



# final report

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## **Sterlings to Coast Farmers- Optimal pasture phases for livestock in Crop based rotations**

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## Abstract

Stirlings to Coast Farmers Incorporated (SCF) is a membership based organisation with a steadily increasing membership of over 80 farm businesses.

The MLA project sought “optimal pasture phases for livestock in a crop based rotation”. The project trials demonstrated:

- Early summer sowing (January-February) of Serradella pod was a viable option. The current district practice of dry seeding bare pasture seed in Autumn on sandplain soils was outperformed by summer pod sowing or seeding when soil is moist after full seasonal break.
- Pasture mixes were more productive over the growing season with a more optimal feedbase.
- Precision planter trials demonstrated that modifications of conventional seeding systems could improve plant establishment efficiency by more than 35%.

Converting these trial results to practice change could be accelerated with a “Farmer to Farmer” Pasture Check process.

## Executive summary

Stirlings to Coast Farmers Incorporated (SCF) is a membership based organisation with a steadily increasing membership of over 80 farm businesses. The MLA project sought to identify “optimal pasture phases for livestock in a crop based rotation”.

### Project Results:

- Summer sowing of Serradella pod and twin sowing needed testing as the Stirlings to Coast Southern region of WA has highly variable summers sometimes with wet and mild conditions and lower temperature fluctuations in the soil. This is in contrast to the rest of Southern WA where hot dry summers are the norm. The trial results were conclusive that summer sowing of pod was very effective in this region, however the results for twin sowing and the grower experience remained inconclusive. Most success in the trials came from the summer sowing of Serradella pod (Margurita).
- Integrated Weed Management trials were implemented across the broad-scale MLA pasture trials. Weed control in the pasture phase remains a priority (especially in a season where non-wetting causes staggered germinations for both the pasture species and the weeds. Herbicide resistance (HR) testing is an essential part of testing new rotational systems. There is need to monitor changes in HR status as an overall impact of system changes such as introducing a pasture phase in a cropping rotation. Ongoing HR testing is undertaken in a separate self funded SCF project and the trial sites were included in this program.
- An initial claying treatment was done in 2015 and a further trial with claying treatment applied in 2016 for M1. A trial hosted by Scott Smith with +/- clay treatments is being monitored for Serradella regeneration. Observations in this trial and in other paddocks is that claying has highly beneficial impacts on the regeneration of pastures (especially Serradellas).
- The MLA trial sites are being monitored for regeneration performance post project. The apparent flexibility of Margurita to wet or dry summers could be a significant factor with our variable summers, but herbicide test results indicate Santorini type maturity is best suited for spraytopping late ryegrass cohorts.
- M5 (Summer sowing pods vs autumn pasture mix systems), and
- M6 (Messina vs Balansa on marginally saline and waterlogged areas) were recommended at the review and are in progress in 2016/17. Messina only arrived for sowing on 10 June (and was sown on 10 June) but has proved a very viable option for the marginally saline and waterlogged areas.

### Recommendations for future action:

- Managing seasonal variability (MSV) remains a barrier to adoption as lessons learned in one season can be countered in next seasons. However the theme of MSV can be an opportunity to stimulate practice change with extension programs such as the Farmer to Farmer Initiative (SCF have two established Farmer to Farmer Groups that are ready to re-activate on self determined specific topics).
- There remains a need for an extension program based on the trial results to date, but also a focus on how well individual grower's own pastures are regenerating after tight crop rotations. To drive this requirement it has been suggested that a *pasture check* type program (with key rules of thumb) be coordinated with the two SCF Farmer to Farmer Groups, and facilitated by a pasture agronomist be considered.
- As specialist pasture agronomists are a limited resource in WA's agricultural industry there is scope for train the trainer type initiatives (with provision for rewarding private IP where identified).

- The use of a Green seeker in doing FOO estimates has been shown in another PRS project to be a very cost effective research tool (Brad Woolridge). With local calibration this tool could be effective in extension on growers' own paddocks and relating results to benchmarks from our research and where possible farm scale trials.
- Simple "Test as You Grow" farm scale trials can be supported by the R&D team at a cost of around \$6,000-\$8,000 per trial, depending on treatments and measurements made. The MLA PDS program is seen as a lead in this direction and SCF have established 3 PDS sites this year (2017).
- The WIIFM (What is in it for me?) question needs to be answered specifically for each grower to result in practice change. A Pasture Check approach provides a "rule of thumb" on what is good performance, and what is mediocre performance for growers own paddocks. This could provide enhanced results as new tools and apps are developed in the PRS outcomes and in other programs. The limited availability of specialist pasture consultants means the "Farmer to Farmer" extension methodology could be applied.

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# 1 Background

## 1.1 Optimal Pasture phases in a crop based rotation

### 1.1.1 MLA Project B.FDP.0028

The research questions SCF had included:

Site 1:

What are the optimal species combinations for pasture phases to drive the productivity of the livestock enterprise within a tight crop: pasture rotation? Does including grazing oats or Italian ryegrass in the legume mix increase early feed, without negatively affecting the legume establishment and legume seed bank for the crop: pasture rotation?

Site 2: Best pasture establishment methods

What are the most efficient and cost effective pasture establishment methods for sandplain soils?

Will twin sowing in the previous crop year or summer sowing in pasture year achieve a better early feed source?

### Background-

#### 1. Stirlings to Coast Farmers Incorporated

Stirlings to Coast Farmers (SCF) is a membership based, farmer led organisation, with a steadily increasing membership of over 80 farm businesses. This represents over 180 farmers and their families, managing approximately 250,000 ha of mixed farming enterprises. The membership area is the South Coastal region of WA, predominantly South and also West of the Stirling Ranges (from Boxwood Hills to Frankland and Manypeaks to Tenterden). The member businesses have almost all got dual enterprises of livestock production (running more than 400,000 dse total) and grain production.

The group is recognised as a progressive organisation with steadily growing membership, and is able to attract key sponsors as well as a growing number of corporate members. The focus on research and development is supported by our R&D Team, as well as a Research Subcommittee led by one of our Management Committee members. This focus has led to a wide variety of trials being implemented either independently, or in partnership with our sponsors and industry funders.

SCF have a strong history of running very successful events. This includes the Crop Updates plus Winter and Spring Field days, as well as many timely and season base field walks and workshops. These events are planned and managed by two sub committees operated by the western grower members and the eastern grower members.

Communication of the latest farming opportunities, timely pest and disease alerts, and the latest R&D information through our members' newsletter, eNews and regular emails ensure

SCF members are kept up to date. The Group has participated in a wide range of industry based projects (including GRDC, COGGO, SCNRM partnered projects) and with growth in SCF membership has come the opportunity for increased R&D for the livestock enterprise in our members' farm businesses.

The Stirlings to Coast Farmers Committee established through consultation that a key priority for the group is investigations on best ways of re-introducing pasture phases into mixed farming systems. Most growers report that many paddocks have now had intensive cropping phases and conventional pastures have lowered productivity and/or are in need of re-sowing. Lowered pasture productivity and legume content from self regenerating pastures after long cropping phases, increasing weed resistance from cropping phases, lowered organic nitrogen, increased diseases, nematodes etc, seasonal variability, need for improved livestock productivity in the business and other factors collectively, mean growers are now considering best ways of re-introducing pasture phases.

**New legume species:** The Stirlings to Coast Farmers Committee considers that better matching of land use to land classes will reduce risk. Lower and wetter parts of the landscape are prone to water-logging and frost and these areas are higher priority for phased pastures to reduce risk. Deeper sand units with low PWAC, low pH and low potassium levels are also targets for more selective land use and significant pasture phases that reduce risk to enterprises. While current research suggests there are answers, the perception remains that perennial based systems have higher establishment costs and management requirements. For example rotational grazing is critical to achieving good persistence in all perennials (except Kikuyu).

There is also an interest in the new hard-seeded annual pasture legumes, including serradellas, because these options offer increased flexibility in crop-pasture rotations. Recent experience with the new serradella varieties suggest higher productivity was being achieved even with a series of below average growing seasons, with exceptional productivity outcomes recorded in above average season like 2013.

**There are identified needs** on how to grow and manage these new pasture species:

More robust weed control options, particularly for broadleaf weeds are needed. Recent experience with re-sowing pastures has been that weeds of high priority for weed seed bank control (e.g. annual ryegrass and especially radish) are difficult to manage, especially in planned pasture seed crops.

Questions on paddock preparation, new sowing techniques (like twin sowing), grazing management for IWM etc. abound. Long term research by Peter Newman (ryegrass seed bank management) and Bill Campbell (Radish resistance control) all highlights the long term impacts on grazing systems if weed seed banks are allowed to rebuild in one year.

Producers need to be able to invest in pasture sowing with confidence, with a reduced risk of failure because margins continue to be tight for livestock enterprises. Growers have identified a need for local broad-scale pasture species evaluation, both in terms of reliability of establishment success, and in terms of improved livestock performance.

A component of this whole system is to have cost effective sources of good quality seed. Growers have experienced harvesting difficulties with some of the new serradellas and are seeking easily harvestable legumes, for example, Cadiz types, and husbandry methods that optimise harvest-ability. Once achieved this will overcome a major obstacle to broad-scale pasture resowing.

### **1.1.2. The Opportunity:**

Pasture research by DAFWA pasture specialists (Bradley Nutt and Angelo Loi 2010 & 2013) and recent SCF growers experience from 2010-13 confirm our current rotations can be upgraded to generate increased profitability with the introduction of the newer pasture phases. This especially applies to crop based rotations with a need for short pasture phases to increase the feedbase and to tackle emerging herbicide resistance. The hard seeded serradellas have performed well in adverse seasons but also especially well in 2013. New establishment systems had also been recently developed including twin sowing and summer sowing. What SCF required is the testing of best options and broad-scale validation of net benefits.

## **2 Project objectives**

### **2.1 Objectives**

**By 1st July 2017,**

1. Investigated the best options from newer legume varieties (hard seeded types) to assess which are more suited to the area's dominant soil types within a tight crop:pasture rotation.
2. Compared local legumes sown to a mix of legume varieties with a grazing cereal or Italian ryegrass for their potential to increase the early growth of feed on offer (FOO) without reducing seed regeneration.
3. Investigated the more recent methods of establishment of these pasture types, such as twin sowing in a previous crop, summer sowing, autumn sowing for their production on the main soil types in the area.

## **3 Methodology**

### **Consultation:**

Consultation was ongoing with the SCF R&D Committee in 2013, October 2014 and October 2015 and the SCF board in February 2014, October 2015 and March 2016. Initial consultation involved the SCF R&D Committee and SCF Board identifying research priorities from within the 14 grower members (plus industry) and contact with SCF members. This feedback was underpinned by a knowledge base review with industry and R&D agencies (esp. DAFWA pasture specialists).



Subsequently two R&D surveys were implemented during the major field days of the project term. The R&D Committee identified three information gaps after the first season of the project:

1. Grower experience was that twin sowing is a difficult fit and was largely unsuccessful. The question then was, will summer pod sowing work here with our very mild summers?
2. Will pasture mixes with a cereal for early bulk outperform sowing single pasture species?
3. Will changing seeders impact establishment rates? Small seed (pasture seeds, canola etc.) establishment has been variable, with some conventional seeders performing badly on non wetting soils especially when dry seeding.

