



# Charting Pathways

←

## ANNUAL REPORT 2021





## Mission and Vision

**Vision:** Prosperous African farmers sustainably managing crop nutrition to provide consumers with a secure supply of nutritious foods at a reasonable price.

**Mission:** Enhanced plant nutrition for a resilient and food-secure Africa.

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# Foreword

I am delighted to introduce the second edition of the African Plant Nutrition Institute's (APNI) annual report. Duly entitled **Charting Pathways**, this year's report takes us on an eye-opening journey in discovery of the various challenges, trends and potential of African agriculture. For those of us with a keen interest in the subject, APNI's reporting is always a source of new learning.

There is something to be said about APNI's continuous growth as a scientific center, and what it means for a community of researchers working tirelessly to revamp Africa's agriculture.

2021 was a particularly fruitful year for APNI not only in terms of its intellectual production, but also of its outreach capacity. After only two years of existence, the numbers speak for themselves: 36 scientific publications, a presence in 11 countries, 14,682 in-field trials, 17 fellowships granted and 120 collaborative R&D partners.

Other than these impressive numbers, it is also the diversity of APNI's partners that is inspiring. They now include entities from academia, international organizations, government agencies and industry, proving once again that the future of our continent's agriculture is the business of everyone.

Speaking of which, the stakes involved in African agriculture themselves appear to be in continuous evolution. If international milestones like the UN Food Systems Summit and COP26 are any indication, the intersectionality of the sector is today a *fait accompli*.

In the context of Africa, one cannot possibly tackle agriculture without considering climate & weather, soil health, nutrient management, smallholder farmers, economic imbalance or gender equality. Such is the nature of sustainability nowadays: its manifestations do not stop in soils, plants or fields but extend far beyond that to livelihoods, communities and social ties themselves. Resilient agriculture leads to resilient ecosystems and vice-versa.

Throughout its sections, APNI's 2021 annual report has demonstrated exactly that: the ability to trigger thought leadership on the critical challenges of African agriculture.



In facing such challenges, science is without a doubt the silver bullet. All of science, from all specialties. The makeup of APNI's family is the best proof of that: be they agronomists, economists, data scientists, sustainability experts or communications professionals, the dedicated experts of APNI are driving synergy in their problem-solving approach. In doing so, they are inspiring us all to continue investing our drive, energy and intellect for a more productive, sustainable agriculture in Africa.

Happy reading!

Hicham El Habti, APNI Board Chair

# Message from the Director General

APNI completed its second full year of operation in 2021, albeit under a fading COVID-19 cloud that bounced between relief and resurgence. Our report's theme **"Charting Pathways"** marks significant accomplishments achieved in 2021, and reinforces the fundamental importance of efficient and effective plant nutrient management to food and nutrition security, improved land performance, rural prosperity, and overall agricultural development in Africa.

Our activities focused on constraints and inherent variabilities faced by small farms of Africa, and sought solutions guided by accepted principles of 4R Nutrient Stewardship and Integrated Soil Fertility Management. We filled critical capacity gaps within the Institute to better integrate socio-economic aspects into our plant nutrition solutions, strengthen our sustainability and evidence-based initiatives, and communicate better with peers and stakeholders.

On the research front, an extensive network of on-farm experiments generated valuable insights on crop responses to nutrients in Africa. We are actively working with partners to streamline data management to be fully FAIR compliant. Fresh funding from donors helped us focus on two new research areas: 1) how access to farm inputs, good agronomic practices and digital extension can help farming communities rebound from COVID-19 disruptions; and 2) better benchmarking of agricultural sustainability trajectories in Morocco, Ghana, and Kenya.

The African Tree Crop Systems (ATCS) program is another exciting development within our research portfolio. Tree crops are major contributors to livelihood and environmental outcomes in Africa. However, much needs to be learned about how plant nutrition can improve tree crop performance. Novel research on high-priority tree crops provides APNI with the opportunity to develop the transferable knowledge, principles, and practices needed to optimize the benefits from better nutrient management.

Our capacity building and outreach efforts fostered deeper engagement with Mohammed VI Polytechnic

University (UM6P) through classroom teaching, coordination of a new Masters' course on Precision Agriculture, and supporting internships and doctoral programs. With UM6P, we continued recognizing exceptional African graduate students and mid-career researchers who are making outstanding contributions in responsible plant nutrient management in Africa.

The newly instituted African Plant Nutrition Research Fund selected its inaugural recipients through a rigorous competitive process. With a strong focus on tangible economic, social, and environmental outcomes, these research projects will look at improving the performance of key crops through innovative plant nutrition, synergizing the capacity of multiple institutions. With such strategic funding on core research areas, we expect to broaden our understanding and fill crucial knowledge gaps that often restrict the performance of African food production systems.

We strongly value our relation with the global fertilizer industry. Their support in assessing nutrient performances in the diverse ecologies are pivotal for our efforts on precise nutrient management in the major crops of Africa. In 2021, APNI partnered with the International Fertilizer Association (IFA) and the Consultative Group on International Agricultural Research (CGIAR) to establish the Consortium for Precision Crop Nutrition (CPCN) for enhanced collaboration and data sharing between international and national research programs and the industry, and facilitate innovations on data-driven precise crop nutrition solutions.

The last two years have revealed the fragility of the global food system that ebbed under the pandemic, bringing millions of people back to acute crisis in Africa and elsewhere. This time has also underscored the need for continued investment in agricultural research and better synergy in our efforts to prepare for future disruptions, be it from climate, soil degradation, or from pandemic diseases. Plant nutrition was, and



remains, the central pivot of global food and nutrition security, and APNI remains committed to the optimism of a hunger free world.

**Charting Pathways** chronicles the resilience of our staff, our partners and collaborators, and our donors for their unwavering conviction to the catalytic role of crop nutrition for a better tomorrow. Our Scientific Advisory Committee has been steadfast in their constructive role to guide our research and outreach programs. The APNI Board of Directors, and the Board Chair and President Mr. Hicham El Habti, are ever supportive in their role to nurture this young institution. I am personally thankful for such overwhelming support that keeps us on track to achieve our strategic goals.

