

# Forages for the Future



## Taking stock

This is #3 of the newsletter on *Forages for the Future*. Time to take stock on what has happened during the first year of implementing the *Global Strategy* for the Conservation and Utilisation of Tropical and Sub-tropical Forage Genetic Resources (TSTF). The strategy has three main objectives:

- Community building;
- Efficient conservation; and
- Better utilization.

This year, we have worked heavily on building the community, especially by starting this newsletter that received a stunning echo from all over the world; positive and supportive reactions did not change after newsletter #2. Although, some world regions are not well covered by our distribution list that has now grown close to 600 recipients. For instance, there is the whole of West Africa only represented by 6 recipients. We think there are many more potential forage users than conservers among our audience. So we wonder what your preferred stories would be. But we also wonder where the national genebanks are with reasonable forage germplasm holdings that may want to share their experiences.

Besides congratulations we received little feedback. We are still feeling a bit like *a spider in the web*, and it's difficult to imagine how much direct interaction has begun among newsletter contributors and readers.

The report on using Mucuna as livestock feed prompted some remarks. Datta Ragnakar from India, for example, commented "I was particularly happy reading the report from Zimbabwe (Livestock – Mucuna and El Niño) since much of my involvement, in the last few decades, has been with smallholders from ecologically fragile areas, with unfavorable soil moisture and conditions. I have been looking out for such reports since in a country like India where holdings are small not much cultivable area can be spared for forage production." Can we have more of such responses?

In this edition #3, we feature a broad overview of TSTF-related themes; starting with species/accession selection (p. 3), looking at forage seed production (p. 4), evaluating forages on farm (p. 5), making the most of evaluation data (p. 6), and recognizing the outstanding contributions of one of us, Rainer Schultze-Kraft (p. 7).

We update you on the implementation of the strategy on *page 2*. A lot of effort was put into a species prioritization exercise that will, ultimately, lead to more efficient conservation. We are thankful to the *Global Crop Diversity Trust* and the *Genebank CRP* that initiated the development of the strategy and sponsored the newsletter in its first year. The future is not yet clear – but nonetheless we wish you enjoyable reading and *a happy 2017 for you and tropical forages!*

Brigitte Maass & Bruce Pengelly



## Forage seed production

Availability of forage seed is one of the biggest bottle necks for many. Often accessions are used that are not necessary the most suitable due to availability of seed.

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## Future forage options identified

Past and current Australian forage scientists conducted a meta-analysis of evaluation data to come up with new candidate forage species and accessions.

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# An update on implementing the forage strategy #3

We believe we have made some decent headway during the year. There have been many other parts of implementing the [Global Strategy](#) for the Conservation and Utilisation of Tropical and Sub-tropical Forage Genetic Resources in addition to the newsletter. Through Steve Hughes, Curator of APG in Adelaide, we gained comprehensive insight into challenges and benefits of switching to **GRIN-Global** as a genebank management system. We have assembled ca. 60 papers on **characterising TSTF** that help define the diversity contained in many species collections. These papers are only a start and will soon be listed on the Genebank Platform website. Bringing more of similar papers together should be a priority in 2017.

The strategy implementation and advisory teams have also participated in getting support for an **update of SoFT** (Selection of Forages for the Tropics). SoFT is widely recognised as being a valuable training and species selection tool that enables the best adapted forage germplasm to be identified for particular uses and environments. Bruce Cook argues on [p. 3](#) that germplasm availability and selection is a major factor in determining the contribution forages can make to livelihoods; certainly further development of SoFT remains a key objective for 2017.

A major part of implementation in 2016 has been **prioritising genera and species**. We used the **CIAT** and **ILRI** species lists as the basis. Because of that decision, there will undoubtedly be some species not included in the process and they will most likely be species held in genebanks with sub-tropical focus, such as the USDA collection. But we feel confident that these will be the exception.

The species lists are long. ILRI has > 1000 species of legumes and > 500 species of grasses. The CIAT collection is not as diverse, but still has > 800 species in total. These collections have been assembled over decades. Many accessions and species were collected during the very active years of plant collecting when little was known about the potential of particular taxa.

It was well known before the prioritisation exercise that we had an abundance of species of little or no forage value and, conversely, we knew we had large collections of species of proven or probable value. We did not know the proportions in each of these categories.

