Issue 2 – September 2016

Forages for the Future

RESEARCH PROGRAM FOR Managing and Sustaining Crop Collections
CGIAR

Editorial

In the days after sending out the first newsletter on "Forages for the Future", there has been an overwhelming response. We received emails from all over the world requesting to be included in the mailing list—only one wanted to be removed! Emails congratulating us for the initiative—congrats that belong with the Global Crop Diversity Trust, the Genebank CRP that initiated the development of the strategy and sponsor the newsletter, and those who have taken the time to share their stories. Also, ILRI immediately published a story in their news blog to announce the newsletter. What does this all tell us? We think it is high time to revive the international forages community!

In this edition #2, we start portraying genebanks with TSTF collections: China (p. 3), the USA (p. 4), and Australia and South Africa (p. 5). Genebanks play an important role for making germplasm available to the users. Their contributions may sound less exciting than the forage adoption stories that directly impact the livelihoods of poor people. However, genebanks can help to overcome bottlenecks for biotic and/or abiotic constraints. What—for example—would be the consequences if any disease or pest hit mucuna in Zimbabwe? Again, farmers wouldn't have forage available for their goats during drought and return to their previous situation. But genebanks with tropical and subtropical forage (TSTF) collections have to be ready to tackle such issues, while prioritizing their limited resources on those forages with the highest potential. For instance, the current holdings of major genebanks are only 37 (CIAT), 17 (USDA) and 14 (ILRI) accessions in *Mucuna* spp., a genus apparently worth further collecting and evaluation so we are better prepared for the future. Once a large species collection has been put together, usually a representative subset should be defined for large-scale evaluation, commonly called a 'core collection' (p. 2). To do this, characterization data need to be analyzed. Part of the TSTF strategy is to make such data available—we therefore need you to help us locate characterization data!

The first newsletter was sent out to 200+ addresses—this one to almost the double of it. Nevertheless, we expect more active involvement of the readers: you need to send us your stories, news, upcoming events and meetings relevant for the TSTF community!

We hope that this is not only good reading for you, but also showing the opportunities that do exist with tropical forages.

Brigitte Maass & Bruce Pengelly

Continue on page 2 for an update on the forages strategy

Forage germplasm collections

Substantial TSTF collections exist in international, regional and national institutions. Among other, we portray the one held in South China (photo).

Pages 3-5

Forages that make a difference

Livestock, *Mucuna* and El Niño in Zimbabwe: farmers have enhanced their goat production by coping with dry-season feeding, greatly improving their livelihoods.

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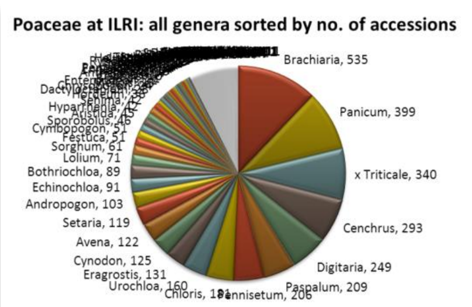
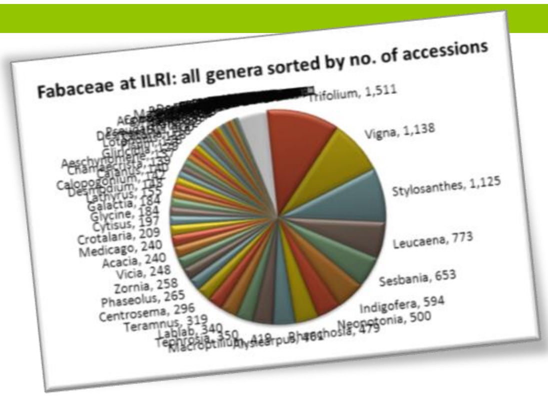
ACCESSIONS IN COLLECTIONS





The immense generic and species diversity of forage collections requires prioritization: examples from ILRI's tropical forages collection; number of accessions behind each genus

What is ...?

What is a core collection?