**Dr. Kaushik Majumdar**  
Director General



# Our Organization: 2021



## BOARD OF DIRECTORS

President & Board Chair  
**Mr. Hicham El Habti**

## DIRECTOR GENERAL

**Dr. Kaushik Majumdar**

## SCIENTIFIC ADVISORY COMMITTEE

**Ms. Fatiha Charradi**, Vice President Farming Development, OCP Group

**Dr. Simon Cook**, Professor, Curtin and Murdoch Universities

**Dr. Achim Dobermann**, Chief Scientist, International Fertilizer Association

**Dr. Ken Giller**, Professor of Plant Production Systems, Wageningen University

**Ms. Lucy Muchoki**, Chief Executive Officer, Pan African Agribusiness & Agroindustry Consortium

**Dr. Michael Wironen**, Senior Scientist, The Nature Conservancy's Center for Sustainability Science

## DIRECTOR OF OPERATIONS

**Mr. Steve Couch**

## OPERATIONAL SUPPORT

**Ms. Ann Odera**, Operations Manager

**Mr. Mohammed Saddiki**, Administration Officer

**Mr. Mourad Elattoubi**, Accounting Clerk

## COMMUNICATIONS

**Mr. Gavin Sulewski**, Communications Lead & Editor

**Ms. Yousra Moujtahid**, Communications Specialist

## DIRECTOR OF RESEARCH & DEVELOPMENT

**Dr. Shamie Zingore**

## DIRECTOR OF BUSINESS & PARTNERSHIPS

**Dr. Thomas Oberthür**

## PRINCIPAL & SENIOR SCIENTISTS

**Dr. Pauline Chivenge**, Principal Scientist

**Dr. T. Scott Murrell**, Principal Scientist

**Dr. Steve Phillips**, Principal Scientist

**Dr. Mohammed El Gharous**, Senior Consulting Scientist

**Dr. James Mutegi**, Senior Program Manager

## SCIENTISTS, PROGRAM MANAGERS & COORDINATORS

**Dr. Ivan Adolwa**, Farming Systems Scientist

**Dr. Pricilla Marimo**, Socio-economist

**Dr. Thérèse Agneroh**, Program Manager

**Dr. Hakim Boulal**, Program Manager

**Dr. Koukou Amouzou**, Program Coordinator

**Dr. Samuel Njoroge**, Program Coordinator

## AGRONOMIC & RESEARCH SUPPORT

**Mr. Mahdi Dahane**, Agronomist

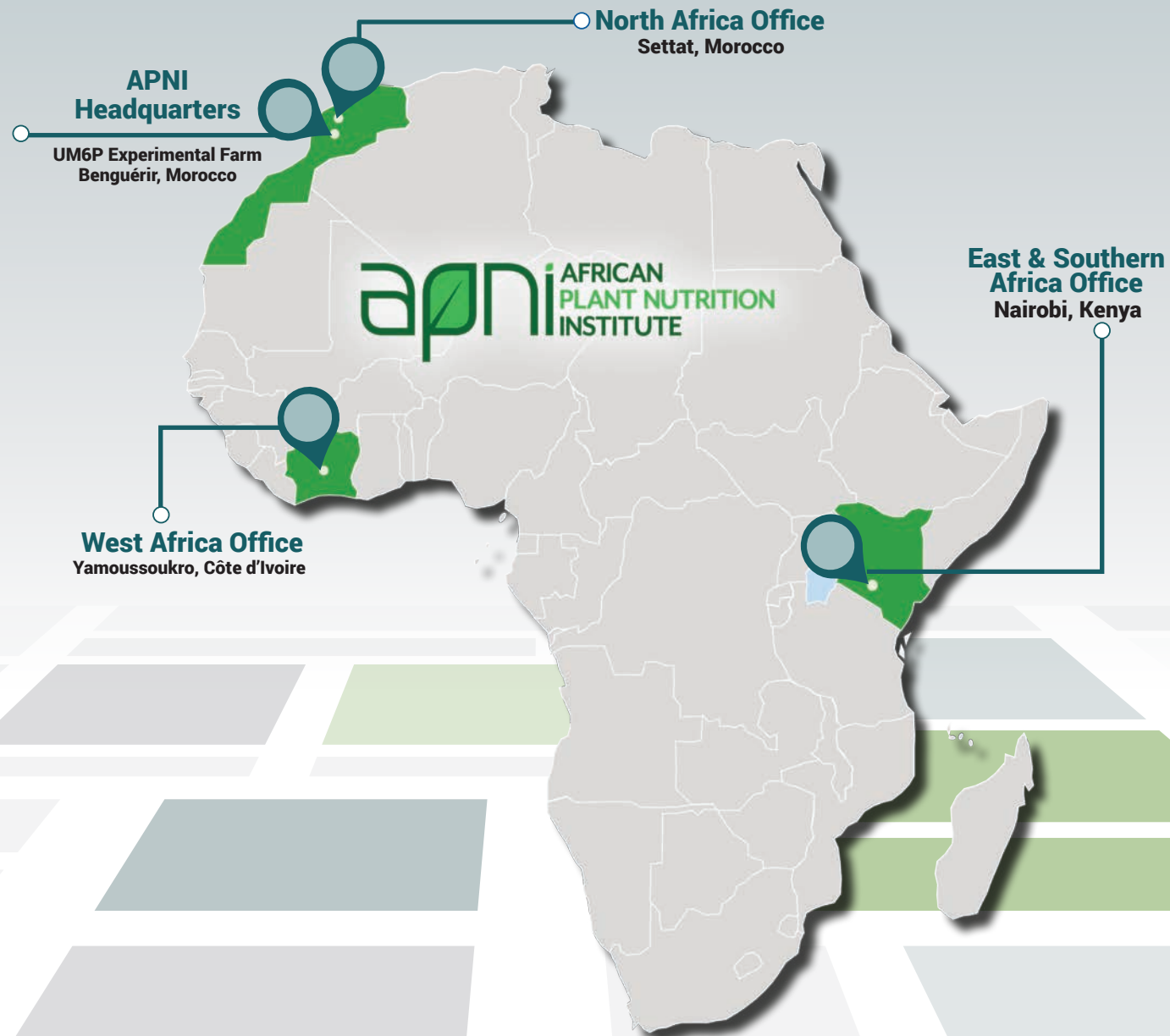
**Mr. Joses Muthamia**, Agronomist

**Ms. Angela Gitonga**, Research Assistant

**Ms. Esther Mugi**, Research Assistant



# Headquarters & Satellite Offices



# Administration & Lead Scientists

## APNI Headquarters

UM6P Experimental Farm  
Benguérir, Morocco



**Dr. Kaushik Majumdar**

Director General  
k.kajumdar@apni.net

### SPECIALTIES

Soil mineralogy, Nutrient budgets,  
Scale-appropriate fertilizer  
recommendations