Using the process and categories (see figure) from the 2015 strategy, we asked two eminent forage scientists, Dr Rainer Schultze-Kraft and Mr Bruce Cook to allocate species to one of five categories. Over 50% of grass and legume species held at either ILRI or CIAT were considered low priority, but 42% of legume and 50% of grass accessions belonged to species in Category 1. Possibly of greatest interests are the holdings of material in Categories 2 and 3, which are relatively small for both grasses and legumes.

We believe the results provide a foundation for genebank conservation and research priorities for the next decade at least. Some of these might include:

1. The size of Category 1 and, in some cases Category 2, suggest a need to assess the real genetic diversity being held so that core collections can be established and made available, and to gain efficiencies in regeneration, which is always a major commitment and expense for genebanks.
2. Categories 2 and 3 should be the focus of new characterisation and evaluation studies. The limited diversity in some of these species might focus new acquisitions and plant collecting.
3. The small number of species and accessions considered crop wild relatives and of little value as forages (Category 4) may be more likely to be used by breeders if held in the appropriate crop genebanks.

*Continue p. 8*

## FAST FACTS

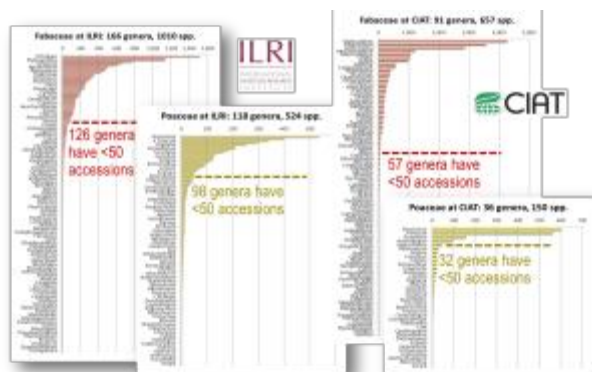
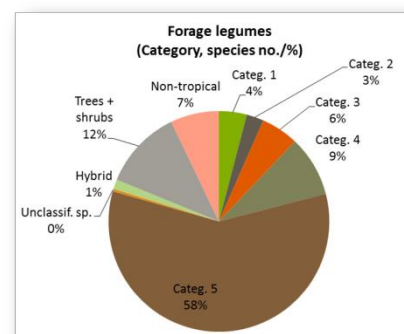
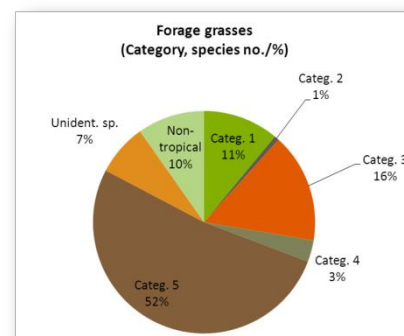
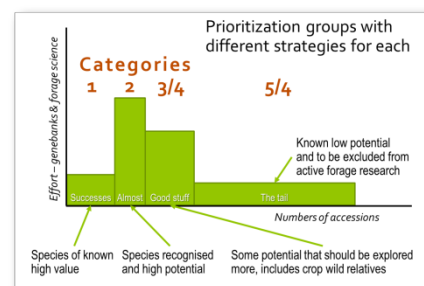
# >50%

Of grass and legume species of the CIAT and ILRI forage collections are considered low priority species for forage used (Category 5).

# 17%

About 17% of grass species (N=95; 15% of accessions) and 8% of legume species (N=108; 23% of accessions) in the CIAT and ILRI collections were classified under Category 2 and 3 that deserve particular research and conservation efforts in the near future.

## PRIORITISATION OF FORAGE SPP.





# Getting more out of the genebanks

## Germplasm bottlenecks

*"Farmers/rural households/industries are often robbed of the potential benefits that the best forages can bring because the current state of knowledge is not being used... and donors are being short-changed and valuable dollars wasted funding forages projects because, in many instances, the forages for which seed is available are known not to be adapted from the outset."* How many **Forages for the Future** readers relate to this comment recently expressed to me by a colleague?

With the best part of 50 years of forage R&D experience behind me, it is a view that I endorse. In the following discussion, we should keep in mind that the key to a successful improved forage-based livestock enterprise lies in the application of forage plants that are not only well adapted to the particular environment, but also appropriate to the farming system in which they are to be applied.

