From a nutritional point of view, as one plant becomes reproductive and less nutritious, a well-planned mix would have another variety to offset this by producing quality feed as it enters its vegetative stage later in the season. Because of the unusually wet conditions in the 2022 trials, the clovers didn't establish well. However, due to its particularly hard seed, the serradellas performed well, and the ryegrass thrived, producing large amounts of biomass.


Pasture Growth Rates (PGR)
160
140
120
100
80
60
40
20
0
PLANET BARLEY & FORESTER OATS
OATS, BARLEY
LEAFMORE GRAZING BRASICA
RM4 VETCH
PASTURE MIX 1*
LEAFMORE
ILLABO WHEAT
OATS, BARLEY, SUB CLOVER
PASTURE MIX 2**
RM4 VETCH
PLANET BARLEY
BARLOO & RM4 VETCH
PGR 0-10 DM/Ha
PGR 10-16 DM/Ha
0-16 Week PGR DM/Ha


Pasture DM/Ha
14000
12000
10000
8000
6000
4000
2000
0
PLANET BARLEY & FORESTER OATS
OATS, BARLEY
LEAFMORE GRAZING BRASICA
RM4 VETCH
PASTURE MIX 1*
LEAFMORE
ILLABO WHEAT
OATS, BARLEY, SUB CLOVER
PASTURE MIX 2**
RM4 VETCH
PLANET BARLEY
BARLOO & RM4 VETCH
10 Week DM/Ha
16 Week DM/Ha
0-16 Week DM/Ha


ME/Kg of Dry Matter
14
12
10
8
6
4
2
0
Oats, Barley
Planet Barley & Forester Oats
Pasture Mix 1*
Pasture Mix 2**
Leafmore Grazing Brasica
Planet Barley
Leafmore
Oats, Barley, sub clover
Barloo & RM4 vetch
Illabo Wheat
RM4 Vetch
RM4 Vetch
10 Week ME/Kg DM
16 Week ME/Kg DM


Carrying Capacity
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Barloo & RM4 vetch
Illabo Wheat
Oats, Barley, sub clover
Pasture Mix 1*
Pasture Mix 2**
Planet Barley & Forester Oats
RM4 Vetch
Leafmore Grazing Brasica
Leafmore Grazing Brasica
Oats, Barley
Planet Barley
RM4 Vetch
DSE/ha
DSE/100mm

Re-establishment Sites

The second aspect to this trial was to monitor the trial sites from 2020 and 2021 to identify which varieties would re-establish in following years under differing management systems and environments. This could be useful in assisting growers when choosing long term pastures or in identifying pasture that could re-establish after a year or two in crop. Overall, the re-establishment sites have some interesting results. Unfortunately, the Neridup site at John Wallace's was accidentally sprayed out, so there was nothing to observe this year, although, it could be a point of interest next year. The 2020 site at Grass Patch had been overgrown with a medic, and therefore no re-establishment was observed this year. However, the 2021 North Cascade and the Grass Patch sites had a number of pasture species that were of particular interest as stand out performers for re-establishment. There were ten samples collected at the 16-week cuts, five from each site. These were tested for feed quality (NRI test) and their biomass was measured and calculated as kilograms of dry matter per ha (kgDM/ha). Dry matter was then used to calculate a theoretical carrying capacity measured as DSE/ha (dry stock equivalent per hectare).

North Cascade Re-establishment Site

In 2021 the North Cascade site was sown to fifteen varieties or mixes and randomly replicated three times. This site had strong growing season rainfall, providing a good establishment with a soft finish, positioning all varieties for great seed-set potential. It was noted that all varieties performed well except for Casbah Biserulla which had a poor establishment.