**Mr. Steve Couch**

Director of Operations  
s.couch@apni.net

### SPECIALTIES

Finance, Accounting, HR,  
non-profit management,  
Logistics



**Dr. Thomas Oberthür**

Director of Business & Partnerships  
t.oberthur@apni.net

### SPECIALTIES

Nutrition of perennial crops,  
Value-chain support with  
market-driven research



**Dr. Shamie Zingore**

Director of Research & Development  
s.zingore@apni.net

### SPECIALTIES

Soil fertility & nutrient management,  
Farming systems analysis



**Dr. Mohammed El Gharous**

Senior Consulting Scientist  
m.elgharous@apni.net

### SPECIALTIES

Soil & plant analysis, Cropping  
systems, Long-term research trials,  
soil & water conservation



**Dr. Pauline Chivenge**

Principal Scientist  
p.chivenge@apni.net

### SPECIALTIES

Soil & nutrient management,  
Carbon sequestration



**Dr. T. Scott Murrell**

Principal Scientist  
s.murrell@apni.net

### SPECIALTIES

Strategic analysis of multi-  
disciplinary scientific evidence



**Dr. Steve Phillips**

Principal Scientist  
s.phillips@apni.net

### SPECIALTIES

Precision nutrient management,  
Adapting scale-appropriate fertilizer  
technology on farms



**Dr. Pricilla Marimo**

Socio-economist  
p.marimo@apni.net

### SPECIALTIES

Socio-economic research, Gender  
analysis, Agricultural technology  
adoption, Behavioral economics

Settat, Morocco

Benguérir, Morocco

Nairobi, Kenya

Yamoussoukro,  
Côte d'Ivoire

## North Africa Office

Settat, Morocco



**Dr. Hakim Boulal**

Program Manager  
h.boulal@apni.net

### SPECIALTIES

Conservation agriculture in dryland  
conditions, Annual & orchard crops



**Dr. James Mutegi**

Senior Program Manager  
j.mutegi@apni.net

### SPECIALTIES

Managing ecosystem nutrient  
balances, Environmental impacts



**Dr. Ivan Adolwa**

Farming Systems Scientist  
i.adolwa@apni.net

### SPECIALTIES

Soil fertility management,  
Agricultural technology adoption  
& scaling research



**Dr. Samuel Njoroge**

Program Coordinator  
s.njoroge@apni.net

### SPECIALTIES

Analysis of yield response  
patterns, Development of  
decision support tools

## East & Southern Africa Office

Nairobi, Kenya

## West Africa Office

Yamoussoukro, Côte d'Ivoire



**Dr. Thérèse Agneroh**

Program Manager  
t.agneroh@apni.net

### SPECIALTIES

Phytopathology &  
crop nutrition



**Dr. Koukou Amouzou**

Program Coordinator  
k.amouzou@apni.net

### SPECIALTIES

Implementing on-farm  
nutrient technology,  
Climate change adaptation



# Key Achievements - 2021



**11**

Countries we  
work in



**14,682**

In-field trials



**362**

On-farm trainings



**120**

Collaborative R&D  
partners



**36**

Scientific  
publications



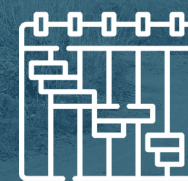
**36**

Scientific  
presentations



**17**

Awards granted



**15**

On-going research  
projects

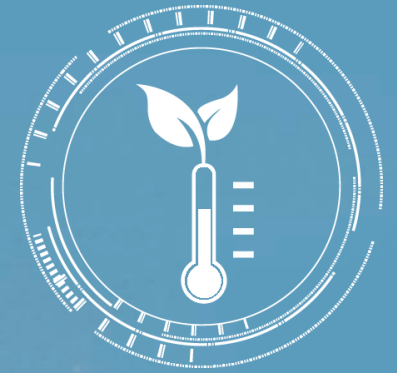


**8**

New research  
proposals



# Climate & Weather-Smart Plant Nutrition



## OUR PRIORITIES

- 1 Increased water productivity
- 2 GHG emission mitigation
- 3 Crop diversification

## OUR METHODS



- Identify regional opportunities
- Develop partnerships
- Engage & innovate via collaborative R4D
- Implement pilot projects

## ANTICIPATED OUTCOMES

Diversified knowledge in local cropping systems

On-farm solutions to managing changing weather

Reduced water scarcity

Economic stability

Food & nutritional security

Halting of desertification

Improved livelihoods

Long term resilience to climate change

Growth in C sequestration farming systems

Biodiversity preservation

Viable, carbon-positive agroforestry & permanent cropping systems

## FIELD SCALE BENEFITS



- Increased carbon sequestration
- Enhanced nutrient cycling
- Reduced soil degradation
- Increased water productivity (more crop per drop)
- Better nutrient use efficiency
- Yield stability





# Climate and Weather - Smart Plant Nutrition

Our Climate and Weather-Smart Plant Nutrition theme explores the main challenges for African agriculture as it adjusts to climate change. Activities are focused on how innovations within the plant nutrition domain can mitigate the impacts of increasing water scarcity, promote technologies for carbon sequestration, and improve crop diversification. Whether the consequences of slowly changing climate trends, or the more frequent weather extremes, this theme's activities are aimed at generating local adaptation strategies for farmers through improved plant nutrition practices suited to managing these adverse conditions.