## Breaking the bottlenecks

There are two issues implicit in the above statement, and the solutions to both are simple:

**Issue 1:** Finding reliable sources of information to help compile a list of species that are most likely to satisfy the needs of farmers or researchers for a particular situation.

**Solution:** Improved use and awareness of online expert forage systems

**Issue 2:** Finding a source of sufficient seed of the chosen species to initiate the research or development activity.

**Solution:** More effective functioning of genebanks.

## 1. Developing the list of appropriate germplasm

The knowledge of experienced forage professionals has been captured in several online expert systems, each incorporating a selection tool and fact sheets to help users obtain more information about forage species. Two systems currently available online are:

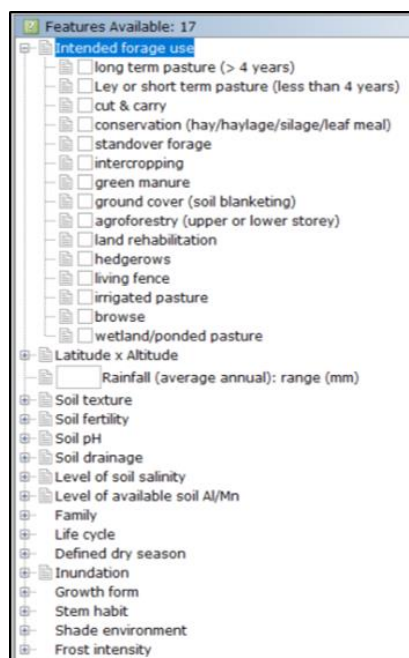
**Pasture Picker** – Tropical Grassland Society (<http://www.tropicalgrasslands.asn.au/pastures/pasturepicker.htm>) and

**Tropical Forages**, An interactive selection tool/ Selection of Forages for the Tropics (SoFT) (<http://www.tropicalforages.info/>).



Opening page of SoFT

A third system, Forage Adaptation Selection Tool (FAST), should be available in 6 to 12 months, and will be in English, French and Portuguese. Pasture Picker uses 8 criteria to select from a list of 86 species, while SoFT uses 17 criteria to select from 180 species. The SoFT decision support package adopts a more technical approach and incorporates more detailed fact sheets than Pasture Picker. SoFT is now 11 years old and in need of updating, but still provides the most comprehensive system currently available. The SoFT selection tool functions on MS Internet Explorer, possibly with a need to accept Java, but does not work on Mozilla Firefox or MS Edge. However, SoFT fact sheets can be accessed on all browsers. Efforts are underway to overcome current problems as well as expand application to mobile devices.



Search frame for SoFT

Users of the selection tools must have a clear idea of the environment in which the forages are to be used, as well as intended management details. The more of the 17 features in the SoFT search frame that you can respond to accurately, the more likely you will be to obtain a relevant list of candidate entries for your forage program. The selection process will provide you with a number of species that are worth assessing in accordance with your questionnaire responses. You can then go to the list of fact sheets to find out more about each of the species, and select genotypes/accessions for your list.

## 2. Sourcing seed

Seed availability is probably the most common restriction to the final choice of species/genotypes included in a forage program. Many forage workers are reduced to accepting species not selected by the expert system, or cultivars/accessions not recommended in the fact sheets, purely on the basis of seed availability. This can result in a less effective outcome to the work. Genebanks have been established by various CGIAR and national agencies to conserve and disseminate germplasm, but often their focus is more on conservation than dissemination. It would be ideal if the genebanks could maintain dissemination stocks of seed of core collections of recognised forage species (BL Maass, **Forages for the Future**, #2), which should include cultivars and promising germplasm as well as those lines selected on the basis of geographic origin, and agro-morphological and molecular diversity. While genebanks fulfill their dissemination function to an extent, the amount of seed distributed is usually too minimal to commence a forage program. A further 2 years or more may be required in a seed increase phase, prior to any actual field evaluation program. A great deal of time and money could be saved if sufficient seed stocks of each component of the core collections were maintained to supply 20-50 g of each line requested. This is sufficient to sow a total of 200-500 m<sup>2</sup> at the generous sowing rate for most tropical species of 10 kg/ha seed.

