Genebank Platform
CGIAR

Editorial

Another year of implementing the Global Strategy for the Conservation and Utilisation of Tropical and Sub-Tropical Forage Genetic Resources is rapidly advancing. After having lots of interactions with the ***national systems*** in 2017, we will strongly focus on progressing implementation with the two ***CGIAR centers*** now, and hope to bring the national and international centers together in a small workshop in early 2019.

Making collaboration happen

The closer collaboration with the CGIAR centers was kicked off in a meeting of a handful of people from ILRI, CIAT and the Global Crop Diversity Trust taking place in ILRI's new genebank building in April this year (p. 4). It was the first meeting with ILRI's new forage genebank manager, ***Alieu Sartie*** (p. 4), after Jean Hanson's retirement (p. 2).

This meeting has already been followed up by ILRI's Chris Jones and Alieu Sartie visiting CIAT headquarters in Cali, Colombia in early June 2018. Hosted by colleagues from the Genetic Resources Program, they have visited CIAT's genebank and some field sites to help build their understanding of the systems and processes that CIAT has in place for their forage germplasm collection as part of the strategy to bring both of their forage collections under a joint management system. They have also visited colleagues in CIAT's Tropical Forages Program to discuss how they can work more closely together in the area of forage plant breeding.

Continue building community

Another focus for 2018 is to plan for a meeting for national and international genebank scientists. That meeting will provide an opportunity for the key national and international genebanks to meet (few have ever met each other face-to-face) and work out options for closer collaboration. Over the course of the last few years, many suggestions have been put forward on how individual genebanks would benefit from working more closely with others. Examples include options for rescuing important germplasm that has been lost from some centers and collaborative work on characterization of important species.

The tentative timing for February 2019 is to take the opportunity for the genebank managers to meet with the team who is upgrading the Tropical Forages Database (p. 6). One of the aims of this new version of the Database is to fabricate a product that can be embedded into day-to-day genebank management and, especially, in the need to ensure genebanks provide the most appropriate forage species and ecotypes/ cultivars to users. We think this is more likely to happen if the key people have actually met each other.

We wish you happy reading with yet another diverse issue of this newsletter!

Brigitte Maass & Bruce Pengelly

IN THIS ISSUE

South African grass in Argentina

The grass *Acroceras macrum* is native to South Africa and shows great promise for wet soils in Argentina, where 174 hybrids were produced by crossing.

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Push-pull system in eastern Africa

Mulato brachiaria and Greenleaf desmodium are used in this smart technology putting agrobiodiversity to work.

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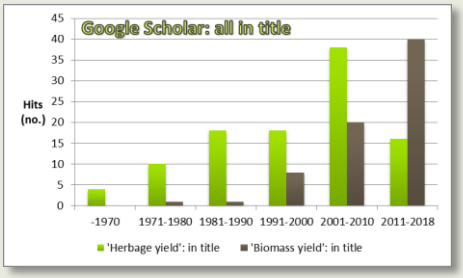
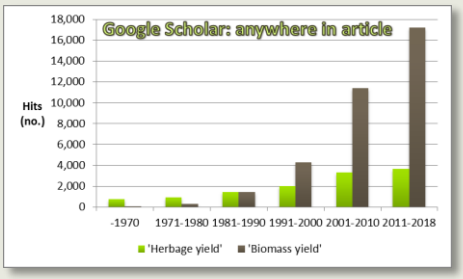
What is ...?

What is herbage?

It is interesting to read recent forage articles that refer to assessing forage dry matter (DM) yield/production. Most of them now use the term '***biomass yield***' instead of '***herbage yield***'. This was an unconscious notion, I had. But after searching in Google Scholar—and every search, I made sure that at least one of the words "forage, fodder, pasture, feed, or forraje" would appear—I could prove my idea. Since the 1990's, 'biomass' seems to be much more preferred.





So what is herbage and what herbage yield? And don't scientists have use for this term anymore?

According to an internationally agreed terminology, '***forage***' consists of "*Edible parts of plants... that can provide feed for grazing animals or that can be harvested for feeding*"; this includes browse, herbage and mast. As part of forage, '***herbage***' is "*The above-ground biomass of herbaceous plants, other than separated grain; grasses, grass-like species, herbaceous legumes and other forbs collectively; the foliage and edible stems of herbs.*" ***Biomass***, on the other hand, "*can include both forage and non-forage vegetation*" (all quotations from Allen et al. 2011).

