

Supplied for NAAIC / TC / GBC joint conference
Lethbridge Alberta Canada
July 2014

Forage Breeding Developments in New Zealand

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In New Zealand, pastoral production generates approximately half of export revenue, and uses half of our land area. The notable trend is toward increased land area for dairy production, with sheep and beef production becoming increasingly reliant on extensive land and exhibiting marginal economics at the farm level. Forage breeding activity primarily has an Australasian focus, with lesser emphasis on the Americas, Europe and Asia. New cultivars are delivered through private and public sector entities, with active breeding projects in *Lolium*, *Festuca*, *Trifolium*, *Medicago*, *Chicorium* and *Plantago*. Grass-based programmes have an emphasis on the fungal endophyte symbiosis in addition to forage yield, quality, and persistence traits. Legume breeding is primarily focused on yield and persistence-related traits. The major new development is a forage cultivar benchmarking system for New Zealand, the Forage Value Index (FVI). A joint initiative of the dairy and seed industries; the first aim is to assess yield, quality and persistence of perennial ryegrass::endophyte cultivars at the regional level in a validated pastoral context. The FVI also offers an index selection focus for plant breeding, and includes a substantial program of underpinning research. Development of *Trifolium* inter-specific hybrids is the major source of innovation from a forage trait perspective, with abiotic stress tolerance and nutrient use efficiency the major foci. Breeding systems research includes development of genomic selection capability for *Lolium* and *Trifolium*, paternal selection in white clover, validation of QTL-informed marker-assisted selection, and investigation of semi-hybrid approaches to harnessing heterosis. Basic research has generated a genome of the disomic tetraploid white clover, and through collaboration we have access to a ryegrass genome to complement our genomics platform in key species. Genotyping-by-sequencing is our preferred marker platform, with a pan-sector project aiming to enhance and extend adoption of the marker platform. A new project in legume:rhizobia symbiosis is revitalizing an area of research effectively dormant in New Zealand for the past decade. Annual plant collection trips in the Northern Hemisphere continues to improve access to genetic resources including the tertiary gene pool of *Trifolium*, and new types of grass fungal endophyte. Novel trait research continues, despite the inclement regulatory environment in New Zealand, and reluctance in key export markets to embrace transgenic traits. Resource constraints include limited capacity in field breeding, field-based high throughput phenotyping, plant physiology, plant quantitative genetics and pasture ecology. Support for seed production research is inconsistent. Increased research engagement with the pastoral sector while strengthening linkages to the seed industry, is essential to achieving acceptable rates of gain in temperate pasture species.