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# Village farmer forage seed production in Thailand



Mombasa guinea grass seed crop showing tied seed heads; all photos from M Hare



Tying Tanzania guinea grass seed heads



Cleaning Tanzania guinea grass seed



Field cleaning Ubon stylo seed

Ubon Forage Seeds Co. Ltd. produces tropical forage seeds that are harvested by smallholder farmers in villages in northeast Thailand and northern Laos. Through a long association and successful support from a USA seed company, Tropical Seeds LLC, a subsidiary of the Mexican seed company Grupo Papalotla, tropical forage seeds are mainly harvested by hand and cleaned either by hand or through small seed cleaners in villages. In 2016, 180 tons of seed have been exported and sold to 20 tropical countries. For the coming seed season, November 2016 to May 2017, over 500 hundred farmers plan to produce 80 tons of seed (Table 1).

**Table 1** Seed production targets 2016-17 seed season.

Species	Amount of seed (kg)
Mombasa guinea grass	50,000
Tanzania guinea grass	30,000
Mulato II hybrid brachiaria	10,000
Ubon paspalum	5,000
Ubon stylo	1,500

## Grasses

Seed heads of cvs. Mombasa and Tanzania guinea grass (*Panicum maximum*) are tied together in October and seed is knocked every 1-2 days into large canvas bags. The seed is dried slowly in the shade and then out in the sun to moisture content of about 9%; it is cleaned through small locally made seed cleaners that Ubon Forage Seeds donates to each village.

In Thailand, the farmers let all the Mulato II hybrid brachiaria seed fall to the ground; and from December to January, they remove all the vegetation and sweep the seed up. The seed is roughly cleaned in the field and finally cleaned through small machines donated by Ubon Forage Seeds.

## Further reading

Hare MD. 2014. Village-based tropical pasture seed production in Thailand and Laos – [a success story](#). Tropical Grasslands—Forrajes Tropicales 2: 165–174.



Field cleaning Mulato II seed

In Laos, the farmers tie the seed heads together in October and hand-knock the seed out in November. The Laos seed is cleaned by hand using winnowing trays and small fans. When the seed arrives at Ubon Forage Seeds, it is acid-scarified to improve seed germination from below 20% to above 70%.



Hand-harvesting Ubon paspalum seed

Ubon paspalum (*Paspalum atratum*) seed is hand-harvested in late September-early October, by tying seed heads together and knocking the seed out. This is the first species whose seed is harvested every year.

## Legumes

Ubon stylo (*Stylosanthes guianensis* var. *guianensis*) is planted in July, and seed is swept from the ground from January to February and roughly cleaned in the field. Ubon Forage Seeds acid scarifies the seed to increase seed germination from below 10% to over 90%.

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# Africa RISING making a FEAST for Cattle in Babati District, Northern Tanzania

## Lack of planted forages

Livestock in Tanzania are largely underfed with farmers meeting only 65% of feed needs in a year, under best conditions. Farm areas with crops range from 0.3 to 0.7 ha, while the area committed to forages is <0.04 ha. Grazing areas are overgrazed and dominated by poor natural pasture species; and high-yielding planted forages lack, especially herbaceous legumes. These problems are exacerbated by strong seasonal feed variations, high wastage of forage on farms during feeding, and knowledge gaps amongst farmers on how to select, plant, grow and use planted forages. The Africa RISING program is working to introduce high-yielding improved forages into existing systems to reduce feed scarcity, nutrient losses and water pollution. A rapid assessment of the farming systems was conducted using the Feed Assessment Tool (FEAST; [www.ilri.org/feast](http://www.ilri.org/feast)) and the Farmer Centered Diagnosis (FCD) methodology.



An Africa RISING scientist discussing with farmers characteristics of Napier grass accessions

## Integrated livestock feed intervention

This Integrated Livestock Feed Intervention Package, led by ILRI in collaboration with CIAT, consists of three sets of trials including: (a) assessing productivity of Napier grass (*Pennisetum purpureum*), herbaceous legumes and different combinations; (b) assessing productivity of cereal crop and forage combinations including the integration of fodder trees and shrubs on boundaries and soil conservation structures (contours); and (c) testing performance of forage-based diets. Within the Napier grass trials, soil moisture was measured weekly over a 2-year period. The aim of the integrated package was to evaluate: (i) suit-

ability and productivity of forages in different agro climates and farming systems; (ii) the effect of forages on milk yield and; (iii) impacts of forages on water and nutrient fluxes through leaching and runoff to water ways.