Bradley Nutt and Neil Ballard were consulted: This occurred through delivery to SCF Crop Updates and Field days and then personal consultation on R&D design and analysis. The trial design was based on broadscale trials using farm scale machinery as systems of establishment were a key focus of the project objectives.

### **3.1 Research Sites**

#### **3.1.1 The trial sites for the project**

Almost all research on pasture phases for crop based rotations has been done in the Southern wheatbelt within different agro-ecological zones (AEZ') to the South Coast region. Consultation was undertaken with Pasture researcher Bradley Nutt. This included a keynote address at the 2014 Crop Updates and subsequent consultation with Brad Nutt and Angelo Loi (Researchers), and recognised pasture consultants, Neil Ballard and Paul Omodei, in the project planning period.

2014-17

- M1: Pasture mixes versus single cultivar (Growers: John & Ashton Hood)

2015-17

- M2 & M4: Serradella establishment methods (twin sowing & summer pod sowing) (Growers: John & Ashton Hood)
- M3: Using Precision Planter for non wetting soils (Growers: Peter & John Diprose)

2016-17

- M5: pasture mixes with cereal vs summer sown Serradella pod (Grower: Mal Thomson)
- M6: Options for waterlogged/marginally saline pastures: Messina vs Balansa (Grower: Iain Mackie)

**Latitude and Longitude of the M1 site:** S 34 deg. 32.988 mins and E 118 degrees 21.445 minutes

**Rainfall** Growing Season Rainfall: 400mm

**Predominant soil type(s) at the site:** sand over gravel (20-50cm) over clay 60-80cm

**Soil sample chemical analysis:** see appendix

**Site description and topography:** lateritic sand-plain soils with acidic pH (original vegetation Mallee, Chittick, Banksia etc).

**Site history:** 2 years of crop prior to 2014, very low clover bank, SU history not an issue as high rainfall in 2013

**Site map:** John and Ashton Hood's Home property: "Sand Paddock" – site 1 is alongside main driveway for ease of management. Site 2 is near Chillinup Rd on same property.

## 3.2 Treatments

### Site 1: MLA Trial: Optimal Pasture phases for Crop based rotations: Trial Site M1: John, Dorothy and Ashton Hood property

The purpose of Trial Site 1 (M1) is to evaluate species and pasture phase systems (including hard seeded annuals) for sand-plain soils (with low pH and low available soil water) in crop-based rotations.

**Front paddock:** Site soil tested in March 2014 and March 2015. Rotation: 2012 Canola / 2013 Barley / 2014 Pasture / 2015 Canola / 2016 Pasture.

**Rainfall:** Average Growing Season Rainfall: 380mm. The trial in 2014 received less than Decile 1 GSR for start of the season but the growing season in 2015 had an early start (April 10).

#### M1 Trial Sowing Plan:

A clayed strip was added across the 2014 plots. During 2015 the net benefit of the 2014 legume phases (versus non-legume phases) to the Canola crop was monitored and measured with yield data from plot measurements.

MLA project Site M1		Optimum pasture phase for crop based rotations on Stirling Sandplain
	<b>Project-MLA-18 Apr</b>	<b>John, Dorothy and Ashton Hood- Final sowing plan</b>
	Treatments	All with pasture seed to sown with 10 Kg/Ha Alosca inoculant or seed treated with peat culture
	<b>First Time of Sowing</b>	
	1	Santorini Serradella/ Bartolo bladder clover mix at regular seeding rate
	2	High seeding rate of the mix ( Serradella plus Bartolo Bladder clover)
	3	Mix + Tetraploid ryegrass
	4	Margurita French Serradella with Alosca
	5	Santorini Yellow Serradella with Alosca
	6	Control of volunteer pasture – no seeding but still run the bar over with fertiliser
	7	Serradella with peat inoculant

	8	Margurita with Peat inoculant (5.8 Kg/Ha)
	<b>Second Time of sowing</b>	
	9	Second time of sowing: Santorini Serradella with peat inoculation
	<b>Other</b>	
	10	Lucerne + chicory
<b>Plot</b>	<b>Treatment</b>	
A1	B	Buffer
1	3	Santorini serradella, Bladder Clover with peat inoculant and Drummer ryegrass No Pre-plant Propyzamide
2	6	Control of volunteer pasture – run the bar over with fertiliser no PPP
3	3	Santorini serradella and Drummer ryegrass
4	8	Margurita with Peat inoculant (5.8 Kg/Ha)-No preplant propyzamide
5	2	Santorini Yellow Serradella with Alosca inoculant (oversown)
6	5	High seeding rate of the mix (Santorini Serradella plus Bladder clover)
7	4	Margurita French Serradella with Alosca inoculant
8	1	Serradella/ bladder clover mix at regular seeding rate (5kg + 5kg per Ha)
9	2	High seeding rate of the mix (Santorini Serradella plus Bladder clover)
10	9	SECOND TIME OF SOWING Santorini serradella with peat inoculant
11	3	Santorini serradella, Bladder Clover with peat inoculant and Drummer ryegrass
12	6	Control of volunteer pasture – fertiliser only
13	8	Margaretta with Peat inoculant (5.8 Kg/Ha)-No preplant propyzamide
14	4	Margurita French Serradella with Alosca inoculant (?)
15	1	Santorini Yellow Serradella with Alosca inoculant (oversown)
16	5	Serradella/ bladder clover mix at regular seeding rate (5kg + 5kg per Ha)
17	9	SECOND TIME OF SOWING Santorini serradella with peat inoculum
A2	10	Lucerne + chicory

### Additional treatments

1. The perennial based mix (Lucerne plus chicory) was added as host farmers and the committee were keen to see a comparison with the new hard seeded Serradellas. This required separate grazing treatment and Elders and the TruTest company (suppliers of electric fence materials) part sponsored fencing for strip grazing.
2. The Peat inoculum treatments were added due to flow problems with the dry inoculum Alsoca when mixed with the seed. The seeder was setup for sowing fine seed (ryegrass, lucerne, chicory, clover and serradellas) however the Alosca had variable particle sizes causing flow problems.

3. The second time of sowing was added to the trial (there was debate in the SCF group about dry sowing versus wet sowing) given the dry April (decile 1).

**Note:** the host farmers and the SCF funded the extra treatments.

## **Sowing dates**

First time of sowing 17/18 April 2014 – DRY (Alosca inoculant on 4 plots only- reverted to peat inoculum for rest of treatments). Seed supplied by Ballard Seeds, Irwin Hunter Seeds and John & Ashton Hood. All seed registered and tested with > 70% germination.

Second time of sowing 6 June 2014 (soil wetter treatments applied 27 May – 15L /Ha Lure). The soil wetter was applied in a separate operation, as seeder not currently setup for banding of wetter.

Second rep of the first sowing of the Serradellas with Alsoca was re-sown on 6 June due to flow problems with Alsoca when mixed with the seed.

## **Site 2: MLA Trial: Optimal Pasture phases for Crop based rotations: 2014/ 2015 Trial Site M2: John, Dorothy and Ashton Hood property**

The purpose of trial site 2 (M2) is to address a key question from the SCF Working group: Will twin sowing in the previous crop year or summer sowing in pasture year achieve a better early feed source, while still fitting within the management system?

This second trial in 2014/ 2015 was initiated to test:

1. Twin sowing (application by sowing or spreading of seed pod in previous crop),
2. Summer spreading of Serradella pods, and
3. Sowing de-hulled seed in April 2015.

GPS – South East Corner of trial: E 626454m / S 6177490m (2a) and E624775 / 6178929 (2b)

## **M2 Modified Sowing Plan - Changes to Sowing Plan**

Site 2a: Treatment 4 was changed from Avilla Serradella to Bartolo Bladder clover for the summer sowing as seed producers were not producing Avila seed in 2015. April sowing on clayed area was undertaken on site 2b.

In assessing the equipment options on how to implement “twin sowing” a couple of major limitations were identified:

- a.) Many farmers’ seeders do not always have an additional bin for dispensing a second seed type (e.g. a separate bin for Serradella pod additional to the standard seed bin for dispensing the cereal seed), and
- b.) The cereal and the pasture seed need to be sown at different sowing depths (1-3cm versus 0-1cm). The most practical option in consultation with pasture researcher Brad Nutt was to broadcast the pod out over the 2014 cereal crop (to provide nine months of seed coat

softening) in a separate operation. Seeder modifications to investigate a full twin sowing system are being considered by several SCF growers for 2016.

	<b>M2a trial - John and Ashton Hood</b>	Unclayed	
PLOT	Treatment	Treatment	
<b>B</b>	Buffer	0	
<b>1</b>	April sowing of Serradella – Santorini seed	7	Applied 11 April 2015
<b>2</b>	Santorini treated pod broadcast in crop 2014	3	Applied 9 July 2014
<b>3</b>	Summer sowing of Santorini (treated) in pod	6	Applied 17 Jan 2015
<b>4</b>	Summer sowing of Margurita serradella pod	5	Applied 17 Jan 2015
<b>5</b>	Margurita pod broadcast in crop winter 2014	1	Applied 9 July 2014
<b>6</b>	Avila pod broadcast in crop winter 2014	2	Applied 9 July 2014
<b>7</b>	Summer sowing of Bladder clover	4	Applied 17 Jan 2015
<b>8</b>	Margurita pod broadcast in crop winter 2014	1	Applied 9 July 2014
<b>9</b>	Summer sowing of Margurita serradella pod	5	Applied 17 Jan 2015
<b>10</b>	Avila pod broadcast in crop winter 2014	2	Applied 9 July 2014
<b>11</b>	Summer sowing of Bladder clover	4	Applied 17 Jan 2015
<b>12</b>	Santorini treated pod broadcast winter 2014	3	Applied 9 July 2014
<b>13</b>	Summer sowing of Santorini (treated) in pod	6	Applied 17 Jan 2015
<b>14</b>	April sowing of Serradella – Santorini seed	7	Applied 11 April 2015
<b>B</b>	Buffer	0	

	<b>M2b trial - John and Ashton Hood</b>	Clayed	
PLOT	Treatment	Treatment	
<b>B</b>	Buffer - Santorini	0	Sown at 6.5 Kg/Ha on 9 April 2015
<b>1</b>	April sowing Margurita, Santorini and Bladder Clover seed	4	Sown at 11 Kg/Ha on 10 April 2015
<b>2</b>	April sowing of Serradella Margurita seed	1	Sown at 4.25 Kg/Ha on 10 April 2015
<b>3</b>	April sowing of Serradella Santorini seed (de-hulled)	2	Sown at 6.5 Kg/Ha on 10 April 2015
<b>4</b>	April sowing Bartolo Bladder Clover	3	Sown at 8 Kg/Ha on 10 April 2015
<b>5</b>	April sowing of Serradella Santorini seed (de-hulled)	2	Sown at 6.5 Kg/Ha on 10 April 2015
<b>6</b>	April sowing Bartolo Bladder Clover	3	Sown at 8 Kg/Ha on 10 April 2015
<b>7</b>	April sowing of Serradella Margurita seed (de-hulled)	1	Sown at 4.25 Kg/Ha on 10 April 2015
<b>8</b>	April sowing Margurita, Santorini and Bladder Clover seed	4	Sown at 11 Kg/Ha on 10 April 2015
<b>B</b>	<i>Buffer - Santorini</i>	0	Sown at 6.5 Kg/Ha 9 April 2015

### **M3: SCF/MLA Trial: Optimal Pasture phases for Crop based rotations: 2015 Preliminary Test: Precision seeding of Serradella**

#### **Site 3: Peter and John Diprose – owners of precision seeder and host for test site.**

This preliminary test site was implemented following SCF interest in the outstanding performance on sowing small seed (in 2014 – Canola) into non wetting soils in an adverse growing season start (2014 with <Decile 1 dry start).

