



Final report

The More Sub-Clover Package

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Abstract

A desirable mixed pasture contains up to 40% sub-clover to ensure optimum animal and pasture production, nitrogen fixation and weed control. The how do I get more sub-clover package provided producers and advisors with a simple diagnostic approach using Pasture Paramedic to assess clover pastures. The rule in rule out table would identify the leading reasons for possible sub-clover decline and six factsheets on relevant management practices to address limitations. The factsheet expanded on past knowledge and included updated information from MLA Feedbase research to ensure an ongoing utilisation of the research legacy. For separate merchandise/reseller companies were trained in the key components of assessment, diagnosis and management in training workshops for the purpose of extending the reach of the project. Most producers utilise the services of agricultural companies for purchase of inputs and services and to access information. A key result of the project was the introduction of merchandise companies to the capability of MLA products and events. The introduction was successful and is expected to provide an ongoing participation. Agronomy companies expressed desire to be trained and be provided with materials with good practical information. This project provides ongoing benefits to the red meat industry with its legacy of resource materials that can be used across multiple leaning platforms to maintain or improve sub-clover content in a mixed pasture.

Executive summary

Background

Sub-clover is a key component of a stable pasture where ideally 30% to 40% of the pasture composition is clover. MLA expressed desire to extend the research messages regarding sub-clover management that had been developed from the Feedbase Investment Plan (FIP) and modernise past extension material through the Feedbase Adoption Plan (FAP).

The target audience of this project was advisors and their producer clients in the southern feedbase where sub-clover is the dominant companion legume. The project focus was to develop products to rapidly assess sub-clover content, identify the leading reasons for possible sub-clover decline and the management practices available to address these limitations. Then to use merchandise resellers to help promote the products and key message to producers and further increase the project reach.

Methodology

Product development was designed to consider producer temperament (personality) types to appeal to different market segments. Road testing of products occurred to develop high quality resources. Products were promoted through training workshops with merchandise resellers.

Results/key findings

The products developed included:

- a simple diagnostic approach using Pasture Paramedic to assess clover pastures and a diagnostic guide involving a rule in rule out table to identify the leading reasons for possible sub-clover decline.
- Six factsheets on relevant management practices which addressed limitations.
- Two short videos related to grazing management and cultivar identification.
- Five producer case studies to highlight good management practices and principles.

Four separate merchandise/reseller companies were trained in the key components of assessment, diagnosis and management and showed evidence of extending the reach of the project to producers.

Benefits to industry

The benefit of MLA having ownership of sub-clover products and advisors/merchandise resellers trained in their delivery will potentially improve management of sub-clover in mixed pastures. This in turn can help the industry provide increases in animal production and more efficient use of nitrogen fertiliser and assist with weed control.

Future research and recommendations

Further promotion of products and their key components is needed to maximise their value. There was an appetite for the products from producers and producer organisations. While some of this could be met within the project, Covid lockdowns and producers not being a target audience, meant there is opportunity for future extension. Connection to other relevant PGS packages and awareness by their coaches could help achieve full value. The creation of a Legume hub to house the sub-clover resources to make them easily accessible will be a valuable addition to MLA online resources.

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1. Background

Sub-clover is a key component of a stable pasture where ideally 30% to 40% of the pasture composition is clover (Kemp and Dowling 1991, Kemp et al, 1996). Its value in a mixed pasture is threefold:

- Offers high feed quality – its fast passage through the rumen increases feed intake and drives animal production. Commonly used to increase weight gain of growing livestock.
- Nitrogen fixing – provides a source of nitrogen which drives pasture quantity and reduces reliance on applying nitrogen fertiliser.
- Provides a strong resilient pasture, more resistant to weeds.

Recent MLA FIP (Feedbase Investment Plan) funded research shed light on the possible decline of sub-clover for multiple reasons including:

- Managing soil borne diseases of sub-clover (B.PSP.0005)
- Factors affecting nodulation, such as soil acidity, nutrient deficiency, herbicide residues (B.PSP.0013)
- Competition from subtropical grasses and soil fertility (B.PSP.0001)
- Phosphorus efficient legume pasture systems (B.PUE.0104)

In addition, pasture research into grazing method showed rotational grazing strategies favour production of desirable perennial grasses and decrease the amount of sub-clover (Broadford Grazing Experiment, Orange EverGraze Proof site and Sustainable Grazing Systems Trial Balmoral). Many extension materials have an emphasis on management of desirable grass content but failed to acknowledge the grazing management strategies needed to maintain sub-clover within mixed pastures.

MLA expressed desire to extend the research messages regarding sub-clover management that had been developed from the FIP and modernise past extension material through the Feedbase Adoption Plan (FAP).

The target audience of this project was advisors and their producer clients in the southern feedbase where sub-clover is the dominant companion legume. Anecdotal feedback from training providers such as Rural Information, Skills Training (RIST) was that a whole generation of producers have missed vital basic pasture and livestock extension training. Multiple reasons are surmised for the declining producer skills. They are thought to involve producer movement into cropping when poor livestock prices existed and a decline in state department run advisory programs.

The project focus was to develop products to rapidly assess sub-clover content, identify the leading reasons for possible sub-clover decline and the management practices available to address these limitations. Then to use agronomists to help sell the products to producers and further increase the project reach.

Products developed will provide a legacy available through future extension projects such as:

- PGS training packages, e.g. Manipulation, Resowing, PayDirt
- E learning modules
- Making more from Sheep Modules
- MLA E news and Feedback magazine.
- MLA proposed legume hub

2. Objectives

The project had the following objectives:

1. To create and road test with producers a diagnostic guide to assess the current condition of sub-clover pastures and rank the most important limitations.
2. To create and road test with producer’s management notes and develop associated producer management case studies on how to practically address the most important limitations identified. These management notes were to link existing technical information that is already available with practical paddock application.
3. Train agronomists, advisors and retailers in the use of the diagnostic tool and management options. This is to ensure there is awareness and support from other sources when the product is released.