Herbage is, thus, different from general (aboveground) biomass in that it has to do with accessibility and acceptability, meaning edibility of the biomass for the animal.

Does today's non-use of 'herbage' reflect that there are less forage scientists in the world? Or is it just an old-fashioned term that is not needed anymore in forage science?

Brigitte Maass

Reference: Allen VG, Batello C, Berretta EJ, Hodgson J, Kothmann M, Li X, McIvor J, Milne J, Morris C, Peeters A & Sanderson M 2011 An international terminology for grazing lands and grazing animals. Grass and Forage Science 66(1):2-28.

Jean Hanson

Recipient of the inaugural Crop Trust Legacy Award

"*In the early days of her career, Jean Hanson often wondered what the future would hold and where her career path would take her....*" This is how a comprehensive article by the Crop Trust starts. Here, we present some parts from the full article about Jean Hanson, the retiring leader of the ILRI Forage Diversity Project.

Jean even retired twice from ILRI! She retired at the end of 2010 after 24 years with this CGIAR center. After a few years as a consultant, in 2014, ILRI asked her to return to her previous role as project leader on forage genetic resources until they recruited a new leader. And that temporary position turned out to last four years, until her final retirement from ILRI in 2018.

Jean is a graduate from the University of Birmingham, UK, where she did her MSc in genetic resources conservation and her PhD in seed longevity during storage. After stations as a postdoctoral scientist at CIMMYT in Mexico in the mid-1970's, and as a technical advisor in Indonesia and with the International Plant Genetic Resources Institute (IPGRI; now Bioversity International) in Rome in the early 1980's, she arrived at ILRI (then known as the International Livestock Centre for Africa—ILCA) in Ethiopia in 1986 to become the forage genebank manager. Three years later she was leading ILRI's project on forage genetic resources and remained in that position until her first retirement in 2010.

1987: Jean with trainees in forage seed production

One of her utmost concerns has been mentoring and supporting countless people around the world in order to help build the capacity of the next generation.

Many changes in the past decades have meant that genebank managers have had to develop an ever-expanding skillset.

Jean Hanson at the Svalbard Global Seed Vault

Not only do they require a strong foundation in science and exceptional organizational skills, they need to be financially shrewd, politically savvy and capable of seeing the big picture while also attending to the details.

Jean's scientific contributions over the last 40 years have earned her international respect and recognition among the crop conservation community. During the celebrations of the 10th anniversary of the Svalbord Global Seed Vault (see p. 4), on 25 Feb 2018, the Crop Trust bestowed its 'Legacy Award' on Jean Hanson along with six other distinguished scientists, for dedicating her career to forage conservation.

Extracted (incl. photos) largely from Jean Hanson: Building the next generation of genebank managers and modified by BL Maass

Abbreviations & Acronyms

ACIAR	Australian Centre for International Agricultural Research
Africa RISING	Africa Research in Sustainable Intensification for the next Generation
APG	Australian Pastures Genebank
ARC	Agricultural Research Council, South Africa
ARS	Agricultural Research Station
CGIAR	Consultative Group on International Agricultural Research
CIAT	Centro International de Agricultura Tropical
cv.	Cultivar – registered, commercial variety
GIZ	German Agency for International Cooperation
IBONE	Botanical Institute of the Northeast, Arg.
icipe	International Centre for Insect Physiology and Ecology
ILRI	International Livestock Research Institute
ILSSI	Innovation Lab for Small Scale Irrigation
INTA	National Inst. of Agric. Technol., Argentina
NEA	Northeast Argentina
R&D	Research and development
TSTF	Tropical and Sub-Tropical Forages
USAID	US Agency for International Development
USDA	US Department of Agriculture

Nile grass (*Acroceras macrum*) for Argentinean waterlogged soils

Background

Acroceras macrum (Nile grass) is a forage grass native to sub-Saharan Africa, and recommended for its good adaptation to wet soils with poor drainage and waterlogging tendency of NE Argentina (NEA). Its greatest limitation for commercial use is the strenuousness to obtain fertile seed for large-scale sowing. Due to the lack of commercial seed, producers propagate it by manually planting rhizomes. This leads to genetically highly uniform stands.