SCF intends to contract a slot seeder and a conventional Tyne seeder to sow alongside the precision seeder in a dry April start (not 2015 season as thankfully > 40mm was received in 36 hours starting on 10 April). Site has been soil tested and the crop sequence has been 2013 Pasture 2014 Saia Oats, 2015 Sown Serradella pasture, 2016 Canola.

P L O T	<b>M3 preliminary test with Precision planter for Serradella establishment – Peter and John Diprose - Wellstead</b>	<b>19 April 2015</b>	Wellstead
#	Treatment	Tmt #	
<b>B</b>	Buffer –Precision sown Margurita	<b>0</b>	Sown at 100 seeds per sq. m approx. 3 Kg/Ha on 19 April 2015
<b>1</b>	Precision sown Margurita April sowing 250mm row spacing	<b>2</b>	Sown at 200 seeds per sq. m approx. 6 Kg/Ha* on 19 April 2015
<b>2</b>	Precision sown Margurita: April sowing of Serradella seed at 500mm row spacing	<b>1</b>	Sown at 100 seeds per sq. m approx. 3 Kg/Ha** on 19 April 2015
<b>3</b>	Precision sown Margurita: April sowing of Serradella seed at 500mm row spacing	<b>1</b>	Sown at 100 seeds per sq. m approx. 3 Kg/Ha on 19 April 2015
<b>4</b>	Precision sown Santorini (centre 8 rows): April sowing of Serradella seed at 500mm row spacing	<b>3</b>	Sown at 100 seeds per sq. m approx. 3Kg/Ha*** on 19 April 2015
<b>B</b>	Buffer –Precision sown Margurita	<b>0</b>	Sown at 100 seeds per sq. m approx. 3Kg/Ha on 19 April 2015

\*\*\* Santorini seed weight 180,000 to 220,000 per Kg

### M4 trial - John and Ashton Hood- Kojaneerup: Test Modified Twin sowing system

	M4 trial - John and Ashton Hood- Pod applied 21 May with barley sown 21 May 2015- for pasture establishment 2016	10m in from fence	
PLOT #	Treatment	Treatment	Pod application rate
1	Margurita topdressed before barley sown	1	49 kg/ha
2	Control	0	0
3	Santorini topdressed before barley sown	2	38 Kg/ha
4	Avila topdressed before barley sown	3	38 Kg/ha
5	Margurita topdressed before barley sown	1	49 kg/ha
6	Avila topdressed before barley sown	3	38 Kg/ha
7	Control	0	0
8	Santorini topdressed before barley sown	2	38 Kg/ha

Plots 10m x 100m with 4 treatments including control (Nil)

Ground drive spinner trailer

NE cnr

GPS 626716 6178106

### M5 Summer sown Serradella pod vs Pasture mix wet sown: Grower host: Mal Thomson

Fence line Plots start 12m from West fence. North-	1	L	25kg/ha	Sown 29/2/2016	Summer pod Feb sown LR
	2	H	50kg/ha	Sown 29/2/2016	Summer pod Feb sown HR
	3		12Kg/Ha mix	Sown 19/4/2016	Pasture mix April sown
	4	M	38kg/ha	Sown 29/2/2016	Summer pod Feb sown MR
	5	L	25kg/ha	Sown 29/2/2016	Summer pod Feb sown LR
	6		12 Kg/Ha Mix	Sown 19/4/2016	Pasture mix April sown
	7	H	50kg/ha	Sown 29/2/2016	Summer pod Feb sown HR
	8	M	38kg/ha	Sown 29/2/2016	Summer pod Feb sown MR



## IWM Post emergent herbicide / Foliar fertiliser treatments across M4 and M5 trials

### Treatments (2 replicates of each treatment 2m x 96m)

1. 500ml/Ha of MCPA
2. 500g/Ha of Simazine
3. 1L /Ha of Paraquat
4. 50g/Ha of Raptor
5. 35g/Ha of Raptor & 700 ml Bromoxynil/Ha
6. 1.5/Ha Bromoxynil
7. 80 Litres /Ha Flexi N
8. Control (nil post emergent)

## M6 Trial layout: Neptune Messina vs Balansa on waterlog/saline area

Host: Iain Mackie

Messina trial		
1	M Balansa	Messina
2	Messina	M Balansa
3	H Balansa	M Balansa
North <input type="checkbox"/>		

Trial site had knockdown (3 L/Ha of Roundup) on 3 June 2016. Seed spun on to surface 10 June 2016 – ponding on site already significant (Note: Site was deliberately selected to test Messina tolerance of waterlogging and marginal salinity). Seed not received from Bell Pasture Seeds PL until 10 June (same day it was sown!). Site fenced and NPK topdressed.

Soil testing showed that pH profile was marginal for Messina (subsoil <5.2) and in 2017 lime treatments were applied. The new rhizobia for Neptune Messina was introduced in additional plots in 2017.

**Average Salinity** of trial site was 395 mS/m and ranged from 189- 476 mS/m (marginal to significant salinity – as shown by barley grass dominance and lack of subclover at site selection).

### 3.3 Monitoring:

Plant counts, dry matter production and sseed/pod/burr weights were measured. Plots grazed after biomass measurements taken and grazing days recorded. Pasture cages used to measure utilisation. Weed and insect control treatments applied by growers and where necessary additional sprays applied using SCF 5m boomspray.

### **3.4 Statistical analysis**

ANOVA of treatments in each trial were undertaken on data sets of dry matter production and seed/pod weight measurements (see results section). LSD calculations and SE reported in tables and graphs

### **3.5 Economic analysis (if applicable)**

Treated Seed cost versus Serradella Pod seeding systems compared on a iso-cost basis with sowing of bare seed at 10Kg/Ha versus Serradella pod at 30- 40 kg/Ha.. This was based on farm case study of Serradella pod seed production of \$2.07 per Kg versus purchase of bare seed at \$8.30 per kg. Only Gross margins reported in trial site M5 comparing pasture mixes and summer pod sowing systems

### **3.6 Extension and Communication**

Field walks: 2014 and 2015 – these involved hosting of walks with farmer and industry groups, including Landmark and Elders client field walks.

The MLA trials were featured in the annual Stirlings to Coast Farmers Spring Field Days. The SCF 2014 Field Day , 2015, 2016)and highlighted in radio talks preceding and after the Field Days. See photos – results section and appendix

Newsletter articles with results from the trials were included each year.

Presentations at MLA state meetings 2014 & 2015 – MLA project Updates presented by John Hood & John Blake

MLA state meeting April 2017 – MLA project results summary presented by Ashton Hood & John Blake

Radio talks were undertaken with ABC Rural Breakfast session and Radio West before and after the major field days.

Papers presented at Stirlings to the Coast Farmers R&D Committee and the SCF board and at SCF Crop Updates March 2015 (South Stirlings/ Green Range), March 2016 (Kendenup) and March 2017 (South Stirlings).

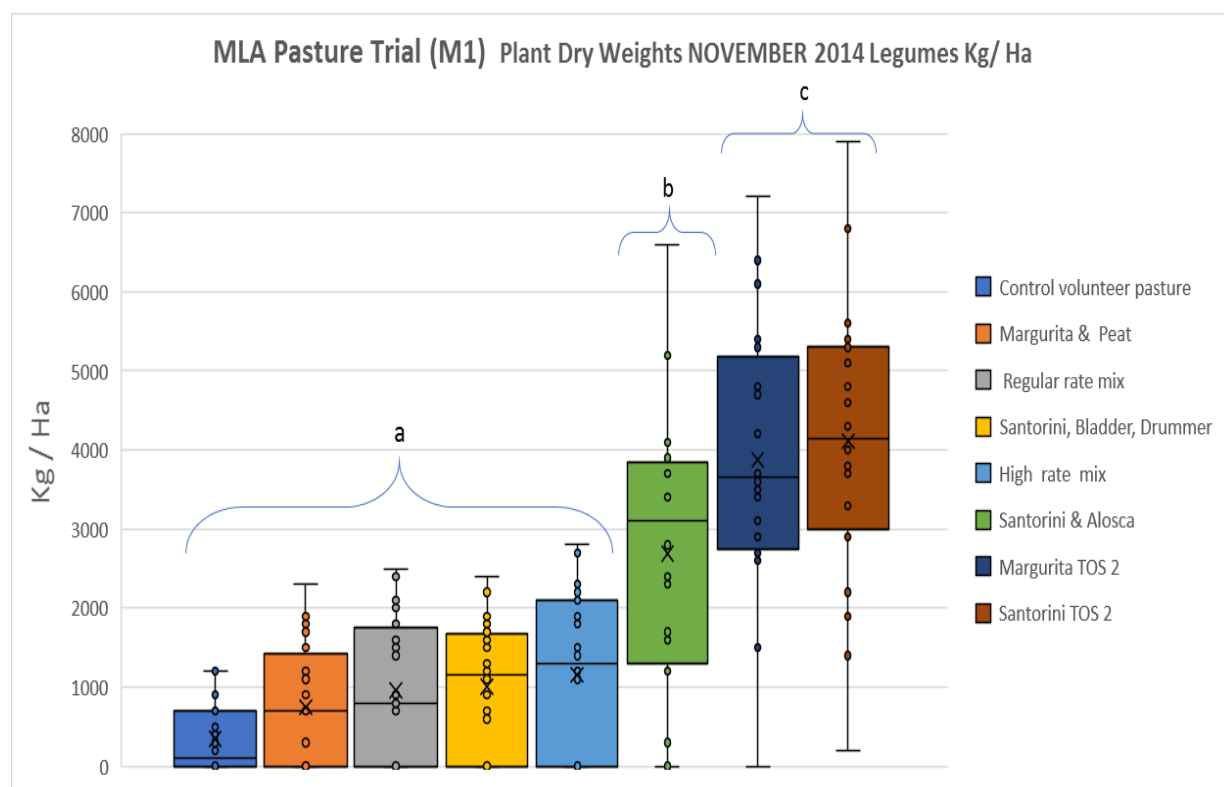
## 4. Results

### 4.1 Measured trial results

Output: Increased Dry Matter and pod production based on establishment success

**Site M1:** Pature phases for crop based rotations: Feedbase gain in quality and quantity

The adverse start in 2014 (< decile 1) resulted in the second time of sowing producing more legume biomass and pod. This is likely to occur in only 1 in ten years, however dry sown (April) treatments had very low establishment rates compared to later wet sown (May-June) on non-wetting soils. Excellent pod set in second time of sowing vs dry sowing treatment was carried though into year 3 & 4 with a legume dominant pasture in year 3 only from the initial second time of sowing plots.