The first objective was achieved through the development of key information related to sub-clover condition within the assessment tool Pasture Paramedic and the diagnostic tool factsheet called “How do I ...determine why my sub-clover is underperforming?”

The second objective was met through meeting the project deliverables of six management factsheets, five producer case studies (four was the deliverable) and the production of two videos. Feedback was sought from producers and agronomists throughout their development to ensure that the information was user friendly, visually appealing and useful. An additional case study was developed on spring management of sub-clover to complete all the of season’s management by producer Simon Gabb.

The final objective was met through running training workshops specifically designed for merchandise reseller companies.

3. Methodology

3.1 Accounting for temperament type

Product development and its extension was to consider temperament type to appeal to different market segments.

Factsheets and case studies were chosen based on their appeal to Myers Briggs Type Indicators (MBTI) SJ’ or ‘SP’ personality types to improve producer engagement. These temperament types which account for 80% of producers are people who like detail and have been further refined into the temperament types called the “Dependables” and “Doers”, (Nicholson and Long, 2015). The factsheets also were developed to this group by providing their information preferences such as information presented in clear steps or pathways and information on implications, costs, opportunities and systems fit.

The doers like learning from each other and so the principle-based case studies would focus on describing what was done and its outcome. The doers often being busy and having many jobs on the go, would want to access and read factsheets when they have downtime. Visual evidence from photographs and videos are most likely to appeal to this group because they may not have time to go through all the details in a factsheet. This group rely on supply chain influencers such as

merchandise sellers to provide information and therefore workshop training of this target group was necessary.

Another group ('N' types, NF- Team builders) who are focused on big picture thinking were to be engaged through the messaging involving environmental/social aspects of sub-clover providing better pastures through increased nitrogen, free nitrogen and reducing reliance on fossil fuels and nitrogen fertilisers.

The remaining group the (NT- Pioneers) who learn by connecting patterns or bits of the jigsaw and are future focused were targeted to become engaged with the material through the 'consultants, agribusiness and networks they engage with. Therefore, a focus was to make these advisors aware of the products and have access to the extension material.

3.2 Diagnostic guide

The first part of the objective was to assess the current condition of sub-clover pastures and that was achieved through the development of Pasture Paramedic (PP) tool in project L.FAP.1903 (The persistence and productive pasture package). PP is a tool to rapidly assess pasture composition. Its creation started with literature research to formulate benchmarks. Within PP it contains two critical assessment measurements related to sub-clover. One is the visual assessment of clover content in the winter/early spring assessment and the second was the measurement of dry litter which influences sub-clover germination in the late summer/early autumn period.

Small demonstration plots were established to collect images and basic data on the amount of litter and its effect on germination (Brogden J, 2020). This allowed creation of simple messages and demonstration of targets such as "Leave 1000 kg DM/ha which is equivalent to one to two handfuls of litter scraped up from within a 0.1m² quadrat by the autumn break to encourage sub-clover germination." Road testing of this product and prototypes involved testing product development through numerous groups.

This tool comes with an assessment quadrat, support manual (hardcopy and online version) and recoding booklet. The manual contains photographs and key distinguishing traits to help identify sub-clover from other clovers and ensure it is not an oestrogenic clover. A support video in how to use Pasture Paramedic tool was also developed. More information on the development of PP and its road-testing will be contained in project L.FAP 1903 final report.

The second part of the objective was to rank the most important limitations. Once producers identified less than desirable clover content, they needed information on how to address the cause. The development of the factsheet, How do I ...determine why my sub-clover is underperforming, then helps them work out what might be limiting sub-clover growth by using a rule in, rule out table containing common to less common reasons.

The benchmarks to develop this table, were collected through literature research and contain critical conditions when sub-clover persistence is threatened and is likely to drop out of the pasture. The conditions in which sub-clover decline commonly occur where prioritised and contained the factors agronomists commonly look for when asked to diagnose what might be causing poor sub-clover.

3.3 Management notes

The diagnosis factsheet helped identify limitations and these limitations were then further explained in management factsheets. The topics behind the six factsheets were created based on scanning the literature for gaps in extension material to identify topics and then thoroughly researched and photographs collected. Sub-clover factsheets are downloadable from the MLA website and hardcopies were printed for handouts through workshops. Throughout the design process producers, agronomists and researchers were involved in making sure the products were suitable and technically correct.

The methodology, key messages and the gaps in extension material the six factsheets provide is briefly mentioned below.

i) How do I ...identify sub-clover cultivars?

It was realised that producers and agronomists needed to be able to easily check that their clover was not oestrogenic or even a problematic outclassed cultivar before embarking on improving its content within a pasture. Also, within the diagnostic factsheet, a possibility for poor sub-clover persistence was the suitability of sub-clover cultivars for the soil conditions and growing season and therefore identification of cultivars was necessary.

There was scarcity of data available on how common the presence of oestrogenic clovers was, but it was highlighted through a project involving MLA, The University of WA and DPIRD, WA and MLA donor company and through anecdotal feedback from agronomists that oestrogenic cultivars have persisted and could still be an issue.

In addition, it was recognised that very few agronomists had skills in sub-clover cultivar identification and couldn't easily recognise clovers sown within their pastures.

While sheep fertility issues may give some cause for consideration of the issue, there needed to be some product developed to help producers identify sub-clover cultivars. There was information available on identification of oestrogenic clovers, such as BIGG PDS - Oestrogenic clovers – good clover bad clover and MLA factsheet - Oestrogenic sub clover pastures: identification and remediation but no recent material involving identification of new cultivars that may have been sowing. Although The University of WA project involved developing a booklet that contained identification information on the 80 different cultivars, but this was presumed to likely be overwhelming for most producers.

