Putting nitrogen fixation to work for smallholder farmers in Africa

N2Africa - www.N2Africa.org

• Funded by the Bill & Melinda Gates Foundation
• Led by Wageningen University; main partners IITA, AGRA, ILRI and many national partners
• Funding US$22M 2009-2013; US$30M - 2014-2019 >90% to partners
• In eleven countries - Ghana, Nigeria, Ethiopia, Tanzania, Uganda, DR Congo, Kenya, Rwanda, Malawi, Mozambique and Zimbabwe

How to increase the inputs from N₂-fixation

• Increase the area of land cropped with legumes (targeting of technologies)
• Increase legume productivity – agronomy and P fertilizer
• Select better legume varieties
• Select better rhizobium strains and inoculate
• Link to markets and create new enterprises to increase demand for legumes

N2Africa – target legumes

West Africa
• Cowpea, groundnut, soyabean

East & Central Africa
• Common bean, groundnut, soyabean, cowpea plus chickpea and faba bean in Ethiopia

Southern Africa
• Common bean, groundnut, soyabean, cowpea

N.B. Soil fertility improvement is a secondary goal – farmers have consistently rejected green manures, cover crops and fertilizer trees

Genotype x Environment x Management

\[ (G_L \times G_R) \times E \times M \]

Where:
- \( G_L \) = legume genotype
- \( G_R \) = rhizobial strain
- \( E \) = environment
  - climate (temperature x rainfall x daylength etc) - to encompass length of growing season etc
  - soils (nutrient limitations, acidity and toxicities)
- \( M \) = management
  - agronomy – inoculation, seeding rates, plant density (row spacing etc), weeding,
  - Diseases and pests are also a function of G x E x M...

N2Africa is a development to research project

• Delivery and dissemination are the core
• Monitoring & evaluation provides the learning
• Research analyses and feeds back
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**Overall research question**

What works where, why, when, for whom?

- **Country**
- **Region**
- **Farming System**
- **Farm (household)**
- **Field**

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**Rwanda and DRC Mandate Areas: Length of Growing Period**

**Rwanda and DRC Action Sites: Development Domains**

**A ‘demonstration’ trial or farmer try-out**

- Soybean, no inputs
- Soybean, + P
- Soybean, + inoculation
- Soybean, + P + inoculation
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Effect of P-fertilizer and/or Inoculant on soybean grain yield (t ha⁻¹) in Nigeria, 2011 and 2012

Response to inoculum and P

Cumulative probability of soybean grain yield (t ha⁻¹) in Nigeria, 2011 and 2012

Non-responsive soils

Double pot experiments - Nigeria

Prospective - Mg - P - micronutrients control

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Cumulative probability of absolute increase (t ha\(^{-1}\)) in soybean grain yield compared to control in Nigeria, 2011 and 2012

Cumulative probability of relative increase (%) in soybean grain yield compared to control in Nigeria, 2011 and 2012

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Cumulative probability of economic return to use of inputs in soybean (USD ha\(^{-1}\)) in Nigeria, 2011 and 2012

Response to P and inoculation with soybean in Kenya

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When yield gaps are poverty traps...

“Our analysis suggests that smallholder farmers are unable to benefit from the current yield gains offered by plant genetic improvement”


N2Africa focuses on closing (legume) yield gaps and enhancing agricultural productivity at farm scale

Large scale dissemination of legume technologies to 225,000 farmers

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Reaching female farmers….

Zimbabwe 2011-12 season:
- Input distribution: almost 62% women
- Lead Farmers: almost 47% women
- 17 Field Days, total 3546 people participating: 58% women
- Training records of 614 participants: 46% women
- Training Value addition/home processing: almost 100% women

Land area per household member

Available farm land (ha) per household member
Food self-sufficiency and land gaps – where will a value chains approach work?

Short-duration cowpea in West Africa

• Yields during hunger period
• Allows two crops within the season

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Improving food self-sufficiency – climbing beans in DRC

Long rains season 2010 in Sud Kivu, DRC

Development to research and adaptation

• Development through D&D at scale is the core
• M&E provides the learning
• Research analyses and feeds back
• Farmers adapt and adopt

D&D = Dissemination and delivery
M&E = Monitoring and Evaluation

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Some advances and surprises

- Accumulating evidence for need for inoculation of common bean, groundnut, cowpea
- Residual benefits of legumes much larger than can be explained through N alone (e.g. *Striga* control)
- Farmer preferences for varieties driven largely by taste, cooking time and market opportunities
- Working through public-private partnerships (PPPs) is starting to pay off...

Conclusions

- Good ($G_L \times G_R \times E$) needed – but $M$ overrides
- $N_2$-fixing grain legumes flexible and ‘best fits’ available for all farmers – rich and poor
- N2Africa moving from supporting to enabling role
- Enhanced role of strategic public and private partners
- Focus on continuous learning and improvement
- We have built a great network and collaboration
- It’s time to put legume nitrogen fixation to work in African agriculture

For updates

www.N2Africa.org

Lots of video resource materials

N2Africa Podcaster - Monthly Newsletter