During the 1970's, the Agricultural Research Council (ARC) in South Africa began an improvement program. Plants were collected from different African populations; agronomic evaluations were carried out; and fertile crosses were achieved, although with low reproductive efficiency. As a result, to date the only registered cultivar of the species is cv. Cedara Select, which is of clonal propagation [1].

Nile grass in Argentina

During the 1980's-1990's, Argentinean producers introduced cv. Cedara Select to NEA from South Africa. Waterlogging during the rainy season is an extended, serious problem for a wide area in NEA, where the scarcity of pastures produces drastic declines of livestock, which is the basic regional economic resource. Producers found that Nile grass allowed more efficient production. This created interest of INTA to evaluate and, subsequently, improve the species.

Depending on environmental conditions and management, cv. Cedara Select can achieve 5 t DM/ha. Regarding nutritional quality, on average, this cultivar presents crude protein (CP) contents of 17% in leaves, 7% in stems, and 10.5% for the overall aerial portion; with digestible energy of 2.85 Mcal/ kg [2].

Nutritional quality of grasses that prevail on waterlogged soils in subtropical regions is usually poor. A few wild grasses have favorable nutritional composition and high digestibly, but they only represent a low percentage in the botanical composition, are low-yielding and short-season annuals. Nile grass is one of the few subtropical C_3 perennial grasses. It has nutritional quality similar to that of temperate species. INTA's evaluations of cv. Cedara Select showed very high CP content, digestibility and yield compared to the natural pastures in NEA's wetlands.

In fact, with adequate fertilization and good cattle handling strategies, DM yields are roughly similar to the C_4 cultivated pastures mostly used in the subtropics, but it has higher quality and palatability. Also, a wide production period, outstanding persistence (e.g. > 20 years at the INTA Experimental Station Corrientes), and resilience were noted. Therefore, Nile grass has become an interesting alternative to increase the productivity of livestock systems in NEA.

A plot with cv. Cedara Select of *A. macrum* at INTA-Corrientes. *PHOTOS: all from S Ferrari*

In 1995, INTA professionals introduced 57 experimental lines from ARC to Corrientes. In 2011, the Botanical Institute of the Northeast (IBONE) and INTA-Corrientes together began the basic studies necessary to start an *Acroceras macrum* breeding program. This included investigation of ploidy levels, genetic diversity of material, and reproductive studies (i.e. fertility, mode of reproduction, pollination system). As a result, 27 genetically different lines were identified,

Evaluation-crossing plot containing the *A. macrum* germplasm collection at INTA-Corrientes, containing 27 different genotypes originating from ARC, South Africa.

including 22 tetraploid (2n = 4x = 36) and5 hexaploid (2n = 6x = 54), as well as wide genetic diversity [3] and higher fertility between 4x homoploid crosses [4].

Nile grass improvement

Cross-pollination resulted the predominant system in our preliminary studies. Intra-specific crosses were designed and 16 families of complete siblings were obtained. Efficiency was variable depending on the cross, resulting between 2 and 32 hybrids per family. The entire population had 174 hybrids evaluated since 2015. These had important variability not only in yielding but also in growth habit (height : base ratio), nutritional value, leaf : stem ratio, leaf and stem widths and lengths, tiller density, internode length, and resilience to different kinds of stresses, e.g. drought, freezing, grazing, and permanent waterlogging. Interestingly, during the spring-to-late summer period, some of the new hybrids obtained from crosses (with average yields as much as 8 t DM/ha per cut under a cutting regime of 45 days) were higher than cv. Cedara Select in NEA, not only in yield but also resilience, quality and leaf : stem ratio. This indicates that, within our hybrid materials, there are superior types than the material disseminated in our region and used in other parts of the world.

Hybrid cultivar development is going on in a number of projects coordinated by INTA-Corrientes, aiming at

- Selection of 1-2 hybrid materials for use in NEA production systems available in the medium term; and
- Hybrid materials with the capacity to produce quality seed in adequate quantity in the long term.

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References

[1] Rhind JM, Goodenough DC 1979 *Acroceras macrum* Stapf (Nile grass) – A review. Proc. Ann. Congr. Grassl. Soc. Southern Africa 14(1):27-33.
[2] Gándara L, Ferrari-Usandizaga S, et al. 2016 Efectos de la densidad de plantas y la fertilización en la implantación del Pasto Nilo (*Acroceras macrum*). Rev. Arg. Prod. Anim. 36: Supl. 1: 364.
[3] Ferrari-Usandizaga SC 2015 Estudios sobre sistemas genéticos y diversidad en *Acroceras macrum* Stapf. PhD thesis. Univ. Nac. Rosario. Arg.
[4] Ferrari-Usandizaga SC, et al. 2015 Reproductive behavior of *Acroceras macrum*. V Internat. Symp. Forage Breeding, Buenos Aires, Argentina.