In this project, the cultivar identification factsheet was not created to get producers or agronomists to become experts in sub-clover identification but a tool to help narrow down and eliminate the possibility of oestrogenic clover. While a few experienced agronomists/researchers can identify the clover cultivar from subtle differences in leaf markings, to most producers, they all look similar and are confusing as they differ between winter and spring and leaf markings can fade. A key was created based on identifying three clearly distinguishable traits (Hairy runners or not, red band on flower tube or not, red pigmentation on stipules or not, were used to narrow down the choice of cultivars into six main groups. Oestrogenic clovers were highlighted within these groups. From these groups, further information on cultivar traits and other information such as release date or flowering time was included that could be used to further narrow down to the specific cultivar if desired.

Feedback from agronomists was, they also wanted leaf images and so these were provided from numerous sources including the project team, seed companies, universities and from published material.

- i) How do I ...replace outclassed or troublesome sub-clover cultivars?

If producers or advisors identified oestrogenic or a problematic clover this factsheet focussed on its removal and how to draw down the seedbank. While there are resources available that run through pasture establishment, there was a gap in how to rid pastures of problematic sub-clover cultivars.

While it was recognised that newer cultivars offered greater production potential and were regularly promoted as replacements, producers expressed that they were unlikely to replace older cultivars such as Trikala which were they deemed effective. Therefore, outclassed cultivars defined in the factsheet involved only those with issues which rendered potential significant losses in winter production. This factsheet also linked to the substantial MLA work on soil borne diseases and the selection of tolerant cultivars as a management tool.

- ii) How do I ...optimise sub-clover based pastures?

This factsheet is the starting point for sub-clover grazing management. It provides a simple message that there are five parts of the sub-clover lifecycle that we can influence by grazing management and the principles of sub-clover growth for ensuring persistence, the need to build a seedbank consisting of 200 kg seed/ha to ensure reserves maximise germination and survive through dry springs and false breaks. Clear photographs show producers key parts of the lifecycle to manage.

- iii) How do I ...maximise sub-clover establishment in existing pastures? And
iv) How do I ...manage grazing to maximise sub-clover seed set?

These two factsheets follow on from optimising sub-clover factsheet and provide concise tactics around two key areas of sub-clover management, establishment and seed set. A small case study outlining how sub-clover seed growers maximise sub-clover seed production is also given.

- v) How do I ...manage soil health to grow good sub-clover?

This factsheet outlines the common soil constraints that lead to poor growth of sub-clover, how to identify them and treatment options. This included soil borne diseases, phosphorus and nodulation which were all components of FIP research.

Five producer case studies were developed with the aim of highlighting key messages of sub-clover management. Producers were selected based on their successful management skills and interviewed. These interviews were turned into stories that were provided to MLA to publish in the E newsletter or Feedback magazine. Stories were also utilised in SFS news and placed on their website.

Table 1 Description of sub-clover case studies

Case study	Theme covered	Producer	Publishing details
1	Dry feed management over summer to break down hard seed and maximise germination.	Simon Gabb	Story called "No summer holiday," Published 14/1/21, MLA Friday Feedback E news.

2	Autumn and winter grazing management	Simon Gabb	Written, to feature in Mar/Apr 2021 edition of Feedback magazine. Titled: Gabbs' gift for autumn- sub-clover action.
3	Spring grazing management	Simon Gabb	Sub-clover pastures set up high spring performance. Published 22/10/2021
4	Managing constraints to production including soil condition and insect pests	Brad Venning	Managing challenges to reap the benefits of sub-clover. Published 12/11/21
5	Setting up pastures to build a good seed bank of sub-clover including <i>brachycalycinum</i> sub types which don't actively bury burr.	Charlie de Fegely	Pasture Legumes Drive Prime Lamb Production. Not yet published

The information within the grazing management factsheets of sub-clover was used to develop a script and video called More Sub-clover. This video was produced by Southern Farming Systems and can be accessed through the following link: <https://www.youtube.com/watch?v=BYyQ66QiYnk>. The video steps through the stages of sub-clover growth and what management is required so producers can consistently have good clover years. A second video on identification was created from the identification of sub-clover factsheet. The instructional video runs through the basic steps of sub-clover cultivar identification. MRL media was hired to produce this video to speed up the production and provide a more professional finish with regards to sound quality.

3.3 Train agronomists

The first pilot training event was held with Nutrien involving 14 agronomists. The first part of the workshop session was held indoors for two hours, followed by a one-hour field walk. The workshop session was designed to be interactive and different engagement methods such as quizzes to maintain interest, short videos, PowerPoint slides and a field walk to practice using tools.

At this workshop, the approach was to cover relevant information from sub-clover, weeds, soils and pasture projects and this in hindsight was too much information to cover. It was expected that there would be a foundation of knowledge and therefore a quiz approach was used to engage them and maintain their interest and then deliver information in the form of fast facts. However, discussion generated from the quiz meant that delivery took too long and consequently the delivery had to be shortened.

The field component also did not work well. The weather was cold, wet and windy. This made delivery in the paddock challenging. An evaluation was planned to take place at the end of the session in the paddock but due to the weather didn't take place. Instead, a follow up interview with the team leader occurred. Any future evaluation needs were identified to be collected indoors.

After delivery of the Nutrien workshop, all workshops were put on hold due to Covid lockdowns in Victoria. The next workshop was held online with 25 Elder's agronomists. The event was online because Elders didn't want a face-to-face event because of the risk of Covid transmission. Also, an

online event meant NSW, SA and Victorian agronomists could take part. The allocated delivery time was 1 hour and 25 minutes.