## Enhancing the Resilience of Smallholder Farms in North and West Africa through Upgrading of Women-Managed Dairy Value Chains

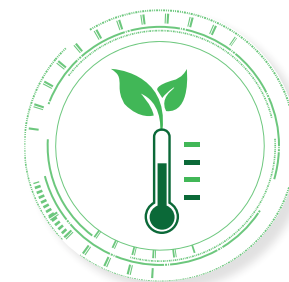
The overall goal of the project is to address the problem of vulnerability of family farms to global and local forces of climate change, land degradation, economic power imbalance, market shocks, and the exclusion of rural women from participating in the development of more resilient local solutions to these problems. The project aims to upgrade dairy value chains with commercial, social or institutional interventions that can generate additional smallholder income, especially for women.

### Key Achievements

- The project set up an incubator comprised of international experts and APNI scientists to support, advise and guide the developmental

processes and research results. The implementing partners - R&D Maroc in Morocco and IED Afrique in Senegal - set up relevant national-level partnerships to support the project activities.

- R&D Maroc and IED Afrique conducted pre-diagnostic and diagnostic studies in the Rehamna and Ferlo regions to understand the background of the goat milk and cow milk value chains, respectively.
- Stakeholder workshops were conducted in Morocco (December 2021) and in Senegal (February 2022) to: assess project progress so far, and validate constraints and opportunities for upgrading the value chains. This work will help prioritize three or four short-term (women) farmer-centric interventions needed for producing a Proof of Concept.



### Time Frame

2020-2022

Proof of concept phase

### Regions

Morocco and Senegal

### Targets

Mixed cereal-legume-forage livestock systems

Women livestock farmers (cattle in Senegal; goats in Morocco)

### Local Partners

National stakeholders including NGOs, local cooperatives, extension agencies, Ministry of Agriculture, Universities, National Agricultural Research Systems

### Implementing Partners

R&D Maroc  
IED Afrique (Senegal)



### Financial Partner

International Development Research Centre (IDRC)



Learn more at: <https://apni.net/project/dairy-shcs-01>



# Soil Health & Improved Livelihoods



## OUR PRIORITIES



- Better soil, human, animal & environmental health outcomes
- Integrated soil fertility management within Africa's food systems
- Integrated crop-livestock systems
- Sustainable food production

## OUR METHODS



- Generate data, review and document
- Harmonize knowledge through partnership
- Focus on soil health-driven, high quality plant products
- Disseminate for adoption & evidence-based decision-making

## FIELD SCALE BENEFITS



- Enhanced soil health
- Improved nutrient recycling & retention
- Higher value, more nutritious & marketable crop products



- Reduced land degradation
- Better nutrient use efficiency

## ANTICIPATED OUTCOMES

Tested agronomic solutions for mitigating plant nutrient-driven environmental degradation

Healthier ecosystems

Economic stability

Food & nutritional security

Improved livelihoods

Better functioning, more vibrant communities

Growth in C sequestration farming systems

Biodiversity preservation





# Soil Health for Improved Livelihoods

Our Soil Health for Improved Livelihoods (SHIL) theme links the dynamics of improved soil biology, chemistry and soil physical properties to the enhancement of crop yield and quality, and the “one health” concept of concerted improvement in human, animal and environmental health. SHIL activities will take center stage in developing knowledge on the role of plant nutrition in food security, livelihoods and environmental sustainability, and in building a broad base of partnerships designed to enable APNI's contribution to food system and one health initiatives.

## Mitigating COVID-19 Impact on Food Security in Kenya

COVID-19 disruption affected farmers access to quality fertilizer and seeds, predisposing millions of smallholder Africa farmers to food insecurity. The COVID-19 mitigation project was developed by APNI with an overarching aim of supporting the most vulnerable farmers in their efforts to sustain good availability of quality food during, and beyond, the pandemic.

### Objectives

- 1 Increased resilience of smallholder farmers to COVID-19 disruptions by facilitating access to farm inputs, information on good agronomic practices and digital extension services.
- 2 Improved food and nutrition security amongst the vulnerable communities through promotion of the integration of legumes and vegetables into local cropping systems.

- 3 Use of this COVID-19 case to improve our understanding of the effects of disruption on food security, and identify the most important interventions for building resilience amongst vulnerable farmers.

### Key Achievements

- Our COVID mitigation survey tool aided the assessment of the extent of COVID-19 disruption on the food supply in Kenya.
- This project supported 14,118 farmers from 15 sub-counties of Siaya, Bungoma, Kakamega and Makueni with seeds, fertilizers, and good agronomic practices.
- 30 t of seeds including maize, legumes and vegetables were distributed while agronomic advisory services were provided at planting, top dressing, harvesting and post-harvest.



APNI distributed 30 t of certified seeds to over 14,000 vulnerable farmers in 4 Counties in Kenya for COVID-19 impact mitigation.



### Time Frame

2021-2022

### Regions

Kenya

### Targets

Maize, Beans, Green gram, and Vegetable cropping

+14,000 farmers in Makueni, Siaya, Bungoma and Kakamega Counties

### Local Partners

County Governments of Makueni, Siaya, Bungoma and Kakamega

### Co-implementing Partners

Kenya Agricultural & Livestock Research Organization (KALRO)

AGRA



### Financial Partner

USAID via AGRA



Learn more at: <https://www.apni.net/project/ky-sh-01/>



# Improved Livelihoods



*Farmer's field visits allow an opportunity for APNI Staff, AGRA officials, and County Government Staff to interact with farmers.*



*Dr. James Mutegi explains to farmers how to identify plant nutrient deficiencies.*



*Ms. Angela Gitonga showing harvested Nyota variety beans that are rich in iron and zinc, possess a three-fold market value advantage relative to other bean varieties, and are capable of transforming farmers' lives.*



*APNI and a section of County Government officials distribute seeds to vulnerable farmers. County governments supported APNI in the Identification of the beneficiaries.*



