QUARTERLY PROGRESS SUMMARY: October - December 2018

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 are being monitored to ensure they are ready for harvest in January 2019. Agronomic evaluation of the best tetraploid AR501 lines has continued across New Zealand. Chemical analysis of the plants used in insect tolerance studies has been completed, and the grazing trial paddocks have been prepared for the grazing trial to begin in the next quarter. The new grass pastures (containing AR501, AR37 or a blend of AR501 & AR37) at Lincoln are in good condition and is on track for the animal safety grazing trial to begin in late January/early February 2019.
- We have analysed *P. chartarum* spore data from the 2018 Manawatu plot trial and despite conditions that should have favoured facial eczema spore accumulation, particularly in early autumn 2018, spore levels were consistently low in all three samplings taken in 2018. However, when assessed over all nine samplings in 2017 and 2018 facial eczema seasons we have seen reductions in facial eczema spore accumulation by ~40% in perennial ryegrass. The impact of 16 newer PGP-endophyte strains on *P. chartarum* spores has been assessed. Additional data from this trial, including hyphal biomass and alkaloid production have also been analysed. An additional spaced plant trial containing plants infected with the new bioactive PGP-endophyte ARZ have been established in Palmerston North for facial eczema testing in 2019. Clonal replicates of our best plants have been polycrossed at Lincoln to determine endophyte transmission levels in the resulting seed. A new field trial has been established in the Waikato.
- The feed conversion efficiency project continues to make excellent progress against all objectives. A second trial to determine the efficacy of the trait under field conditions was completed in this quarter. A small yield penalty was identified and overcoming this will be a focus of 2019 programme. Elite genotypes from families with trait expression in the target range were crossed this quarter to create the next generation of progeny. From these will come the parents for the first product.
- Several new herbicide tolerant raphanobrassica selections are being developed and the best candidates are in field trials to demonstrate their herbicide tolerance.
- The Firefly Cleancrop kale cattle grazing trial grazing has been completed and results reported. This demonstrated that there were no animal safety issues with cattle grazing Firefly kale.
- There has been good progress on clubroot screening and tolerant plants have been selected for finished lines and/or used within the breeding programme as crossing parents.

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. 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.
- 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 and 2018. The seed yields have exceeded the target by at least 30%. 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 raphnobrassica 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 continue to be monitored. These increases utilize the new knowledge generated on endophyte transmission.
- Insect test results have been analyzed and a final report is being prepared.
- Field trial results on the impact of our PGP endophyte on facial eczema will be analysed and reported.
- 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 ~5,500 plants screened for the key traits of interest. 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	$268,025	$253,206	$521,231
Programme To Date	$7,083,013	$6,873,586	$13,956,599