The Nutrien workshop provided a number of learnings that were incorporated into this workshop. An approach to deliver quality not quantity and a go slow approach employed. Therefore, content was focused solely on sub-clover, with an offer to provide further workshops to cover off on other product information if required. The workshop outline used is below:

- Introduction to PP to assess pasture condition and sub-clover assessment.
- Identification of sub-clover cultivars & an identification activity using sub-clover plants they had brought along.
- Diagnosis of the reasons why sub-clover was poor
- Grazing management of sub-clover
- Other new resources related to sub-clover management
- Wrap up and evaluation

The time constraints meant the presentations had to be snappy and informative. Different presenters (Cam Nicholson, Jess Brogden and Lisa Miller) covered different topics, to break up the presentations. This meant key information was delivered but there was still time for a couple of questions.

To ensure engagement, agronomists used clover samples they had collected to use in identifying which of the six clover groups their samples fell into.

The evaluation involved the agronomists answering three simple questions in the chat box, so that quality information could be captured.

The third workshop was with Vickery Bros and McDonald Rural. What started as a commitment of 12 agronomists, slowly diminished to only four attending on the day. This reflected the busy time, due to silage making and the backlog of activities that were now proceeding because lockdowns had ended. This workshop followed a similar format to the successful Elders format but with a greater time allocation which allowed visual indicators of soil condition in relation to sub-clover to also be covered. A paddock walk allowed the participants to use the tools. The paddock contained an example of a high-quality pasture and so discussion focused on how this was achieved. This discussion included liming, nutrients, pest control and grazing management.

Premier Ag is a small consulting firm that operates throughout the Western district. All of its agronomists attended the training event. The agronomy team wanted an overview of all the MLA products available as well as training in the use of MLA sub-clover particularly grazing management and diagnosis of why sub-clover content may be poor. In the paddock walk, Pasture Paramedic was practiced to rapidly assess pasture condition including clover content and the factsheet on How do I identify sub-clover cultivars was used to show and practice cultivar identification.

Table 2. Details of five agronomist training workshops

Company Name	Date of delivery	Location	Workshop Format
Nutrien	June 23 rd , 2021	Dunkeld	Face to Face training. Paddock activities on farm.

Elders	26 October, 2021		Online training. Clover id activity
Vickery Bros/McDonald Rural	28 October, 2021	Hamilton	Face to Face training. Paddock activities on farm.
Premier Ag	22 November 2021	Inverleigh	Face to Face training. Paddock activities on farm.

3.4 Producer engagement

Producer engagement was not a direct objective of the project but there were six events that involved promotion of the sub-clover products which are shown in table 3. The majority were held online, and all involve multi-topic presentations, rather than being just on sub-clover.

Sub-clover management was discussed at the event titled “Follow-up Friday” as part of the SFS Agrifocus video release on 16th October 2020. This forum allowed producers and agronomists to ask questions about sub-clover management.

Table 3. Promotional events of the sub-clover products

Event name	Topic promoted	Presenter	Location and Format	Date
Women on Farms – Integrated Weeds Management	Lifting competition and promotion of sub-clover through grazing management to fill in pasture gaps.	Lisa Miller	Online	6/5/2020
SA Livestock advisors conference - Tools for pasture recovery	Promotion of sub-clover assessment tools and factsheets	Cam Nicholson, Nicon Rural	Online	30/7/2020
SFS Agrifocus, 2020 Video and Follow up Friday	Launch of the video, More Sub-clover and answer technical questions	Lisa Miller, SFS	Online	16/10/2020
MeatUp, Gawler – Feedbase what is there	Grazing management factsheets	Cam Nicholson, Nicon Rural	Gawler	5/3/2021
SFS Trial results day	How do I ...determine why my sub-clover is underperforming.	Jess Brogden, SFS	Face to face, Live streamed and recorded	23/3/2021
GSSA spring seminar - Grazing	and new MLA sub-clover resources	Lisa Miller, SFS	Online	29/9/2021

Management for Sub-clover Longevity				
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4. Results

4.1 Products

4.1.1 Road-testing

The results of road-testing products led to improvements and alterations during the product development especially in relation to the diagnostic factsheet and identification of sub-clover factsheet but also in relation to technical content. Some of the feedback collected is listed below and demonstrates the type of feedback collected.

Diagnostic factsheet

- “There is lots of information, have the most important information up front.”
- “Having quantifiable information, rather than just saying something is high or low or vague like getting soil condition right.”
- “The diagnostic chart is really useful, you can find what you want really quickly, without trying to read back through the document. It’s like a summary.”
- “There are things I haven’t even thought of, like carryover herbicide effects.”
- “I think the pasture trash information is where most farmers get wrong, and it’s because it’s not easy to get rid of.”
- “Having the table in different colours, breaks up the topics.”

Identification of sub-clover factsheet

- “The sub clover ID fact sheet is looking good, much needed. Good to start key with the runner hairiness as the leaf differentiation is so difficult & so variable over the year – most other guides start with the leaf stuff. Can you put the leaf pictures for all the cultivars in each group in your fact sheet too – once you get to the Hairy Red, Hairy Combination, Hairy Green etc can then narrow them down on leaf photos? There wasn’t a bit on cultivar differentiation in all the categories.” Consultant
- “Regarding your cultivar ID book, you’ve put a lot of work into it and it is well targeted at farmers.” UWA.
- “Firstly, can I say what a great document that comprehensively covers the variation between cultivars and even touches upon the variation across a season. The two images of Trikala leaf markings where one shows strong flushing and another with it completely absent are striking a representation of that seasonal variation. It highlights the need for identification methods that aren’t solely based on leaf markings. I’m sure the document will prove invaluable to many agronomists and producers.” Research Agronomist, Barenbrug Australia Pty Ltd.
- “Tom Dickson had a draft copy of your identification guide included on an email and it looks very good – well done. I agree that having better tools for variety ID is really important and your document will greatly aid this purpose.” Southern Breeding Manager, Barenbrug Australia Pty Ltd.

