N2Africa Podcaster no. 54

September 2018 - January 2019

Introduction

This is our first news of 2019 so we hope you all enjoyed a good break and wish you all a peaceful, productive and enjoyable year ahead. We're now in the last six months of funding from the Bill & Melinda Gates Foundation. Our N2Africa teams in Ethiopia, Ghana, Nigeria, Tanzania and Uganda have been very busy conducting a large survey to understand the outcomes and impacts of the programme. We're using a variety of methods and will report more in detail in future Podcasters. We also have contracted consultants to assist us in exploring the current market opportunities for rhizobium inoculants in Africa, and to examine how policies could be better shaped to support diversification and intensification of crop production through the promotion of grain legumes and associated technologies.

Our programme continues to attract many enquiries for information on the yield-improving technologies for legumes we have developed and continue to promote. There are a number of ongoing initiatives to follow-up on the current phase of N2Africa. We hope these will be successful and help us meet the demands of our stakeholders for information and support. We receive requests from a wide variety of stakeholders – who range from farmer groups to the ministries of agriculture in the different countries where we work to newspapers and television companies!

In this Podcaster we provide updates from different countries on the supply of rhizobium inoculants and how they are taking off in Africa. It's quite amazing to read how the use of inoculants has changed since we started N2Africa activities almost 10 years ago. We can't claim that N2Africa is solely responsible for this impact – but we have certainly made a key contribution in proving the need for inoculants, in creating awareness and opening up the opportunity for companies.

We have an interesting research report from Travis Goron who works on a Canadian post-doctoral fellowship examining the impacts of legumes on infestation with the parasitic weed *Striga*. Don't forget to check the links to different student theses and other news items on the back page. We hope you enjoy this Podcaster and we will be following up soon with more news on the outcomes and impacts of N2Africa.

Ken Giller

NoduMax production and sales

During the 2018 rainy season, about 7.2 tons of NoduMax inoculant was distributed in seven countries; namely, Benin, Burkina Faso, Cameroon, Ghana, Mozambique, Nigeria, and Togo. The product has been successfully registered in Nigeria and partially in Ghana.

In Nigeria, we have been able to identify two potential distributors that are financially reliable and that distributed good quantities of NoduMax this year. Other clients also bought small amounts of the product for personal use on their fields and gave positive feedback. In addition, NoduMax was tested with a Brazilian soyabean variety in collaboration with a food processor to understand the level of responsiveness on about 300 hectares of land in Kaboji, Niger State, and it was discovered that the variety cannot grow well without the inclusion of NoduMax. A yield of about 600 - 700 tons of soyabean seed is expected from the 350 hectares cultivated through IITA GoSeed with local varieties. As for the export market, the Nodumax was readily accepted and about 2 tons was sold in neighbouring countries.

Farmers' perception about the product
NoduMax was readily accepted both locally and internationally by farmers. They are happy with the product and are willing to continue to apply NoduMax when planting soyabean as they can expect increased yields of about 30–40%.

Challenges
Farmers, especially the small scale farmers do not order in advance. This gives some problems of the availability of Nodumax at grassroots level In the coming season the

A 300 ha field of soyabean inoculated with NoduMax at Kaboji, Niger State

Soyabean plants inoculated with NoduMax (at flowering stage).

Nodumax team will try to solve this with a closer co-operation with the Nigerian Soybean Association. Initial discussions have started already to have a plan in place for the planting season in 2019.

Challenges were encountered in the process of marketing NoduMax:

- Potential distributors have problems with pre-payment and this tends to have a negative effect on cash flow, hence, the identification of FMN and Harvestfield that are financially reliable as distributors.
- Bureaucracy at the border crossing poses a challenge as well and could be resolved with improved public relations.

In conclusion, the market potential for NoduMax is 350 tons in Nigeria, of which only 10% is targeted (35 tons). Therefore, the opportunity for expansion is enormous. At present, the capacity of the factory is 11 tons and can be stretched to 16 tons. The franchise model could be considered with FMN and Harvestfield Industries for orders above 16 tons.