95% LSD = 1122 Kg/Ha

## Anova: Single Factor

## SUMMARY

<i>Treatment Groups</i>	<i>Count 2 reps by 10 quadrats</i>	<i>Sum</i>	<i>Average DM Kg/Ha</i>	<i>Variance</i>
Control of volunteer pasture	20	7000	350	187894.7368
Margurita with Peat	20	15000	750	598421.0526
Mix at regular rate	20	19200	960	793052.6316
Santorini, Bladder and Drummer	20	20100	1005	652078.9474
High rate of the mix	20	23100	1155	1111026.316
Santorini with Alosca	20	53800	2690	3296736.842
Margurita TOS 2	20	77500	3875	2919868.421
Santorini TOS 2	20	82200	4110	3356736.842

- a. No significant difference between Control volunteer pasture, Margurita & Peat, Regular rate mix, Santorini, Bladder, Drummer and High rate mix was evident – this confirms the poor and variable result obtained with dry sowing of most of the treatments. The exception being Santorini.
- b. Dry sown Santorini & Alosca had significantly more productive drymatter yield than all other treatments except the wet sown treatments in the second time of sowing (TOS 2).
- c. Margurita TOS 2 and Santorini TOS 2 had significantly higher plant dry weights than all the other treatments.

Note: the second TOS treatments were not crash grazed in 4 /5 August and had 220 grazing days/dse/Ha less than dry sown plots.

Table 2: Legume pod and clover burr yields in the MLA trial hosted by John and Ashton Hood, Kojaneerup.

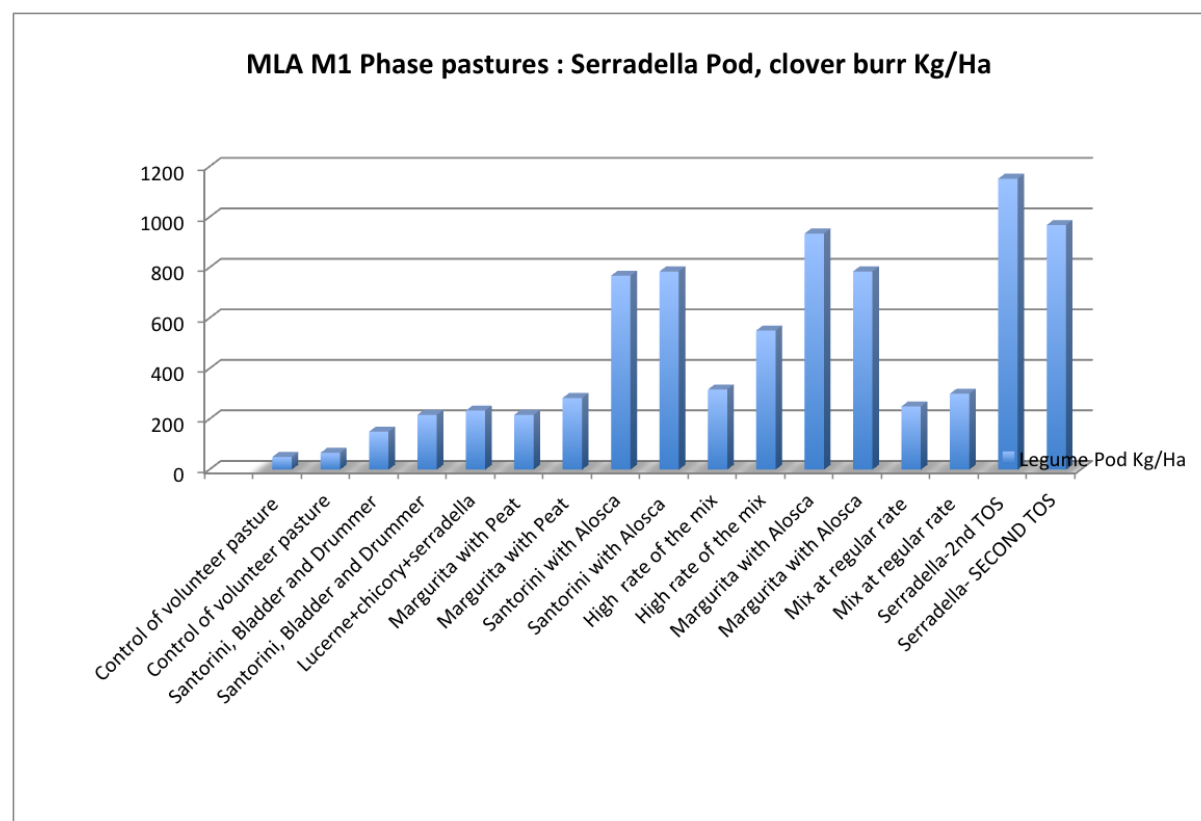




Fig 1: Margurita pod set in year 1: 2014 on John and Ashton Hood's trial

## Site 1: MLA Trial: Optimal Pasture phases for Crop based rotations:

### Trial Site M1: John, Dorothy and Ashton Hood's property

This first trial site involved Pasture trial first year then Canola year 2 and Cereal year 3

**2014:** The purpose of Trial Site 1 (M1) was to evaluate species and pasture phase systems (including hard seeded annuals) for light sand-plain soils (with low pH and low available soil water) in crop-based rotations. M1 Trial results: Refer to previous reports. High producing Second time of sowing in 2014 carried through to 2016.

**2015** the net benefit of the 2014 legume phases (versus non-legume phases) to the Canola crop was monitored and measured with plot sampling of control plots and 2014 2<sup>nd</sup> TOS Serradella plots. A yield response of 0.23t/Ha was measured in the plots with highest legume biomass.

**2016:** A Pasture strip within the crop paddock was used to monitor year 3 regeneration. In 2016 the regeneration of pasture from the 2014 seed set was assessed. Again, the best regeneration followed the second time of sowing of Serradella, with highest pod set in 2014. The unclayed section was used to assess pasture species tolerance to spray treatments and weed control in IWM.

Note: The contrast between 2013, 2015, 2016 and now 2017 (moist soils when April sowing) with 2014 (April dry sowing) has been very significant and demonstrates best methods will be seasonal dependent.



## Site 2: MLA Trial: Optimal Pasture phases for Crop based rotations:

### 2014/ 2015 Trial Site M2: John, Dorothy and Ashton Hood's property

#### Sites M2a&b

Will twin sowing in the previous crop year or summer sowing of pod in pasture year achieve a better early feed source, while still fitting within the management system?

Soil tests undertaken in 2014 and 2015 (see Appendix ). Predicata B tests were undertaken with the Soil DNA test laboratory.



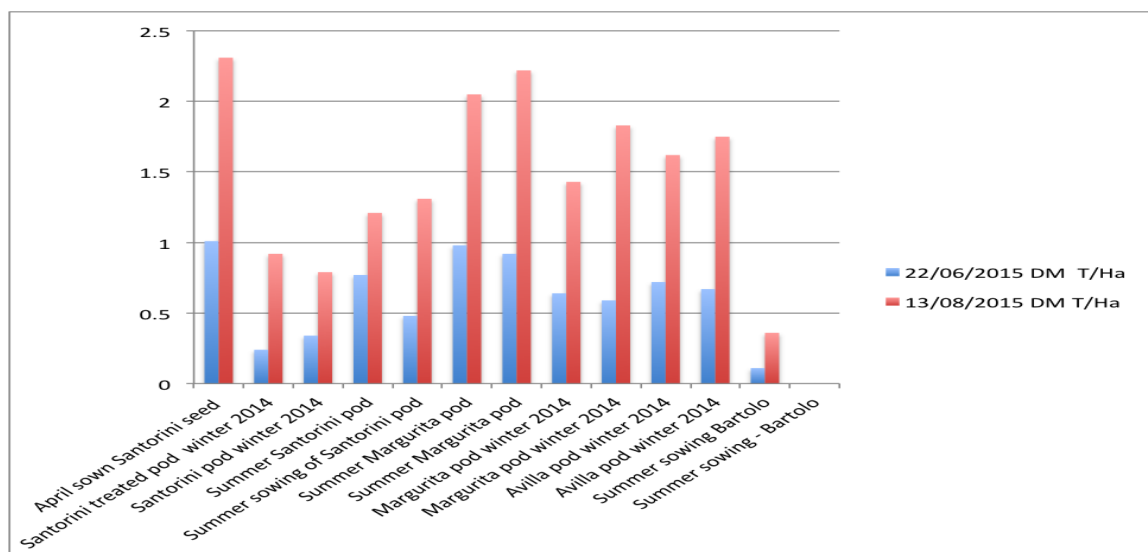
**Fig 2.**

John Hood at his M2 trial site 2015

Treatments:

- Twin sowing (application by sowing or spreading of seed pod in previous crop) June 2014,
- Summer application of Serradella pods, January 2015, and
- Sowing de-hulled seed in April 2015.

It appears there is varying hard-seed levels with Margurita Serradella and in the 2014 and 2015 trials M1, M2, M4 and M3 all having good regeneration of Margurita\*\*\* during the exceptionally wet summer. Santorini and Avilla have had low levels of regeneration by comparison after the December and January rain events and did not regenerate well even after the March rainfall events.



## Site M3

### **M3: SCF/MLA Trial: Optimal pasture phases for crop based rotations: 2015 preliminary test: precision planting of Serradella**

**Site 3: Trial Host: Peter and John Diprose – owners of precision planter and host for test site.**

This preliminary test site was implemented following SCF interest in the outstanding performance on sowing small seed (Canola) into non wetting soils in an adverse growing season start (2014 with < Decile 1 dry start) using a precision planter. SCF intended to contract a slot seeder and a conventional tyne seeder to sow alongside the precision planter in a dry April start (not 2015, 2016 or 2017 season thankfully). The crop sequence was; 2014 Saia Oats, 2015 Sown Serradella pasture, 2016 - planned Canola, but because of outstanding Serradella performance in previous year it was retained as a pasture paddock.

Test site was sown on 19 April (9 days after the break) into good subsoil moisture (but with drying topsoil). Seedling establishment was monitored, with post sowing insecticide applied on 27 April. Plant counts were carried out in May 2015.

**Fig 3: Site M3 – Precision sowing of Serradella on non-wetting soils – sown 19 April 2015 and re-established in 2016 (normally a crop phase)**



**Fig 4: Site M3 – Precision planting of Serradella at 250mm row spacing (plot 1) on non-wetting soils – 11 August 2015 Peter Diprose & John Blake**



**Fig 5: John Blake presenting to Bus 2 group at 2015 SCF Spring Field day 17 September 2015. Paul Omodei in foreground preparing to address participants on utilisation.**



**Soil Type:** **Stirlings Sandplain: Medium level water repellence.**

**Crop:** **Serradella (cv Margurita and Santorini)**

1. Establishment rates of 70% were exceptional.
2. 250mm row spacing is the maximum spacing of plant rows as at 500mm row spacing full canopy closure was not achieved until early September.
3. At commencement of podding pasture dry weights in Treatment 1 were 5.3 t/Ha. Though, please note that a very dry spring in 2015 caused severe moisture stress in the highest biomass plots.
4. A wet summer and autumn in 2016 found the Margurita produced cohorts of Serradella plants with each rain event. This resulted in sufficient plant numbers for a 2016 pasture phase.