# Improved Livelihoods

LEARN MORE AT:



**“ The 7 t of certified Nyota bean seeds distributed to our farmers increased bean availability by 14 to 20 t.”**

**- COUNTY MINISTER FOR AGRICULTURE OF BUNGOMA -**



**Most smallholder farmers manually harvest, thresh and winnow their beans and green grams.**

## More SHIL Initiatives

**Strengthening Availability, Dissemination and Use of Effective Fertilizers Among the Smallholder Farmers in Kenya**

<https://apni.net/project/kenya-smallholders>

**Assessment of Micronutrient Deficiencies for the Main Crops in Morocco**

<https://apni.net/project/morocco-micronutrients>

**SAM Consortium: Guiding the Pursuit for Sustainability by Co-developing a Sustainable Agriculture Matrix**

<https://apni.net/project/sam-sh-01>





## Time Frame

2021-2024

Implementation  
phase

## Target Crops and Countries

Olives and Date palm -  
North Africa

Climate Adaptation  
Catalysts including Argan  
and Carob - North Africa

Cocoa - West Africa

Coffee - East Africa

## Collaborators

Universities, National  
Agricultural Research  
Systems, Tree crop  
producers' networks,  
Private sector



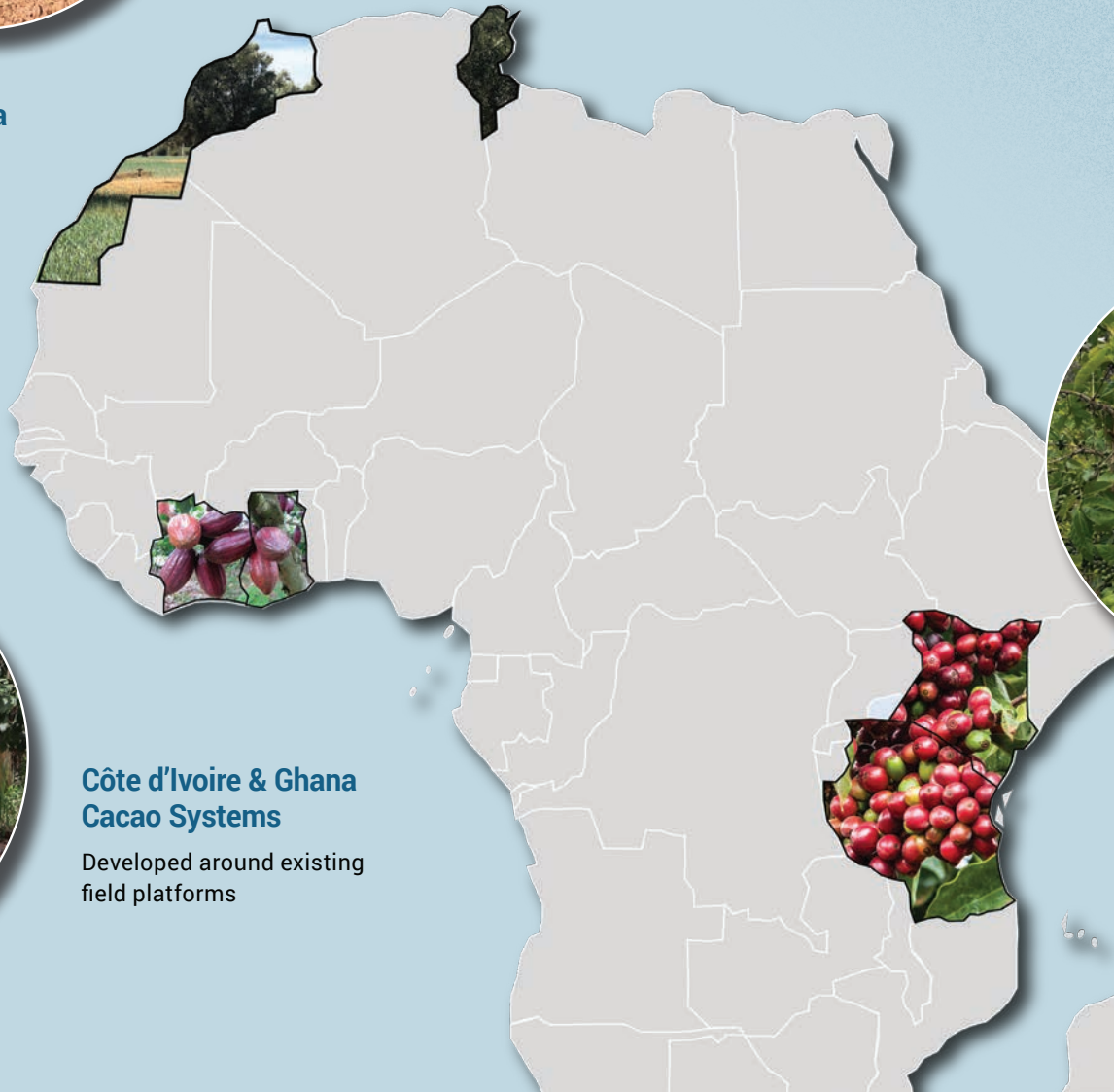
# African Tree Crop Systems Program

This initiative is implementing research to clarify how good agricultural management, and in particular crop nutrition, can support the ability of smallholders to create value and realize environmental benefits from tree crop systems. Tree crops are noteworthy in their contribution to the economic growth in Africa through key ecosystem services of food, feed, fuel woods, and fiber production, and through their contribution to the livelihood security of African communities. Satisfying the growing demand for tree crop commodities without compromising the environment, requires solutions for sustainable nutrient management.