Mrs Oke Bolanle, Manager Nodumax, IITA Ibadan

New soyabean inoculant registration stems from collaboration between N2Africa and Rizobacter

Rizoliq Soy, a liquid rhizobia inoculant for soyabean with the highest quality standards recently gained approval by local authorities to be commercialized in Tanzania. Behind this achievement is a recent public-private partnership between Rizobacter and IITA Tanzania, mediated by N2Africa. Through this accomplishment the firm continues to strengthen its position in Africa.

The registration process concluded in September this year but started in 2016, when through N2Africa's assistance Rizobacter was able to partner with IITA Tanzania to facilitate local testing, which was coordinated by Dr Freddy Baijukya. This association was fundamental to generate the requested data and obtain the final 'green light' from authorities. After a few months of dossier analysis the product was approved and the registration certificate issued.

Inoculant and seed are key inputs for soyabean cultivation, and both are required at sowing by growers. This is why Rizobacter has found in Seedco an ideal counterpart for the future development of the Tanzanian soyabean market. FIPS Africa have a small 'army' of VBAs (Village Based Advisors), 1,600. Out of these 450 operate in soyabean producing Districts. Working closely with this team will spearhead awareness and adoption of this new technology to smallholder farmers in Tanzania. The association between both firms and support of FIPS Africa, is elemental towards offering a bundle composed by the highest-yielding, locally-adapted soyabean varieties and the most reliable and efficient rhizobia inoculant.

Image 1. From top left and clockwise: main office; growth chamber for quality control and R&D, R&D Farm and Production plant, all in Pergamino, Buenos Aires, Argentina.

Inoculant availability remains a challenge in Tanzania and many parts of Africa, but it is through this kind of collaboration and systemic approaches that legumes can become a profitable option for smallholder farmers.

Further enquiries?
Contact:

- Rizobacter's Regional Manager in Africa, Ignacio Ardanaz (iardanaz@rizobacter.com)
- Rizobacter's Consulting agent in East Africa, Joe Iracha (joe.iracha@freshcare.africa)

Inoculant production and use in Zimbabwe for the last five years

Zimbabwe has traditionally grown soyabean with inoculation since the 1960's, particularly in the large scale commercial farms. The country has a government run inoculant production facility at the Soil Productivity Research Lab (SPRL), producing inoculant for a wide range of legumes. Soyabean is the main crop for which rhizobium inoculant is produced, accounting for more than 90 % of inoculants sold. The Soil Productivity Research Laboratory received support from N2Africa in 2012 for rhizobium research, production and development and to train personnel in rhizobiology.

Inoculated in foreground - uninoculated behind the farmers

Soyabean - inoculation trials

The SPRL produces a rhizobia inoculant on a bagasse carrier medium. For soyabean, one sachet of rhizobium inoculant is sufficient for 1 ha or 80 to 100 kg of seed. However, many smallholder farmers use the sachet on less than one ha because they may grow only that much soyabean as soyabean is a secondary crop, competing for land and financial resources with maize and other crops.

In the past five years, rhizobium inoculant use has peaked at about 40,000 sachets per year (Fig. 1). In response to this, the rhizobium inoculant production target at SPRL was set at 40,000 sachets in 2015 and 2016. In those years, inoculant use fell to just over 12,000 (2015) and just over 11,000 (2016). This was a result of several factors, including the failure in those years to match the timing of demand with supply as well as the El Nino induced drought.