People & meetings

ILRI & CIAT harmonize forage genetic resources curation

TSTF genetic resources specialists gathered at the ILRI forages genebank in Addis Ababa, Ethiopia in April 2018: Peter Wenzl, leader of CIAT's Genetic Resources Program, Chris Jones of ILRI's Feed and Forage Development Program, Alieu Sartie, ILRI's genebank manager, Angela Hernandez, Systems Analyst for CIAT's Genetic Resources Program, Charlotte Lusty, the CGIAR Genebank Platform coordinator from the Crop Trust, who commissioned the TSTF strategy and its implementation by Bruce Pengelly & Brigitte Maass, the latter also joining the meeting. The purpose of the meeting was to agree on a roadmap for harmonizing the curation of the two international TSTF collections.

Forage genetic resources specialists meeting in April in Addis Ababa, Ethiopia together with ILRI genebank staff in front of the new forage genebank building in April 2018. *PHOTO: ILRI*

'CIAT joins the seed party at the North Pole'

"Shipping seed samples from CIAT in Colombia to the Seed Vault in Norway takes 4-5 days: Palmira – Bogotá – Miami – Cincinnati – Leipzig – Copenhagen – Oslo. *CIAT has made use of this large and secure storage facility since its inauguration in 2008. …"*
"In addition to achieving a ***back-up copy*** *of 94% of its bean collection and* ***92% of forages*** *(i.e. 20,284 accessions) in Svalbard, CIAT's genebank is also celebrating the quixotic idea of the Government of Norway from 10 years ago of converting an old mine into a seed bank for humanity."*

Read more of this article in the CIAT Blog

Successions in forage genetic resources

USA: Dr. Brad Morris is now the curator for the warm-season grasses in addition to the legumes at the Plant Genetic Resources Conservation Unit, USDA-ARS in Griffin, Georgia, USA. Brad Morris follows Gary Pederson, who retired in early 2017 (see Forages for the Future #2, p. 4). Among others, he has been working on cowpea (*Vigna unguiculata*) and hyacinth bean (*Lablab purpureus*) to develop germplasm for high protein content.

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ILRI: Since February 2018, Dr. Alieu Sartie is the new ILRI genebank manager of the forages genebank based at Addis Ababa, Ethiopia. He follows Jean Hanson at ILRI (see this issue, p. 2). However, in the mid-term, his responsibility will be to curate both the ILRI and CIAT forages collections.

PHOTO: BLMaass

Alieu Sartie holds a PhD and MSc from Massey University in New Zealand, and a BSc from Njala University of Sierra Leone. He has working experiences as a Forage Breeder in New Zealand. He has been a Post-Doctoral Fellow at the International Institute of Tropical Agriculture (IITA) in Nigeria; and he also worked as a Research Assistant in Seed Technology and Breeding at the Rice Research Station in Sierra Leone.

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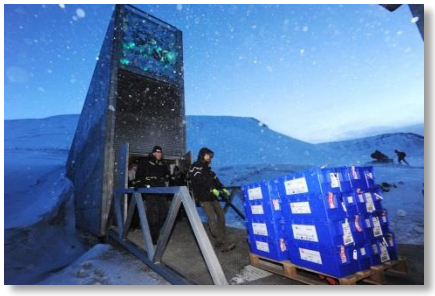
1,060,987

Unique crop varieties or accessions of almost 6,000 species have been deposited by 76 institutions into the Seed Vault, since February 2008. Read more.

'Svalbard Global Seed Vault celebrates 10 years'

"The Svalbard Global Seed Vault first opened its doors in February 2008, as a backup facility for the world's seed banks. It received deposits of over 300,000 different kinds of seeds in its first year and deliveries have continued several times a year from many countries worldwide."