#### Pasture trial - precision planting of Serradella cultivars

Treatment	Sowing Rate	Target seed density	Average plants no's at 8 WAS	Establishment of germinable seed	DRY Matter by 11 Aug	DM on 8 Sept	DM on 8 Oct	Date of full Canopy Cover	Pod Dry weight 11 Dec 2015
<b>Treatment 1 Margurita Serradella</b>	250 mm row spacing : 6 Kg/Ha	200 seeds per sq. m	142	62.2%	2.22 t/Ha	3.46 t/Ha	5.34 t/Ha	Early August	0.27 t/Ha
<b>Treatment 2 Margurita Serradella</b>	500 mm row spacing : 3 Kg/Ha	100 seeds per sq. m	74	71.6%	1.32 t/Ha	2.43 t/Ha	3.85 t/Ha	Early September	0.39 t/Ha
<b>Treatment 3 Santorini Serradella</b>	500 mm row spacing 3 Kg/Ha	100 seeds per sq. m	73	70.7%	1.41 t/Ha	2.67 t/ha	4.11 t/ha	Late August	0.48 t/Ha

Establishment rates were relatively high ( with a 50% improvement on rates recorded in Serradella establishment using conventional seeders). The narrow rows provided canopy closure more than a month earlier, which assists with weed control. Despite poor finishing rains the pasture trials produced good dry matter yields, though pod yields were down.

Budworm spraying with alpha Cypermethrin was less effective on the larger budworms, and penetration into the heavy canopy was not optimal, thus requiring a reapplication. Santorini set more pod earlier in maturity, and was less affected by high spring temperatures, less affected by budworm escapes, spraytopping grasses and by the very dry finish in 2015.

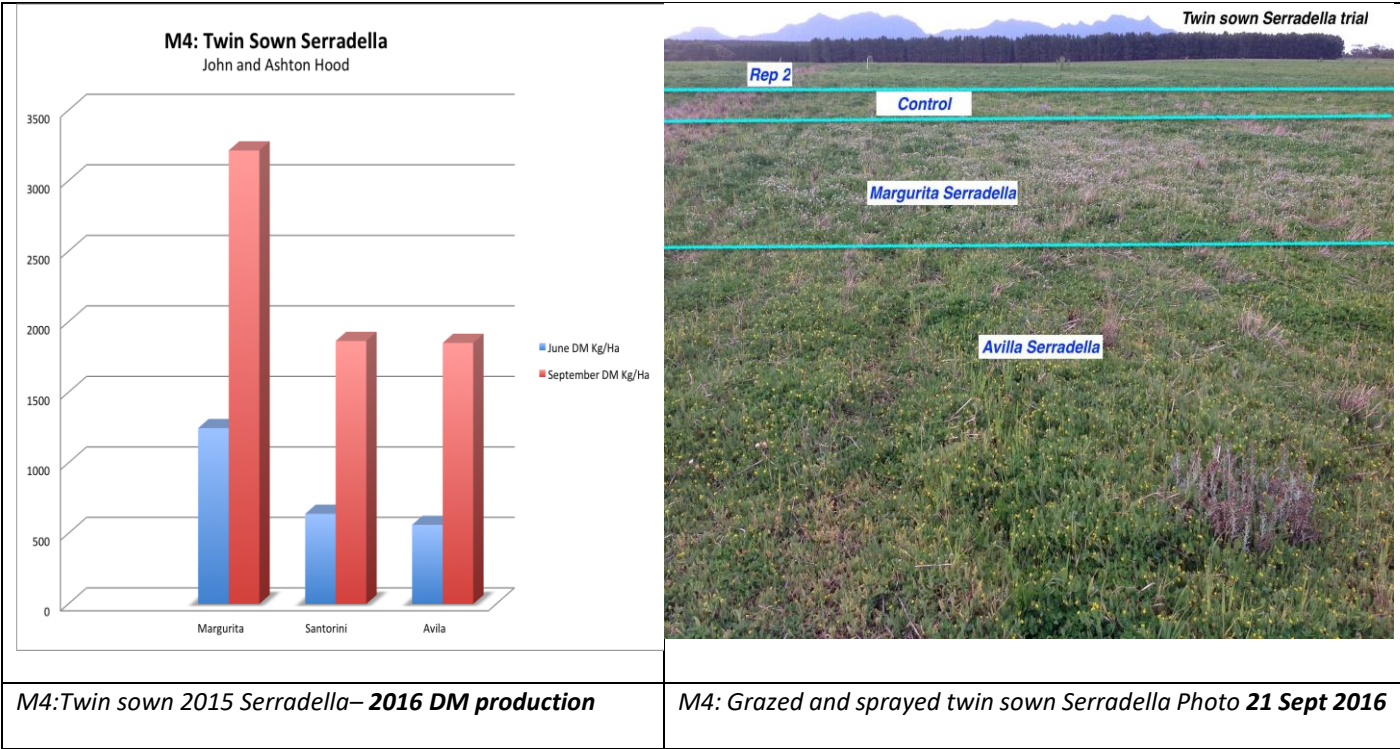
The new Serradella pasture (2015) paddock was to be cropped in 2016, but with good summer rain the Margurita serradella had cohorts continue to emerge after each rain event, and grower decided to stock paddock.

#### **M4: Trial: Evaluating twin sowing of pasture phases for Crop based rotations: 2015 Application of Serradella pod in front of seeding a cereal crop in 2015:**

##### **Site M4: John and Ashton Hood**

	<b>M4 trial</b> - John and Ashton Hood- Pod applied 21 May with barley sown 21 May 2015 - for pasture establishment 2016	<i>10m in from fence</i>		Legume Plant counts 5 April 2016
PLOT #	Treatment	Treatment	Pod rate	
<b>1</b>	Margurita pod applied in cereal crop 2015	<b>1</b>	38 kg/ha	39
<b>2</b>	Control	<b>0</b>	0	
<b>3</b>	Santorini pod applied in cereal crop 2015	<b>2</b>	38 Kg/ha	6
<b>4</b>	Avila pod applied in cereal crop 2015	<b>3</b>	38 Kg/ha	22
<b>5</b>	Margurita pod applied in cereal crop 2015	<b>1</b>	38 kg/ha	48
<b>6</b>	Avila pod applied in cereal crop 2015	<b>3</b>	38 Kg/ha	19
<b>7</b>	Control	<b>0</b>	0	
<b>8</b>	Santorini pod applied in cereal crop 2015	<b>2</b>	38 Kg/ha	9

Summer rain had cohorts germinating from January onwards with staggered emergence. Margurita performed the best in the twin sowing method, although plant numbers overall were lower than with the summer pod sowing method in the M5 trial (see below chart and M5 results below). For statistical analysis see attached.



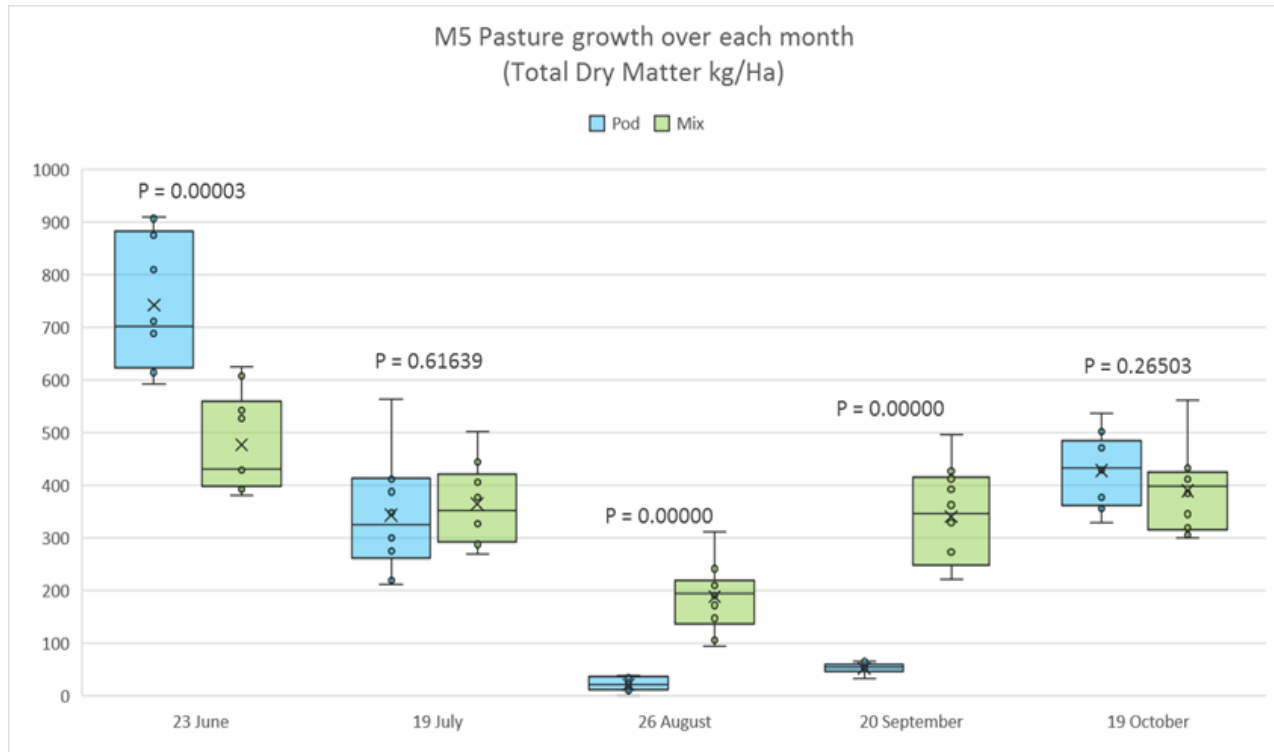
M4 Kojaneerup August 2016 – the white flowering Margurita plots evident in the drone shot



