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Recent development of pasture plants in Queensland

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Why continue to develop new pasture plants in Queensland?

The beef (AU$3,280 M), dairy (AU$230 M) and sheep (AU$197 M) industries contribute significantly to the Queensland economy (Queensland Government 2011). Introduced tropical grasses and legumes, used in permanent or temporary pastures, are the primary feed base for dairy and beef-finishing operations. Sown legumes are also used to increase the productivity of extensive native grasslands, particularly for beef breeding and sheep production. By the mid-1990s, the net present value of sown pastures to the beef industry alone was estimated at AU$712 M with an annual gross benefit of AU$80 M (Walker et al. 1997).

There is continued impetus to develop new pasture plants. Key reasons in the last 10 years include: increasing productivity (biomass and feed quality) of pastures to maintain business profitability (*Brachiaria* and *Arachis* spp. for beef finishing and dairy); imparting tolerance to diseases (*Stylosanthes guianensis* and *Macroptilium atropurpureum*) and insect pests (*Leucaena leucocephala*); developing new agricultural systems (*Clitoria ternatea* and *Macroptilium bracteatum* in crop/graze systems); and developing summer-active grasses in temperate areas and filling production niches where few plants exist (*Desmanthus virgatus* and *Stylosanthes seabrana* for beef production on vertisols). Current emphasis in Queensland is placed on legumes to enhance the productivity of sown and native beef pastures in moderate rainfall zones.

Historical approaches to pasture plant development and release

Tropical pasture development began in earnest in Queensland during the 1960s, with the development of well-resourced federal and state government programs. By 1997, 72 tropical grass and 65 tropical legume cultivars had been released in Australia, mostly in Queensland (Hacker 1997). Co-funding arrangements between grazing industry development corporations and government agencies saw systematic evaluation programs, in which a wide range of accessions were introduced to Australia, assessed under a range of environments and promising types progressed towards commercial release (Clem and Jones 1996; Pengelly and Staples 1996; Bishop and Hilder 2005). (Mostly) public cultivars were released by government agencies once vetted by a committee comprising government agencies, universities and seed companies.

The Australian Tropical Forages Collection (ATFC), a seed-bank comprising tropical grasses and legumes collected over some 40 years, has been the key resource for developing new tropical pasture varieties in Queensland (Hacker 1997). Following significant downsizing, it now contains ~10,000 (614 species) warm-season grasses and ~2,700 (255) legumes targeting cultivar development in Australia (Cox et al. 2009). However, difficult access to plant description and field performance data (where known) and declining quality and volume of stocks compromise its future use.

Despite the best intentions of plant evaluation teams, the introduction of new pasture plants, even palatable types, can result in the naturalization of plants deemed undesirable by the broader community. Notable examples in Australia include *Andropogon gayanus* and *Hymenachne amplexicaulis*. At present, the beef industry and Queensland Government are co-funding the control of certain unpalatable legumes before they spread from plant evaluation sites and become widespread contaminants of grasslands (Cox 2006). Clearly, the development of new cultivars should include protocols which minimize the risk of releasing a new weed.

Recent approaches to pasture plant development and release

Government agencies have significantly reduced investment in sown pastures over the last 20 years and private sector involvement in developing new pasture cultivars has

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Table 1. Some recent approaches to the development of new pasture varieties grown at the Queensland Government seed production facility in north Queensland.

	Method	Organization(s)	Genera (no. of species)
1	Importing elite overseas varieties[1]	Queensland government, seed companies	*Brachiaria* (*Urochloa*) (2), *Cenchrus* (1), *Chloris* (1), *Dichanthium* (1), *Panicum* (3), *Stylosanthes* (1)
2	Identifying useful accessions in ATFGRC[1]	Queensland government, seed companies, university	*Arachis* (2), *Bothriochloa* (1), *Chloris* (1) *Digitaria* (1), *Lablab* (1), *Macroptilium* (2), *Urochloa* (1)
3	Re-selecting plants from old evaluation sites	Queensland government, university	*Desmanthus* (2), *Stylosanthes* (2)
4	Plant breeding and selection program	Queensland government, seed companies, university	*Chloris* (1), *Macroptilium* (1)
5	Plant collection and selection (Australia)	Queensland government	*Dichanthium* (1), *Heteropogon* (1), *Setaria* (1), *Themeda* (1)

[1]Often using the knowledge of retired government research workers.

increased. A range of methods have been employed to maintain momentum in pasture cultivar development, including rapidly progressing imported material or accessions of known merit from the ATFC, re-selecting accessions from old plant evaluation sites and, in a few recent instances, undertaking plant breeding programs (Table 1). Most involve collaboration between government and seed companies and universities, if only to produce seed at the Queensland Government facility to support breeding, evaluation and commercial adoption. Recent releases include public and proprietary cultivars, including some with international intellectual property rights. The release process is less structured than in the past, following the disbanding of the advisory committee.

The current approach of using government, university and private facilities has been effective for quickly and inexpensively developing and releasing new pasture plant varieties. However, the identification of promising accessions and cultivars is heavily reliant on the infrastructure (ATFC, evaluation sites and government research facilities) and personal knowledge developed over 40 years of research, often targeting different goals from those we seek today. Whereas there have been some within-organization assessments of plant performance, there has been no coordinated or systematic approach for comparing new public or private varieties in grazing operations, including assessment for weediness. As a result, graziers often rely on incomplete or outdated recommendations for their businesses.

Conclusions

In the absence of well-resourced sown pasture programs, processes used to develop new pasture cultivars in Queensland have recently focused on progressing 'best-bets' as efficiently as possible, and the performance of many of these cultivars has not been rigorously tested under a range of grazing management systems. On-farm demonstration and independent promotion of new pasture plants is urgently required. Given the increasing development of varieties by private enterprises, this can best be achieved through public-private sector collaboration, preferably adhering to the priorities of the grazing industries. In the longer term, as previous knowledge becomes less useful for emerging needs, a greater focus on the plants entering evaluation programs will be needed. Assuming the ATFC remains a key source of useful pasture plants, the grow-out, describing and publishing of data on carefully selected genera/species, prioritized by industry needs, will benefit both private and public plant development programs.

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