"The Seed Vault is a ***secure backup facility*** *for the seed banks of the world. Many seed banks – while engaged in the vitally important work of seed conservation and use – suffer from inadequate funding, political instability or the risk of catastrophic natural disasters. The Seed Vault provides secure storage for their seeds."*



Seed is arriving at the Seed Vault; *PHOTO: Crop Trust*

The Seed Vault is the largest collection in the world of crop biodiversity held in one place. The building is owned by the Norwegian Government and operates under a three-party agreement between the Norwegian Government, NordGen and the Crop Trust. Depositors to the Seed Vault have responsibility for the samples that they deposit and only they can open the boxes and retrieve the material.
Read more in ***this press release*** from the Crop Trust by: Ch B Edelman & Cierra Martin (Emails: charlie.binder@edelman.com and cierra.martin@croptrust.org)

New seed for depositing in the Seed Vault is being shipped from CIAT, Colombia; *PHOTO: CIAT*

Desho and Napier grasses help smallholders to produce year-round forage in Ethiopia

Desho grass

Desho grass (*Pennisetum pedicellatum*) is native to Ethiopia. It is a perennial grass, well adapted to a wide range of agro-ecologies and capable of growing in different niches such as soil bunds, road sides and degraded lands. It must not be confused with the annual, so-called deenanath grass that is known for its invasiveness into cropland.

A decade ago, ILRI introduced Desho grass to western Ethiopia and evaluated it through the Nile Basin Development Challenge Program. After a few years of action research and promotion, the grass has turned out very effective as a source of good-quality forage for cut-and-carry systems. It has become particularly popular as a means of biological control in stabilizing soil bunds and control runoffs and soil erosion.

Desho grass integrated in the arable land for fodder, and soil and water conservation. PHOTOS: Aberra Adie

By planting Desho grass on soil bunds, farmers can increase both crop yields and feed availability. From the sale of both Desho root splits and fresh herbage, farmers started generating significant amounts of cash income. Nowadays, the forage is scaled to almost all highland areas (from c. 2300 to 3000 m asl.) and is integrated in the natural resource management schemes of Ethiopia.

Napier grass

Napier grass (*Pennisetum purpureum*), as a perennial and high yielding grass, has the potential to provide year-round feed for smallholders, when watered during the dry season. This grass was introduced to different mid-altitude areas (about 1600 to 2300 m asl.) of Ethiopia with supplemental small-scale irrigation schemes. Farmers are able to harvest the grass 6-9 times per year with total dry matter yields ranging 18-23 t DM/ha. Intercropping Napier with legumes such as pigeon pea (*Cajanus cajan*) and Silverleaf desmodium proved effective in increasing herbage yield and nutritional quality of the forage produced. For instance, by intercropping Napier with early- or late-maturing pigeon pea, it was possible to increase the herbage yield by 33-50% as compared to sole cropping. The intercropping also resulted in improving the fodder quality of Napier grass as the crude protein content increased from 8.3 to 11.5% and the *in vitro* digestibility from 49.1 to 51.3%.

Based on local fodder market prices (which stand at 1.5 to 2.0 ETB/kg of fresh forage, c. 0.06-0.07 USD), irrigated Napier grass was estimated to have a gross income potential of 150,000 to 200,000 ETB per hectare per year (c. 5500-7400 USD). This has motivated many smallholders to increase the size of their Napier grass plots from 100 to more than 400 m^2 in Robit Bata district of northern Ethiopia, to the extent that they replaced other high-value perennial cash crops, such as Khat (*Catha edulis*) with Napier grass.

Desho grass for mid-altitude

"*In June 2016, Bimrew Asmare graduated from Jimma University, Ethiopia with a PhD in Animal Nutrition. He investigated the agronomic, utilization, nutritive and feeding value of Desho grass (*Pennisetum pedicellatum*) in North-western and Southern Ethiopia.*" Read the full 2017 news release by Peter Ballantine from ILRI on Desho grass, a feed resource for mid and high altitude regions of Ethiopia; and browse the publications resulting from Bimrew Asmare's PhD thesis indicated on the same website. Interestingly, ILRI's genebank keeps only 10 Desho grass accessions.

Napier grass intercropped with either Desmodium (above) or pigeon pea (below) on smallholder farms in Ethiopia. PHOTOS: Aberra Adie

The work has been supported by USAID through ILSSI and Africa RISING projects.

