Challenges to Domesticating "Native" Forage Legumes

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Introduction

If ruminant production from cultivated and natural grasslands is to depend less on petroleum-based products, forage legumes must serve as protein sources. Commercially available legumes for warm-dry climate grasslands are, however, very limited and resources available for developing such legumes are inadequate. Indeterminate flowering and dehiscent seed pods combined with the need for specialized seed harvesting equipment are major impediments (Butler and Muir 2012). Warm climates often present environmental challenges such as poor rainfall distribution, extended dry seasons, temperature extremes and aggressive grass species (Muir *et al.* 2011). Erosion of indigenous knowledge and replacement with inappropriate land management approaches from moist-temperate regions compound the challenges.

Limited efforts to commercialize local "native" legumes address this opportunity. The few current programs are regional and limited to locations with support from wealthy segments of the population. South Texas Natives (Smith *et al.* 2010), one success story in North America, benefits from ranchers interested in wildlife restoration, government agencies under pressure to avoid exotic germplasm for rangeland restoration and roadside revegetation, energy companies obligated to restore disturbed grasslands with natives and interested local commercial seed companies. Such broad-based support including involvement of grazing managers is rare, especially where most distinctly needed.

Germplasm for native area restoration is sought from the target ecosystem, but such local seed is often expensive and may not be available. Some herbaceous grassland legumes, however, are found across wide ranges of latitude, longitude, soil, climate and ecosystems. Examples in North America include *Desmanthus illinoiensis* (Michx.) MacMill. found from southern Canada to northern Mexico and *Desmodium paniculatum* (L.) DC. native from the Rio Grande to the Atlantic coast (Diggs *et al.* 1999). Specific ecotypes of these species, however, are rarely suitable everywhere the species is endemic. To provide adaptable varieties for use on a commercial scale, groups such as South Texas Natives are forced to work within plant adaptation regions (Vogel *et al.* 2005) with genetically diverse populations.

Current Status

Past and current research topics

Research on local herbaceous legumes in warm-dry climates has been ongoing for decades. Table 1 summarizes some of these efforts. With few exceptions, insufficient germplasm has been collected for thorough evaluation. Germination assessments indicate widespread hardseededness requiring scarification for rapid stand establishment. Tremendous range in growth form among species and wide genetic variation within some promising species provide opportunities. Forage nutritive value and palatability differences among legume species and between legumes and grasses require consideration for sustainable populations with bunch-grass growth more favourable to most legumes than sod-forming grasses.

Future research needs

Future research is needed on seed harvest technology (especially how to mitigate pod dehiscing), seedling vigour, grazing/browsing tolerance, persistence under natural conditions, multiple uses, and long-term population dynamics. Success will require research at scales and locations beyond typical trials.

Conclusions

Efforts to domesticate "native" legumes for warm-dry climates have had limited application in grasslands. Some progress has occurred, but seed cost of even the most successful varieties limits extensive use. Further research and marketing are required if native legumes are to contribute to productive and sustainable natural and cultivated grasslands. A commercially viable seed industry to support widespread use of native legumes will require acceptance of broadly adapted, genetically diverse, and superior genotypes rather than only local ecotypes. Discerning and wealthy clientele are also a prerequisite for success.

Table 1. Examples of published research focusing on domestication of native herbaceous grassland legumes.

Topic	Genera	Location	Results	Citation
Diversity/collection	Multiple	Southern Africa USA, Brazil	Variable	Maposse *et al.* (2003) Smith *et al.* (2010) Trytsman *et al.* (2011)
Germination	Multiple	USA	Scarification	Multiple
Seed yield	*Neptunia*, others	USA	Variable	Muir *et al.* (2005)
Agronomy	*Desmodium* *Dalea, Rhynchosia*	USA	Determinate, upright	McGraw *et al.* (2004) Muir *et al.* (2005)
Quality	*Strophostyles*	USA	High	Foster *et al.* (2007)
Mixes	*Desmanthus* *Lespedeza*	USA	Bunch grasses	Springer *et al.* (2001) Muir and Pitman (2004)
Persistence	*Dalea*	USA	Relative palatability	Berg (1995)
Genetic variability	*Desmanthus* *Acacia*	USA	Wide	Kulakow (1999) Noah *et al.* (2012)
Releases	Multiple	USA	Universities, NRCS	Muir *et al.* (2011)

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