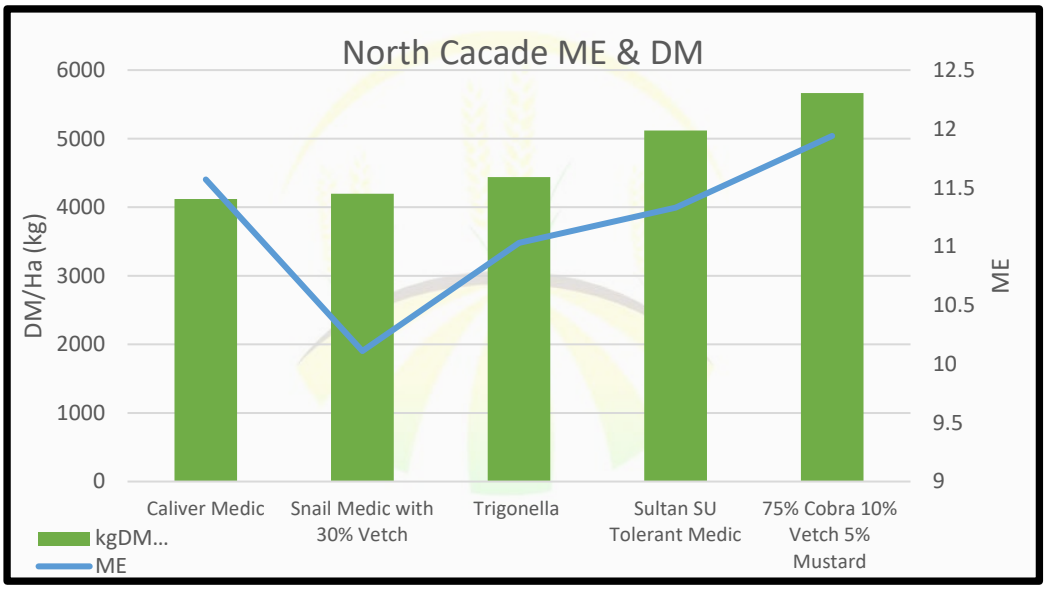
North Cascade - Lortleaze 2021	
Sown	16/03/2022
Soil PH (CaCl)	5.8 (0-10cm) to 6.5 (50-60cm) measured 2021
Sowing Details	25kg RM4 Seed
Post-Emergent Herbicide	Clethodim & Targa 25 May
2021 Varieties & Rates	Spartacus Barley @ 80kg
	RM4 Vetch @ 25kg
	Capello Vetch @ 25kg
	Express Grazing Oats @ 70kg
	RM4 Vetch @ 20kg & Express Grazing Oats @ 50kg
	Trigonella @ 8kg
	Tetila Ryegrass @ 15kg
	Cavalier Medic @ 12kg
	Snail Medic @ 12kg
	Sultan Medic (SU Tolerant) @ 6kg
	Casbah Biserulla @ 6kg
	SARDI Grazing Lucerne @ 6kg
	Cobra Clover @ 6kg
	Ballard Mix Ball ThumpA @20kg – *(Rose clover, bladder clover, soft pink serradella, sub-clover & tetraploid Italian ryegrass)*
	Ballard Mix Ball SalinA @ 20kg – *(Scimitar burr medic, balansa clover, tetraploid Italian ryegrass)*

In March 2022 all plots were over-sown with RM4 vetch along with the rest of the paddock. The season broke with a 97mm rainfall event over three days in mid-April and continued to be a very soft season. The RM4 quickly covered over and became dominant. A grass selective herbicide was applied which effectively took care of ryegrass and cereals that may have persisted from the previous year. At the time of the ten-week cuts there was insufficient biomass produced from the 2021 pasture regeneration therefore, samples were unable to be collected. At sixteen weeks there was a markable difference in the presence of 2021 self-seeded pastures. The five varieties that had sufficient biomass to be collected in this reestablishment trial were Sultan medic, Trigonella, Cavalier medic, Cobra

balansa and Snail medic. In some cases, varieties that weren't originally sown in the same plot in 2021 were found together in 2022. It is likely that through the processes of oversowing vetch, the seed-set from the 2021 pasture was spread across neighbouring plots.