BY: Melkamu Derseh, Aberra Adie, Michael Blummel, Kindu Mekonnen, ILRI Ethiopia, Chris Jones, ILRI Kenya

EMAILS: M.Derseh@cgiar.org; A.Adie@cgiar.org; K.Mekonnen@cgiar.org

READ MORE:

Leta G, Duncan A, Abdena A 2013 Desho grass (*Pennisetum pedicellatum*) for livestock feed, grazing land and soil and water management on small-scale farms. NBDC Brief 11. ILRI, Nairobi, Kenya.

Desho grass is not invasive

In Ethiopia, Desho grass is not invasive as it rarely sets seeds and is propagated by root splits. Farmers, actually, prefer it due to its non-invasiveness to be planted on soil bunds/terraces within arable lands to control erosion and, at the same time, produce forage for livestock. It tillers and continues to expand, but farmers easily manage it within crop lands. It is more suitable for a cut-and-carry system as it does not tolerate intensive grazing, especially when long dry periods occur.

New Website

The Australian Pastures Genebank (APG) has launched a ***new public website*** to facilitate online access to their collection of seeds.

Clients looking for specific accessions can now easily search APG's collection and order online through a much faster and more efficient process. APG's new website is accessible via the following link https://apg.pir.sa.gov.au/gringlobal.

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Green grass & greenhouse gas

Scientists are investigating the links between them. A research team at ILRI is testing Napier, Rhodes and Brachiaria grasses for cattle feed, and then physically measuring the emissions in a respiration chamber within the institute's laboratory.

"*The study will help African countries monitor, measure, verify and report their emissions with the aim of reducing their nationally determined contributions. … The measurements will help find better locally available tropical feeds for the region as opposed to overreliance on feeds from the temperate world,*" said ILRI principal scientist Klaus Butterbach-Bahl.

READ MORE: ILRI Clippings 1 & ILRI Clippings 2

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Updating the international database for tropical forage adaptation and use

Revision of the online ***Tropical Forages*** database and selection tool is well in hand. The current plan is to have the new version of the database on line by May 2019 and it will be able to be accessed faster than it is today and will be accessible on whatever device you are using from desktop to smartphone.

Tropical Forages (www.tropicalforages.info) is an open-access expert knowledge system created by an international team of experienced forage specialists initially released online in 2005. The database currently provides detailed information on ~160 forage species that are adapted to the tropics and sub-tropics, and it incorporates a species selection tool based on target environment and forage use.

50 years of forage R&D history

The website was developed to bring together over 50 years of forage R&D history and an aggregate of hundreds of years of forage research experience from across the tropics; from Asia, Africa, Tropical America and Australia. It has been extensively used by researchers, extension workers, universities, NGOs and farmers with about 250,000 website visits per year. However, 2005 is long ago and ***Tropical Forages*** is overdue for an update to accommodate new information on forage performance and use. The update also provides an opportunity to bring the system up-to-date with the many changes in technology since 2005, when the internet was still very much in its infancy for many parts of the world. And there was still widespread use and reliance on CDs and DVDs, while tablets and smartphones were unheard of by most of us.

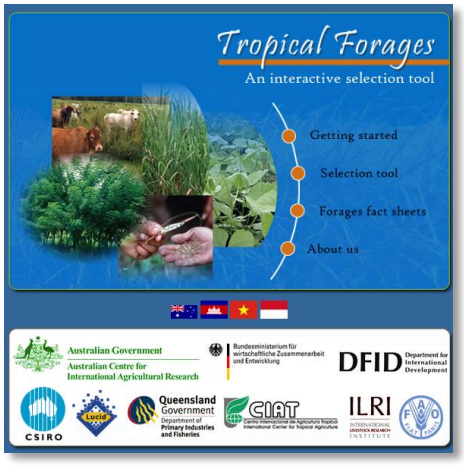
160

Detailed information on about hundred sixty forage species is contained in the Tropical Forages expert system.

The update project

The update project is being funded by ACIAR (Australian Centre for International Agricultural Research)—who were the prime funders of the development of the original version of ***Tropical Forages***—and the German agency for international cooperation, GIZ, and it is being coordinated by CIAT (Centro Internacional de Agricultura Tropical).

The work is being largely undertaken by a small group of retired forage specialists and Identic, the IT company responsible for the LUCID software used on the website.



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See also: *Getting more out of the genebanks* by Bruce Cook in ***Forages for the Future*** NL #3, p. 3.