Napier grass-*Desmodium intortum* cv. Greenleaf intercrop at one of the sites in Babati

## Giving farmers a choice of forage options

In every agro-ecological zone, at least one Napier grass accession was outstanding regarding dry matter yield (DM) or quality attributes, giving farmers options to choose from. In participatory assessment, in some cases farmers preferred certain accessions because of their leafiness, ability to endure drought and rapid regeneration after cutting even if they did not have the highest DM yield, indicating that farmers' preferences need to be accommodated. Different combinations of Napier grass accessions with four legumes (*Desmodium intortum* cv. Greenleaf, *Vigna unguiculata*, *Vicia villosa* and *Lablab purpureus*) were tested. To encourage faster adoption, two farmer-managed centres for multiplying vegetative planting materials have been established in Long, Sabilo, Seloto and Hailu villages of Babati district.

## Planted forages benefit the environment

Water runoff results indicated there were significant differences between the forage grass-legume combinations and the bare control. The control had higher runoff regimes (>60%) than the grass-legume combinations and the forage grasses and forage grass-legume interactions had a significant influence on water productivity. Clearly graphical trends depicted that some Napier grass accessions were superior, both

with Greenleaf and as sole components, over the two years. Overall, the Napier-Greenleaf combination performed better than the Napier-Lablab combination which, in turn, outperformed the sole forage grasses.



A sole Napier grass plot on a farm in Long village



A farmer harvesting Napier grass planting material at one of the bulking sites in Babati; all photos from Ben Lukuyu, ILRI

BY: Ben Lukuyu  
with contribution of Dr. Chris Jones (ILRI)

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FURTHER READING: Kizito, F., Lukuyu, B., Sikumba, G., Kihara, J., Bekunda, M., et al. 2016. The role of forages in sustainable intensification of crop-livestock agro-ecosystems in the face of climate change: [The case for landscapes in Babati, northern Tanzania](#). In: Climate Change and Multi-Dimensional Sustainability in African Agriculture (pp. 411-430). Springer International Publishing.

**Acknowledgement:** This work is supported by the Africa Research In Sustainable Intensification for the Next Generation ([Africa RISING](#)) program, comprising three R4D projects supported by the United States Agency for International Development as part of the US government's Feed the Future initiative. The ILRI forage genebank provided the germplasm.

# Meta-analysis of historical legume evaluation for tropical pastures in Australia

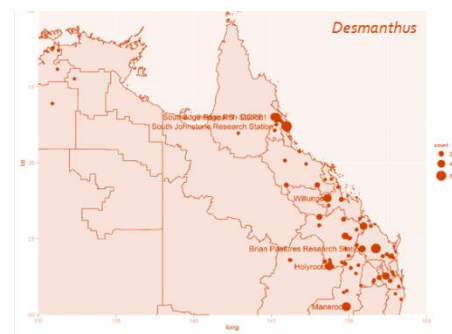
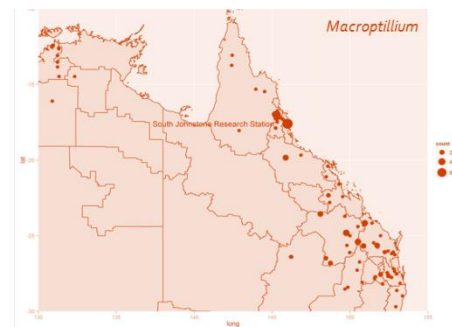
Adding legumes to tropical pastures has the potential to have large benefits for the productivity and profitability of beef production enterprises in northern Australia. This has long been recognised and a large effort has been made in the past to develop forage legumes suited to a range of environments and production systems in northern Australia. Much could be learnt from this past research effort. This study aimed to collate and store legume evaluation data and knowledge from past and current legume evaluation, and then analyse this data to see if this revealed genera, species and/or accessions that might offer new candidates for further evaluation and/or potential commercialisation. Past and current pasture researchers gathered to prioritise and bring together past evaluation data on legumes for tropical pastures into a common database. From published and unpublished data, over 180,000 records of evaluation data of pasture legumes from 567 sites in the tropics and subtropics of Australia were collated. This data included assessments of biomass production, establishment and persistence, forage quality, seed yield, grazing tolerance and tolerance to abiotic and biotic constraints.

