21. Exploring hidden economic losses in sub-clover pastures

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PRELIMINARY FINDINGS

- Sowing late into a high disease burden may offset any benefits of varietal disease resistance or the benefits of chemical control methods (i.e. seed treatments).
- Seasonal conditions can affect the disease complexes that exist in any season (eg. the drier summers in 2014 & 2015 would be expected to cause a higher incidence of Rhizoctonia, whereas Pythium sp., Aphanomyces sp. and Phytophthora sp. are likely to be more dominant in wetter seasons).
- Varietal differences were observed in establishment and persistence, however it is yet to be determined if this was due to root disease tolerance.

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.

2015

Methodology:

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 the trial sites, six replicated 1m strips of Woogenellup seed (a susceptible variety) treated with five different fungicide treatments and a nil control were sow. 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. Nodulation assessments were also conducted at approximately 94 days.

Results and Discussion:

Producer Research Sites – Seed treatments

Five seed treatments - including the commonly used Apron (metalaxyl) - were compared to an untreated control. Initially there was a significant difference with one of the seed dressings (not a registered product in sub-clover) appearing to have an adverse effect on the germination and establishment of sub-clover when compared to the untreated control and other seed treatments (including Apron seed dressing). These effects had diminished by the 63 day assessment, with no further significant differences being observed.

Producer Research Sites – Varietal assessment

Ten varieties were assessed to determine if there was a difference between varieties in their disease resistance status. Some older varieties have documented resistances, however not as much is known about the newer varieties. The varieties used were selected based on producer feedback around common varieties planted, and from seed suppliers and agronomists with regards to newer varieties that they thought might be suitable for the region and potentially have good levels of disease control.

Figure 1 shows the varietal responses with and without the addition of Apron at the Avenue Range site. It can be seen that Trikkala, Dalkeith and Antas all have significantly higher germination and establishment when compared to Goulburn and Woogenellup. There was no response to the application of Apron seed treatment across these varieties, suggesting that the differences were either not due to disease, or that the disease burden was so high that the chemical suppression was not enough to offset the disease and that the only 'force of defence' was in-built varietal resistance.

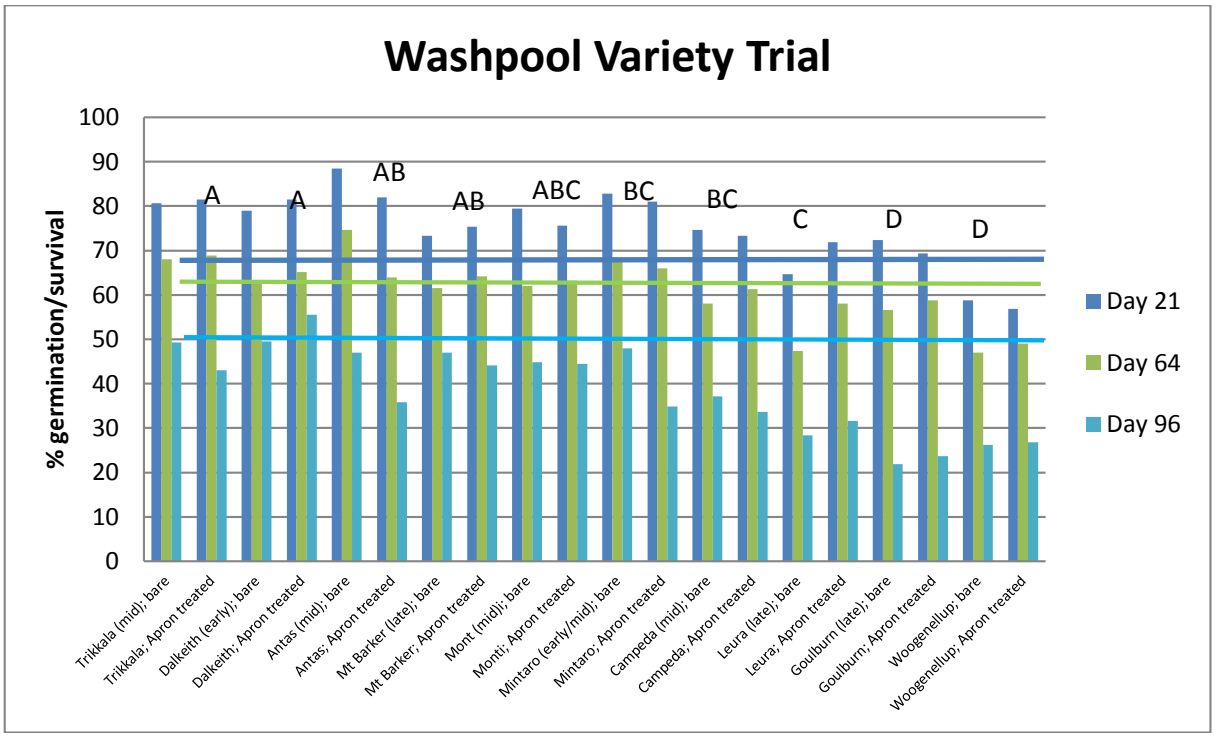

Figure 2. *Germination and survival of 9 common varieties, compared to Woogenellup.*

It has been suggested by Professor Martin Barbetti (University of WA) that visually the level of root disease present at both sites was quite severe (this conclusion has been reached after viewing photographs of the plants, roots and plant growth). Figure 3 shows a photo of diseased vs. healthy plants and the subsequent growth

No visible disease and good nodulation

Diseased and stunted roots clearly visible and ineffective nodulation

Figure 3. *Diseased vs. healthy plants. Photo courtesy of University of WA.*

The trials were sown quite late (mid-July), and it may have been that the time of sowing affected the results (ie. that the level of disease present was too high when the trials were sown). Professor Barbetti suggests that the total disease loading potentially being too high may have affected the ability of the seed treatments or varietal differences to significantly reduce disease effects.

Conclusions and Future Activities:

The SARDI Predicta-B test has recently been expanded and developed to include the identification of soil borne pathogens that affect pasture. This test will be utilised and sites resampled to try and understand how the pathogen levels vary based on different seasonal conditions.
After a dry spring and summer period the year before, it is thought that Rhizoctonia was a major disease issue in 2015. It is expected that this will change in wetter seasons, with Phytophthora, Pythium and Aphanomyces being more of an issue. A lot of the seed treatments used (including Apron) are effective on these 'water loving pathogens' and the dry seasonal conditions that were experienced in 2015, along with a potential shift in the pathogen complex due to the dry seasons. may have been why results (particularly those of Apron) were not entirely as expected.

The effect of some common chemical seed treatments will continue to be explored, with results from 2015 allowing us to make more informed decisions around product choice. Information from other MLA-funded trials across South Australia and into Victoria are helping to determine products that may have potential.

Differences in commonly grown varieties (compared with the susceptible variety Woogenellup) will also continue to be explored, with biomass production also being measured. As the level of root disease increases, the level of growth and plant size decreases. Measuring germination and establishment, as well biomass in these varieties, should provide us with information regarding the economics of potential disease losses.

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