- “I think they look good, not sure I’d be completely confident identifying cultivars but I think that certainly is of interest to producers,” Holbrook Landcare Network.

4.1.2 Product capacities

There were a number of key features targeted by the project with the development of the diagnostic guide and management notes to consider temperament type to appeal to different market segments. These are listed below and the results.

One of the main ways was to appeal to the temperament type “Doers” was to incorporate information in clear step like pathways. Examples of this approach were:

- Rule in rule table in the Factsheet: How do I ...determine why my sub-clover is underperforming?
- Sub-clover life cycle picture in relation to a calendar in Factsheet: How do I ...optimise sub-clover based pastures?
- Identification flow chart to divide clovers into 6 groups in Factsheet: How do I ...identify sub-clover cultivars.

Deliberate use of the word health in relation to the Factsheet: How do I ...manage soil health to grow good sub-clover, was done to appeal to “team builders.” Also, the messages around healthy nodules and the ability to create “free nitrogen” and reduce reliance on nitrogen fertiliser.

An example of how the seed industry maximises seed set in How do I manage grazing to maximise sub-clover seed set was likely to appeal to “Doers.”

Visual imagery and photography were used to show comparisons and educate. Examples of these were:

- Use of animations in the more sub-clover video.
- Use of graphic images to depict key identification factors of sub-clover.
- Sub-clover lifecycle in the “How do I ...optimise sub-clover based pastures?”
- The effects of soil borne diseases in “How do I replace outclassed or troublesome sub-clover cultivars.”
- Measuring trash levels in “How do I maximise sub-clover establishment in existing pastures.”
- Size of clover leaves in “How do I manage soil health to grow high quality sub-clover.”
- Effect of herbicides on sub-clover flowering in, “How do I determine why my sub-clover is underperforming.”

The development of the new resources (factsheets and case studies) and through their promotion, also allowed signposting and therefore potentially greater awareness of and links for easy accessibility to existing MLA tools and resources. Examples are:

- Case study stories linked to relevant sub-clover factsheets.
- Oestrogenic sub clover pastures: identification and remediation MLA factsheet by The University of WA, 2020.
- Good clover bad clover fact sheet by the Mackillop Farm Management Group that was funded by MLA.
- Existing MLA factsheet “How do I manage soil borne root diseases in sub-clover pastures?”

- In more information, promotion of the MLA feedbase hubs to control weeds, healthy soils and persistent pastures.

The materials developed also provided the potential creation of new material such as the E learning platform (for example Grazing management of sub-clover) and material for MLA newsletters. There is no current eLearning package available, however the “How do I optimise sub-clover” factsheet has been used to source information for eLearning published on 7/4/2020 at

<https://elearning.mla.com.au/lessons/how-do-i-optimise-sub-clover>

Two corporate MLA stories, “Unleash your sub-clover’s superpowers,” March 17th, 2020, and “Five steps to productive sub-clover,” March 16th 2020 were used to advertise the three grazing sub-clover technotes which are currently located on the MLA website.

Some other additional examples of the sub-clover resources are to be uses in the PGS training packages being developed on Resowing and Manipulation.

Sharing of the factsheets and case studies with other groups helped extended the reach of products. Examples were:

- Southern Farming Systems
 - EUpdate 3-5-21 Getting Clover up and away – 555 total opens, 24 clicks on the link to go to read more in the Friday Feedback article.
 - EUpdate 1/11/2021 Reprint of the Sub-clover case study called “Sub-clover pastures set up high spring performance.” – 341 opens, 19 clicks to read more of the MLA article.
 - EUpdate 20/9/2021 Now is a good time for Sub-clover cultivar identification. 598 opens.
- Holbrook Landcare group
 - Included a sub-clover update and linked to grazing factsheets products in March 2020.
- Grassland Society of Southern Australia
 - Used material from MLA factsheets in an article titled, The powers of sub-clover, June 2021 and to promote Hamilton branch sub-clover field day (which was cancelled due to Covid).
 - GSSA invites SFS to participate in a week of promotional face to face events to present the sub-clover products in late winter but was cancelled due to Covid restrictions.
- Making more from Sheep
 - Module 6 (Healthy soils) and 7 (Pastures) were updated to contain links to sub-clover resources in June 2021.
- Nutrien
 - Endorsed and promoted MLA products in their newsletter on 9/8/2021.

4.1.3 Product distribution

Aspirational and ambitious targets set in the Monitoring and Evaluation plan were a 10% improvement in access/download/use of MLA tool/website and 20% improvement in access/download/use of MLA publications. To date there are only three sub-clover factsheets available on the web site with a legume hub to be launched in autumn 2022. Information on their downloads is in table 4. Total numbers of downloads of the factsheets have been 116.

Initially 500 of each of the grazing management factsheets were printed into hardcopies. Distribution is listed in table 7 and about half of these factsheets have been distributed through promotional events and requests for Pasture Paramedic tools.

By July 2021, another 1000 of each factsheet was printed in readiness for a presentation at a major event- SheepConnect which can have producer attendances of up to 2000. However, this event was postponed due to Covid and has not been rescheduled.

Table 4. Number of factsheet downloads, stats are based on 12 months.

Factsheet Name	Number of downloads from MLA website	No of views from MLA website
Factsheet: How do I ...optimise sub-clover based pastures?	17	36
Factsheet: How do I ...manage grazing to maximise sub-clover seed set?	43	55
Factsheet: How do I ...maximise sub-clover establishment in existing pastures?	56	58
Totals	116	149

Three case studies have been published, with good readership by producers in the MLA Friday Feedback E newsletter and Feedback magazine, averaging 1188 views, (see table 5). Feedback from MLA Editorial manager indicated that the stories were of high quality. “This case study had a really good response from MLA so thank you for providing such a great story! Even my husband (we’re sheep producers) took this page out of my magazine proof as he was very interested in some of Simon’s strategies.”

