26. Exploring hidden economic losses in sub-clover pastures

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Funding Body: Meat and Livestock Australia

Project Code: B.FDP.0054 Project Duration: 2014-2017

KEY MESSAGES

- Seasonal conditions can affect the disease complexes that exist for sub-clovers in any season (eg. the drier summers in 2014 & 2015 would be expected to cause a higher incidence of Rhizoctonia, whereas the wetter season in 2016 saw Pythium sp., Aphanomyces sp. and Phytophthora sp. more likely to be the dominant diseases).
- Current sub-clover establishment management practices (knockdown herbicide, cultivation, use of Apron seed dressing and sowing newer varieties or those that are widely adapted to the region) appear to be reducing the risk posed by root disease across the region.
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Background

The project aims to quantify the level and effects of sub-clover root disease in pastures across the south-east region of South Australia. It aims to understand the production and economic impact of root disease and, through the evaluation of chemical and cultural control methods, establish cost-effective solutions to manage these diseases.

The main soil-borne pathogens that effect sub-clover include Pythium sp., Phytophthora sp., Aphanomyces sp.and Rhizoctonia. These pathogens usually exist as a disease complex that can affect establishment and persistence, reduce germination, destroy roots, reduce plant size and cause failure of nodulation and persistence of pastures. The prevalence of each of these diseases across the region is currently not fully understood.

The project consists of three key elements;

1. Understanding the level of sub-clover root disease by quantifying the extent of root disease across the region,
2. Improving sub-clover establishment by understanding chemical or cultural control methods to increase the initial sub-clover germination, growth and survival, and
3. Managing existing sub-clover stands by investigating products that may be able to improve the regeneration and persistence of sub-clover pastures.

By the end of the project, we will have increased our understanding of the levels of root diseases in sub-clover in the high rainfall areas of the south-east of South Australia, the pathogens involved, and the potential production and economic impact of these diseases. We will have investigated best practice methods to both improve pasture establishment and maintain legumes in our annual pasture stands, and assessed these methods for their economic viability.

Figure 1: Root disease affecting sub-clover pasture growth in the field.
Photo courtesy of Prof. M. Barbetti, UWA.

2014

In 2014, eight demonstration sites were established looking at the commonly grown and well adapted variety Trikkala, with and without ApronTM seed dressing (metalaxyl) across the south-east region from Mount Burr in the south to Padthaway in the north. Two additional Producer Research Sites were established; one at Woolumbool and one at Furner. At these sites we were investigating the 'standard' susceptible variety Woogenellup compared with Trikkala under various times of brown-out following a knock-down spray with Glyphosate.
Post-emergent spray applications of potential fungicides were also assessed in existing sub-clover stands to see if they resulted in increased biomass production.

The differences between varieties at the Producer Research Sites (Trikkala had a much greater emergence and survival compared to that of Woogenellop), and the increase in level of germination and survival of sub-clover plants across the region with the addition of metalaxyl seed dressing, suggested that root disease is having an effect on the germination and survival of sub-clover across the south-east region of South Australia and that further investigation was warranted. No significant differences were found between products or rates of post-emergent fungicidal spray treatments.

2015

Two Producer Research Sites (the existing site at Furner) and a new site at Avenue Range (identified as part of the 2014 sampling process) were established to assess varietal and chemical control methods on sub-clover germination and survival. At both trial sites, six replicated 1m strips of Woogenellup seed (a susceptible variety) treated with five different fungicide treatments and a nil control were sown. Assessments for germination and establishment of these plots were then conducted at approximately 21, 63 and 94 days (3, 9 & 12 weeks) after seeding, and at approximately 94 days a nodulation assessment was also conducted.
At the same sites, varietal assessment was conducted using ten different varieties with and without Apron™ (metalaxyl) seed dressing. The 1m row method used for the fungicide treatments was also used for assessing varietal differences. Assessments of these plots (for germination and establishment) were conducted at approximately 21, 63 and 94 days after sowing (3, 9 & 12 weeks). Nodulation assessments were also conducted at approximately 94 days.

No significant differences were found between the five fungicide treatments, including Apron™, at days 63 and 94, although a slight adverse effect was detected on germination of one treatment at the first assessment at day 21. The varietal responses with and without the addition of Apron™ show that Trikkala, Dalkeith and Antas all have significantly higher germination and establishment when compared to Goulburn and Woogenellup, with Campeda, Mintaro, Monti, Mt Barker and Leura all intermediate in their response.