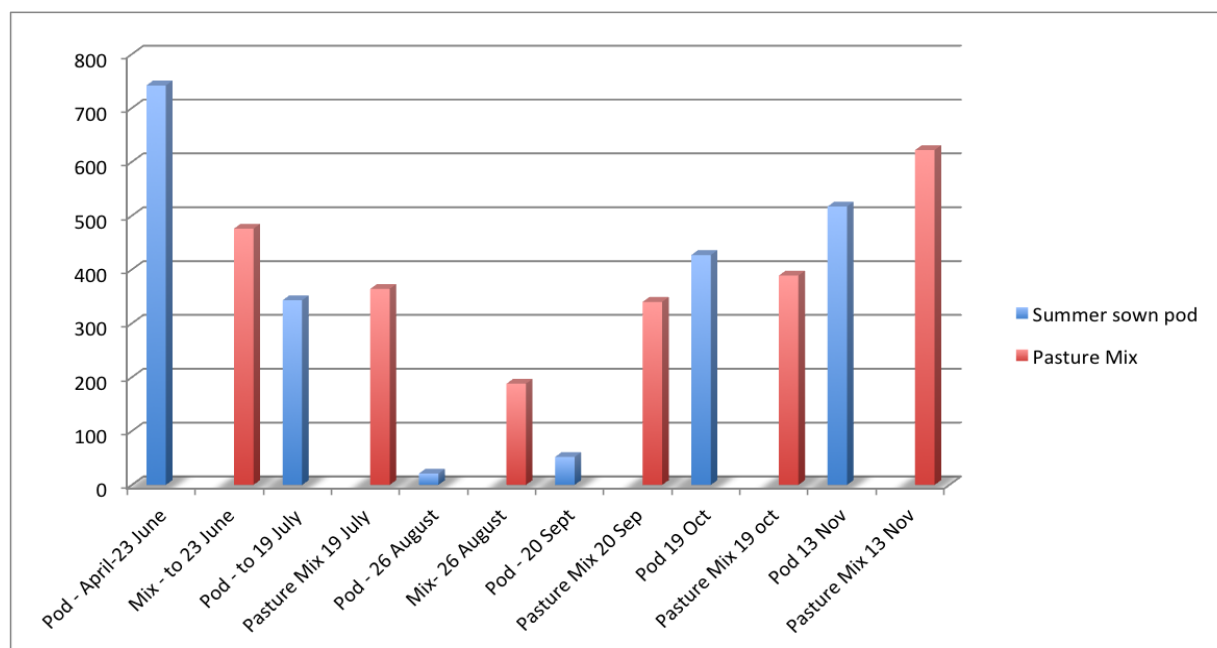
## M5: MLA Trial: Evaluating summer sowing of pasture phases for Crop based rotations:

### 2015 Sowing of Serradella pod in February 2016 versus direct seeding of bare seed pasture mixes:

Pasture Growth from Summer sown Serradella pod ("Pod") vs Pasture mix with Saia Oats ("Mix")



Excellent Autumn growing conditions	June Waterlogging	July Severe waterlogging	August Severe waterlogging	September Still waterlogging	October improved conditions	November Serradella still growing
Update data set below						



NOTE: With decile 10 rain-fall in total of summer, autumn and winter (5 Dec 2015 to 5 October 2016) the whole paddock, including the trial site was affected by more severe waterlogging (perched water-tables) than experienced on the site over the last two decades.

During the 2016 growing season the pasture mixes (Saia Oats, Erica Serradella plus Monti Clover) were more productive than single species of summer sown Serradella Pod. The pasture mix was sown 14 April 2016.

Mal Thomson's trial had good establishment despite a stubble fire, but later waterlogging showed the advantage of using pasture mixes (Mal's mix was Saia Oats 15 Kg/Ha, Erica Serradella 5Kg/Ha plus Monti sub clover 5Kg/ha ), with pasture mix plots out producing summer pod sown Margurita Serradella. Serradella production went into zero growth due to winter waterlogging in >decile 10 rainfall.




**Mal's Pasture Mix:** Mal's mix is Erica Serradella at 5 Kg/Ha, Saia Oats at 15 Kg/Ha and Monti sub Clover 5Kg/Ha.

**Paddock stocking rate:** Mal's paddock has carried just over 10 dse/Ha for three months despite waterlogging.

### SPRAY cross treatments applied 9 Aug 2016

The Dilemma: Pasture mixes can be more productive across paddocks but weed control (especially grasses if over-sowing with a cereal) more difficult.



	
<p>Fig: M5 Mal Thomson sowing Margurita serradella pod summer Trial: February 2016 (note: sprayed out self sown barley)</p>	<p>Fig: M5 trial site on 5 April 2016 showing emergence from Summer sown (Feb 2016) Margurita pod at 38 Kg of pod/Ha. Regrettably emerging seedlings partly burnt in April in stubble fire on 10 April. Photo 5 April 2016.</p>
	
<p>M5: Mal Thomson trial: Margurita Pod summer sown plot (RHS plot) vs Pasture mix with Saia oats (LHS plot). First replicate of treatments. Photo: 8 November 2016</p>	<p>M5: Margurita summer pod sown plot with cross treatments of herbicide sprays. Raptor showed best results Photo 19 October 2016</p>

### IWM Post emergent herbicide / Foliar fertiliser treatments across M4 and M5 trials

1. 500ml/Ha MCPA - Serradella 30-40% biomass reduction less than expected, no activity on toad rush
2. 500g of Simazine – very good activity on toad rush. Knocked Serradella biomass by about 30%
3. 500ml/Ha of Paraquat: Ok on toad-rush, ok on Serradella 20-30% biomass reduction
4. 1L /Ha of Paraquat: Good weed control but severe on Serradella: 80% biomass reduction
5. 50g Raptor: Very soft on Serradella. 40% reduction in toad-rush biomass& good brome-grass control.
6. 35g of Raptor& 700 ml Bromoxynil/Ha: Same weed control as Raptor, 15% Serradella reduction.
7. 1.5 bromoxynil: No activity on toad rush, 20% less biomass than Raptor and Bromoxynil.
8. 80 Litres /Ha Flexi N – no improvement on Serradella – main response from Toad rush and in Saia Oat: pasture mix plots!



**M6: MLA Trial: Evaluating sowing of pasture species for waterlogged and marginal salinity:** 2016 Pasture species 10 June 2016 (supplier delay) Messina versus Balansa: Site 6: Trial Host: Iain Mackie



M6: Messina (rear plot showing exceptional growth given delayed sowing) vs Balansa (front plot) on waterlogged and marginal salinity. Trial Host: Iain Mackie. Photo: 9 November 2016



M6: A real test for Messina vs Balansa: (seed had to be top-dressed on waterlogged site due to late arrival of seed on 10 June 2016) – this photo 6 weeks after sowing at end of July – ongoing water inundation and marginal salinity – site selection assured that test sowings would get a high challenge.

Dry Matter Yields 10 November 2016 (Note: plots not planted until June 10)

<b>Legume Pasture for waterlogged &amp; marginal salinity areas</b>	Average dry matter yield (somewhat variable across plots) Kg/Ha	Pod/burr yields Kg/Ha
Messina – Melilotus -legume	4285	394
Balansa – Clover - legume	3120	276

- Topsoil pH marginal <5.2 and average Salinity was 395 mS/M
- New Rhizobia for Neptune Messina applied in 2017 – additional plots

## 4.2 Extension and communication

<b>Date</b>	<b>Activity</b>	<b>Number of people</b>
2014 July	Field Walk	
2014 October	Western SCF Field Walk – Perry Dolling	55
2014-17	SCF Newsletters <ul style="list-style-type: none"> <li>• SCF 2014 Winter Newsletter</li> <li>• SCF 2014 Spring Newsletter</li> <li>• SCF 2015 Summer Newsletter</li> </ul>	150 150 150
	Farm Weekly	
9 <sup>th</sup> July 2015	Field Walk (LandMark)	23
22 <sup>nd</sup> July 2015	Grazing Crops Field Day +Precision planter assessment - CSIRO John Kirkegard +SFS Anmieka Paradeen, Phil Barrett Lennard (AgVivo) and John Diprose	29 +5
17 <sup>th</sup> September 2015	SCF 2015 Spring Field day + Paul Omodei	91
13 <sup>th</sup> October 2015	Pastures Field Day with Rob Davy, Adrian Anderson, Neil Ballard and Peter Diprose	16
	Western Field Walks	
22 nd September 2016	SCF 2016 Spring Field day with	87

**The need for further extension:** There remains a need for an extension program based on the results of the trials to date. Extension must also focus on how well grower's own pastures are regenerating after tight crop rotations. The field days were successful, however apart from increased awareness of participants' and an increased interaction between other SCF members and agribusiness, limited practice change is evident to date. Positive opportunities exist from extending these results to the broader industry and others in the PRS program - see sections on Promotion.



### 4.3 Participant reactions

**1. Dry seeding.** Prior to this MLA project, the common practice was to dry seed pastures in March – April. Observations by growers and treatment differences in the first trial confirmed that dry working on non-wetting soils damaged the soil's surface “bio pores” and made non-wetting much worse compared to sowing wetted soil (treatment TOS 2 in M1 trial).

The results from the M1 trial has affirmed that poor establishment from dry seeding year 1 impacts severely on pasture regeneration compared to sowing into wetted soils. This difference was evident over the three years of the rotational phase. Growers increased awareness of the benefits of claying, which has resulted in an increase in claying. However because of seasonal effects attribution of this finding is difficult.

**2. Summer pod sowing and twin sowing:** these are newer pasture establishment systems and remain under utilised. There remains a need for an extension program based on the results to date in the trials, with an additional focus on onfarm impacts on pastures regeneration after tight crop rotations.

**3. Conventional Seeder performance vs Precision planter performance.**

The 2015 trial resulted from a review of a Precision planter at the 2014 Spring Field day. Several growers modified their DBS, while others were planning to update their seeders with systems better adapted to sowing small seed. No growers in the group have converted back from tyne seeders to disc seeders for pasture seeding, though several have updated their seeders. This was highlighted in grower discussions during the field days both in Canola establishment trials and the pasture establishment trials.

**4. Pasture mixes vs monoculture**

### 4.4 Producer Research Site Program

The R&D committee reviewed and modified the project program:

1. Summer pod sowing and Twin sowing of pods - research and methods – Neil Ballard, Brad Nutt and Paul Omodei.
2. Pasture mixes – added perennials treatment in year 1 (lucerne and chicory) but not continued as plant survival and seed set insufficient with spraytopping and tight crop rotation.
3. Precision planter assessment for non wetting soils was introduced in 2015 following 2014 Field day demonstrating high establishment efficiency for small seeded crops (canola and pasture seed in particular).