Germplasm collections of important species tend to have several hundreds or even thousands of accessions. In order to make evaluation and utilization of these collections more efficient and effective, sub-sets of the large collection, or 'core collections' are being composed to represent the maximum diversity of a species. This refers not only to geographic representation, but also to agro-morphological and molecular diversity. The basis of a core collection is always good documentation of passport data and a comprehensive characterization that helps to understand the patterns of useful diversity available in a germplasm collection. Forage core collections have been developed, for example, for *Lablab purpureus* (Pengelly & Maass 2001), *Calopogonium mucunoides* (Sousa et al. 2012), *Stylosanthes* spp. (Santos-Garcia et al. 2012; Garcia et al. 2013) and Bermuda grass (*Cynodon* spp. by Anderson et al. 2009; Jewell et al. 2012). In absence of characterization data, Rainer Schultze-Kraft proposed lately an initial core collection only based on geographic provenance for *Pueraria phaseoloides* germplasm stored at CIAT that will be characterized in China and Uganda.

A core collection usually contains 5-20% of a collection's accessions (van Hintum et al. 1999). As this still could result in substantial numbers, so-called 'mini-cores' have been proposed (Upadhyaya et al. 2002). The majority of grass and legume species contained in the large TSTF collections lack a core collection to be defined. Part of the Forages Strategy is to advance in this field for a more rational use of germplasm collections, avoiding redundancy.

REFERENCES: see page 8

CONTACT: Brigitte Maass (Email: Brigitte.Maass@yahoo.com)

LINKS: Core collections of plant genetic resources and glossary by FAO-WIEWS

An update on implementing the forage strategy

As reported, the first newsletter of this series sparked wide interest from across the globe, and we are now sending this newsletter to over 400 recipients. Most of those are working directly with tropical or subtropical forages, which is a very encouraging number. The newsletter has also drawn out several stories on the successful use and the value of TSTF, and summaries from some major national genebanks. We have furthermore been given the opportunity to highlight TSTF and the strategy with an oral presentation at Tropentag, an annual development-oriented conference organized by European universities on *Tropical and Subtropical Agriculture and Natural Resource Management*, which this year is being held in Vienna, Austria, in mid-September.

The 2015 strategy on TSTF highlighted the need to prioritise the genera and species held in national and international genebanks. Prioritising genera and species should be a critical first step towards more effective and efficient research and eventual utilization. If priority species can be identified and agreed, national and international centres will be able to target limited resources into conservation, collection, characterisation and utilisation, where it is needed, and is more likely to lead to production and sustainability impacts.

There are, at first count, 610 grass species and 1268 legume species held in the CIAT and ILRI forage collections. That number will change as issues of nomenclature, especially synonymy, are considered during the prioritisation process. However, only a fraction of these species are considered by anyone to have a forage value. In the last few weeks a process, led by two eminent tropical forage specialists, Dr Rainer Schultze-Kraft and Mr Bruce Cook, to prioritise these species has commenced. We expect to be reporting preliminary results of that prioritisation in the next newsletter.

ILRI's seed production plots of forage germplasm at Wolaita Soddo, Ethiopia; photo: BL Maass

CONTACT: Bruce Pengelly (Email: Bruce.Pengelly@gmail.com)

LINKS: A Global Strategy for the Conservation and Utilisation of Tropical and Sub-tropical Forage Genetic Resources

Abbreviations & Acronyms

ACIAR	Australian Centre for International Agricultural Research
APG	Australian Pastures Genebank
ARC	Agricultural Research Council, South Africa
CATAS	Chinese Academy of Tropical Agricultural Sciences
CGIAR	Consultative Group on International Agricultural Research
CIAT	Centro International de Agricultura Tropical
CRP	CGIAR Research Program
CSIRO	Commonwealth Scientific and Industrial Research Organisation
FAO-WIEWS	World Information and Early Warning System on Plant Genetic Resources for Food and Agriculture
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
ILRI	International Livestock Research Institute
SARDI	South Australian Research and Development Institute
TSTF	Tropical and subtropical forages
USDA	US Department of Agriculture