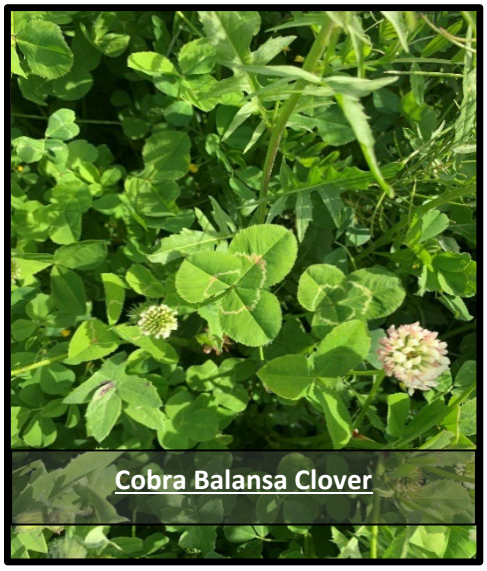
Pasture variety	Moisture	DM %	Crude Protein	ADF	NDF	Lignin	TDN	ME	RFV	DM/ha	PGR	DSE/ha
Sultan SU Tolerant Medic	83.4	16.6	27.8	21.6	21.9	3.42	70.9	11.33	306	5119.44	38.49	30.79
Trigonella	82.1	17.9	24.1	26.9	28.7	4.05	69.3	11.03	220	4439.2	33.38	26.70
Caliver Medic	84.6	15.4	31.9	22.2	20.3	3.6	72.2	11.57	328	4121.04	30.99	24.79
75% Cobra 10% Vetch 5% Mustard	83.2	16.8	30	21.4	19	3.45	74.2	11.94	354	5664.96	42.59	34.07
Snail Medic with 30% Vetch	86.3	13.7	23.3	26.5	29	4.85	64.4	10.11	219	4197.68	31.56	25.25

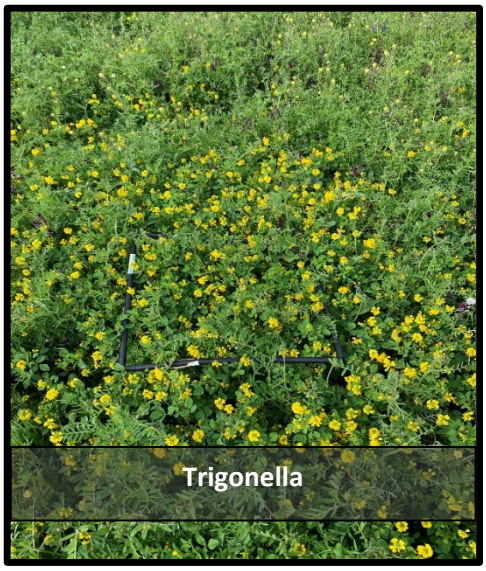
The sixteen-week cuts all included oversown RM4 vetch, however there was a significant difference in DM of 922kg and PGR of approximately 7kg per ha per day, which would translate to over five DSE per ha of extra carrying capacity between the highest and lowest performing pastures. Although the ME was considerably higher than a DSE's requirements, the variation between pastures is still worth noting. The ME content between the highest and lowest performing pasture was 2ME/kgDM, enough to maintain an extra quarter of a DSE/ha. The sample containing the Cobra balansa, RM4 vetch and a small amount of Indian hedge mustard produced both the highest level of biomass (5664kg) and megajoules of energy (11.94ME/kg/DM), however, the lignin levels were also high. We assume this is because of the presence of the Indian hedge mustard. While there are limited options to control Indian hedge mustard in clover and vetch, it's tall and prostrate growing habit would make it possible to target with a wick wiper prior to its seed set.