In 2017, soyabean was introduced to two government input schemes, a contract farming scheme and a smallholder development support scheme. The target for the contract farming programme, was 60,000 ha of soyabean under both smallholder and commercial farming systems. In response to this, SPRL set the target for rhizobium inoculant production to 80,000 sachets, sufficient for the 60,000 ha, as well as non-contract farming growers, SPRL met this target and 55,255 standard sachets were sold. The second programme was targeting smallholder farmers and a "special" 30 g packaging was specifically made to match farmer requirements. Despite the quick turnaround time and high inoculant demand from the 2 government sponsored schemes SPRL managed to sell 63,958 ha worth of rhizobium inoculant with the smaller packaging alone. Soyabean inoculant is more than 50 years old in Zimbabwe and almost forty years old in the smallholder communities, and yet still not very well known in smallholder communities. These government programmes are a great opportunity to introduce soyabean production and inoculant to many smallholder communities and thereby stimulate demand in the future.

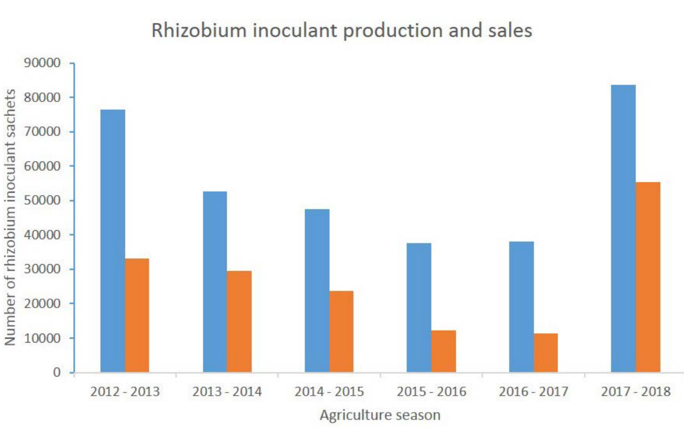


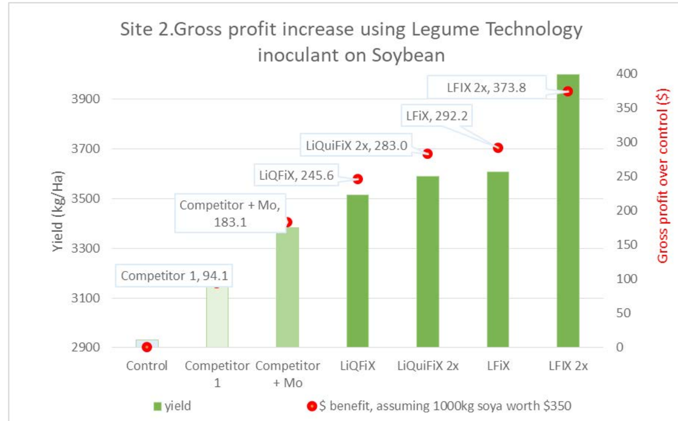
Figure 1. Rhizobium inoculant production and sales in Zimbabwe from 2012 to 2017

The legume inoculant factory is operating below capacity since the majority inoculant production is targeted at rainy season crop production. The SPRL manages to meet the inoculant demand. There is a need to stimulate more demand so that more farmers can benefit from inoculant use; and to develop more efficient inoculant distribution to ensure access by all farmers throughout the country. SPRL intends to boost all the programmes to popularise rhizobia inoculant with media advertisements, more decentralisation and closer coordination of the rhizobium sales.

Mazvita Chiduwa, SPRL, Zimbabwe

LEGUME Technology expanding in Africa

Legume Technology are now in final commercial discussion with FarmAg International to begin commercial supply of legume inoculants across Africa. With initial targets in South Africa, Zambia, Malawi, Mozambique, Angola, Tanzania and Uganda we aim to have distribution and sales in many more over the coming 2-3 years. The graph show results from South Africa where FarmAg placed LEGUMEFiX and LIQUIFiX in independent trials against a major brand in the market. Both our liquid and peat inoculants performed much better than the competitor product giving the grower nearly 880kg/ha more yield in this trial. For the future Legume Technology have begun an investment program that will give the company 24,000 L fermenter volume for a new generation of liquid inoculants for both the existing nitrogen fixing inoculants and also new biological agents that increase the efficacy of this relationship and also target other non-legume crops. Although we will continue to target commercial growers, Legume Technology are also evaluating new innovative production techniques to bring smaller packets of our high quality inoculant to the Smallholder market especially in Malawi, Tanzania and Uganda. This high throughput, large scale production will give a really competitive product offer for this important sector of the inoculant market.