Tropical and subtropical forage germplasm resource conservation in South China

Tropical Pasture Research Center of CATAS

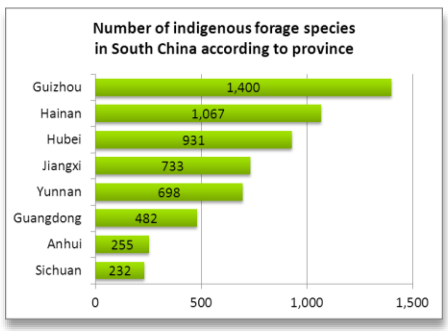
The Tropical Pasture Research Center (TPRC) of the Chinese Academy of Tropical Agricultural Sciences (CATAS) was set up in the early 1960's. It is the only research institution for tropical forages under the administration of the Agricultural Ministry of China. There are a total of 18 professional staffs, 10 of them with PhDs, and 8 are senior researchers. The main research of TPRC/ CATAS are collection and conservation of tropical forage germplasm resources, selecting and breeding new forage varieties, forage cultivation and management technologies, seed production, animal breeding and production, multiple utilization and development of forages integrated in different farming systems, as well as commercial production of hay and leaf meal.

Seed bank building

Tropical and subtropical forage genetic resources: status

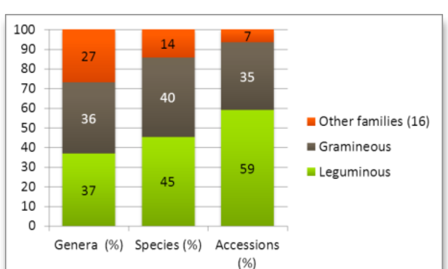
Most of South China experiences good climatic conditions with ample heat and moisture to support plant growth. It also has abundant grassland resources and biodiversity in tropical and subtropical regions. There has been loss of forage genetic resources from four sets of factors: 1) natural factors such as climate change, soil degeneration and pollution, 2) man-made factors, including road construction, mining, expansion of industrial areas, and conversion of forests or grasslands into new farmland; 3) science and technology innovation, including extension of new crop varieties, application of chemical fertilizers, and mechanization of agriculture; and 4) socio-economic induced changes such as reduced use of some old varieties because of low social and commercial benefit.

Despite the degradation of grasslands from overgrazing and vegetation removal, forage genetic resources maintain a high level of biodiversity. During the period 1978-1990, it was estimated that there were 4,125 potentially useful indigenous forage species in the region coming from 879 genera within 127 families. This was made up of 972 grass species from 173 genera and 646 legume species from 81 genera. TSTF resources identified varied according to province:



Collection and conservation of tropical and subtropical forage genetic resources

By 2015, TPRC had led collaborating teams on tropical and subtropical forage germplasm conservation in South China by establishing and maintaining a genebank to conserve seed under low temperature conditions (0-4 °C and <50% humidity), an *in vitro* conservation unit and a field genebank.



Did you know?

In the tropical and subtropical areas of South China, 2 and 1 million hectares are sown to the exotic forages King grass (*Pennisetum americanum x P. purpureum*) and *Stylosanthes guianensis*, respectively.

The seed bank for tropical and subtropical forage germplasm has a size of 80 m³ and contains 8,840 accessions (from 622 species, 235 genera from 16 families); the *in vitro* conservation unit holds 482 accessions (6 spp., 6 genera from 3 families); and the field genebank conserves both in field and greenhouse 397 accessions (14 spp., 12 genera from 5 families). However, forage accessions conserved belong predominantly to legume and grass families.

Collecting tropical grasses

Conservation in the field genebank; all photos by CATAS

BY: Bai Changjun, Liu Guodao, Zhang Yu, Yu Daogeng, Yan Linling

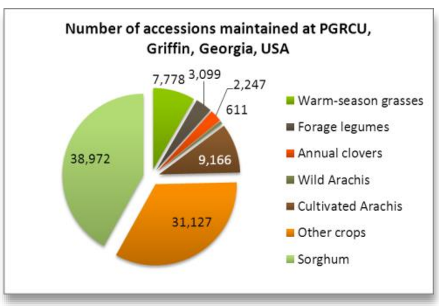
CONTACT: Dr. Bai Changjun, Tropical Crops Genetic Resources Institite of CATAS (Email: baichangjun@126.com)

LINK: TCGRI

FURTHER READING: Changjun B, Guodao L, Yu Z, Daogeng Y, Linling Y. 2013. Technical challenges in evaluating southern China's forage germplasm resources. Tropical Grasslands—Forrajes Tropicales 1(2):184-191.