Initial interrogation of this database with high-power statistical genotype x environment analysis was conducted across a range of past evaluation locations and conditions. This revealed several tropical legume species that have higher productivity potential than commercially successful species. In particular, several *Desmanthus* species showed high levels of persistence and higher year-3 productivity than other species across a range of environments, indicating that many have wider potential for development. Some *Macroptilium* species also demonstrated wide potential, with *M. lathyroides* in particular, showing higher productivity levels in both year 1 and year 3 and performing relatively better than other species at locations with lower site yields. Some *Alysicarpus* species were found to increase their yield over time and to have amongst the highest yields in year 3, particularly in more favourable conditions. However, further examination of within-species variation or comparisons amongst

individual accessions may reveal further information on genotype performance across the full set of evaluation experiments.

The project also used expert opinion to analyse commercially proven legumes, adapted legumes but not successfully or widely adopted, and prospective species across 12 production regions of northern Australia to identify where further legume development needs are greatest. A limited set of well-accepted options are available but gaps are evident in this array of legumes and/or agronomic constraints or limitations restrict their uptake or wider adoption. Highest priorities for further legume development identified were (i) legumes that persist in competitive grass pastures in the subtropical semi-arid inland, and sub-humid coastal hinterland; (ii) legumes for clay soils in northern tropical regions; (iii) legumes for light soils (sandy and duplex) in inland subtropics; and (iv) more robust ley legume options. Several species and accessions were identified in *Desmanthus*, *Stylosanthes*, *Macroptilium*, and *Aeschynomene* that have shown promise in past evaluation work and are thought to have attributes, which improve on key limitations of commercial varieties but are not yet commercialized.

Overall, the work found several areas for potential gains in the range and performance of legumes available for pasture systems in Northern Australia.



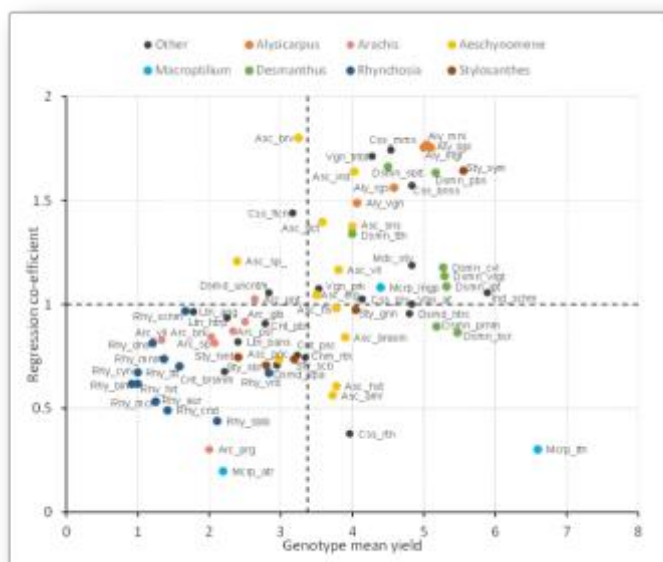
Locations and intensity (number of accession.site.years) of historical evaluation in *Macroptilium* and *Desmanthus* in northern Australia.

BY: Lindsay Bell, Justin Fainges, Ross Darnell, Kendrick Cox, Gavin Peck, Trevor Hall, Richard Silcock, Arthur Cameron, Bruce Pengelly, Bruce Cook, Bob Clem, David Lloyd from CSIRO, DAF-Q, and DPI-NT.

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FULL REPORT AVAILABLE [ONLINE](#)

Finlay-Wilkinson plot for third-year productivity amongst species and environments in the database. Species noted to the left are less productive in year 3 and to the right more productive in year 3 (dotted line indicates the mean of all species); Species indicated to the top perform better in more favourable conditions and to the bottom in less favourable conditions. The genus species label has been abbreviated to the first 3 letters.