Bruce and Jacky Knight, LEGUME Technology.

An update on Nitrofix in Malawi

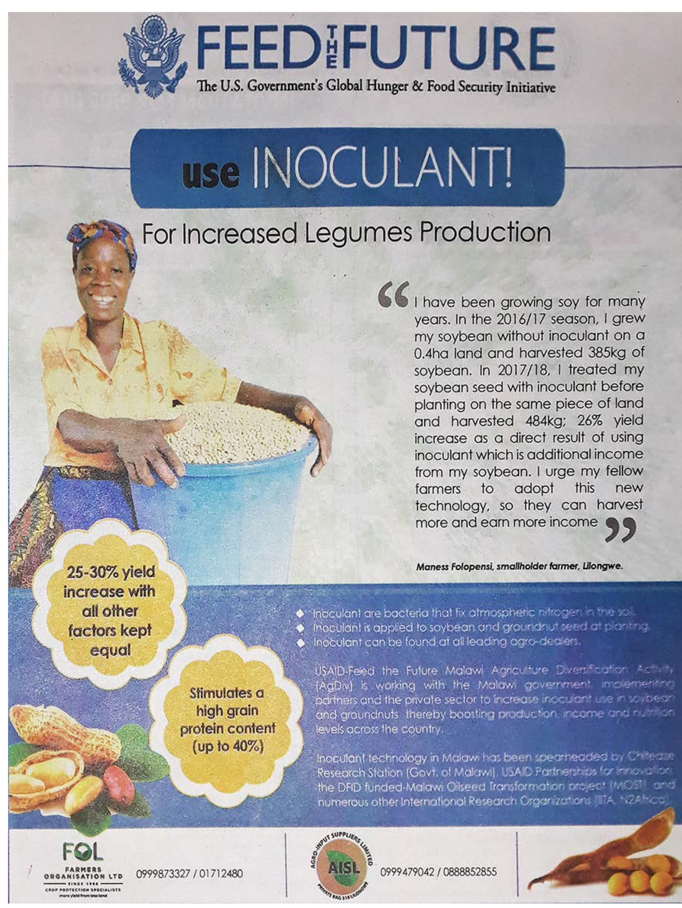
AISL begun local production and distribution of Legume inoculant in 2015 following a working arrangement it had with Department of Agricultural Research Services (DARS) in Malawi. From a pilot production of 20,000 sachets in 2015 AISL is now able to produce and sale over 400,000 sachets of legume inoculant. In 2015 AISL started with soyabean inoculant but now has both soyabean and groundnut inoculant on the market with bean and pigeonpea inoculants under development and are expected to be introduced on the market in 2019 and 2020 respectively.

In order to consolidate its position on the market AISL is installing fermenters at its laboratory facility in Lilongwe in order to start production of liquid NITROFIX. This expected to improve product efficacy and elongate shelf life from the current 6 months to 12 months.

The entrance to the laboratory near completion

AISL in partnership with GIZ MEIRA project and USAID FtF Agricultural Diversification Program is promoting the adoption and use of Legume Inoculants in Malawi.

Fredric Kawalewale, AISL, Malawi



Advert from December 2018 in the newspaper Malawi News with the caption 'Use INOCULANT! For increased Legume Production'

Secondary benefits of strigolactones from legumes to control striga parasitism in Kenyan cropping systems

Introduction

Striga parasitism can devastate maize fields in Kenya

The parasitic weed striga (Striga hermonthica) is able to draw nutrients directly from a suitable host plant such as maize through a haustorium, an underground root-root connection. In regions of sub-Saharan Africa (SSA) including Western Kenya, striga can cause up to 70-100% yield loss in fields of maize and other crops (Khan et al., 2006) (Fig. 1).