## Morocco & Tunisia Olive & Date Palm Systems

### Argan & Carob

Developed around  
existing field  
platforms



## Côte d'Ivoire & Ghana Cacao Systems

Developed around existing  
field platforms



## Kenya & Uganda Coffee Systems

Developed around  
new partnerships



## Key Achievements

- Evidence gathering on key research questions concerning: 1) nutrient management interventions on tree crop yield and quality responses, 2) tree growth and nutrient uptake and efficiency, 3) biomass and carbon sequestration.
- A series of farmer diagnostic surveys were conducted across target agro-ecological zones and cropping systems to assess tree crop contributions to local livelihoods.
- Field and data missions were developed to assess the impacts of nutrient management on tree crops yield and product quality responses, and associated nutrient uptake and removal.
- Strategic dialogues with key partners were started in Ghana, Morocco, and Tunisia to gain feedback on the program design, priorities, and target agro-ecological zones; as well as conceptual knowledge platforms, and work packages.



*Dr. Hakim Boulal (far left) and Dr. Kokou Amouzou (far right) meeting with INRA Marrakech to explore R&D needs and opportunities at the interface of germplasm, nutrient and water management in olive and date palm orchards in Morocco.*



## UM6P Students Supported by African Tree Crop Systems Program

The core ATCP team engaged three first-year M.Sc. Students from Mohammed VI Polytechnic University (UM6P) to initiate collaborative literature reviews and field and data research missions.



*Left to right: Mr. Aboubacar MARIKO, Mr. Mouddan ZIYAD, Mr. Reda MOKERE, 1st year M.Sc. students from UM6P.*

Learn more at: <https://apni.net/project/ATCP>



# Precision Nutrient Management



## OUR PRIORITIES



- Identify environmental, economic & social drivers for precise nutrient use
- Establish, evaluate & update best agronomic practices
- Scale delivery of field-specific decision support

## OUR METHODS



- On-farm experimentation & farmer engagement
- Researcher-led trial & benchmarking networks
- Engage geospatial, remote sensing & climate modelling methods

## FIELD SCALE BENEFITS



- More tailored fertilizer recommendations
- Less risky decision-making for fertilizer use
- More equitable access to the agricultural advice & support



- Balanced soil nutrient budgets
- Better nutrient use efficiency
- Higher, less variable yields

## ANTICIPATED OUTCOMES

Farmer-centric & farmer-led on-farm experimentation

More knowledge on crop nutrient requirements

Smaller yield gaps

Economic stability

Food & nutritional security

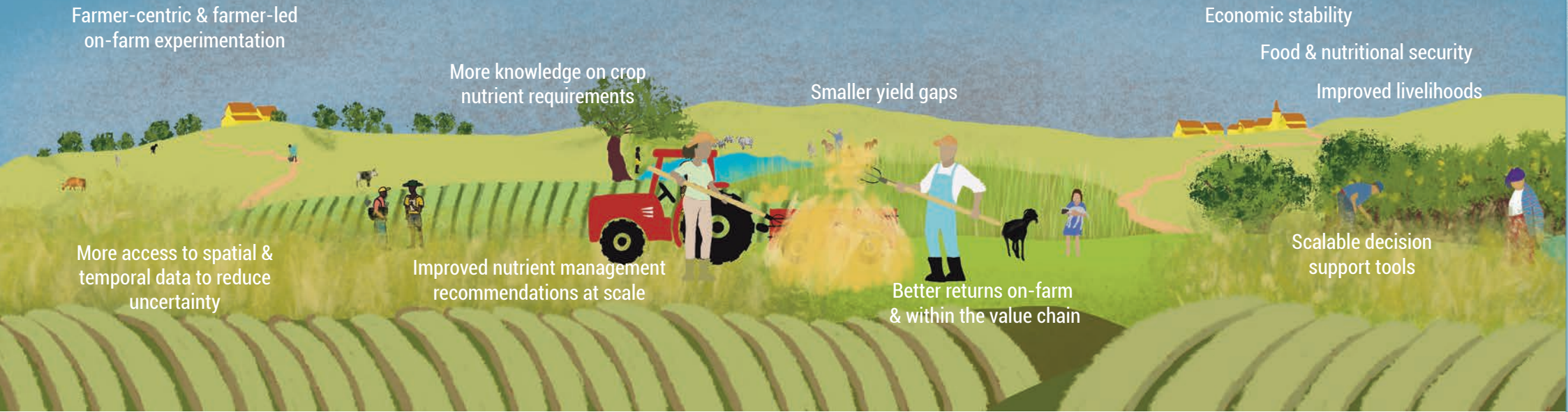
Improved livelihoods

More access to spatial & temporal data to reduce uncertainty

Improved nutrient management recommendations at scale

Better returns on-farm & within the value chain

Scalable decision support tools





# Precision Nutrient Management

Our Precision Nutrient Management (PNM) theme delivers improved nutrient management recommendations at scale. Improved recommendations are developed according to the principles of 4R Nutrient Stewardship, which guide applications of the right nutrient source at the right rate, right time, and in the right place. The PNM thematic framework is foundationally established on the three main platforms: 1) on-farm experimentation, 2) researcher-led and benchmarking trial networks, and 3) use of geospatial, remote sensing, and climate data. Activities will develop concepts and trial solutions, but will also develop platforms that facilitate the operationalization of programs developed through the Soil Health for Improved Livelihoods and Climate and Weather-Smart Plant Nutrition themes.

*Dr. Samuel Njoroge inspects wheat and teff 4R validation trials in Ethiopia.*



## 4R Nutrient Solution Project

The project seeks to improve the socio-economic wellbeing and resilience of 80,000 smallholder farmers, particularly women in Ethiopia, Ghana and Senegal by improving crop productivity and farm income through incorporation of 4R Nutrient Stewardship practices into fertilizer management while incorporating important gender and environmental resilience strategies.

### Key Achievements

- Developed a customized 4R training handbook for extension agents and farmers in Africa.

- Launched an online 4R extension agent's certification course.
- Established on-station 4R validation trials in Ghana and Ethiopia that will allow for detailed quantification of the yield, income, and environmental benefits of applying 4R practices in maize cropping systems in Ghana and wheat and teff cropping systems in Ethiopia.
- Established on-station 4R adaptation cropping systems trials that will evaluate options for adapting 4R practices to local cropping systems in Ghana and Ethiopia.