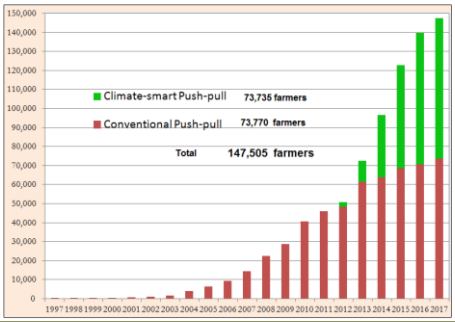
Back issues of the ***Forages for the Future*** Newsletter can be found on: http://www.tropicalgrasslands.info/index.php/tgft/pages/view/News

The smart use of agrobiodiversity: Push-pull technology

A conservation agricultural approach known as 'Push-Pull' technology has been developed for integrated management of stemborers, striga weed and soil fertility. Push-pull was developed by scientists at the International Centre of Insect Physiology and Ecology (icipe), in Kenya and Rothamsted Research (UK), in collaboration with other national partners. The technology is appropriate and economical to the resource-poor smallholder farmers in the region as it is based on locally available plants, inexpensive external inputs, and it fits well with traditional mixed cropping systems in Africa.

Striking technology uptake

To date it has been taken up by >157,500 smallholder farmers in East Africa, where maize yields have increased from about 1 to 3.5 t/ha, achieved with minimal inputs.



Uptake of the push-pull technology in East Africa. SOURCE icipe

Push-pull technology involves intercropping maize (or sorghum) with a repellent plant, such as desmodium, and planting a trap plant, such as Napier grass, as a border crop around this intercrop.

Gravid stemborer females are repelled or deterred away from the target crop (PUSH) by stimuli that mask host apparency, while they are simultaneously attracted (PULL) to the trap crop, leaving the target crop protected. Desmodium produces root exudates some of which stimulate the germination of striga seeds and others inhibit their growth after germination. This combination provides a novel means of in-situ reduction of the striga seed bank in the soil through efficient suicidal germination even in the presence of graminaceous host plants. Desmodium is a perennial cover crop (live mulch), which is able to exert its striga control effect even when the host crop is out of season and, together with Napier grass, protect fragile soils from erosion. It also fixes nitrogen, conserves soil moisture, enhances arthropod abundance and diversity and improves soil organic matter, thereby enabling cereal cropping systems to be more resilient and adaptable to climate change while providing essential environmental services, and making farming systems more robust and sustainable.

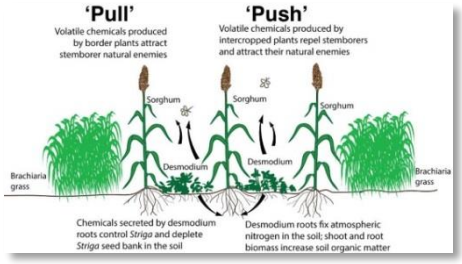
Searching for new trap plants

The trap plants and intercrops used in conventional push–pull were selected to suit the current average rainfall (>800 mm per annum) and moderate temperatures (15-30°C) of Western Kenya. The rising un-certainties of rain-fed agriculture for farmers in this region and those in warmer, drier agro-ecosystems led *icipe* scientists to begin the search for new trap plants and intercrops.

Working with Rothamsted Research and national partners in Ethiopia, Kenya and Tanzania, *icipe* scientists tested a total of 500 potential grasses, identifying 21 that were suitable for controlling stemborers. They then worked with farmers to select the trap plant of their choice. The grass that farmers selected, *Brachiaria* cv. Mulato, controls stemborers effectively by supporting a parasitic wasp, which feeds on their larvae. Crucially, it can also withstand periods of up to four months with no rainfall, and temperatures in excess of 30°C. In addition, the grass is extremely palatable to livestock.

Control of striga & stemborers

At the same time, the team worked to identify new species of desmodium. They needed plants that not only had the desirable characteristics of Silverleaf desmodium – controlling striga, emitting volatiles to repel stemborers, fixing nitrogen, producing high biomass and spreading on the ground – but were also drought-tolerant. Forty-three accessions of 17 species were collected from arid regions across Africa, and Greenleaf desmodium was selected. In addition to its known ability to control striga and stemborers, it fixes more atmospheric nitrogen and produces more fodder than Silverleaf desmodium.



Both Brachiaria and Greenleaf desmodium seed are commercially available, which meant that the new climate-smart push–pull package could be rapidly disseminated to farmers. Uptake of the new, climate-smart components has gone even more rapidly than the uptake of the technology in the past. Farmers are most excited about the increase, availability and easy accessibility of high-quality forage for their animals.

