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ABANDONED PASTURE LEGUMES OFFER POTENTIAL ECONOMIC AND ENVIRONMENTAL BENEFITS IN SEMIARID CLAY SOIL RANGELANDS

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ABSTRACT

In the 1980's CSIRO and QDPI established a number of pasture legume evaluation trials throughout clay soil regions in Queensland's semiarid tropical rangelands. These sites have long since been abandoned and incorporated into regularly grazed paddocks. Grass quality is often poor in semiarid rangelands; any surviving legumes from these trials would potentially enhance pasture quality, and thus livestock production in a region where suitable sown legume species are virtually unknown. Legumes also have the potential of enteric methane abatement, reducing greenhouse gas emissions from ruminant livestock. Graziers are however unlikely to use legumes solely for the environmental benefits of CH_4 mitigation unless there are positive economic impacts on livestock production. Re-examination of a number of abandoned legume trial sites in rangelands on clay soils show that accessions of *Desmanthus* are often the only survivors. *Desmanthus* genotypes offer exciting new prospects and choices for graziers, with associated potential economic and environmental benefits. This paper focuses on the results of surveys at "Hillgrove Station" Charters Towers where *Desmanthus* was found to be persisting some 25 years after the original trial was sown.

Key words: *legumes, semiarid, rangelands, Desmanthus, clay soils*

INTRODUCTION

It has long been a goal of graziers and researchers to seek adapted pasture legumes for rangelands (Eyles and Cameron 1985) as the major limitation to increased livestock production is nutritional and Thomas and Grof (1986) state the best option for increasing productivity is by using legumes.

In the 1980's CSIRO and QDPI established pasture legume evaluation trials throughout semiarid tropical rangeland parts of Queensland's clay soils regions. These sites have since been long abandoned and incorporated into regular grazed paddocks. Any legumes that are still surviving at these trial sites that are productive and palatable offer real potential as new pasture legumes for sustaining and enhancing pasture and livestock production in this region where few, if any sown legumes are available. By improving the quality of feed on offer such legumes may also contribute to reducing greenhouse gas emissions from livestock. Beauchemin *et al.* (2007) in a review of enteric methane abatement state that legumes hold promise for CH_4 mitigation but farmers are unlikely to adapt these measures unless there are positive economic impacts on animal production.

Surveys of abandoned legume trial sites at: Blackall, Isisford, Julia Creek, and Longreach where legumes species including: *Alysicarpus, Centrosema, Chamaecrista, Clitoria, Desmanthus, Macroptilium, Stylosanthes* and *Vigna* genotypes where planted in the 1980's revealed that only accessions of *Desmanthus* survive today (Gardiner 2004). *Desmanthus* is a legume known to be palatable, adapted to heavy grazing, non toxic, non thorny, high protein, enhances wool growth, is drought and frost resistant and adapted to clay soils (Ocumpaugh *et al.* 2004; Cook *et al.* 2005; Rangel 2006). Such persistent surviving legumes offer exciting new prospects and choices for rangeland graziers in environments where there is a dearth of available legumes to produce positive economic and environmental benefits. This paper focuses on the results of surveys at "Hillgrove Station" Charters Towers where an old pasture

legume trial site on a black clay soil has only recently been rediscovered some 25 years after the original trial was sown.

METHODS

Hillgrove Station is located some 90 km north west of Charters Towers at 19^0 40' S, 145^0 45' E. The AAR is 542 mm (T. Mann per com 2008).

Figure I. Location of trial site at Hillgrove Station

The abandoned legume evaluation site is located on a black cracking clay soil. The site was previously fenced but for many years now the fences have been down and the plot has been incorporated into a paddock grazed at 5ha/beast (T. Mann pers com).

The Hillgrove trial was originally planted in 1983 to explore the climatic and edaphic adaptaion of new legume species. Only very scant details of the trial exists today including; the location, soil type and that there was a focus on *Stylosanthes hamata* (80 accessions) and *Desmanthus* spp (30 accessions). Other species included: *Alysicarpus* sp, Arachis sp, *S.scabra*, *Centrosema molle*, *C.pascuorum*, Macroptilium and *Vigna* spp. In all 150 accessions were trialed (Burt 1986).

In early 2008 an intensive whole site survey of the area was undertaken. When populations of sown legumes were encountered their identity, location (GPS), density (plants/m^2), phenology, habit, health and associated vegetation were recorded. Where available seed was collected and pressed specimens taken. Four top soil samples (top 10cm) were collected and bulked for laboratory analysis by Pivot Pty Ltd.