Conservation and utilization of forage grasses and legumes at Griffin, Georgia, USA

The Plant Genetic Resources Conservation Unit (PGRCU) at Griffin, Georgia, USA, preserves and distributes seed of over 93,000 accessions of 1,648 crop and wild species to users throughout the world. The U.S. Department of Agriculture, Agricultural Research Service and southern USA state experiment stations support this genebank in the S-009 Multistate Project with species adapted to the climate of the southern USA. Crops at PGRCU include sorghum, groundnuts (*Arachis*), *Vigna* spp., warm-season grasses, legumes, and various vegetables such as sweet potato, chili peppers, watermelon.



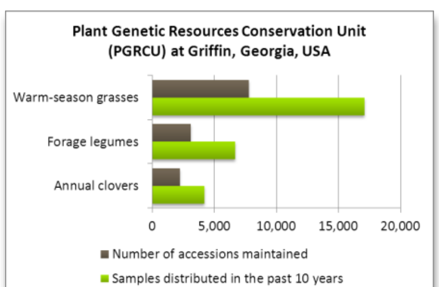
Conserved forages

The main forages conserved at Griffin comprise annual clovers, legumes, warm-season grasses, forage sorghum, and wild groundnut species. A total of 2,247 annual clover accessions are maintained including *Trifolium alexandrinum*, *T. incarnatum*, *T. nigrescens*, *T. resupinatum*, *T. subterraneum*, and *T. vesiculosum*. The total of 3,099 forage legume accessions held contain *Aeschynomene americana*, *Macroptilium atropurpureum*, *Neonotonia wightii*, *Desmodium* spp., *Lablab purpureus*, *Desmanthus illinoensis*, *Kummerowia striata*, *Lespedeza cuneata* among others. Warm-season grasses (N=7,778) consist of *Andropogon gerardii*, *Bothriochloa* spp., *Cenchrus ciliaris*, *Cynodon* spp., *Digitaria* spp., *Panicum* spp., and *Paspalum* spp. Among other uses (grain, sweet sorghum, or broomcorn), sorghum accessions are utilized for forage. Also some of the wild groundnut species held at PGRCU are used for forage. The bulk of all seed is preserved in sealed bags at -18 °C, while samples for distribution are maintained at 4 °C and 25% relative humidity. Almost 89% of all accessions are available for distribution and over 97% of the accessions have a safety backup sample at Ft. Collins, Colorado, USA.

Two large collections have been received by PGRCU from USA breeding programs in recent years: The Norman-Taylor-clover-collection was donated by the University of Kentucky—675 annual clover accessions; the University of Florida donated the Albert-Kretschmer-Jr.-collection—3,000-4,000 legume accessions. To fully incorporate these donations into the PGRCU collection means that all these materials require further seed cleaning, viability testing, and proper packaging before they, hopefully, will be available for distribution in the future.

Forage germplasm distribution

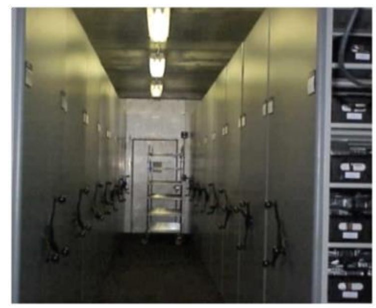
In the last 10 years, PGRCU has distributed over 4,200 annual clover, over 6,700 legume, and over 17,100 warm-season grass accession samples to researchers and educators throughout the world. Thousands of sorghum and groundnut accessions have also been distributed, though most of these samples were used in grain sorghum or cultivated groundnut breeding rather than forage uses.



Clover, legume, and warm-season grass accessions have been utilized for more than just traditional plant breeding and cultivar development. These resources provide genetic material for current as well as future improvement of pastures and rangeland. The conservation of forage and rangeland genetic resources at PGRCU offers researchers the range of genetic diversity required to continue to understand and improve the world's pastures and rangelands.