## 5 Discussion

### 5.1 Outcomes in achieving objectives

The project had three objectives and each had outputs and outcomes

Project objectives up to July 2017	Outcome
1. Investigated the best options from newer legume varieties (hard seeded types) to assess which are more suited to the area's dominant soil types within a tight crop:pasture rotation	<p>The project had five trials which included the newer Serradellas and one trial on the Neptune Messina: The summer sowing of Margurita Serradella pod was the most successful in terms of legume biomass on light soils. The dry sowing (in &lt; decile 5 Autumns) of Serradella bare seed in early autumn (April) the least successful. The more hard seeded Serradellas are less suited to summer pod sowing and so Santorini is better sown as bare scarified seed into moist soil and treated as a crop.</p> <p>The Late maturity Serradellas are affected (reduced pod set) by spray topping late ryegrass cohorts at the end of the growing season. This remains an impediment especially for later French Serradella types to full adoption as a pasture phase within a tight cropping rotation. In these tight rotations growers need minimise the use of selectives as ryegrass resistance to such herbicides is steadily emerging.</p> <p>The output has been increased awareness of the limits in dry seeding light soils. The outcome will be less dry seeding of bare seed although after 2014 evry autumn has had summer and autumn rains and light soils have been wetted by April.</p>
2. Compared local legumes sown to a mix of legume varieties with a grazing cereal or Italian ryegrass for their potential to increase the early growth of feed on offer (FOO) without reducing seed regeneration	<p>Pasture mixes were demonstrated as a more robust system across the usual mix of soil types in paddocks and the range of seasons. Pasture mix plots out produced summer pod sown Margurita Serradella and also dry sown serradellas for total biomass (FOO) in the front half of the growing season however Seradella pod set in pasture mixes is severely reduced because of need to spring graze to limit ryegrass seed set.</p> <p>The outcome has been increasing use of pasture mixes although only partially attributed to this project. However the objective research evidence of this project has supported grower experience and observations that in variable seasons more robust mixes were overall more productive in terms of increasing high value feedstock.</p>

<p>3. Investigated the more recent methods of establishment of these pasture types, such as twin sowing in a previous crop, summer sowing, autumn sowing for their production on the main soil types in the area</p>	<p>The summer sowing of Margurita Serradella pod was the most successful and dry sowing of Serradella bare seed in early autumn (April) the least successful. The more hard seeded Serradellas are less suited to summer pod sowing and so Santorini is better sown as bare scarified seed into moist soil and treated as a crop.</p> <p>Twin sowing with Serradella in the trial mirrored the poor results growers were experiencing. Seeder configurations and herbicide regimes were not suited to twin sowing and especially the summer weed control programs which means early cohorts of Serradella also get knockdown. Growers are reluctant to use selectives over partial germinations of pasture and summer weeds.</p> <p>An outcome has been increased awareness and understanding of the options. Followup extension as suggested in following sections on extension and communication is required to generate change of practice in the regional industry and on-farm.</p>
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## 5.2 The value of the research results (Benefits/Costs)

### Benefits of the project

- Benefits from outcomes:

1. The MLA trials demonstrated that early summer seeding (January-February) of Serradella pod was a viable option. The summer sowing of Serradella pod has outperformed the twin sowing methods and dry sowing bare seed in Autumn in the two relevant MLA trials conducted by SCF growers.
2. **Benefits:**
  - i. Summer sowing of Serradella pods has an additional benefit in that it allows pasture sowing to be separate from Canola sowing in April. This increases the sowing window flexibility. In a average season the first rains in Autumn are peak opportunity for Canola sowing and historically pasture seeding has been relegated to dry sowing before the rains. As shown in the MLA trials dry sowing has penalties on sandplain soils (see 2. below).
  - ii. Serradellas have a higher tolerance of sub soil acidity and despite topsoil liming programs, the lighter soils have increasing sub soil acidity.
  - iii. During the project years when summer rains have occurred from harvest onwards (except for the first year in 2014), some soft seeded Margurita has emerged and provided feedstock. However, weed control with various cohorts of Serradella require knockdown/spray graze techniques not suited to Serradellas. Growers have used mixes of more hard seeded Serradellas to overcome this and to retain the benefits.
  - iv. Direct seeding of pods can be a large saving in seed costs. Off-farm purchase of treated seed averages \$8.00 per kg of seed (on-farm including freight or cartage) while harvested pod has been costed on-farm at around \$1.95 per Kg

(depending mostly on pod yields). Pod sowing rates between 25 Kg/Ha and an iso-cost (pod vs seed) rate of 40 Kg/Ha have been successful.

3. The MLA project challenges the current district practice of dry seeding pasture seed in Autumn on sandplain soils because of the severe limitations compared to summer pod sowing or seeding full seasonal break when soil is moist. This was confirmed in the 2014 season trial where the second time of sowing (into wetted soil) outperformed the first time of sowing in total legume biomass production and pod yield. This advantage has carried right through to seed set in Year 3 (in M1 trial Santorini and Margurita plots). The dry seeding causing increase of non-wetting is worst on unclayed sandy surfaced soils.

### **Benefits:**

- i. Higher legume content and pod yields when pasture establishment is undertaken after soils have wetted, carries through to crop benefits and year 3 pasture regeneration
- ii. Sowing when soil wetted achieves high pasture density. The poor results of dry seeding results in inferior weed control necessitating use of selectives and/or spraytopping before the Serradellas have completed pod set further reducing the ultimate legume biomass in the subsequent pasture regeneration phases.

### **Cost:**

- iii. Delaying pasture seeding on non wetting soils until topsoil is wetted up means pasture seeding competes for time with the crop sowing program (especially canola) and this penalty ranges from 20-50 kg/Ha of lost grain yield/Ha. The options of Summer pod sowing and/or prior claying of non wetting soils can remove this opportunity cost. This will require a ongoing communication and extension program as discussed in later sections.
4. Claying – from the MLA trials the advantage for pasture establishment is significant in aiding soil wetting and germination. Dry seeding in unclayed sandy soils results in poor pasture establishment (M1) and growers now have an added impetus to start and continue claying programs. Pasture regeneration has been observed to be higher in clayed vs unclayed areas in paddocks in the project area. Trials in another project have confirmed the crop yield advantages in claying.

### **Benefit**

- a. The benefit for crop rotations has been measured however research on impact on pasture performance is a longer term project plan proposed for 2018 and beyond.

### **Cost**

- b. The cost of claying is greater than \$500/Ha even with own equipment and the pasture improvement component in claying is a priority for further research
5. The performance of a precision planter for sowing Serradella in a 2015 trial demonstrated that modifications of conventional seeding systems could improve plant establishment efficiency by more that 35% on non wetting soils.
  - a. Even plant establishment means higher productivity and also aids weed control as in patchy establishment weeds will flourish where there is no competition from pasture plants.

- b. Two growers have changed seeders and others have been assessing how to modify existing seeders.
  - c. Future collaboration is being planned with engineering groups (Including Daryl Hine at Direct Seeding P/L) on improving Seeder efficacy with establishing small seeded pastures (and also canola).
6. The hard seeded Serradellas are performing well in specific treatments in the MLA trials even on the lower fertility, acidic and non-wetting sandplain soils. Later maturity Serradellas like cv Margurita lose significant pod set with spraytopping ryegrass compared to Cadiz or Santorini.

#### **Other Benefits in this project:**

1. Prior to the SCF running this MLA project the perception of growers in the region outside the membership in the region has been that SCF is exclusively a cropping grower group.  
The increasing emphasis of the SCF is now on Livestock issues as > than 90% of members are strongly mixed enterprises. The membership increase and further potential increases have been/will be from mainly livestock producers. This can be partly attributed to the MLA project through communication and extension.
2. This project has provided the group with more opportunities to engage key researchers including Brad Nutt, Perry Dolling, Paul Sanford, John Moore, Svetlana Micic, Angelo Loi, CSIRO-John Kirkgard, Jeremy Lemon and pasture and livestock consultants Paul Omodei, Ed Riggall, seed producers and marketers – Kelvin Ridgeway and Neil Ballard, , Animeka P, Phil Barrett Lennard, Erin Gorter

### **5.3 Promotion of research results and its effectiveness**

Increased awareness and understanding of pasture options for Stirlings Sandplain

- The MLA trials demonstrated that early summer seeding (January) of Serradella pod was a viable option. The summer sowing of Serradella pod outperformed the twin sowing methods in the two trials conducted by SCF growers and this option is being considered by growers but reliable on-farm pod production options need be developed and fitted into their systems by the growers.
- The current district practice of dry seeding pasture seed in Autumn on sandplain soils has severe limitations compared to summer pod sowing or seeding when soil is moist after full seasonal break. The next dry autumn (so far not since 2014) will be the test. Managing seasonal variability (MSV) remains a barrier to adoption as lessons learned in one season can be countered in next seasons however the theme of MSV can be an opportunity to stimulate practice change with extension programs such as the Farmer to farmer Initiative (SCF have two established Farmer to Farmer Groups that are ready to re-activate on self determined specific topics).
- The performance of a precision seeder for sowing Serradella in a 2015 trial demonstrated that modifications of conventional seeding systems could improve plant establishment efficiency by more that 35%. This was clearly understood and there is high interest in options to improve conventional seeder efficiency and this remains a research gap that scf is keen on partnering with engineering organisations (Including initiatives being supported by Direct Seeding P/L a local undertaking) and the Kondinin Group.
- The hard seeded Serradellas performed well in specific treatments in the MLA trials even on the lower fertility, acidic and non-wetting sandplain soils. Mixed maturity

Serradellas like cv Margurita lose significant pod set with spraytopping ryegrass compared to Cadiz or Santorini and this remains a barrier to adoption and also an ongoing research gap.

### **Promotion of Research:**

Communication and Extension programs had some success in increasing the understanding of the options however followup is required to achieve attributable practice change. The SCF R&D committee (with hosts of the PRS project) maintained oversight of the project and have made several recommendations (see last section).

As reported in earlier section the annual field days and newsletters reached the full membership of SCF, the agribusiness service sector and industry. The field days were successful with the participants' engagement in considering the options. The other SCF members and agribusiness have had increased awareness and understanding but limited practice change has been fostered to date.

Extension beyond the SCF group is planned in July 2017 with assistance of the MLA PRS program.

### **Barriers and options to overcome such barriers:**

Managing seasonal variability (MSV) remains a barrier to adoption as lessons learned in one season can be countered in next seasons however the theme of MSV can be an opportunity to stimulate practice change with extension programs such as the Farmer to farmer Initiative (SCF have two established Farmer to Farmer Groups that are ready to re-activate on self determined specific topics).

There remains a need for an extension program based on the results to date in the trials but also a focus on how well individual grower's own pastures are regenerating after tight crop rotations. To drive this it has been suggested that a *pasture check* type program (with key rules of thumb) coordinated with the two SCF Farmer to Farmer Groups and facilitated by a pasture agronomist be considered. As specialist pasture agronomists are a limited resource in WA's agricultural industry there is scope for train the trainer type initiatives (with provision for rewarding private IP where identified).

### **Pasture check programs:**

The use of a Green seeker in doing FOO estimates has been shown in another PRS project to be a very cost effective research tool (Brad). With local calibration this tool could be most effective in extension on growers own paddocks and relating results to benchmarks and where possible farm scale trials.

Simple "Test as You Grow" farm scale trials can be supported by the R&D team at a cost of around \$6,000-\$8,000 per trial depending on treatments and measurements made. The MLA PDS program is seen as a lead in this direction and SCF have established 3 PDS sites this year (2017).

## 5.4 Effectiveness of the participatory research process

- How the producers were engaged and the attributes that made the group work.

The SCF R&D committee in 2013 had included in the top R&D priorities, the need for higher performing pastures in crop based rotations. The SCF board supported this priority and the arrival of MLA PRS program was opportune.

The leads in the SCF pasture initiative were John and Ashton Hood who both at various times guided the PRS proposal to successful funding. Both through the three years of the project participated in State and Interstate MLA PRS conferences.

John and Ashton also guided the reviews by the SCF R&D committee and the SCF Board. Other growers then established pasture trials following the early initiatives, and the SCF R&D committee and SCF board supported the program expansion with additional funding from the group's own funds.

There were also significant investments and time provided by other trial hosts, including Peter Diprose, Mal Thomson and Iain Mackie, as well as research organisations and industry consultants.

Ashton has since been a lead in the SCF application for the MLA PDS program. Ashton has established a Producer Demonstration Site for dual purpose crops and is consistently pushing the evidence base required to drive practice change.

- Use producer quotes to demonstrate the value of group processes in conducting the PRS and the value to their businesses.