North Cascade Re-Establishment

16 Weeks Cuts 24th August 2022





Grass Patch Re-establishment Trial

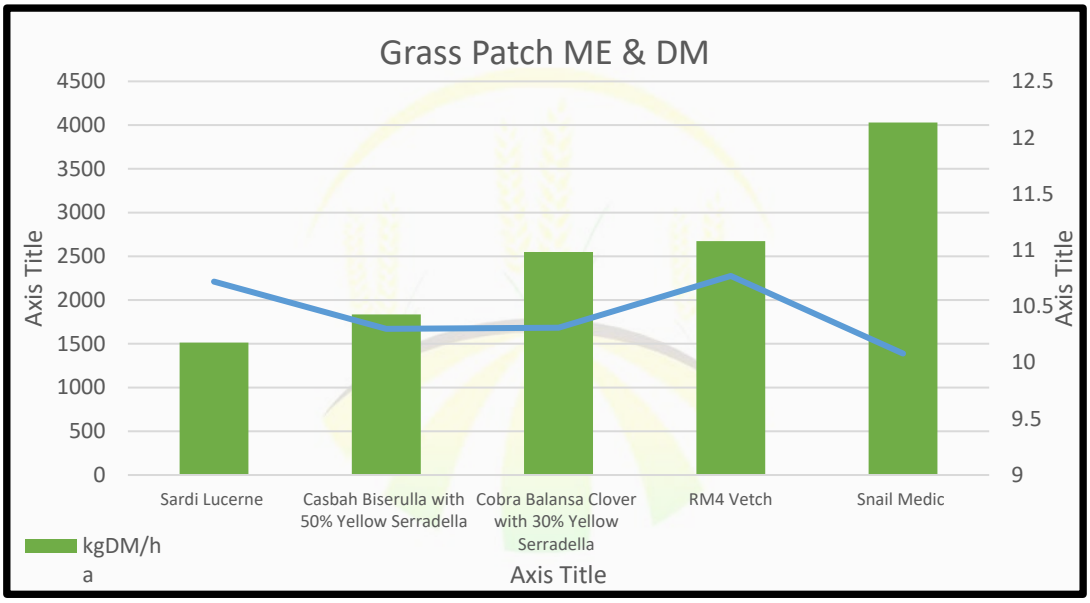
The grass patch trial was also originally sown as a plot trial in 2021 to fifteen different varieties and mixes. This site experienced very strong opening rains and subsequently had an excellent

establishment across all varieties, with the exception of Sulla which was unable to be collected. All other varieties measured high levels of DM at the 16-week cuts with express oats and tillage radish being the standout varieties, recording 8900 and 5000kgDM/ha respectively. As the season continued, rainfall subsided and the soil began to dry out during September, resulting in a poor finish and less than optimal seed set.

Grass Patch - Wattledale 2021 Trial Site	
Sown	Not over sown in 2022
Soil PH (CaCl)	7.4 (0-10cm) to 8.7 (50-60cm) measured 2021
Pre-Emergent Herbicide	None
Post-Emergent Herbicide	None
2021 Varieties & Rates	Sulla @ 5kg
	Trigonella @ 8kg
	Express Grazing Oates @ 70kg
	Express Grazing Oates @ 50kg & RM4 Vetch @ 20kg
	Tillage Radish @ 6kg
	Snail Medic @ 12kg
	Leafmore Grazing Brassica @ 5kg
	Casbah Biserulla @ 6kg
	RM4 Vetch @ 25kg
	Mawson Subcover @ 6kg
	Cobra Clover @ 6kg
	SARDI Grazing Lucerne @ 6kg
	Tetila Ryegrass @ 15kg
	Ballard Mix Ball ThumpA @20kg – *(Rose clover, bladder clover, soft pink serradella, sub-clover & tetraploid Italian ryegrass)*
	Ballard Mix Ball SalinA @ 20kg – *(Scimitar burr medic, balansa clover, tetraploid Italian ryegrass)*