**Learn more at:** <https://apni.net/project/4r-solution>



*Engagement between 4R project implementing partners and farmers hosting on-farm teff 4R nutrient omission trials in Ethiopia.*



*Drs. Shamie Zingore (left) and Ivan Adolwa (right) inspect 4R nutrient omission teff trials.*



### Time Frame

2019-2024

### Regions and Crops

Ghana: Maize, Rice, Groundnut, Soybean  
Ethiopia: Wheat, Teff, Chickpea  
Senegal: Maize, Rice, Groundnut

### Local Implementing Partners

Savanna Agricultural Research Institute (SARI)  
Ethio-Wetlands and Natural Resources Association (EWNRA)  
Amhara Region Agricultural Research Institute (ARARI)  
ONG 7a  
Senegal Institute of Agricultural Research (ISRA)

### Co-implementing Partners







## MANUEL DE CONCEPT 4R DE LA GESTION DES ELEMENTS NUTRITIFS

MODULES D'APPRENTISSAGE  
POUR AGENTS DE VULGARISATION



apni  
INSTITUT AFRICAIN DE  
NUTRITION DES  
PLANTES



## Online Learning

A new short course offered in English and French focuses on best nutrient management in Africa that are consistent with the principles and practices of 4R Nutrient Stewardship. A certificate acknowledging the completion of this course is available for all who enroll.

Learn more at: <https://apni.net/e-learning/>



## Certificate of Achievement

PRESENTED TO



In recognition of their completion of the e-Learning course

### 4R Nutrient Stewardship for Africa

DATE

apni  
AFRICAN  
PLANT NUTRITION  
INSTITUTE



*[Signature]*

Dr. Kaushik Majumdar, Director General  
African Plant Nutrition Institute



## Consortium for Precision Crop Nutrition

The Consortium for Precision Crop Nutrition (CPCN) was established in 2021 to co-create common data, standards and resources that enable its members to develop, validate and disseminate their own customized nutrient management solutions.

Building on many previous research and extension activities, CPCN aims to join up R&D efforts and data from international and national research programs and better link them to industry stakeholders.

- Members from any public or private sector organizations are encouraged to contribute relevant data and expertise to the overall platform.
- Members may also engage in bilateral or multi-lateral projects with each other.
- CPCN interacts closely with other global or regional initiatives on data and digital tools for agriculture.

### Key Achievements

- Dr. Pauline Chivenge, APNI Principal Scientist, was appointed CPCN coordinator.
- CPCN identity and website was established.
- Committees were established to oversee activities, data policy and management guidelines.
- Bi-weekly seminar series held 26 recorded events during 2021.

### Ongoing Initiatives

#### Global Crop Nutrient Removal Database

- A resource needed to improve estimates of nutrient removal, nutrient use efficiency, and

to develop site-specific recommendations and decision support systems for optimal nutrient management.

#### Standardized Nutrient Omission Trial Data

- A resource needed to develop site-specific recommendations, decision support systems, and support the benchmarking of key yield and nutrient performance parameters such as attainable yields, yield gaps, and agronomic nutrient use efficiencies.

**Learn more at:** <http://precisioncroppnutrition.net/>



#### Co-implementing Partners



*APNI is an implementing CPCN partner and Dr. Pauline Chivenge coordinates the consortium's activities.*

**“CPCN focuses on working together on data-driven crop nutrition solutions for small- to medium-size farms in low- and middle-income countries, with a particular emphasis on Africa and Asia.”**



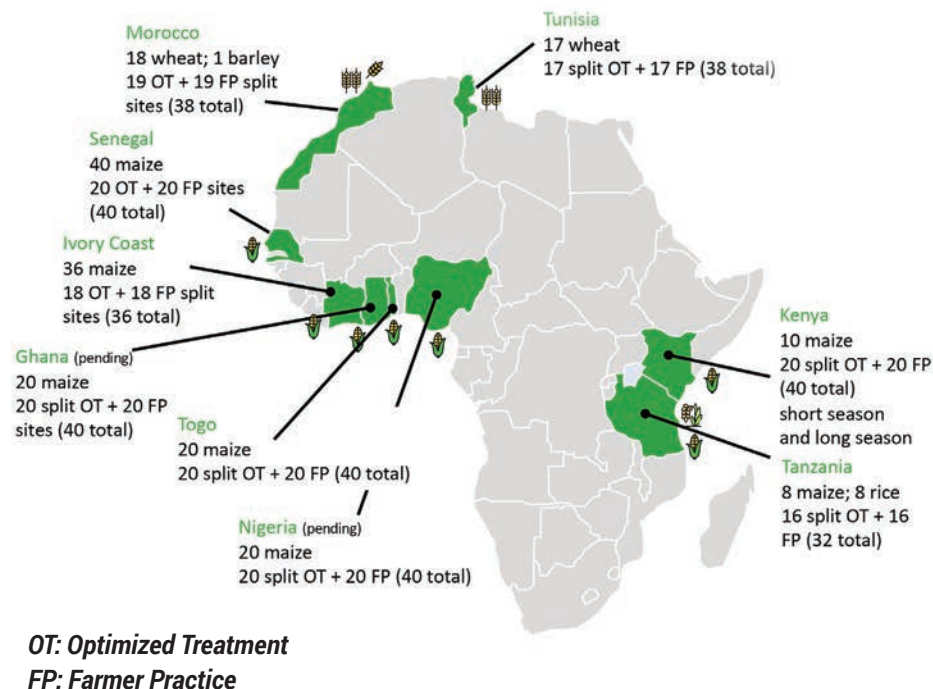
# Nutrient-Catalyzed Agricultural Transformation for Africa (NUTCAT)

NUTCAT is focused on growing a network of on-farm learning forums, and developing scalable decision support tools to enable good decision-making in smallholder fields. The NUTCAT project is built around a suite of farmer-centric and farm-scale research and training programs focused on the adoption of precision nutrient management in Africa. Structured as a network of smallholder farm-scale plots 2 ha, or less, in size, NUCAT experiments make a simple comparison between an Optimized treatment (OT) and Farmer practice (FP). APNI scientists partner with local in-country teams of cropping system experts to define what comprises a regional OT. Strategic multi-stakeholder partnerships ensure effective engagement with farmers.