Strigolactone exudates allow striga to germinate and parasitize maize

The strigolactones (SLs, Fig. 2) are a group of plant hormones involved in regulating beneficial symbioses, for example between mycorrhizal fungi and maize. However, maize-exuded SLs can also induce striga to germinate, locate, and infect roots of the host plant.

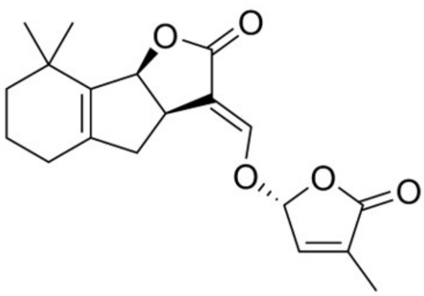


Figure 2. 5-deoxystrigol, considered to be the basic structural strigolactone. Adapted from Yoneyama et al., 2008.

In Kenya, legume species are often rotated or intercropped with maize, which can increase yields due to nitrogen fixation, as well as provide food security (Fig. 3). Legumes also produce and exude SLs, associated with establishing effective nitrogen fixing symbioses with rhizobial bacteria. Striga is an obligate parasite, but unable to form a connection with most legumes, resulting in germination and death of the weed upon detection of legume-derived SLs. This non-nitrogen benefit of legumes can reduce the striga seed bank in a field, and reduce parasitism in a subsequent maize crop by up to 70% (Khan et al., 2006). However, the large environmental diversity present in smallholder systems has made characterization of this effect a challenge, and warrants further study.

Figure 1. Maize field (A) in Kenya infested with Striga hermonthica (purple flowers). Detail of a single striga plant (B).

Figure 3. Soyabean (A) and groundnut (B) are often intercropped (displayed) or rotated with maize in Western Kenya as a method to increase soil fertility and reduce weeds.

Hypothesis

It is hypothesized that rotating maize with legumes will reduce the striga seed bank and subsequent parasitism of a maize crop in a variety of environments.

Objectives

1. Quantify striga seed bank in maize fields of high and low infestation.
2. Correlate seed bank and striga emergence with soil physiochemical characteristics.
3. Compare striga emergence and seed bank between maize in monoculture or rotation with a legume crop.

Methodology

Selection of field sites

Maize fields in Western Kenya were selected from three different counties (Bungoma, Busia, and Kakamega) ranging from 1100 to 1500 m in elevation, with average high temperatures during the growing season of 25 to 30^{o}C (Fig. 4). In each county, three fields of both high and low striga pressure were identified by visual inspection of striga emergence. Farmers were surveyed with regards to crop history, fertilizer use, and methods of striga reduction. Soil samples were collected from each field.