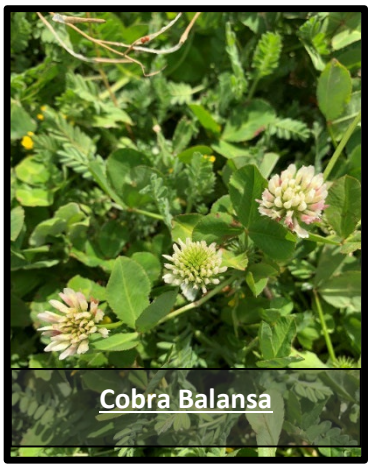
In 2022 this site was left as a pasture, and it was neither oversown nor treated with additional fertilisers or chemicals. The April rainfall was exceptional, followed by a drier-than-average May through July and a wetter-than-average August. Due to the drier winter and cool conditions, pastures established well but grew slowly. As a result, no 10-week samples could be collected or analysed. Of the fifteen varieties planted in 2021, there were five that re-established well enough to allow for pasture cuts to be collected in 2022. These five varieties were Casbah biserulla with yellow serradella, snail medic, Sardi lucerne, RM4 vetch and Cobra balansa with yellow serradella.

Pasture variety	Moisture	DM %	Crude Protein	ADF	NDF	Lignin	TDN	ME	RFV	DM/ha	PGR	DSE/ha
Casbah Biserulla with 50% Yellow Serradella	81.5	18.5	24.3	28	29.8	4.8	63.9	10.3	210	1835.2	13.80	11.04
Snail Medic	77.2	22.9	20.8	28.2	29.8	4.67	64.2	10.08	209	4030.4	30.30	24.24
Sardi Lucerne	82.4	17.6	25.7	22.4	25.3	3.91	67.6	10.72	263	1513.6	11.38	9.10
RM4 Vetch	80.4	19.6	31.4	26.2	26.9	4.27	67.9	10.77	237	2673.44	20.10	16.08
Cobra Balansa Clover with 30% Yellow Serradella	80.2	19.8	25	24.4	25.5	4.4	65.4	10.31	255	2550.24	19.17	15.34




RM4 Vetch


Snail Medic


Cobra Balansa

The 16-week cuts reveal adequate levels of CP and ME with the biomass ranging from 1835kg to 4030kgDM/ha, more than doubling the number of DSE that can be maintained between the top and bottom performers. The standout variety for biomass in this trial was snail medic, although it also recorded the lowest levels of ME/kg, DM which is consistent with the north Cascade trial. RM4 vetch once again performed well in both ME and DM/ha. However, grazing strategy must be considered if you are planning on letting vetch set seed. As mentioned earlier in this report, woolly pod vetch such as RM4 can induce secondary photosensitisation and can lead to livestock deaths if grazed during seed-set. Cobra balansa may be a better option if seed set is the target as it remains nontoxic during flowering. In this trial, it produced slightly less biomass and ME than the RM4 vetch. However, Cobra balansa has an extremely high seed count of around 1.4m seeds per kg, providing a dense re-establishment after seed set. It is also relatively hard seeded in cooler climates, protecting it against false starts. Being the earliest flowering balansa clover, Cobra ensures seed-set even in a tight finish, however, stocking rate should be carefully managed as over grazing during pasture reproduction will reduce seed-set and therefore plant density in the following year.

Agronomic Summary

While this report acknowledges pastures that stood out from a biomass and feed quality point of view, there are many other factors that should be considered, such as paddock history, weed control or the future plans for the paddock. A whole farm systems approach should be considered when selecting pasture options. Some of these considerations are outlined below.

Carrying Capacity

When choosing the type of pasture to grow, consider the key times of the year where the highest feed requirement is and, where possible, match the livestock class to fit these key periods. For example, late pregnancy and early lactation is when livestock are at their greatest demand for feed. If your farm system allows, lambing could be aligned with peak pasture growth. However, if this didn't suit the overall farm system, surplus peak season feed could be baled to produce hay or silage for feeding during times of peak feed requirement when pasture is less available. Often more than one variety may be required to match livestock demands or season variability. For example, a quick-to-graze species could be paired with a species that will grow biomass in winter and spring to extend your grazing window. Or an aerial seeded species could be paired with a subterranean clover to ensure pasture persistence in a tight year while staying well positioned to make the most of a soft finish when the opportunity presents. Furthermore, a biodiverse pasture can reduce the risk of livestock health issues.