2016

Two producer research sites were established in 2016, and the work was very similar to that conducted in 2015. The existing site at Furner was maintained for a third season and a new site was established at Binnum to enable co-location with the University of Western Australia. Both sites again used 1m row plots to assess three different seed treatments to an untreated control. Assessments for germination and establishment were conducted at approximately 21, 63 and 94 days (3, 9 & 12 weeks) after seeding.

At the same sites, varietal assessments were conducted; the varieties chosen were driven by results from 2015; five varieties were sown at Furner and eight varieties at Binnum – all varieties were assessed with and without the addition of Apron™ (metalaxyl) seed dressing. The 1m row method was used for the variety site at Furner, and the site at Binnum was sown with a 0.8m wide cone seeder, with the assistance of Heritage Seeds.

Results and Discussion

Producer Research Sites – Seed treatments

Seed treatments - including the commonly used Apron™ (metalaxyl) - were compared to an untreated control. There were no significant differences between the untreated control and any of the three seed treatments at germination (day 21) or the two or three other times of measurement (Day 42 was an additional measurement at the Binnum site only). The Binnum site did have higher survival and persistence than the Furner site at days 62 and 84.

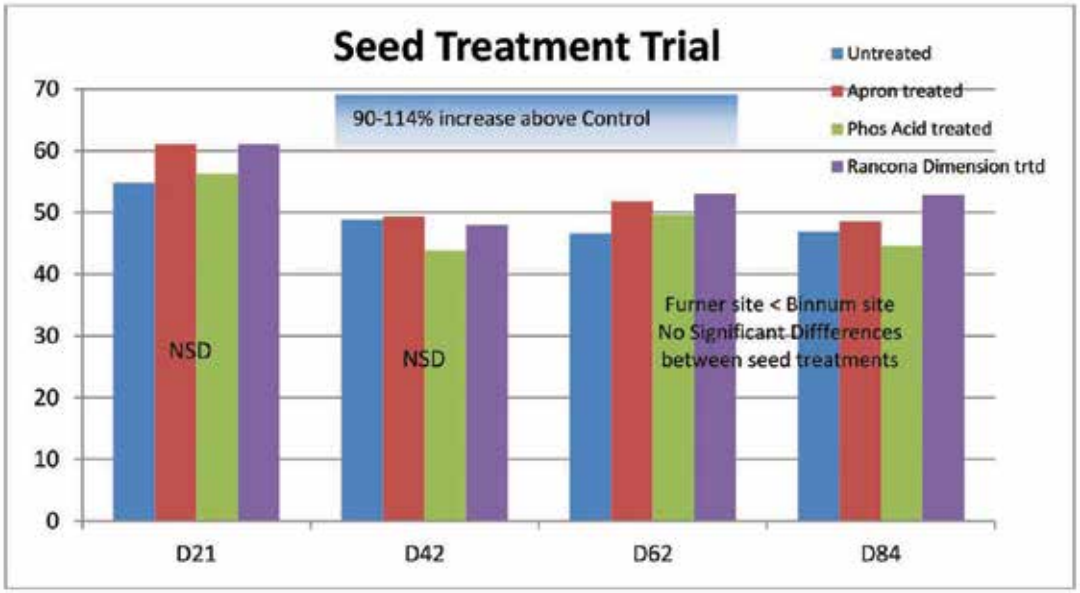

Figure 2: 2016 germination and survival of Woogenellup with four different seed treatments.

Producer Research Sites – Varietal assessment

Five varieties were assessed at Furner and eight varieties at Binnum to further evaluate if there was a difference between the varieties or their response to Apron™ seed dressing (metalaxyl) under different seasonal conditions, and to see if this may be due to differences in disease resistance. Some older varieties have documented resistance to some diseases, however not as much is known about the newer varieties. The varieties selected were based on feedback from producers and local seed suppliers. The results from 2015 also influenced the varieties chosen.

Figure 3 shows the varietal responses with and without the addition of Apron™ at the Furner site.
There was on average an increase of 5% in germination and persistence where Apron™ was added, however this difference was not statistically significant. Unfortunately the Binnum site had very poor germination (2-10%) and will not be reported.
There was a significant difference between varieties with Trikkala having the highest initial germination and the best persistence over time. This result was also observed in 2015 at both sites.