It is also noteworthy that this climate-adapted variant of the technology is highly effective in controlling fall armyworm, an invasive pest that has recently invaded Africa, causing serious losses to maize yields.

A farmer feeding her goats on Mulato brachiaria from a push-pull plot, Kenya. PHOTO: BLMaass

Scientists have also identified two native African desmodium species (*D ramosissimum* and *D. repandum*) that are even more drought tolerant than Greenleaf (*D. intortum*), but for which there is no commercially available seed at present. Looking to the future, *icipe* is building partnerships with farmers and seed companies to address this constraint.

Prof. Z.R. Khan and his team have amply published scientific articles and extension material in order to spread the successful technology widely. They have also been rewarded with a number of international prizes for their work.

EXTRACTED AND MODIFIED FROM:
http://www.push-pull.net/
(by BL Maass)

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Announcements

FAST FACTS

53%

More than half of the about 160,000 farmers who are using the '***push-pull***' system in eastern Africa have taken up the so-called 'climate-smart push-pull' technology; meaning they use the grass *Brachiaria* ***cv. Mulato*** and the legume ***Greenleaf desmodium*** as technology components.

92%

A back-up copy of 92% (i.e. 20,284 accessions) of all forage accessions maintained in the CIAT genebank has been deposited in the Svalbard Global Seed Vault.

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 opinions matter!

IFTBC International Forage & Turf Breeding Conference
A Global Vision for Innovation

International Forage and Turfgrass Breeding Conference, ***24-27 March of 2019*** in Orlando, FL, USA. This is the first joint meeting of the 10th Molecular Breeding of Forages and Turf Conference (MBFT) and the 6th International Symposium of Forage Breeding (ISFB). More details under: http://conference.ifas.ufl.edu/iftbc2019/index.html

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ILS3 – the Third International Legume Society Conference

The Third International Legume Society Conference (ILS3) will be hosted by the Institute of Plant Genetics, Polish Academy of Sciences from ***21-24 May 2019*** in Poznan, Poland. More information under: http://www.legvalue.eu/news-and-events/events/ils3-third-international-legume-society-conference/

New publication

Sustainable crop-livestock intensification in the Sub-Saharan Africa: Improving productivity through innovative adaptation by DMG Njarui, M Mutimura, EM Gichangi & SR Ghimire. Chapter 8 in: Agricultural Development and Sustainable Intensification Technology and Policy Challenges in the Face of Climate Change Edited by Udaya Sekhar Nagothu; Series: Earthscan Food and Agriculture, Routledge. 2018. Link.

FROM THE JOURNAL:

Tropical Grasslands -Forrajes Tropicales Online Journal

Vol. 6 No. 2 (May 2018)

Research papers

Molecular markers as a tool for germplasm acquisition to enhance the genetic diversity of a Napier grass (*Cenchrus purpureus* syn. *Pennisetum purpureum*) collection [ILRI & embrapa/Brazil]
by AT Negawo, A Jorge, J Hanson, A Teshome, MS Muktar, ALS Azevedo, FJS Ledo, JC Machado, CS Jones

Agronomic characterization of *Paspalum atratum* Swallen and *P. lenticulare* Kunth [Argentina]
by F Marcón, MH Urbani, CL Quarin, CA Acuña

Pre-breeding studies in *Panicum coloratum* var. *coloratum*: Characterization using agro-morphological traits and molecular markers [Argentina]
by E Burgos, C Thompson, M Giordano, MA Thomas

Pastoralists' grazing systems and eco-related outcomes in Yewa Division of Ogun State, Nigeria
by OA Lawal-Adebowale, IA Ayinde, JA Olanite, VOA Ojo, OS Onifade, AO Jolaoso, OM Arigbede

Determinants of adoption of improved forages in selected districts of Benishangul-Gumuz, Western Ethiopia
by A Abebe, A Hagos, H Alebachew, M Faji

Short communication

Chemical composition of hays of the Caatinga shrub legumes mororó and sabiá from different parts of the plant [Brazil]
by OF de Oliveira et al.

NEXT NEWSLETTER ISSUE

We aim at producing the next newsletter by ***November 2018***.

Photos from the title page: top by BL Maass; right top by Silvana Ferrari; right bottom by BL Maass

FOR MORE INFORMATION

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