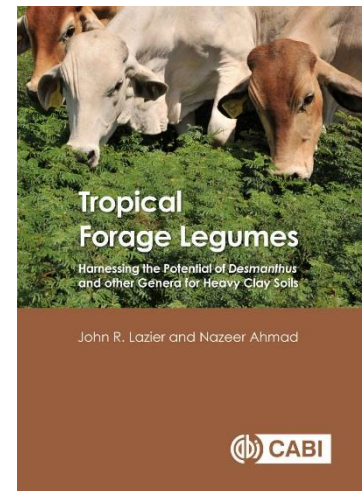


Book Review

Tropical forage legumes: Harnessing the potential of *Desmanthus* and other genera for heavy clay soils

Edited by JOHN R. LAZIER and NAZEER AHMAD.
Published by CABI Publishing, Wallingford, UK, 2016.
480 pp. Price US\$ 225.00. ISBN 9781780646282.
DOI: [10.1079/9781780646282.0000](https://doi.org/10.1079/9781780646282.0000)



Over 200 years ago, Thomas Jefferson, principal author of the American Declaration of Independence and the third President of the USA, also a philosopher and farmer, wrote: “The greatest service which can be rendered any country is to add an useful plant to its culture”. This book, “Tropical forage legumes”, highlights the complexity of the process in domesticating species, and the remarkable work of one person in particular, Dr. Robert (Bob) L. Burt, in adding a useful plant to our culture.

The book itself has a somewhat poignant background, in that two of the initial authors, Dr. Burt and Professor Nazeer Ahmad, died before the book was published. Dr. Lazier, himself a scientist of note, and also a friend and colleague of both great professionals, persisted with the submission out of friendship and the recognition of the need to make the information available to others working in this general field. Dr. Lazier writes: “Since this research was undertaken there has been a marked decline in the funding for such research, and with the retirement of experienced researchers much of this information will be lost. This volume has been written in order that new scientists in this field will not be repeating work which has already been done, and can build upon the results. Recommendations are provided for further research.” Recurrent themes are that: many areas of legume species diversity remain uncollected; potentially valuable genetic material is being lost through global warming and increasing agricultural and urban development; and there is an urgent need to conserve remaining material before it is lost completely. It was gratifying to note that the authors favored a responsible approach to plant introduction, particularly in relation to weediness. “Attempts to meet this demand (adapted legumes) have, in fact, been made for some time, with the due regard that must be paid to the potential of

any new species to be invasive, both within and outside the various regions in which they may be seen to have agronomic and economic merit (Williams and Burt 1982)”.

The book describes the process followed by Dr. Burt, his co-authors and others to expand the range of legumes available for use on heavy clay soils in the tropics, using the range of soils and climates found in Belize and northern Australia as examples. Commendably, they did not feel constrained by the prevailing dogma that would have limited them to a particular group of already recognized forage legume genera, including *Desmodium*, *Macropitium* and *Stylosanthes*, many of which had been selected for acidic soils in the subtropics. The book comprises a total of 19 chapters, largely written as journal papers with Abstract, Introduction, Materials and Methods, Results, Discussion and Conclusions.

The first 9 chapters by various combinations of Burt, Lazier and Ahmad covered all aspects of the work, from collection of wild-type legumes in the Yucatán Peninsula region of Belize, Guatemala and Mexico, as well as in the Caribbean islands, to the very involved methodology of identifying appropriate genotypes for evaluation, and ultimately to the evaluation programs in Belize and Australia. While much of the statistical methodology might have limited appeal to many readers, the actual philosophy and techniques involved in the distillation process, together with the range of genotypes investigated, will have broader appeal. The authors make the point: “It follows that if genetic material is to be selected for trials, for use as ‘core collection’, or ‘representative range’, it cannot be done solely on the basis of geographic or provenance data. A meaningful classification is required.” Krull and Borlaug made a similar observation in 1970: “The major hurdle to

unlocking the secrets (of our genetic resource collections) has been our inability to classify the variability.” Various approaches to overcome this hurdle are proposed and discussed.

The research homes in on two species groups in particular, *Stylosanthes hamata* and *Desmanthus* spp., although a number of other species are put forward as being worthy of further evaluation. It should be remembered that the reported work was conducted in the 1970s and 80s, and results and discussion need to be interpreted in terms of the state of knowledge at that time. It is interesting to note that a number of species identified in the various studies reported have subsequently been absorbed into international tropical agricultural systems, often as a direct or indirect consequence of the work. As well as *Stylosanthes hamata* and *Desmanthus* spp. in grazing systems, *Desmodium cinereum* (long known incorrectly as *Desmodium rensonii*), which they flagged as a species of interest, is widely used in legume hedgerows in Southeast Asia for erosion control and livestock feed. *Calopogonium caeruleum* and *Centrosema plumieri*, considered as having forage potential, have been rejected in this role due to low palatability, but are successfully used as green manure cover crops under plantations. The Australian experience with the shrub, *Codariocalyx gyroides*, was similar to that in Belize; it is very palatable but brittle and fails to persist under grazing. The ubiquitous creeping legume, *Desmodium incanum*, has not been adopted commercially despite being promoted as a grazing legume (Kaimi clover) in Hawaii as early as the 1940s. The mimosoid shrub/small tree, *Acacia angustissima*, attracted some attention in Australia, but was found to be unpalatable and showed the potential to become an environmental weed.