Table 5. Number of views for sub-clover case studies

Case study	Title	Number of page views
1	“No summer holiday,” Appeared Jan 14 th , MLA Friday Feedback E news.	742
2	Written, to feature in Mar/Apr 2021 edition of Feedback magazine. Titled: Gabbs’ gift for autumn- sub-clover action.	1,502
3	Sub-clover pastures set up high spring performance. Published 22/10/2021	1,321
	Average views	1188

Relevant factsheets were further developed into two videos called More Sub-clover and the identification of cultivars. The More Sub-clover you tube video had 420 views in the last six months from the MLA YouTube and 61 views from Southern Farming Systems YouTube channel. One public comment that was made was “very helpful and informative. Thank you for the information.”

The second sub-clover video on identification of sub-clover cultivars was recently released and is available to view at: https://www.youtube.com/watch?v=-K7Bz0_WUuk

4.2 Agronomy workshops

The overall targets of four FAP projects was to reach 200 advisors/merchandise resellers with 13 training days. This project to date has contributed to the running of four training days and 47 agronomists.

An objective and deliverable were to run four training workshops for retailers/agronomists with a target of 40 trained in the use of the diagnostic tool and management options. This was to ensure there is awareness and support from other sources when the product is officially released in autumn.

These training workshops were planned to run in winter 2021 when agronomists were least busy but only one occurred then due to regional Victoria going into lockdown soon after. Restrictions only lifted in October which meant agronomists were prioritising their own field days and performance meetings and this impacted on their availability to attend workshops.

Elders wanted an online event as they didn’t want their agronomists in close contact but Vickery Bros/ McDonald Rural which started off with 10 confirmed agronomists, ended up with only four agronomists attending because of work commitments. Another three agronomist companies requested training, but only Premier Ag wanted training in November. Gorst Rural expressed interest in training during December and Western Ag during February.

The intended practice change targets for these workshops were:

- 65% of participants access and use specific MLA products and resources as a result of FAP 4 workshops and training events.
- 30% of participants participate in other MLA activities/programs.
- 75% of participants will demonstrate improved knowledge, skills or understanding.

Table 6. Summary of merchandise reseller workshop evaluation data.

Name of Agricultural reseller	Number of participants	Satisfaction rating	Knowledge or Competency Increase	Access & use of products	Intent to participate in other MLA activities	Evidence of potential further reach
Nutrien Ag	14	Not recorded	100%	100%	Yes	Yes
Elders	25	4.8	Positive	100%	Yes	
Vickery Bros/McDonald Rural	4	4.25	100%	100%	Yes	

Premier Ag	4	5.0	100%	1005	Yes	
Totals	47	4.7				

The achieved practice change targets for these workshops were:

- That all 100% of participants collected hard copies and requested downloads of the sub-clover products and there was evidence that all the merchandise retailers either used or intended to use this information to increase knowledge of clients or junior staff.
- Anticipated 30% participation in other MLA activities/programs was not able to be measured because further events did not proceed within the project timeline. Only Nutrien demonstrated further extension use by including much of the workshop information within its newsletter. However, Nutrien expressed interest in both staff and selected clients undertaking PayDirt training which had been promoted at that workshop. Both Elders and Premier Ag requested further workshops such as weeds and grazing management of grasses and Vickery/McDonald Bros expressed interest in holding joint training days with producers.
- All 100% of participants demonstrated an improvement in knowledge and skill in assessment of clover content using Pasture Paramedic and cultivar identification during practical activities.

4.2.1 Nutrien

The Nutrien workshop included 14 agronomists attended from locations including Bendigo, Hamilton, Bannockburn, Mortlake, Lake Bolac, Timboon and Warrnambool. Five SA agronomists couldn't come due to border restrictions.

No satisfaction rating of the workshop was collected from participants but comments regarding satisfaction and other feedback was obtained from the Nutrien team leader:

- "Hit the mark – so we will send some of our clients to the planned GSSA sub-clover day at Hamilton."
- "It was all positive from the Agros – good information, more benefits for the junior staff but even the older agros got something from it."
- "Information is well tailored for producers."
- "Found the grazing management thought provoking and saw the pasture manipulation space as the area of priority, as land is so expensive."

Nutrien advisors in the higher rainfall areas expressed interest in having the same management and growth information on white clover.

The field trial component allowed assessment in the use of Pasture Paramedic and within it the assessment of clover content. All participants at this workshop demonstrated an ability to use the tool and to identify sub-clover from its back of leaf hairiness.

Anecdotal comments made during the workshop indicated the value proposition these products offered agronomists. There was a desire to use the products or messages because of their independence coming from MLA rather than them being seen to be making them up to "flog products." Recorded comments were:

- "This will make our jobs easier." In reference to the diagnostic tools.

- “Difficult for us to say it’s (farmers paddock) shit.”
- “It will encourage them to look down and see.”
- “MLA has done it, so it makes the information objective, not us telling them.”
- “Rather than selling product, we are seen to be selling good information.”

The aim of extending the reach of the project was achieved. Evidence of this was:

- Their expressed intention to send electronic copies of the new products to clients.
- They endorsed the products and shared links to clients where the products could be downloaded from the new pasture and soil hubs. Evidence of this is from Nutrien sending a client email newsletter on the 10/8/2021 with the following information. “Meat & Livestock Australian have recently developed a series of technotes and guides to help producers better understand the health of their soils & pastures, followed by useful tools that can help improve knowledge and promote implementation. After browsing through ourselves, we believe it's well worth sharing.”
- Their expressed intention to encourage their clients to attend the upcoming planned sub-clover management day where SFS was presenting.

