

QUARTERLY PROGRESS SUMMARY: January – March 2019

A New Vision for Pastoral Agriculture through Seed and Nutritional Technology Development

Summary of progress during this quarter

- The 2018/19 seed increases of our diploid and tetraploid perennial ryegrasses with AR501 have been harvest in early 2019 and two new seed increases have been sown for prep-commercial trials. Agronomic trialling of the best lines has continued across New Zealand, however, there has been a decrease in persistence from Argentine stem weevil damage. Insect testing is now complete with root aphid counting finalised and results being analysed.
- A grazing trial of grass pastures (containing AR501, AR37 or a blend of AR501 & AR37) at Lincoln has been completed and inclusion of AR501 in a blend with AR37 improved lamb performance to a greater extent than predicted from the proportions of tillers of each endophyte strain in the blend.
- We have been monitoring *P. chartarum* spore accumulation in plots in the Manawatu and Waikato to gauge the optimal timing for facial eczema spore counting in 2019. Comprehensive sampling of tillers from three trials in the Waikato and Manawatu has been initiated. We have also analysed the 2018 Phase I spore data from 16 new strains inoculated into ryegrass and ranked the strains based on *P. chartarum* spore effects. Phase II plants infected with ARY have undergone a further cycle of selection for high endophyte transmission. The seed has also been sown for endophyte transmission testing. We have developed a PCR-based test to assay for presence/absence of each endophyte in individual seed to estimate endophyte transmission.
- The feed conversion efficiency project continues to make excellent progress against all objectives. In the first quarter of 2019 we sowed 6500 progeny and retained the most promising individuals (approx. 1700) for full analysis. A small yield penalty was identified and overcoming this will be a focus of 2019 glasshouse and field screening programme. A new field trial in the USA has been planned with selected individuals sent for evaluation.
- Ten new herbicide-tolerant raphanobrassica selections have been increased for regional field trials this year. These new lines were tested for herbicide tolerance and all have passed the pre-emergence test.
- The raphanobrassica seed production protocols to optimise seed yield have been successfully applied, with commercial seed yields above 2200kg/ha achieved this past year.
- A road map has been developed to discover, validate and implement molecular markers to pyramid clubroot resistance loci to achieve multi-strain clubroot resistance.

Key highlights and achievements

- Our elite perennial ryegrass selections with AR501 endophyte have improved bioactivity against insect pests and excellent agronomic performance, outperforming more than 100 other entries across 8 locations in New Zealand. Our first selection has been entered in the official National Forage Variety Trials. A series of animal safety trials have shown strong animal performance results without any adverse animal health problems demonstrating the animal safety of this endophyte. They have also shown that a mix of AR37 and AR501 also may have animal health and performance benefits. The genetic control of our AR501 endophyte transmission has been determined and the optimal method for progressing this to a commercial product in both diploid and tetraploid perennial ryegrass is underway.
- Draft seed production management guidelines have been completed based on seed production trials.
- The effect of PGP-endophytes on facial eczema spore counts have been assessed under field conditions, demonstrating a reduction of up to 40% in *P. chartarum* spore counts over the past 2-years. Furthermore, this level provides similarly low levels of facial eczema challenge as those observed with tall fescue the best current forage option. The histology and haematology results from our first animal toxicology study have shown no adverse effects of these endophytes in small animal studies. Selection has improved transmission of ARY in perennial ryegrass but still needs further improvement to justify proceeding with an animal safety trial. Several new PGP-endophytes with bioactivity against facial eczema have been identified and are in the development pipeline. A new assay has been developed for rapid identification of several new PGP endophytes.
- We have demonstrated improved water-use efficiency (+38%), aphid tolerance (+32%), clubroot resistance (100%), lower glucosinolate levels (-80%), excellent seed yield potential and improved agronomic performance (+14% DM yield) from Pallaton raphanobrassica compared to Goliath rape across a range of regional sites. Furthermore, our cattle grazing trial resulted in ~30% higher liveweight gain per hectare without any increase in brassica associated liver disease. Initial on-farm studies have also shown strong improvements in lamb finishing systems with >\$2,000/ha profitability gains compared with forage rape and grass pasture.
- A nucleus crop of Pallaton raphanobrassica was produced in early 2016 with further crops harvested in Canterbury in early 2017, 2018 and 2019. The seed yields have exceeded the target by at least 30% with yields averaging >2200 kg/ha. This product is now fully commercial with approximately 6,800 ha of Pallaton sown across NZ in 2018/19. DM yield and liveweight gains to date have been very encouraging. A stand at the national field days at Mystery Creek highlighted the knowledge we have developed from on-farm use of this project over the past year. Pallaton is awaiting a final decision for Plant Variety Rights. Strong performance of Pallaton has been reported across regions of New Zealand that experienced severe drought stress in spring and early summer of the last two years.
- Firefly Cleancrop Kale has proven tolerant to Telar herbicide under worst case scenarios and has shown good agronomic performance at regional evaluation sites. A pre-nucleus seed increase was harvested in Canterbury in early 2017 with nucleus crops harvested in early 2018. Cleancrop Firefly kale is now fully commercial with approximately 7,200 ha sown this year across New Zealand. Reports on performance to date have been excellent. A Plant variety rights application is in its 2nd year. We also completed the cattle grazing trial of Firefly kale in winter 2018 in North Canterbury and no animal health issues were identified.
- Glucosinolates levels for both Pallaton raphanobrassica and Firefly kale have been measured at two locations. The levels of three key glucosinolates were very low compared to both Regal and Sovereign kales. This should improve animal health outcomes for New Zealand livestock systems.
- Several new interspecific brassica hybrids have been developed and are beginning evaluation and several potential new sources of clubroot tolerance have been confirmed.

Upcoming

- New diploid and tetraploid perennial ryegrass multiplications with AR501 will be monitored.
- Insect test results have been analyzed and a final report is being prepared.
- Screening in the Waikato and Manawatu will assess the impact of our PGP endophytes on facial eczema in autumn 2019.
- Seed containing ARY harvested at Lincoln will be tested for endophyte transmission to determine its efficacy for commercialisation.
- New experiments for our improved feed conversion efficiency project will be established and ~6,500 plants screened for the key traits of interest. A 3rd field trial will be run in USA. Methane mitigation results will be confirmed and reported.
- Cleancrop raphanobrassica regional trials will begin and the effect of timing and rate of herbicide application evaluated.

Investment

Investment period	Industry contribution	MPI contribution	Total investment
During this Quarter	\$288,400	\$139,912	\$428,312
Programme To Date	\$7,371,413	\$7,013,498	\$14,384,911