# Forage scientist Rainer Schultze-Kraft receives Chinese government's Friendship Award



Rainer Schultze-Kraft receiving the Chinese Friendship Award in Beijing, October 2016

CIAT emeritus scientist Rainer Schultze-Kraft has received the 2016 Friendship Award from the Chinese government, for his long-term work with tropical forage scientists in the country.

He was one of 50 experts from 18 countries and a wide range of disciplines to receive the annual award, made by China's State Administration of Foreign Experts Affairs, at a special ceremony in Beijing. The award – presented by China's Vice Premier Ma Kai – is considered the highest accolade that foreign experts working with Chinese institutions can receive.

## Collaboration with Chinese scientists

Schultze-Kraft's work with Chinese plant scientists began in 1982, at the very start of the collaboration between CIAT and the South China Academy of Tropical Crops (SCATC), now known as CATAS (Chinese Academy of Tropical Agricultural Sciences). He provided Chinese colleagues with a selection of mainly legume samples from the large tropical forages collection at the CIAT genebank for field trials in Hainan, together with methodologies for evaluating plant performance. Two SCATC/CIAT expeditions to collect wild legume samples in tropical China followed in 1984 and 1988.

It was the beginning of a long-term partnership that also saw young Chinese scientists joining CIAT in Colombia as visiting researchers, specialising in research into tropical forage germplasm. One of these scientists – Liu Guodao – is now professor and vice-president of CATAS – and another – Chaozu He – is professor and director of the Faculty of Tropical Agriculture and Life Sciences at Hainan University.

## *Stylosanthes guianensis* CIAT 184

One of CIAT's forage legumes, *Stylosanthes guianensis* (CIAT 184) – first collected by Schultze-Kraft as a wild plant in the district of Jamundí, near Cali, Colombia – has since been established on hundreds of thousands of hectares in tropical and subtropical China. While originally selected for extensive cattle-rearing in tropical savannahs, varieties from Chinese breeding programs based on this accession are now used in China primarily as

cover crop in fruit tree plantations, to protect soils and improve fertility.

In recent years, Schultze-Kraft, has made a number of visits to Hainan, working closely with Chinese forage scientists there. The work has included training activities at CATAS and joint development of project proposals that involve the use of forage samples from the CIAT genebank. He is currently helping coordinate production of a CATAS compendium on the forage legume genus *Stylosanthes*.

Schultze-Kraft is also co-editor of the open access online journal [Tropical Grasslands-Forrajes Tropicales](#), co-sponsored by CATAS, which publishes new research into the importance of tropical forages in boosting meat and milk production, protecting soils and responding to climate change, as well as a host of other issues.

More recently, Schultze-Kraft and colleagues from CIAT have worked closely with CATAS developing collaboration on the mitigation of greenhouse gas emissions in forage-based systems. This has included staff exchanges and training on processes such as biological nitrification inhibition, which can help reduce both emissions of the potent greenhouse gas nitrous oxide from farming systems, and nitrate leaching, a key concern in China.

"It's a great honour to receive this award," Schultze-Kraft said, following the award ceremony on China's National Day (1st Oct). "I see it very much linked to the significance and value of the tropical forage germplasm collection in CIAT's genebank and the Tropical Forages Program's projections towards Asia. I'm pleased and very grateful that my good intentions have been recognised, and look forward to more collaboration in the future."

STORY: from CIAT's [Blog](#), 27 Nov. 2016

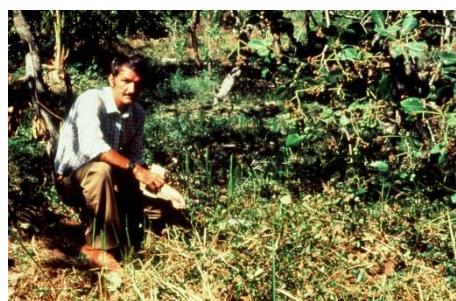
CONTACT: Rainer Schultze-Kraft, Colombia (Email: [r.schultze-kraft@cgiar.org](mailto:r.schultze-kraft@cgiar.org))

FURTHER READING: Devendra C & Sere C 1993. Assessment of the use and impact of *Stylosanthes guianensis* CIAT 184 in China. Unpublished [Report](#), Centro Internacional de Agricultura Tropical, Cali, Colombia.

Liu GD & Chakraborty S 2005. [Stylo in China](#): a tropical forage legume success story. Tropical Grasslands 39 (4):215.