RESULTS

Table I. Summary of soil properties of bulked Hillgrove clay top soil (0-10 cm)

Texture	pH (1:5 water)	Organic Carbon %C	Nitrate Nitrogen mg/kg	Phosphorus (Colwell) mg/kg	Potassium (Colwell) mg/kg	Electrical conductivity dS/m	Sodium (% cations)	CEC meq/100g
Med.clay	7.2	0.6	6.5	5.5	120	0.05	0.3	52.5

Table II. Results of a survey of an abandoned legume site at Hillgrove 25 years post sowing

Sown legume species found	Location	Plant habit	Phenology at time of survey	Plants /m^2	Notes/vigour/ other
Desmanthus virgatus 1	plot 1	Erect multi stemmed	Flowering	1.25	Vigorous/dark green leaf
Desmanthus virgatus 1	plot 2	Erect multi stemmed	Pods	2	Vigorous/dark green leaf
Desmanthus leptophyllus 2	plot 3	Erect multi stemmed	pods	5.75	Vigorous/ green leaf
Desmanthus leptophyllus 2	plot 4	Erect multi stemmed	pods	1	Vigorous/ green leaf
Desmanthus virgatus 3	plot 7	Prostrate multi stemmed	pods	2	Very prostrate
Clitoria ternatea	plot 5	Trailing vine	immature pods	1.8	On boundary of plot
Stylosanthes scabra	plot 6	erect	vegetative	1	Single isolated plant

DISCUSSION

The legumes found surviving in this study have survived the full gambit of environmental tests including droughts, floods, frosts and commercial grazing. Of the 150 accessions sown in 1983 only 5 remain today, which include 3 accessions of *Desmanthus*, possibly 1 accession of *Clitoria ternatea* and 1 accession of *Stylosanthes scabra*. Only a single isolated plant of *Stylosanthes scabra* was encounted in the survey. No *S. hamata* was found nor any sown *Alysicarpus, Arachis, Centrosema, Macroptilium* or *Vigna* spp.

With global climate change, the impacts of grazing on botanical composition, the monoculture and run down of Buffel grass, the pending pressure to reduce methane emissions from livestock in rangelands, the poor quality of the diet of livestock in these rangelands, the time is right to develop and take advantage of the potential livestock production, economic and environmental benefits that these surviving productive legumes offer for the clay soil areas of the rangelands.

REFERENCES

Beauchemin, K.A. Kreuzer, M. O´Mara, F. and McAllister, T.A. (2007). Nutritional management for enteric methane abatement: a review. *AJEA* 48: 21-27.

Burt, RL (1986). Climatic and edaphic adaptation of new legumes. In: G.T. Adams (Ed) CSIRO Division of Tropical Crops and Pastures Annual Report 1985-6. CSIRO Brisbane, pp. 26-7.

Cook, B.G. Pengelly, B.C. Brown, S.D. Donnelly, J.L. Eagles, D.A., Franco, M.A. Hanson, J. Mullen, B.F. Partridge, I.J. Peters, M. and Schultze-Kraft, R.(2005). Tropical Forages: an interactive selection tool., [CD-ROM], CSIRO, DPI&F(Qld), CIAT and ILRI, Brisbane, Australia.

Eyles, A..G. and Cameron, D.G. (1985). Pasture research in Nth Australia – its history, achievements and future emphasis.(Ed J.B. Hacker). CSIRO.

Gardiner, CP**.** Bielig, LM. Schlink, AC. Coventry, RJ. and Waycott, M. (2004). *Desmanthus* a new pasture legume for the dry tropics**.** Proceedings of the 4th International Crop Science Congress Brisbane, Australia, 26 Sep 1 - Oct 2004.

Ocumpaugh, W.R. Grichar, W.J. Hussey, Jr M.A. Abrameit, A.H. Owens, M.K. Reed, R.L. Muir, J.P. Bade, D. and Reilley, J.L. (2004). Registration of "BeeTam 06". *Crop Sci*, 44:1860-1861

Rangel J (2005). Agroecological studies of *Desmanthus* – a tropical forage legume. PhD, James Cook University, Townsville, Australia.

THOMAS, D and GROF B (1986). Some pasture species for the tropical savannas of South America. 1. Species of *Stylosanthe*s. *Herb Absts* 10, 445