In January 2017, Gary Pederson will be retiring after 34 years of service in USDA-ARS with the last 16 years as Research Leader of the PGRCU at Griffin, Georgia.

Seed samples are stored in special molded plastic trays and heat-sealed foil bags at -18 °C in a freezer; all three photos by USDA



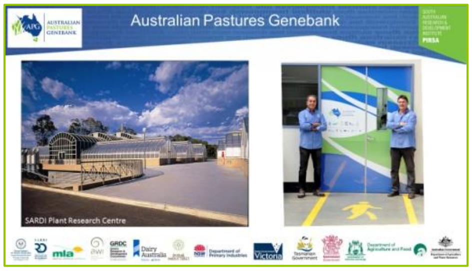
Freezer at -18 °C where most seed is stored to maximize seed longevity

*Gary Pederson on a collection trip for switchgrass (*Panicum virgatum*) in the southeastern USA, in Florida*

CONTACT: Gary Pederson,
(Email: Gary.Pederson@ARS.USDA.GOV)

LINKS: USDA-ARS Plant Genetic Resources Conservation Unit

TSTF germplasm in Australia and South Africa



The Australian Pastures Genebank (APG)

The APG was launched in December 2014 and is Australia's first national pasture and forage genetic resource centre, managed by the South Australian Research and Development Institute (SARDI) and based at SARDI in Adelaide, South Australia. The APG is a partnership between SARDI, the Australian Government Department of Agriculture and Water Resources, State Government primary industry agencies, and Australian Research and Development Corporations representing the meat, wool, dairy, grain and seed industries.

The APG' key role is to conserve and enable development of genetic material of pasture and forage species of current and potential value to Australian agriculture. This includes plants to be grown for livestock consumption, crop rotation and the environment.

Seed and associated data of pasture and forage genetic resources from significant federal and State government collections are currently being transferred to the APG. Seed-lot-associated passport and characterisation data are being consolidated and plans are to have this information available online with free access to the public through GRIN-Global and GENESYS web-based systems.

The APG operates under the framework of the International Treaty on Plant Genetic Resources for Food and Agriculture (Treaty) in accordance with the provisions of Treaty's Multilateral System of Access and Benefit Sharing. Accordingly, distribution is under a Standard Material Transfer Agreement.

Australia's grazing industries are underpinned by improved grasses and legumes imported into Australia predominately from international collection missions led by Australian scientists over the last 70 years.

As a result, the APG currently maintains a globally unique collection of more than 75,000 accessions including over 10,000 tropical legumes, more than 2,500 tropical grasses and over 3,500 Australian native species.

The regeneration of accessions is undertaken in environment-specific locations that best match species' climatic and edaphic requirements: at regional hubs in Queensland (tropical grasses and legumes), South Australia (temperate alkaline species), Tasmania (cool season temperate species) and Western Australia (temperate acid species).

Prioritising of germplasm for regeneration is undertaken annually through a Technical Advisory Committee (TAC) that ensures the relevance of the APG collection to research and breeding, and prioritises activities based on users' needs and accession status (uniqueness, viability and quantity). A key guiding principle of the APG regeneration programs is where possible, priority is placed on (1) plants of high potential application to increase profitability and production in Australian livestock industries or of signifycant environmental or conservation value; (2) development of the capacity to supply suitable numbers of high-quality seeds of high genetic integrity for conservation and utilization; and (3) phenotype accessions to agreed protocols and standardized ontologies to increase our knowledge of the collection and assist future research, education and plant development programs.

Current regeneration priority of APG tropical germplasm in Queensland, led by Dr Kendrick Cox of the Queensland Department of Agriculture and Fisheries, is on regenerating accessions of species suited to beef production, particularly legumes within the seasonally dry tropics (*Centrosema*, *Desmanthus*, *Macroptilium*) and grasses suited to intensive pasture systems. Regeneration is also being completed for pasture legumes for the higher rainfall areas (*Centrosema*, *Vigna*), high-quality grasses (*Brachiaria*, *Digitaria*, *Panicum*, *Urochloa*) and ley legumes for crop/graze systems (*Clitoria*, *Lablab*).