Communication with Rainer Schultze-Kraft in China; photo provided by Bai Changjun



Schultze-Kraft collecting forage legumes in Thailand in the 1980s; photo CIAT



Harvesting *Stylosanthes guianensis* 'CIAT 184' as a feed supplement; photo CIAT in SoFT Eastafrica

## ABBREVIATIONS &amp; ACRONYMS

APG	Australian Pasture Genebank
CATAS	Chinese Academy of Tropical Agricultural Sciences
CGIAR	Consultative Group on International Agricultural Research
CIAT	Centro Internacional de Agricultura Tropical
CRP	CGIAR Research Program
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAF-Q	Department of Agriculture and Fisheries, Queensland, Australia
DPI-NT	Department of Primary Industries, Northern Territory, Australia
FEAST	Feed Assessment Tool
GCDDT	Global Crop Diversity Trust
ILRI	International Livestock Research Institute
R4D	Research for Development
SCATC	South China Academy of Tropical Crops, now known as CATAS
SoFT	Selection of Forages for the Tropics
SSA	Sub-Saharan Africa
TSTF	Tropical and subtropical forages
WANA	West Asia and North Africa

## An update on the forage strategy

*Continued from p. 2*

- The large number of species and accessions in Category 5 provides challenges but also potential efficiencies in genebank management. We are not proposing to completely discard these accessions for a range of reasons. But archiving most of Category 5 in long-term storage (e.g. [Svalbard Global Seed Vault](#)) or transferring it to collections or botanic gardens who have an interest in diversity per se, rather than diversity for use in tropical and subtropical forages, are possible options. Devoting resources to conserving this low-potential material in forage genebanks will undoubtedly impair the ability of the forage genebanks to achieve their overall goal of being the source of the best forage genetic material and most important sources of information on species adaptation and diversity.

This has been a major task and we are indebted to Rainer and Bruce for their enormous efforts. Thank you both. There will, of course, be arguments and disagreements about the allocations of some individual species. That is to be expected. However, we are certain that 'disputed species' would be few and not substantively change the overall picture. We have not presented the list of species in each category here, but they will be soon available online at the Global Crop Diversity Trust.

### Acknowledgement

Finally we would like to thank all those who have supported us this year. As well as Rainer Schultze-Kraft and Bruce Cook, we thank our advisory group of Michael Peters, Chris Jones and Francisco Villanueva; Jean Hanson and Daniel Debouck for the genebank species lists that enabled us to do the prioritization; Steve Hughes who provided the data management document; Charlotte Lusty for all her support during the year and all those who contributed to the newsletter with stories and photos.

**Bruce Pengelly & Brigitte Maass**

## UPCOMING FORAGE STORIES

Despite the enthusiastic welcome for the Forages for the Future newsletter, the international forages community has still been relatively passive in submitting stories to be published. **We will need your active participation to keep this running!**

There are some contributions pending that will appear in upcoming issues, provided that funding is secured, for example:

Mupenzi Mutimura from Rwanda: Forage seed production

Asamoah Larbi and Augustine Ayantunde from West Africa: Forage use in production systems

Charles Midega from Kenya: Screening different *Desmodium* species for their usefulness in the push-pull system

Francisco Villanueva from Mexico: Evaluation of improved forages for Mexican forage needs

***What do you want to read regarding use and conservation of tropical and subtropical forages???***

**Let us know what you are working on!**

## FOR MORE INFORMATION

Read the report on "[A Global Strategy for the Conservation and Utilisation of Tropical and Sub-Tropical Forage Genetic Resources](#)".

## LETTERS TO THE EDITORS

If you are not on the recipient list but you want to receive this newsletter, please contact us.

If you are not interested in receiving further issues of this newsletter, please send us an email.

Please share your opinions and write us letters regarding **controversial issues**. We are eager to debate with you your **agreements or disagreements!**

**Your opinion matters!**

**We wish you a happy festive season and a successful New Year 2017!**

## NEXT NEWSLETTER ISSUE

We would aim at producing next newsletters but do not know yet by when in 2017.

**DISCLAIMER:** The opinions expressed in the articles are those of the authors and do not necessarily reflect those of the CGIAR or the Global Crop Diversity Trust.

## FOR MORE INFORMATION

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