

## QUARTERLY PROGRESS SUMMARY: July – September 2019

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

#### Summary of progress during this quarter

- Two new breeders seed crops with AR501 continue to be monitored and prepared for harvest. Agronomic trialling of the best AR501 lines has continued across New Zealand.
- Reductions of up to 70% in *P. chartarum* spore levels have been observed with our ARY and ARX endophytes in Waikato and Manawatu trials. We also analysed hyphal biomass to determine whether hyphal concentration was correlated with *P. chartarum* spore numbers. Three additional PGP-endophyte strains selected for high bioactivity and transmission into seed have been inoculated into Platform perennial ryegrass.
- Feed conversion efficiency trait performance in the USA field trial was consistent with results obtained from the same families grown under glasshouse conditions in New Zealand. Across all families tested trait expression is at desired levels but we have observed a penalty in herbage yield. This yield penalty is less than in the previous year while expression of our target has increased by ~60%. The next breeding cycle is currently underway to achieve the optimal combination of trait expression and herbage yield.
- The Cleancrop raphanobrassica breeding and evaluation is on track to produce a viable cultivar. Eleven Cleancrop raphanobrassica selections are beginning agronomic testing with the best candidates entered for seed increase.
- Several new interspecific hybrids have also been developed and are either entering the breeding programme. Clubroot screening identified several kale and swede lines with good tolerance.

#### 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. We have shown that a mix of AR37 and AR501 also provides animal health and performance benefits to a greater extent than predicted from the proportions of tillers of each endophyte strain in the blend. 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. A full analysis of 5-years of insect testing is now complete with superior black beetle and root aphid resistance confirmed. 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 70% in *P. chartarum* spore counts over the past 3-years. Furthermore, this level provides similar or better protection against facial eczema challenge as those observed with tall fescue – the best current forage option. The histology and haematology results from our 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. We have also analysed the transmission of 17 new PGP strains inoculated individually into ryegrass seed. The transmission results confirm the greater compatibility between ryegrass and PGP endophytes isolated from ryegrass than those isolated from tall fescue. 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 and quantification of several new PGP endophyte strains.

- The feed conversion efficiency project continues to make excellent progress against all objectives. We have completed three cycles of selection using several thousand plants in each cycle in the glasshouse and the best families have been tested over the past 3-years in field trials in USA. The best families have been identified for use in future breeding. We have confirmed the biological impact of this trait on total gas production and methane emissions in in vitro studies, with methane emissions reduced by approximately 15%, which is comparable with *L. corniculatus*.
- 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 in 2017 and 2018 highlighted the knowledge we have developed from on-farm use of this project over the past year. Pallaton has been granted Plant Variety Rights in New Zealand. 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. A road map has been developed to discover, validate and implement molecular markers to pyramid clubroot resistance loci to achieve multi-strain clubroot resistance.

## Upcoming

- New tetraploid perennial ryegrass multiplications with AR501 will be monitored.
- New seed increases of ARY will be monitored at Lincoln to produce seed for animal safety trials and to determine its efficacy for commercialisation.
- Elite selections from our feed conversion efficiency programme will be used in the breeding programme.
- Cleancrop raphanobrassica regional trials will determine the effect of timing and rate of herbicide application evaluated.

## Investment

Investment period	Industry contribution	MPI contribution	Total investment
During this Quarter	\$242,700	\$162,447	\$405,147
Programme To Date	\$7,902,513	\$7,480,298	\$15,382,811