The APG maintains a backup of the collection in the Svalbard Global Seed Vault and plans another deposit in 2017. Establishment of the APG has provided Australia with an opportunity to contribute to meeting its obligations under the Treaty, and support the conservation and management of Australia's pasture and forage genetic resources to international standards. Over the last 30 years, many individuals championed the importance of genetic resources as a strategic resource underpinning plant improvement in Australian agriculture. The establishment of the APG is testament to their efforts.

CONTACT: Steve Hughes, Leader APG, SARDI, South Australia;
Kendrick Cox, Curator APG Tropical Collection, DAF, Queensland
(Email: Steve.Hughes@sa.gov.au)

LINKS: Australian Pastures Genebank

South Africa: ARC Roodeplaat

The National Forage Genebank of the Agricultural Research Council (ARC) is located at Roodeplaat Research Station, North of Pretoria. This region falls within the dry subtropical zone with long, hot and rainy summers, and short, cool and dry winters. The genebank was established by Dr AJ Kruger in the early 1980's with the aim to conserve the forage biodiversity of southern Africa and to provide well-documented and monitored germplasm for researchers and the public as well as other national and international organizations. His dissertation published in 1999 titled 'Role of plant genetic resources in sustainable land use systems' summarizes the trial results from evaluating indigenous and exotic tropical and subtropical forage grass and legume germplasm.

The ARC-Plant Genetic Resources Unit, established in the early 1990's, was coordinated by Dr Roger Ellis, being responsible for policy development and research in conservation and sustainable use of PGR.

Currently the ARC-Forage Genebank holds many important indigenous forage grass species and has identified the need to focus on indigenous pasture legume species. A total of 8,400 accessions are kept in long-term storage, i.e. *Digitaria eriantha* (255 accessions), *Vigna subterranea* (230), *Panicum maximum* (148), *Panicum coloratum* (140) and *Cenchrus ciliaris* (136) from different donors such as the South African Department of Agriculture, the previous Lebowa Government and other African countries like Botswana, Kenya and Tanzania. A large nursery facility is available for seed regeneration and multiplication; where also vegetative materials of a few *Pennisetum* hybrids and 42 cultivars of *Opuntia* spp. are conserved. Drought resistance was screened on available grass accessions of *Anthephora pubescens*, *Chloris gayana* and *Setaria sphacelata* as well as cold tolerance on *Anthephora pubescens*, *Cenchrus ciliaris*, *Chloris gayana* and *S. sphacelata*. A study to record all known legume species indigenous to South Africa, Lesotho and Swaziland to establish distribution patterns and optimum climatic and soil conditions for growth was completed; a list of those species for further evaluation of their pasture potential, especially under low soil phosphate conditions has been published.

CONTACT: Marike Trytsman, ARC, South Africa (Email: mtrytsman@arc.agric.za)

LINKS: Forage Technology

Multipurpose forages in Central America

CIAT and partners have worked for over 15 years on the integration of grasses and forage legumes in smallholder mixed crop-livestock systems in Central America. Before, CIAT's focus in the region was on grass-alone or grass-legume pastures.

Forages adapted to agro-ecologies

In the Pacific region of Central America most livestock farmers are smallholders in mixed systems based on maize and beans and often with coffee and a livestock component, dual purpose cattle (dairy, beef) or monogastrics (pigs, poultry). They face the challenge of feeding their animals during a 5-7 month dry season, which severely limits milk and meat production.

Multipurpose forages in Central America – 15 years of CIAT involvement

The humid Atlantic region is also characterized by mixed systems based on maize, beans and rice, including an important role for tubers, roots, livestock and, increasingly, cocoa and oil palm. High rainfall causes often inundated pastures limiting livestock productivity. Feed options comprise traditional and improved pastures, crop-residues, rice straw, hay, silage, cut-and-carry forages, some agro-industrial by-products (molasses, rice bran, brewer's grain) and purchased concentrates.