Stocking Rates, Big Paddocks and Crop Grazing

When crop grazing, low-density stocking can cause livestock to graze paddocks unevenly. This could make it hard to get the best value out of the grazing opportunity and leave valuable feed in the paddock. Perhaps even worse, you could be at risk of overgrazing a section of a paddock, costing valuable yield potential. Therefore, matching stocking rate to paddock size and situation is crucial to maximising return from the area grazed. Where the mob size can't be matched to paddock size, strip grazing, using a temporary hot wire, could be an effective tool. When introducing livestock onto lush pastures or crops, stock should be treated with a clostridial vaccine to prevent pulpy kidney disease. It's also important to make hay available to slow the rate of passage as stock acclimatises and the feed hardens.

Weed Populations

Just like any other crop, weed control in a pasture phase has its limitations. It will be important to understand the population dynamics of the weeds on your farm leading into the pasture rotation. An emphasis on the potential need to drive down broadleaf weed populations in cereal rotations, before sowing a pasture, must be considered. While multispecies pastures have many benefits, they can reduce your options for weed control. On the contrary, a carefully considered pasture mix can create a great opportunity to chase grass weeds at a later application date compared to canola. This allows for the control of grass populations with extended dormancy and a later germination window.

Soil Benefits

A pasture phase can provide many soil benefits; perhaps the most notable in a mixed enterprise farm is nitrogen fixation from legume species. Green-manured pastures that break down and add humus and organic material to the profile do wonders for sustaining the longevity and integrity of the soil. They will result in healthier, generally higher-yielding crops. Remember to treat legume species with the correct inoculum group if there is minimal history. Furthermore, deep-rooted pasture species can

add organic material further down the profile, improving soil structure and providing conduits for moisture in non-wetting soils. A well-thought-out pasture rotation can also create a break for soil pathogens and diseases such as nematodes. It is important to consider any disease bridges between pastures and cash crops. For example, when using species such as barley or grazing brassica, consider the rotation as a whole and assess the potential for these species to carry stubble-borne diseases over to the following crop.

Fertilising Pastures

When fertilising pastures, be mindful of nitrate levels. High pasture nitrate levels will be toxic to livestock and may cause deaths. Lower rates applied more often are safer and, when timed well, promote higher plant nitrogen use efficiency. Plant biomass can be tested for nitrate levels to determine how safe it is to graze.

Phosphorus plays an important role in legume pasture systems as it generates cell division and new tissue growth. This allows for an increase in biomass and production which ultimately, allows for a greater carrying capacity. Each pasture species has varying nutritional requirements to achieve optimal biomass. For example, clover-based pastures have relatively high phosphorus requirements compared to serradellas medics and grass species.

Some of the soil types surveyed in the project can be characterised as deep sands, which are typically low in potassium. Soil potassium levels need to be monitored closely in hay and silage production country as removal is high under those systems. Adequate soil potassium levels are critical in plant production in terms of the movement of water, nutrients and carbohydrates. Sufficient levels in the plant result in improved cell strength and standability and allow the plant to combat disease and stress.

Soil Test Results

It is interesting to note the variation in soil types and soil constraints across the different sites and the effect that will have on the selection of pasture mixtures. Pastures can be just as sensitive to declining pH levels or soil sodicity, and consideration of soil constraints is an important component of pasture species selection. Identifying the nutrient status of the soil will enable the fertilisers with the correct composition to be selected to meet pasture requirements and optimise growth and biomass. The nutrient levels of the sites tested were generally considered adequate to meet plant requirements, with no significant nutrient deficiencies noted at any of the sites. Some areas will be responsive to lime. While lime application is not critical this season, pH will decrease over time, indicating that liming may be required in the future. Potential issues associated with the acidity found in the topsoil include root pruning from aluminium ions etc.