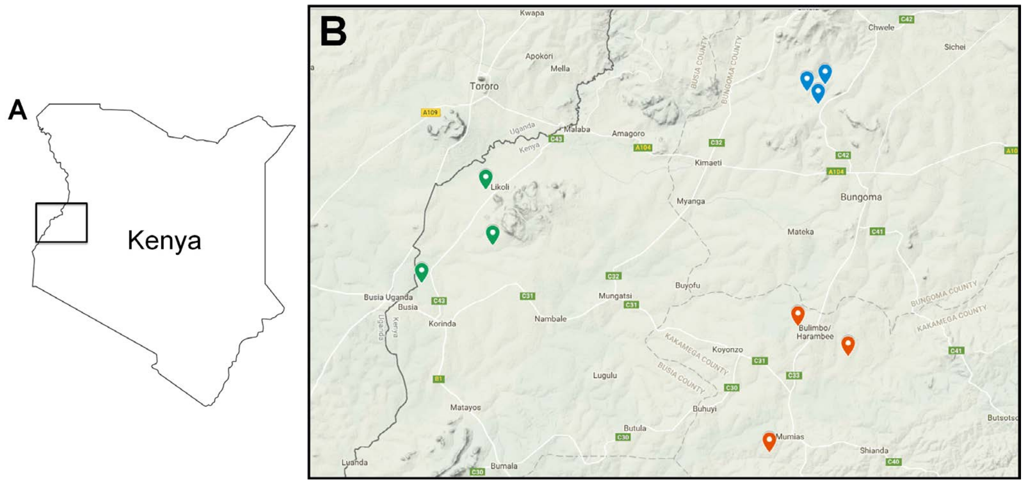


Figure 4. Region of Western Kenya surveyed (A) and detail of field sites sampled (B) in Busia county (green), Bungoma county (blue), and Kakamega county (red).

Soil and seed bank analysis

A physiochemical analysis is underway on soil samples for percent clay, silt, and sand, available P and N, organic content, pH, macronutrients (K, Ca, Mg, Na), and micronutrients (Cu, Fe, Mn and Zn). The striga seed bank is being quantified from soil samples by both microscopy and qPCR.

Field experimentation

In each field two treatments of either legume or monoculture maize will be planted, with high/zero N fertilization treatments to disentangle the legume N_2-fixation benefit. Striga reduction in the subsequent maize crop will be compared between the cropping treatments with visual inspection, and analysis of the seed bank as described above.

Laboratory experimentation

In a side-project, several barley mutants have been generated by a collaborator which will be used as a model system to examine altered SL exudation. In these plants, three key genes involved in the biosynthesis of SLs via the common symbiosis pathway have been repressed. The plants will be grown alongside striga seed in lab and greenhouse experiments, and the induced striga germination will be compared to a barley wildtype control. Later, genotypes of interest will be analysed for unique strigolactone exudation profiles compared to the wildtype. It is anticipated that this portion of research will provide mechanistic understanding of how components of the common symbiosis pathway contribute to SL production and striga parasitism.

Conclusions

This research will provide updated understanding of the degree by which striga parasitism can be combated by legumes, offering promise to control striga in Western Kenya. Future work will include further characterization of the striga-reducing benefit provided by legumes.

Acknowledgements

In addition to N2Africa, Travis' research is supported by a grant from the Natural Sciences and Engineering Council of Canada.

Travis Goron, Wageningen University & Research, The Netherlands

References

Gacheru E, Rao MR. 2001. Managing Striga infestation on maize using organic and inorganic nutrient sources in western Kenya. Int J Pest Manage 47: 233-239.

Khan ZR, Midega CAO, Hassanali A, Pickett JA, Wadhams LJ. 2006. Assessment of different legumes for the control of Striga hermonthica in maize and sorghum. Crop Sci 47:730-734.

Yoneyama K, Xie X, Sekimoto H, Takeuchi Y, Ogasawara S, Akiyama K, et al. 2008. Strigolactones, host recognition signals for root parasitic plants and arbuscular mycorrhizal fungi, from Fabaceae plants. New Phytol 179:484–492.

N2Africa publications

Phenotyping and yield stability studies in soybean (Glycine max (L.) Merrill) under rhizobia inoculation in the savanna region of Nigeria. 2017. PhD thesis by Kehinde Dele Tolorunse

Related newsletters

- Via SeedSystems guest blogging series: How do we scale last mile bean service? Trucks versus AgroVet shops in Tanzania and PABRA reflection on their experience working to connect rural farmers to quality bean seed markets;
- ASHC blog: Soybean Farmers in Nigeria Embrace New Production Technologies;
- GALA blogs: Early lessons from GALA on messages and channel selection and 10 steps to sustainable business models for smallholder farmer market development programs …;
- Soybean Innovaton Lab, Newsletters: August, September, October and November;
- Forages for the Future: Newsletter no. 8.;

