QUARTERLY PROGRESS SUMMARY: July - September 2018

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

Summary of progress during this quarter

- New seed increases of our diploid and tetraploid perennial ryegrasses with AR501 are being monitored to ensure they are well setup for harvest in early 2019. Agronomic data for three tetraploid AR501 selections continues to be collected and entered for analysis across New Zealand. Grass grub feeding trials have been completed for the diploid and tetraploid AR501-infected ryegrass lines, and a porina trial for the tetraploid AR501 ryegrass lines. The root aphid trial has been harvested and counts of root aphid are underway. The new grass pastures (containing AR501, AR37 or a blend of AR501 & AR37) at Lincoln have come through the winter well and are in good condition heading into early spring. Everything is on track for the animal safety grazing trial to begin in late January/early February 2019.
- We continued processing and counting *P. chartarum* spores from samples harvested from the Manawatu plot trial containing ARY and 16 different PGP-endophyte strains. Spore counting for the first harvests is now complete and the second harvests are now being counted. Fresh PGP-endophyte inoculations with ARY and ARZ (another bioactive PGP-endophyte) have continued. Bulk seed harvested in January 2018 for large animal safety trials was retested in July and while the transmission levels were 10% higher than in February it was still below the minimum threshold required to continue with the animal grazing study.
- The feed conversion efficiency project continues to make excellent progress against all objectives. The information generated from two sites was used to select individuals for the 2018 crossing programme. These elite genotypes from families with trait expression in the target range were selected and crossed this quarter to create the next generation of progeny. From these will come the parents for the first candivar.
- Several new herbicide tolerant raphanobrassica selections are being developed and the best candidates are in field trials to demonstrate their herbicide tolerance.
- The cattle grazing study with Firefly Cleancrop kale has been completed and the results are being analysed.

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 at least a 30% reduction in *P. chartarum* spore counts under severe

infection conditions 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 4,500 ha of Pallaton sown across NZ in 2017/18 and 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 in its 2nd year of Plant Variety Rights examination. Strong performance of Pallaton has been reported across regions of New Zealand that experienced severe drought stress in spring and early summer 2017/18.
- 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. Pre-commercial testing of Cleancrop Firefly kale across ~3,000 ha is underway 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.
- 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 utilise the new knowledge generated on endophyte transmission.
- Animal safety trials for AR501 in late-summer.
- New seed multiplications have been planted to try and achieve higher transmission for the PGP-endophytes. These will be harvested in early-2019.
- Seeds and plant material will be prepared for the next field trial for the feed conversion efficiency project.

Investment

Investment period	Industry contribution	MPI contribution	Total investment
During this Quarter	$268,025	$255,056	$523,081
Programme To Date	$6,814,988	$6,620,381	$13,435,368