4.2.2 Elders

The Elders event ran exceptionally well with the shorter format. It was well attended, and questions and interactions were of high quality. An indication of this was the overall satisfaction rating of 4.8.

Elder’s participants were asked to give examples of what they learnt rather than a subjective knowledge increase. Their comments were:

- Where to find new resources
- A better strategy around spray timing in spring and around flowering rather than just avoiding it all together. Figures around seed set targets and germination percentage. I'll be interested in the fungicide work.
- Seed bank targets, weed control / chemical work.
- Identification process.
- How to identify what sub clover type you have - very useful - for identifying oestrogenic clovers. Please send through all of the resources, would be very useful.
- Flow chart checklist good process, trial data e.g., influence of DM on seed production.
- Taking note of the runners signal as a sign of reproductive activity.
- How to identify varieties, especially oestrogenic clovers.

In their clover identification activity, they were able to use the key to narrow down their cultivar into one of six groups as demonstrated by their feedback in the online chat box.

Their team leader made a number of comments post event regarding satisfaction and outcomes.

- “Little bit of gold.”
- “The responses (discussing the high scores) and from how many attended was refreshing. Even senior agros.”
- “Well received.”
- “One agronomist who is really busy with lots of clients and very experienced and knowledgeable, attended, she doesn’t normally. She was sending me photos of the clover she collected from Kangaroo Island that she thought was oestrogenic.”
- “Information was balanced and paired back for producers.”

Evidence of further participation was from their team leader who said they were “Looking forward to doing something in the future,” and wanted the other project topics covered, like weed control early next year.

Evidence of further reach of the project was, “The department used to have resources like Prime Pastures, but they are not doing it anymore. (This was seen as a replacement). The senior staff will use the products and can explain the important bits to both producers and junior staff.”

4.2.3 Vickerys/McDonald Bros

Three junior agronomists attended this workshop with a senior agronomist. Two junior agronomists commented that they had been doing a pasture principles course with another extension provider and they felt the only messages they give has been to graze pastures at the three leaf stage and had learnt nothing about managing the clover component. They expressed they had got far more information out of this short workshop than the multiple session training they had been doing.

Agronomist’s responses to “What was their greatest insight” to reflect what knowledge had been increased was:

- “Simple steps for clover id and working with clover hard seededness.
- Clover identification.
- Information on lime and how it moves through the soil to become effective at depth.
- Sub-clover seed set
- Management of growth of sub-clover, the movement of lime and the need for 5.8 in the topsoils.
- pH at depth”

All expressed interest in utilising the products and three suggested to do this at more training events specifically:

- “grower days, for weed id
- a training day for our clients.
- a training day during winter to ensure people can attend.”

4.2.3 Premier Ag Consulting

This workshop was highly interactive, with agronomists keen to develop a deeper understanding of the topics presented. Their feedback was very positive with all giving the highest score for value.

Comments on feedback sheets were:

- Really enjoyed the session.
- Fantastic products with easy to follow rules of thumb.
- Great workshop.

Agronomist’s responses to “What was their greatest insight” to reflect what knowledge had been increased was:

- Decision making matrix/rule in rule out to run through with clients – not “opinion” based.
- Learning about grazing management and the importance of grazing management to keep sub-clover.
- Identification of different species

- How to improve clover content.
- Updated MLA documents.

The agronomist's expressed intention to use the products or information in the following ways:

- Tools to use with clients.
- Improve service for clients.
- Increase my knowledge
- Circulate factsheets to clients
- Utilise data and rules of thumbs in internal manuals and newsletters.
- Monitoring pasture condition
- Use with clients to identify their cultivars which they often ask.

Other information the group were seeking was on feed budgeting and animal health issues. These agronomists had strong crop agronomy skills and they were keen to develop further skills in livestock production. They were interested in how they could assist their clients with feed budgeting and what information they could provide them with, like feed test data and whether this was something they should be measuring. As a result, further discussions were held with Premier Ag and a workshop organised on feed budgeting, when and how to use it to make decisions. There was also a request to run another workshop on grazing management of grasses when further MLA products were developed.

4.3 Producer Engagement

While not a direct objective of the project, producers were engaged in the project to test products and the extension process and contribute to the target of 500 number of producers to participate at 17 events spread across four FAP projects (L.FAP 1901, 1902, 1903 and 1904).

There were six producer events where the sub-clover products were promoted to 311 participants and details are summarised in table 7. Producer satisfaction measured at two events showed that they had high satisfaction (average 3.3 and 4.1 out of a possible 5). There was also evidence of knowledge increase of approximately one unit at two events.

Covid disrupted many planned events. An agronomist having attended the Nutrien workshop, organised for SFS to present the products at a GSSA Hamilton branch field day which was cancelled on Aug 10th, August 26th and October 12th and to date has not been rescheduled as producers are now busy with hay/silage. In addition, SFS was invited to promote new MLA products at a major event, Sheep Connect, Hamilton field day on August 2nd and 3rd was also cancelled due to Covid and to date has not been rescheduled.

Table 7. Summary of merchandise reseller workshop evaluation data.