Agronomic and participatory selection

CIAT's Tropical Forages Program in Central America has had a strong focus on agronomic and participatory selection of grass and legume germplasm. This has resulted in a range of options of drought-adapted forages to improve dry season feed availability and quality (e.g., *Brachiaria brizantha* cvs. Marandú and Toledo, *Brachiaria* hybrid cv. Mulato, and the legumes *Canavalia brasiliensis* and *Cratylia argentea*). Equally, materials adapted to poorly drained soils, in combination with pest and disease resistance, and high biomass production and feed quality have been developed (e.g., *Brachiaria* hybrid cv. Caimán, (hybrids of) *Brachiaria humidicola*, and *Arachis pintoi*).

Participatory evaluation of grasses for drought tolerance; photo by R van der Hoek

Based on this, the following forage options have been tested at systems level:

1. Enhancing pastures with drought-tolerant grasses to improve dry-season feed availability and animal productivity;
2. More productive and resilient silvo-pastoral systems with improved grasses and legumes;
3. Integration of forage legumes as green manure or as animal feed in mixed maize-bean-livestock systems; and
4. Forage legumes as protein supplement for pigs.

Recently over 500 farmers have experimented through Farmer Field Schools with improved forages, including improved *Brachiaria* pastures with *Arachis pintoi*, forage banks with different forage species, production of silage and silvo-pastoral systems complemented with good management practices. This has led to higher revenues through an increase of 25% in milk production, better milk quality and an increase by 33% in weight gain of calves.

Forage adoption

General adoption of forage-based technologies has, however, been variable. Whereas many large and medium-scale farmers have established pastures with improved grasses like *Brachiaria brizantha* and *Brachiaria* hybrids, access for small farmers has been limited due to high costs of seed and other inputs like labour. Adoption of legumes has been low. Although here seed cost does not need to be a constraint, incentive mechanisms for massive adoption are still inadequate or absent.

CIAT's Tropical Forages Program in Central America has developed and tested a wide range of forage options for small- and medium-scale mixed crop-livestock farmers. Most of these technologies contribute to sustainable intensification of mixed crop-livestock systems and have proven their on-farm applicability. Recently, new perspectives have been added with a focus on value chain development (including improving farmers' access to markets, and increasing product quality) and putting emphasis on the contribution of improved forages to mitigation of climate change.

BY: Rein van der Hoek, Martin A. Mena Urbina, CIAT, Nicaragua

CONTACT: (Email: r.vanderhoek@cgiar.org)

LINKS: CIAT's research boosts development of Nicaragua's livestock sector

Livestock, Mucuna and El Niño

Farmers in a Mucuna field; photos by A van Royen

Mucuna leaves

Mucuna hay to be fed during the dry season

Taking a goat to the market

A multi-purpose legume

Velvet bean (*Mucuna pruriens*) has been introduced into Zimbabwe as a green manure, cover and/or fallow crop. These uses have not led to high adoption rates, most probably because of high labor costs in relation to perceived returns on investments. In recent years, however, through the ACIAR-funded, ZimClifs project, ICRISAT and ILRI promoted its use primarily as a fodder crop to carry livestock over the dry season in semi-arid areas such as Nkayi and Gwanda. Work on-station and on-farm confirmed the role that leguminous crops can play in increasing dry-season animal feed. Farmers were also adamant in their choice of mucuna over other species such as lablab because of the former's resistance to insect damage. Using mucuna as livestock feed has proven to be an effective entry point to its adoption and use; as farmers are now also using it in rotation with cereal crops. Seed are being produced locally by farmers for their own use, and many are selling to other farmers who are interested in its use. More recently seed is being sold to various NGOs who are now also promoting the use of mucuna. Seed were sold for as much as US$5/kg amongst farmers in Gwanda.

Drivers for mucuna adoption

The main driver for adoption of mucuna lies in the work done on improving livestock markets in these districts. Improved market infrastructure, i.e. the bulking of animals at sale pens resulted in significant savings for buyers who used to rely on farm-gate sales only. Some of these savings were transferred to farmers, as traders can now buy the required animal numbers within a very short period of time. Besides, by reducing transaction costs in decreasing processing fees led to further efficiencies in the value chain, making the overall system much more functional. Prices paid increased from less than US$ 20/goat in 2008 to more than US$ 60/goat in 2016! The incentive to keep animals productive is, therefore, significant.