Reports and other output uploaded on the N2Africa website

- Stakeholder Consultations Report by Peter Ebanyat, Tamiru Amanu and Connetie Ayesiga;
- MSc thesis Effectiveness of extension methods for scaling up improved common bean technologies among small-scale farmers in Babati district, Tanzania by Amina Mustapha, student within the SILT (Sustainable Intensification of Legume Technology in Tanzania) project with backstopping from N2Africa;
- MA thesis Effectiveness of communication channels and smallholder farmers' adoption of improved legume technologies: a case of Morogoro region, Tanzania by Charles Byalugaba Lugamara, student within the SILT (Sustainable Intensification of Legume Technology in Tanzania) project with backstopping from N2Africa;
- MPhil thesis Farmers' willingness to pay for soyabean production inputs in northern Ghana, by Kwasi Gyan;
- MPhil thesis Farmers' practices in soybean (*Glycine max*) storage and their effects on viability and vigour of seeds by Karim Abdul Rahaman;
- MPhil thesis Evaluation of liming, inoculation and phosphorus fertilizer on yield components and yield of soybean (Glycine max (L.)) Merrill in the Guinea savannah of Ghana by Ibrahim Issifu;
- MSc thesis Response of promiscuous soybean to rhizobial inoculation in combination with organic and mineral fertilizers in some soils of the Nigerian Guinea savanna by Joy Etopobong Ekaette;
- MSc thesis Analysis of cowpea marketing in Biu local government area, Borno State, Nigeria by Maryam Baba Kyari;
- MSc thesis Analysis of market participation by women soybean farmers in Hawul Local Government Area of Borno State, Nigeria by Mohammed Alkali Hauwa;
- MSc thesis Gender based factors influencing farmer participation in marketing of climbing beans (*Phaseolus vulgaris* L.) in Kabale district, south western Uganda by Kule Birengesyo Eriya;
- MPhil thesis Response of common bean (*Phaseolus vulgaris*) to rhizobia inoculation, nitrogen and phosphorus application and residual benefits to maize on smallholder farms in eastern Zimbabwe by Vongai Chekanai;
- MSc thesis The financial sustainability of concrete technology options for grain legumes: An economic evaluation of input adoption by smallholder farmers in Ghana by Mats Hoppenbrouwers;
- Internship report Challenges and coping strategies in the soyabean market chain in Uganda by Mats Hoppenbrouwers;
- MSc thesis Prediction of bush bean (Phaseolus vulgaris L.) yields in northern Tanzania based on spectral analysis of soils by Charlotte Mallet.

Announcement

Feeding a Hungry Planet

How do we ensure a healthy and sustainable diet for our growing world population? How should agriculture adapt – or stay the same – to support the Sustainable Development Goals? The SDG Academy course Feeding a Hungry Planet: Agriculture, Nutrition and Sustainability, relaunching February 11, 2019, on edX, tackles these questions and more. In this course, you will take a deep dive into the agriculture sector, which is at the heart of issues such as food security, malnutrition, ecosystem management, and the responsible production and consumption of food. You'll also explore how food systems, technological advancement in food production, rural development, and more impact the mission of sustainably feeding the billions of people on our planet. Learn more about the course and enroll.

The Podcaster is published six to eight times per year – we look forward to receiving news and contributions – particularly from partners. Please send in contributions well in time. Contact address for this newsletter is: N2Africa.office@wur.nl

Please feel free to forward this email to colleagues you believe would be interested. This email has been sent to you by N2Africa, funded by The Bill & Melinda Gates Foundation.

When you change your e-mail address and want to keep receiving the Podcaster, please send your new address to N2Africa.office@wur.nl. If friends/ colleagues like to receive future Podcasters let N2Africa.office@wur.nl know as well.

If you want to unsubscribe please send a message to n2africa.office@wur.nl