Name of event	Number of participants	Event value rating	Knowledge or Competency Increase	Factsheet requests
Women on Farms – Integrated	17 (attended), 25 watched later, total 42	Not assessed.	Shift from 2.7 to 3.8 where 1 was no increase to 5	30 of each of grazing management

Weeds Management			considerable increase.	factsheet (90 distributed)
SA Livestock advisors conference	85	Unknown	Unknown	50 of each grazing factsheet (150) distributed)
SFS Agrifocus online	17	Not assessed	Not assessed	15 factsheet requests (45 distributed)
Meatup, Gawler	75	Unknown	Unknown	50 of each grazing factsheet (150) distributed)
SFS Trial results day	32	3.3	Not assessed	20 of sub-clover diagnosis distributed
GSSA spring seminar- Grazing management	60	4.1 from 31 survey respondents	Shift from 2.7 to 3.7 where 1 was low knowledge to 5 high knowledge	No hard copies requested
Totals	311			

An outcome of the SA Livestock advisors conference was Cam Nicholson, consultant to SFS was invited to deliver training by the Bushfire Recovery Coordinator for the Hills and Fleurieu Landscapes Board. This involved training of two private advisors from Coopers of Mt Torrens and DJ Growers Woodside to deliver Pasture Paramedic to groups in the Adelaide Hills. Both advisors were trained in using Pasture Paramedic in October 2021, with 100 kits sent. A further 20 kits were requested, as the first 100 were used up. Producer training was scheduled in November and early December.

Sub-clover management was discussed at the event titled “Follow-up Friday” as part of the SFS Agrifocus video release on 16th October 2020 where they were 28 views of the video recorded. There were 17 participants at this awareness event. This forum allowed producers and agronomists to ask questions about sub-clover management. Due to the online event, it was difficult to collect evaluation data. The value was gauged by attendance, the number of questions asked which was five and the follow up requests for factsheets which was 15.

New tools for diagnosing why your sub-clover is under-performing was presented at SFS trial results day. Total attendance numbers were 32 including 8 producers (2 online), 2 Landcare facilitator (1 online) and 22 advisors (12 online). Of the 9 who completed evaluation forms, the majority thought the tool was useful or very useful and on a scale of usefulness averaged 3.1. Two, advisors (assumed to have a cropping focus) rated the tool as being somewhat useful. The event had a satisfaction rating of 3.3. but the other 7 responses were that it was useful (5) or very useful (2). Another result was a request made to present the products at a Landcare group event, however this event had not been delayed due to Covid.

The results of a poll at the Grassland Society of Southern Australia (GSSA) Spring webinar showed high satisfaction of the presentation of 4.1. The 31 respondents also rated the resources a rating of 3.9, closest to very useful. There was an average knowledge increase of 1 rating unit. Eight or 26% of participants rated their pre-existing knowledge of sub-clover content as low (1) indicating a gap in producer knowledge. Also 27 from 36 (75%) intended to make changes to their management and 8 (some changes 20%) and only one respondent would make no changes.

5. Conclusion

5.1 Key findings

- The project was able to utilise relevant MLA FIP research findings and extend them through products that have high appeal to agronomists and producers.
- Products allowed users to move through the decision-making cycle, by undertaking the objective process of assessment, reflection and diagnosis (interpretation) of the reasons for poor performance and finally access to appropriate treatment information to improve condition once they had decided to proceed with treatment.
- Factsheet development can provide the basis or script for other products such as videos, E Learning, case study development, photo library resource and promotional activities of best practice.
- Merchandise retailers/agronomists valued the sub-clover products developed as being independent, technically correct and practical and showed intention to share with their clients.
- Merchandise retailers/agronomists are a great resource to extend the reach of MLA projects in addition to educators and advisors, especially as the majority of producers access information from them.

5.2 Benefits to industry

This project has raised the profile of sub-clover which had taken a back seat to grass management over many years and helped illustrate its importance in the pasture mix. The benefits of MLA having a valuable set of sub-clover products and advisors/merchandise resellers trained in their delivery will potentially improve management of sub-clover provided these products are actively promoted. This in turn can help provide animal production benefits and more efficient use of nitrogen fertiliser. A number of organisations have expressed interest in making their clients aware of the products but Covid in many cases prevented some of these opportunities from occurring. In particular, merchandise resellers expressed a willingness and receptiveness of to extend the learnings and products to clients and valued them for training of junior staff.

6. Future research and recommendations

The products produced, provided valuable resources but further promotion of them and their key components is needed to maximise their value. There was an appetite for the products from producers and while some of this could be met within the project, Covid and not being a direct project objective, meant there is opportunity for future extension.

Connection to other relevant PGS packages and awareness by their coaches could help achieve full value. The creation of a Legume hub to house the sub-clover resources to make them easily accessible will be a terrific edition to MLA online resources.

Resellers and advisors were keen for accessible and up to date information on sub-clover cultivar identification. MLA's PTN could capture leaf images of sub-clover cultivars that are being tested which could be used to update existing identification resources every four to five years.

The resources of sub-clover have raised agronomist's desire for additional and updated information on some other common legumes such as white clover. In addition, a product not developed but a future topic of interest was the development of factsheets on understanding nitrogen contribution to pastures and practical ways to maximise nitrogen fixation, (inoculation, remediation of soil acidity, etc). There is an assumption that maximum nitrogen fixation is occurring but what can producers do to enhance it was issues uncovered through the "Healthy soils" project L.FAP 1902.

Extension projects which develop and harness the relationship and training opportunities with merchandise sellers as a vehicle for extension are likely to extend the reach of their projects. To date this has been an untapped resource. Resellers have extensive connections to producers and require up to date information to provide them with and have an appetite for learning and training junior staff.

Short but quality events with a focus on go slow to cement understanding and interaction will help agronomists increase knowledge. Online events can be effective and convenient for training, if practical activities can be inbuilt helps to maintain a level of engagement and the chat box is used to collect evaluation data.

Online events, with capabilities of recording, means producers can access them in their own time, but the danger is although their intentions may be good, the busy doers might not make time to watch them. They need to be given a deadline of an additional one to two weeks to watch them before the webinar is removed from access. Consideration of topic podcasts might be of value for producers, to multitask when travelling or working on mundane tasks could be worth exploring.

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