'El Niño' in Zimbabwe

In the season after the recently completed first phase of the ZimClifs project, many farmers who participated in the project's demonstration trials, as well as numerous other farmers planted mucuna when they realized that Zimbabwe was facing a serious drought. News of the eminent El Niño reached farmers even in remote areas, and this bad news were soon substantiated by the very late arrival of the rains. In these areas, mucuna was the only crop farmers were able to grow. Evidence of farmers abound being able to feed and sell off both goats and cattle to markets as far afield as in Bulawayo – a more than 3 hour's drive. Those who did not plant mucuna face critical food insecurity and severe cash shortages.

Out-scaling crop-livestock system with mucuna

Critical events like the 2015/16 El Niño, although devastating, provide clear evidence of the returns that integrated crop-livestock systems provide and are good opportunities to illustrate the income improvements as well as the increased levels of resilience that integrated systems offer. Where, in the past, many sound technologies were introduced but not adopted; we now know that adoption depend on a very clear and tangible illustration of the returns on investments. The role that mucuna plays in keeping animals alive during droughts and dry seasons, and maintaining animal condition (therefore good prices at the market) provides such incentives. ZimClifs II, now underway, seeks to improve the integration between cereals, legumes and livestock using computer simulation modeling in participation with farmers and extension agents. Increasing learning (amongst farmers and other players promoting mucuna) and market access are the main goals of the out-scaling process.

CONTACT: André F van Rooyen, ICRISAT, Zimbabwe
(Email: a.vanrooyen@cgiar.org)

LINKS: Integrating crops and livestock for improved food security and livelihoods in rural Zimbabwe (ACIAR)
Forage farming changes lives of Zimbabwe smallholder farmers (ILRI)

FURTHER READING:

Van Rooyen AF. 2015. Innovation platforms to livelihoods. In: Inclusive Market-Oriented Development: Demand driven innovation benefiting the poor. ICRISAT IMOD Exemplars - Vol II. ICRISAT, India; pp. 21-27.
Masikati P, Manschadi A, Van Rooyen A, Hargreaves J. 2014. Maize–mucuna rotation: An alternative technology to improve water productivity in smallholder farming systems. Agricultural Systems 123:62-70.

FAST FACTS

86%

At CIAT, 86% of the ca. 21,500 forage legume accessions are from 17 genera (357 species) with more than 200 accessions each; 75 genera (301 spp.) each have less than 200 accessions, 45 genera (81 spp.) of which even less than 20 accessions. In the collection, clear priorities have, thus, been given to certain genera, e.g. *Stylosanthes*, *Desmodium* and *Centrosema*.

75%

At ILRI, of the ca. 14,000 legume accessions, 75% are from 20 genera (536 spp.) with more than 200 accessions each; 146 genera (474 spp.) each have less than 200 accessions, 113 genera (195 spp.) of which even less than 20 accessions. Importance has been given to genera such as *Trifolium*, *Vigna*, *Stylosanthes* and *Leucaena*. This helps identify where larger collections are needed, e.g. for example a widely used genus like *Mucuna* is only covered by 14 accessions.

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!

Defining core collections from characterization data!

To avoid redundancies and for more effective use of the forage germplasm collections assembled, there must be an understanding of diversity patterns within the priority species. Over the past 50 years, researchers have examined diversity in key species and much of this work has been published in the formal or gray literature. Where possible, we aim at assisting in core collection development based on understanding diversity patterns. The strategy implementation plan for 2016 includes the assembling as much characterization data as possible, making it available on a dedicated web site or via links.

If you know of publications that belong to this strategic task, then please let us know. Unless we make this effort to assemble the results of phenotypic and/or genetic characterization studies, then there is danger that the work will be either forgotten or might even be repeated, thus, wasting resources.

We expect your contribution!

Evaluation of Tripsacum germplasm in Mexico; photo: Francisco Villanueva

WHAT IS A CORE COLLECTION?

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NEXT NEWSLETTER ISSUE

We aim at producing the next newsletter #3 by early December 2016.

FOR MORE INFORMATION

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