Chapter 10 by Dr. Kendrick Cox from the Department of Agriculture and Fisheries, Queensland, summarizes the significant volume of work carried out in Queensland, Australia, seeking legumes to fulfil a range of roles on alkaline clay soils, mostly in the subhumid and semi-arid areas in central and southern parts of the State. Most of the previous work focused on selecting grazing legumes for the acidic infertile soils of the more humid coastal strip. The research covered in this chapter had two primary purposes: (1) to identify legumes to supplement the limited suite of species that could be used in pasture leys to build up the level of labile soil nitrogen in preparation for subsequent cropping; and (2) to identify legumes that could persist in pastures, particularly the large areas of buffel grass (*Cenchrus ciliaris*) that were becoming less productive as nitrogen became increasingly bound up in the extensive fibrous root system of the grass. Within each of these, additional research was

necessary to ensure seed production would not be a constraint to release and adoption, and to address other issues such as establishment, plant nutrition, nodulation and management. Once again, *Desmanthus* was identified as a source of adapted germplasm for pasture, along with another of the species discussed by Burt, initially known as *Stylosanthes* sp. aff. *scabra* and subsequently as *S. seabrana*. While traditional species such as *Lablab purpureus* were unsurprisingly successful for short-term leys, two species, which had been rejected from earlier evaluations in favor of more persistent species, found a significant role in ley pastures on clay soils – *Clitoria ternatea* and *Macroptilium bracteatum*.

The aim of plant evaluation is to bring new and useful germplasm into our culture, whether it be for immediate use by humans or livestock, or to inject a measure of sustainability into current management or production systems. On this basis, Chapter 11 provides an interesting case study of how Dr. Chris Gardiner from the James Cook University, Townsville, Queensland, capitalized on Dr. Burt’s earlier work in the northern part of the State, by visiting the evaluation sites established in the 1980s, and collecting and identifying legume species, largely *Desmanthus*, persisting in this particularly testing environment – heavy clay soils and low, unreliable annual rainfall. This means he started with genotypes that had persisted for around 20 years under commercial management in the target environment. Drs. Burt and Lazier had already done the painstaking work of selecting genetic material that had a good chance of performing well in this environment. In the ensuing period, Dr. Gardiner and others have undertaken a range of studies to evaluate the most promising varieties, and to define aspects of their agronomy and productivity necessary to proceed to commercial release through a partnership with a private company. Accordingly, a mixture of 5 *Desmanthus* selections (three of *D. virgatus* and one each of *D. leptophyllus* and *D. bicornutus*) is being made available to producers under the Progardes trade mark. This chapter highlights the value of returning to discontinued evaluation sites if persistence is one of the key criteria of merit in selecting useful genotypes, and conversely demonstrates the folly of expecting to select persistent plants from short-term experiments.

In the final chapters, Dr. Lazier focuses again on the situation in Belize, a small country of only 23,000 km², about 1/5 the size of neighbouring Guatemala. He initially outlines the development of the beef industry in the country, identifying constraints to its expansion, one being limited forage development. He follows up the industry review with an analysis of native pastures, in terms of both botanical and chemical composition, and

finally a series of experiments comparing the more productive native legumes with a range of exotic species. As in the earlier chapters, Dr. Lazier's work provides a roadmap of how researchers can approach a forage development program in an untested area. As with any roadmap, there are usually a number of ways to reach one's destination. It is now over 40 years since he commenced his work in Belize, in which time alternative methodologies have been developed for evaluating plants, which may have produced slightly different outcomes, partly through using different comparators, but also through using non-destructive sampling.

A note of caution – some of the species names used in the book are those that would have been applied in the 1970s. Although many appear to have been brought into line with the currently accepted taxonomy, some have not, e.g. the common centro mentioned in the book is listed as *Centrosema pubescens* but is now accepted as *C. molle*, while *C. pubescens* is now applied to cv. Belalto; many former *Cassia* spp. are now classified as *Chamaecrista* or *Senna*; *Macroptilium longepedunculatum* is now accepted as *M. gracile*; the *Arachis pusilla* referred to was actually misnamed in the Australian collection, and should be *Arachis triseminata*. There are misspelt names such as *Desmodium cinerium*, which should be *Desmodium cinereum*, *Stylosanthes sympodiales*, which should be *S. sympodialis*, and *Arachis pintoii*, which

should be *A. pintoii*. There are other name changes and misspellings in the book, but it is not the role of a reviewer to act as proof reader. These are mentioned merely to draw the reader's attention to the issue, in order to prevent perpetuation of incorrectly spelled names.

This is not a text. It is a book that will appeal to people involved in the search for new species to play a role in the development of sustainable agricultural production systems. While it focuses on legumes for alkaline clay soils, potential readership should not be limited to those interested solely in legumes or alkaline clay soils. There are many facets to this publication – legume species, soil chemistry, plant ecology, field and statistical methodology, seed production and philosophy, not to mention a brilliant bibliography. Even the multitude of tables, that some may find tedious, provide detail for others that might not be available elsewhere. I cannot in all honesty say that this is a book that should grace the shelves of every student of leguminology, but it should be considered a must for libraries associated with agricultural R & D agencies around the world in both the tropics and subtropics.

Bruce G. Cook
Agricultural consultant (former Research Agronomist)
Westlake, Qld, Australia

(Published 31 May 2017)

© 2017



Tropical Grasslands-Forrajes Tropicales is an open-access journal published by *Centro Internacional de Agricultura Tropical (CIAT)*. This work is licensed under the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 Unported license. To view a copy of this license, visit <http://creativecommons.org/licenses/by-nc-sa/3.0/>