Rotational Nitrogen Supply and Value of Soil Supplied Nitrogen

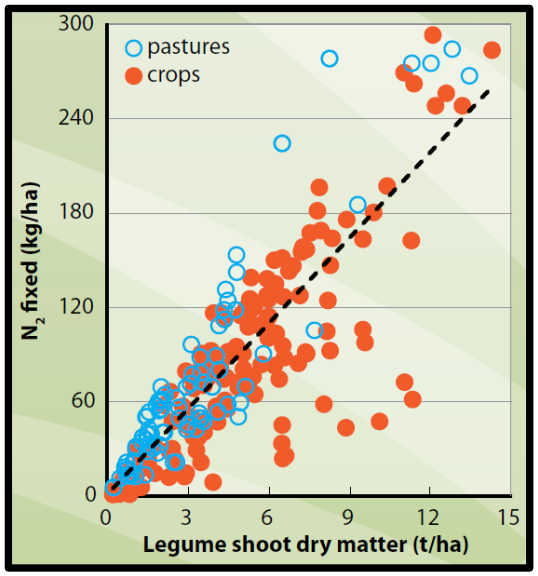
Considering 2022 fertiliser prices, a legume-based pasture in the rotation provides economic benefits in supplying available nitrogen to the following crop and improving soil fertility.

Where 100kg of urea supplies 46 units of N

Price of urea:

- $920/t; 1 unit is worth $2
- $1200/t; 1 unit is worth $2.60
- $1500/t; 1 unit is worth $3.30

A basic rule of thumb is that for every tonne of biomass grown by a legume, 20kg of soil nitrogen is supplied. If the pasture composition is 50% legume and 50% non-legume pasture, the rotational nitrogen will be 10kg (50%) of N per tonne of pasture biomass grown.



Source: Soilquality.org.au, Legumes and Nitrogen Fixation

The project results mention the available nitrogen from legume pasture cages after the 16-week cut. It should be noted that this figure doesn't reflect the exact amount of available nitrogen for the following season, as many other variables are hard to measure. Nevertheless, the figures provide an overview of the value of biomass and nitrogen according to approximate current fertiliser pricing.

Grower Feedback

Epasco - Nick Ruddenklau's Feedback on the Project

The pasture mix of Abundant ryegrass, Forester oats, and Rasina vetch (Condingup Site 3) was an excellent fit for our system at Epasco Farms. The multi-species pasture had a great outcome with multiple applications and feed sources.

Paddock B10 (Condingup Site 3) performed exceptionally well under heavy grazing with enough growth to be able to cut silage at 18T wet /HA, followed by a high level of growth to provide enough biomass for hay to be cut off at 2.2T/HA.

On reflection, providing an inoculant to the annual legumes would have been advantageous as the Rasina vetch did not nodulate to its full potential. The pasture mix required a high level of nutrition. It was a highly demanding "hungry" mix. The lack of nodules on the vetch could not provide enough nitrogen to support the pasture's rapid growth. The minimal nodulation of the Rasina vetch will also restrict the amount of nitrogen available for the following year.

Improvements for 2023

- Include an inoculation with annual legumes - vetch
- This was an unseasonably soft year with above-average rainfall that was beneficial to pasture growth. It was not under moisture stress
- When pastures were grazed hard, the legumes were targeted and grazed out, leaving a high % of grasses to dominate the pasture
- At moderate grazing levels, this allowed the legumes to compete evenly with the grasses and have a uniform species of pastures in the mix

Lortleaze – Simeon Roberts' Feedback on the Project

The combination of the two vetch varieties, RM4 and Barloo, was selected to extend the grazing window for Lortleaze's production system. This pasture variety provided a high level of biomass, recording 12 t DM/ha by the 16-week observations. In addition, high nitrogen fixation and nodulation levels of both vetch varieties were noted. This is highly beneficial in a rotational cropping program for the following year. An inoculant was not provided at seeding as there had been good background rhizobia history. This system will generally produce wheat yields of 5.5 tonne/HA on as little as 17 units of applied N/Ha.