**John and Ashton Hood:** "Our focus is 1. To increase the early winter feedbase 2. Stay on top of weed seed banks and 3. Be able to make evidence based decisions on best systems for establishing pasture phases in crop based rotations".

**Peter and John Diprose:** "Our priority is getting high plant densities with uniform establishment whether it be in small seeded pasture lines or Canola crop hybrids" The ongoing performance of a precision planter is delivering our requirements"

**Mal Thomson:** "I need robust pasture productivity through the full range of variable seasons and variable soil types in each paddock. Pasture mixes I find meets this need".

**Iain Mackie:** " We need all parts of the landscape productive. The waterlogging areas with higher water tables and secondary salinity risks declining to barley grass only should be able to so much better with the right pasture species".

### **Main feedback provided to the researcher and supporting organisations.**

**There were two conflicting demands for new systems, these were:**

1. Need for bulk – growers were seeking best ways to substantially increase in the early winter feedbase.
2. Pasture phases in crop rotations should not result in "dropping the ball" in terms of a focus in ongoing reduction in weed seed banks (esp. ryegrass and radish).

**What future areas of research were identified by the group to help further develop the new research topic?**

- The SCF group was keen on exploring mixes to get feedstock bulk in the early winter. This became a strong component of the research, as while monocultures are easier to research, the practical need of exploring mixes was paramount.
- The group was interested in how a member's precision planter appeared to be doing better than conventional seeders. This became a part of the research.

**What was the experience of producers involved in the PRS – the extent to which they found the project/ activity useful or not useful or of value?**

- John and Ashton Hood, Iain Mackie, Scott Smith, Peter and John Diprose, and Mal Thomson, all had enquiries that became part of the research. By hosting trials on their properties they were very much engaged in the deliverables and what outputs were gained. All participating producers joined into the field days, and contributed significantly with parallel pasture seeding and management during the trials and in the paddocks containing the trials. Growers feedback from this project has found the project had helped them answer their questions.

## **6 Conclusions/Key messages/Recommendations**

### **6.1 Conclusions**

#### **6.1.1 Key messages**

**Conclusions and key messages:**

- Summer sowing of Serradella pod and twin sowing needed testing because the Stirlings to Coast Southern region of WA has highly variable summers. Unlike surrounding areas, the summers here sometimes provide wet and mild conditions, with lower temperature fluctuations in the soil. This is in contrast to the rest of Southern WA where hot dry summers are the norm.
- The trial results were conclusive that summer sowing of pod was very effective in this region, however results for twin sowing and grower experience remain inconclusive. Most success in the trials was from the summer sowing of Serradella pod (Margurita).
- Weed control in the pasture phase remains a significant issue (especially in a season where non-wetting caused staggered germinations for both pasture species and the weeds. Herbicide resistance (HR) testing is an essential part of testing new rotational systems. We monitored changes in HR status as an overall impact of system changes, including the introduction of a pasture phase in a cropping rotation. Ongoing HR testing is being undertaken in a separate, self funded SCF project, and these trial sites were included in this program. Trials involving IWM were implemented across the broad-scale MLA pasture trials.
- Treatments involving +/- soil wetters or new seed coatings were planned as trial treatments gave inconsistent results in 2014. Due to the early breaks and high summer rainfall wetters not applied in 2015 or 2016.
- An initial claying treatment was done in 2015, with a further claying treatment trial applied in 2016 for M1. A trial hosted by Scott Smith with +/- clay treatments is currently being monitored for Serradella regeneration. In previous years the site was used by CSBP, but no pasture data was gathered during the pasture phase in 2014. Observations in this trial and in other paddocks is that claying has highly beneficial impacts on the regeneration of pastures (especially Seradellas).



- The MLA trial sites will continue to be monitored for regeneration performance post project. The apparent flexibility of Margurita to wet or dry summers could be a significant factor with our variable summers, but herbicide test results indicate Santorini type maturity is best suited for spraytopping late ryegrass cohorts.
- M5 (Summer sowing pods vs autumn pasture mix systems), and
- M6 (Messina vs Balansa on marginally saline and waterlogged areas) were recommended at the review and are in progress in 2016/17. Messina only arrived for sowing on 10 June (and was sown on 10 June) but has proved a very viable option for the marginally saline and waterlogged areas.

#### **Recommendations for future action:**

- Managing seasonal variability (MSV) remains a barrier to adoption as lessons learned in one season can be countered in next seasons. However, the theme of MSV provides an opportunity to stimulate practice change with extension programs, such as the Farmer to Farmer Initiative. SCF have two established Farmer to Farmer Groups ready to re-activated on self determined specific topics.
- There remains a need for an extension program based on the results of the trials to date, but also with a focus on how well individual grower's own pastures are regenerating after tight crop rotations. To drive this opportunity it has been suggested that a *pasture check* type program (providing key rules of thumb) is coordinated with the two SCF Farmer to Farmer Groups, with facilitation provided by a pasture agronomist. As specialist pasture agronomists are a limited resource in WA's agricultural industry there is scope for train the trainer type initiatives (with provision for rewarding private IP where identified).

#### **Pasture check programs:**

- The use of a Green seeker in doing FOO estimates has been shown in another PRS project to be a very cost effective research tool. With local calibration this tool could be most effective method in providing extension on growers own paddocks. The related results could then be used as benchmarks, and where possible, underpin farm scale trials.
- Simple "Test as You Grow" farm scale trials can be supported by the R&D team at a cost of around \$6,000-\$8,000 per trial, depending on treatments and measurements made. The MLA PDS program is seen as a lead in this direction and SCF have established 3 PDS sites this year (2017).
- The WIIFM (What is in it for me?) question needs to be answered specifically for each grower to introduce practice change. A Pasture Check approach with "rules of thumb" will define good performance and mediocre performance for growers on their own paddocks. This could have positive impacts as new tools and apps are being developed in the PRS outcomes and in other programs.
- The limited availability of specialist pasture consultants means the "Farmer to Farmer" extension methodology could be applied

## **Acknowledgements**

MLA for the three year funding of this project.

John and Ashton Hood for initiating this project, hosting trials (M1, M2 & M4), providing guidance and equipment, hosting field Days and doing joint presentations at the State MLA workshops each year.

Peter and John Diprose for hosting trials (M3) and providing access to their specialist Precision planter for trials. Also hosting part of the 2015 SCF Spring Field Day.

Mal Thomson for hosting trial (M5) in 2016 and hosting part of the 2016 Spring Field Day .

Iain Mackie for hosting the Messina trial (M6) on his Forest Hill property.

## **7 Bibliography (if required).**

## 8 Appendix

### 8.1 Project detailed results

#### 8.1.1 Summary tables

Most data sets are in excel format and will be aggregated in collated file (tabbed).

Below are some summary tables.

M1 - Summary table: November Dry matter yields after spraying and winter grazing

MLA Pasture Trial (M1) - Host farmers: John & Ashton Hood: Project coordinator : John Blake													
Biomass (November 2014)	PLOT	Plant Dry Weights NOVEMBER 2014 Legumes g/ 0.1 sq m Quadrat										Plant Dm per sq m	Plant DM per Ha
TREATMENT Sown													
Control of volunteer pasture	p2	0	7	0	0	5	12	0	9	0	0	33	330
Control of volunteer pasture	p12	2	0	3	7	0	9	12	0	4	0	37	370
Santorini, Bladder and Drummer	p1	6	16	0	7	0	18	24	15	0	12	98	980
Santorini, Bladder and Drummer	p11	22	0	13	17	9	12	0	19	11	0	103	1030
Margurita with Peat	p4	18	0	17	3	0	9	0	12	7	0	66	660
Margurita with Peat	p13	0	11	0	23	7	15	19	0	0	9	84	840
Santorini with Alosca	p5	16	34	0	34	41	3	28	37	37	23	253	2530
Santorini with Alosca	p15	24	41	66	52	12	34	0	17	39	0	285	2850
High rate of the mix	p6	15	23	0	22	0	14	0	18	21	0	113	1130
High rate of the mix	p9	12	21	11	0	27	0	0	0	19	28	118	1180
Margurita TOS 2	p7	37	72	61	34	42	37	26	53	0	64	426	4260
Margurita TOS 2	p14	54	27	35	36	31	48	47	27	29	15	349	3490
Mix at regular rate	p8	16	18	0	20	14	0	8	0	15	7	98	980
Mix at regular rate	p16	24	0	8	9	21	0	25	0	7	0	94	940
Santorini-TOS 2	p10	19	37	53	2	53	29	46	51	43	56	389	3890
Santorini TOS 2	p17	22	79	37	54	14	40	33	48	38	68	433	4330

Anova: Single Factor: Total Dry  
matter production -November  
g/square meter

## SUMMARY

## Plots

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>	
p2	10	33	3.3	21.12222222	
p12	10	37	3.7	18.45555556	
p4	10	81	8.1	74.98888889	
p13	10	84	8.4	73.37777778	
p16	10	94	9.4	105.8222222	
p1	10	98	9.8	72.17777778	
p8	10	98	9.8	61.51111111	
p11	10	103	10.3	65.34444444	
p6	10	113	11.3	102.4555556	
p9	10	118	11.8	131.9555556	
p5	10	253	25.3	212.0111111	11.9
p15	10	285	28.5	478.2777778	11.9
p14	10	391	39.1	242.1	11.9
p10	10	423	42.3	408.2333333	11.9
p7	10	426	42.6	444.0444444	11.9
p17	10	433	43.3	390.9	11.9

## ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	33837.375	15	2255.825	12.43402105	2.39444E-19	1.736358798
Within Groups	26125	144	181.4236111			
Total	59962.375	159				

t Crit(df,0.05)= 1.977  
95% LSD = 11.9088156

M5	Pasture growth over each month (Total Dry Matter kg/Ha)						Pasture mix vs Summer sown serradela pod						TOT AL
	Pod - April -23 June	Mix - to 23 Jun e	Pod - to 19 July	Pastu re Mix 19 July	Pod - 26 Augu st	Mix- 26 Augu st	Pod - 20 Sep t	Pastu re Mix 20 Sep	Pod 19 Oct	Pastu re Mix 19 oct	Pod 13 Nov	Pastu re Mix 13 Nov	
Summ er sown pod	742		343		21		52		427		499		2084
Pastur e Mix		476		364		188		340		450		620	2438
<div> <div>Ideal growing conditions</div> <div>Water inundation and waterlogging-plant loss</div> <div>Better growing conditions</div> <div>Better growing conditions</div> </div>													
Rep 1	906	392	417	412	12	94	47	426	328	413	424	631	
	625	608	212	287	35	211	39	273	516	306	611	653	
	874	527	299	326	9	241	66	328	355	411	426	459	
	711	399	348	293	13	147	33	392	471	619	580	679	
	693	380	275	444	38	172	58	412	363	421	631	598	
Rep 2	910	542	411	377	22	190	51	247	478	384	366	694	
	592	434	387	269	0	312	64	362	376	345	457	682	
	688	428	219	406	26	106	56	495	502	611	433	655	
	809	625	301	328	37	199	47	249	437	562	526	458	
	614	428	564	502	20	209	59	221	428	432	535	687	
Total from 10 samples	7422	476 3	343 3	3644	212	1881	520	3405	425 4	4504	498 9	6196	