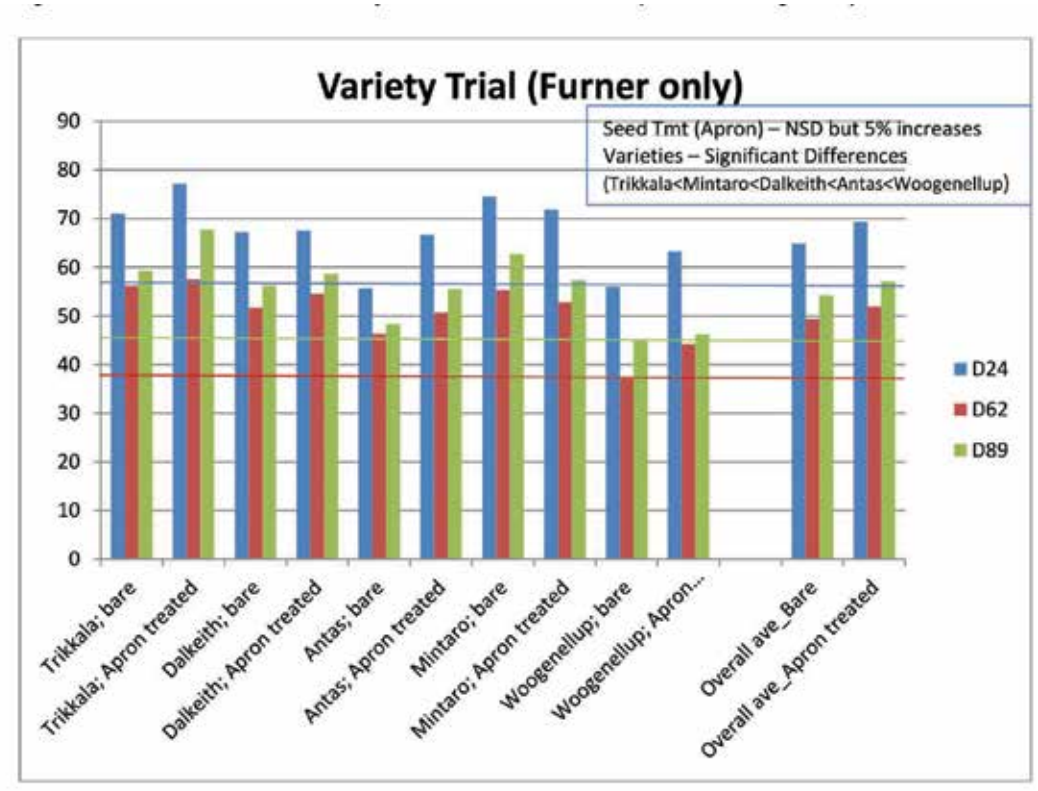

Figure 3: Germination and survival of 4 common varieties, compared to Woogenellup.

a. b.

Figure 4: Healthy (a) vs diseased (b) roots/plants. Photo courtesy of Kevin Foster, UWA.

Conclusions and Future Activities

At the end of the three years of trial work, there were no significant production benefits found from the application of a range of fungicides as seed treatments or as post-emergent spray applications. The continued use of Apron™ as a seed treatment is thought to still be important (germination increases of 5-10% – although not significant) as an insurance policy in case the site being sown has high levels of disease.

There were significant differences in varietal performance over two seasons (2015 & 2016), with some of the newer varieties (purported to have higher disease tolerance) performing well. However, Trikkala (an older variety that has performed well in the region) consistently outperformed the ten other varieties tested, especially Woogenellup (a variety known for its susceptibility to various disease pathogens). Trikkala has been grown across the south-east region for many years, and the seed is bred locally; it is thought that a local biotype with good field tolerance to root disease pathogens may have adapted over time.

Whilst root diseases are clearly present, the lack of disease response over the life of the project suggests that current "best management practices" that are used when new pastures are being established (ie. knockdown herbicide in advance of sowing, cultivation for an even seed bed, the use of Apron™ seed dressing, and sowing newer varieties or varieties that have long been utilised in the region) appear to be ensuring that producers are minimising the potential risk that root disease may have on sub-clover establishment and survival.

ACKNOWLEDGEMENTS

- Nick Edwards (Project Officer)
- John Squires & Dee Heinjus, Rural Directions Pty Ltd
- Prof. Martin Barbetti, Ming-Pei You, Kevin Foster, University Western Australia (Project Collaborators)
- Irene Sobotta, Meat & Livestock Australia (Funding Body)

FARMER COLLABORATORS

- Rob Bateman, Furner
- Graham Clothier, Woolumbool
- Nick and Janelle Edwards, Avenue Range
- Sambell Family, Binnum

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These sites form part of MLA's Producer Research Sites Program

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