Reducing input costs of fertiliser, herbicides, and pesticides inoculants are critical to Lortleaze's production system to minimise risk and increase the profit margin. Barloo vetch in the mix became susceptible to grey mould Botrytis; the early sowing time of March in warmer conditions contributes to Barloo vetch's susceptibility to grey mould. RM4 seemed to show more resistance to grey mould. Whilst livestock was grazing the pasture, there were visual signs of photosensitivity on the nose and ears of the sheep. As a preventive measure, a mineral lick was provided to sheep consisting of gypsum, lime, salt, pre-made calcium sulphur lick, molasses, and magnesium oxide. The lick was to ensure the lactating sheep had sufficient calcium and magnesium whilst grazing green pastures to reduce the incidence of hypomagnesemia and hypocalcaemia. When sown in March, the vetch pasture was still producing viable biomass up to October.

Improvements for 2023

- Ensuring that the grazing cages are taller as the vetch climbed out of the cages – loss in biomass
- A control of each of the pasture varieties is used as a comparison to the mixes
- Research promotes funding towards more vetch species, exploring long seasoned variety for lower rainfall zones, warmer temperatures and aphid resistance

Future of vetch

- Increasing the use of regenerative farming to lower inputs
- Limiting the N inputs
- Decreasing pesticide and herbicide inputs with new resistance/tolerant varieties

Carnigup Farms - Ryan Willing Feedback on the Project

The trial as it was delivered was fantastic to be a part of. Having regular DM cuts and feed quality tests is precisely what is needed to correctly measure the value of a pasture. Unfortunately, despite my best efforts, my field failed to perform in this unusually wet year. Also, having to be re-seeded, it wasn't as profitable as it should have been.

The main positive from the mix was the rye grass that performed well in the wet. The other was that despite the struggle to keep this growing, the cattle did well on it, and I still met my goals of finishing them in September.

The negative, apart from re-seeding, was that none of the legumes survived the winter. As a result, the stocking rate was lower than the same mix in previous years.

Improvements for 2023

- Increase sturdiness of the grazing cages, especially for cattle as they were very destructive; also, running a hot wire around the cages to reduce animals walking around cages.

Integration of Project Feedback

Feedback from 2023 site hosts will be considered to make improvements in the remaining years of the project, including adjusting the size of the grazing cages in vetch paddocks and their sturdiness in cattle paddocks.

In relation to capturing animal weights, unfortunately, whilst this information would be valuable, it is not deliverable within the scope of project resources – the increased level of complexity would require additional funding and also Animal Ethics Approval. However, this feedback will be considered by ASHEEP when planning future projects.

2023 Plans

The ASHEEP Pasture Variety Trials project has two years remaining. In 2023 and 2024, the project will again follow pastures grown by farmers on a commercial scale (10ha minimum) throughout the Esperance region. South Coastal Agencies will continue to drive data collection and analysis. Members of the project team met recently to select sites, and ASHEEP looks forward to sharing these plans in the near future.

Image: Members of the project steering committee meet to plan for 2024, including producers David Vandenberghe, Nick Ruddenklau, Mark Walter, Esperance Rural Supplies agronomist Theo Oorschot, and South Coastal Agencies team members Chad Hall, Rachel Minett and Sarina Clawson.

References

Department of Primary Industries and Regional Development 2020, *Annual pasture quality and quantity in South Western Australia*, DPIRD, viewed 4 February 2023, https://www.agric.wa.gov.au/pastures/annual-pasture-quantity-and-quality-south-west-western-australia

Department of Primary Industries and Regional Development 2017, *Grazing crops with cattle*, DPIRD, viewed 11 March 2023, https://www.agric.wa.gov.au/feeding-nutrition/grazing-crops-cattle

Australian Government Grains and Research Development Corporation 2019, *Paddock practices: key considerations for grazing crops in WA*, GRDC, viewed 11 March 2023, https://grdc.com.au/resources-and-publications/all-publications/paddock-practices/2019/west/may/key-considerations-for-grazing-crops-in-wa