## Key Achievements

- Three-growing season testing cycles established for cereal cropping systems (i.e., maize, wheat, barley, and rice) across 340 locations in seven countries. Further NUTCAT sites are pending for Nigeria and Ghana.
- Standard protocols deployed for collecting high quality, site-specific maize yield data in West Africa.
- Deployment of a survey tool for collecting farmer perceptions of within-field variability in West Africa.

## NUTCAT Field Plot Sites



## Time Frame

2021 – TBD

## Target Crops

Wheat, Barley, Rice

## In-Country Partners

### Morocco

Ecole Nationale d'Agriculture de Meknès

### Senegal

Senegalese Agricultural Research Institute (ISRA)

### Tunisia

Institut National des Grandes Cultures (INGC)

### Ivory Coast

National Polytechnic Institute Félix Houphouët-Boigny (INP-HB) of Yamoussoukro  
National Agency for Rural Development (ANADER)  
Federation of maize producers of Ivory Coast (FEMACI)

### Togo

Advanced School of Agronomy/ University of Lomé (ESA-UL)  
Togolese Agricultural Research Institute (ITRA)  
Institute for Agricultural Extension Services (ICAT)  
Togolese Coordination of Farmers' Organizations and Agricultural Producers (CTOP)

### Kenya

Kenya Agricultural and Livestock Research Organization (KALRO)







## NUTCAT'S WORKSTREAM 1

*Developing actionable precision nutrient management strategies for optimal cereal system production*

Cereal improvement teams are established in each production region to work within a systematic but evolving process to establish, evaluate, and update best agronomic practices, including the integration of right nutrient source, rate, timing, and placement combinations (i.e., 4R Nutrient Stewardship).

*NUTCAT maize/rice site at Kigoma in the western zone of Tanzania.*



## NUTCAT'S WORKSTREAM 2

*Investigating feasible options for use of remotely sensed information to describe the variation in crop performance within and between smallholder fields*

Ultimately, the goal is to achieve a degree of reliability that enables scalable delivery of field-specific agronomic management decisions to what is potentially millions of farmers. As digital technology becomes more accessible in agriculture, the capacities of field research are expanded and the focus can be more easily shifting towards tackling the issues farmers face at more relevant scales.

*Left: Grey-level image from Google Earth for Senegal trial; Right: False-color green-red-NIR image for Senegal trial for September 2021.*

## NUTCAT'S WORKSTREAM 3

*Striving to build platforms for engagement of farmers and value-chain stakeholders to promote farmer-centric innovation, as well as accelerate the adoption of good agronomic practices, enhance co-learning, and improve value chains.*

At its core, the sustainability of the approach depends on a continuous cycle of on-farm engagement, evaluation, feedback, and improvement.

*Partial view of farmer field day participants at Korhogo, Cote d'Ivoire with Drs. Thérèse Agneroh (center) and Kokou Amouzou (right).*

**Learn more at:** <https://apni.net/project/nutcat>



## More PNM Initiatives

**Out-scaling 4R Nutrient Stewardship Knowledge to Support Crop Production in North Africa**

<https://apni.net/project/outscaling-4r>

**Out-scaling 4R Nutrient Stewardship Knowledge to Support Intensive Olive Production in Tunisia**

<https://apni.net/project/tunisia-olive>

**Optimizing Nutrient Management of Olive Orchards based on 4R Nutrient Stewardship in Morocco**

<https://apni.net/project/morocco-olive>

**Enhancing Nutrient Management of Moroccan Citrus Orchards**

<https://apni.net/project/morocco-citrus>

**Improving Fertilization Management Practices of Date Palm Trees under Moroccan Conditions**

<https://apni.net/project/morocco-datepalm>

**Validation and Dissemination of Nutrient Expert for Farming Communities in Morocco**

<https://apni.net/project/ne-morocco>

**Assessment and Validation of Nutrient Expert for Fertilization Recommendations of Maize in Senegal**

<https://apni.net/project/maize-senegal>





*If you want to go fast, go alone...  
If you want to go far, go together.*

African Proverb





## African Plant Nutrition Scholar Award

The African Plant Nutrition Scholar Award was established to encourage development and success within graduate student programs specializing in the sciences of plant nutrition and management of crop nutrients in Africa. During 2021, awards of USD \$2,000 were conferred to ten African graduate students.

Learn more at: <https://apni.net/scholar-apply>



**Ms. Rabiath Féichokpè  
Raïssa ADIGOUN, M.Sc.**

Université Cheikh Anta Diop de  
Dakar (UCAD), Dakar, Sénégal



**Mr. Bright AGBOMADZI,  
Ph.D.**

University of Ghana  
Accra, Ghana



**Mr. Mohamed Emam Sayed  
AMIN, Ph.D.**

Fayoum University  
Cairo, Egypt



**Ms. Rania BRITAL, Ph.D.**

Ibn Tofail University / National  
Institute of Agricultural Research  
Kenitra, Morocco



**Ms. Grace Nnabunnya  
KAWESA, Ph.D.**

Bugema University  
Kampala, Uganda



**Mr. Kouakou Kan Anselme  
KOUAME, M.Sc.**

Mohammed VI Polytechnic  
University, Benguerir, Morocco



**Ms. Lydia MHORO, Ph.D.**

Nelson Mandela African Institute  
of Science and Technology  
Arusha City, Tanzania



**Mr. Alex Mukiibi, Ph.D.**

University of Pretoria  
Pretoria, South Africa



**Mr. Adama SAGNON,  
Ph.D.**

Joseph KI-ZERBO University -  
University of Ouagadougou  
Ouagadougou, Burkina Faso



**Ms. Imen Zouari, PhD.**

Higher Institute of Agronomy, Chott  
Mariem (University of Sousse)  
Tunis, Tunisia



## Young African Phosphorus Fellowship Award

The Young African Phosphorus Fellowship program was implemented to encourage the development of scientific programs relevant to understanding and improving phosphorus management in African agro-ecosystems. In 2021, awards of USD \$5,000 were conferred to five early-career African scientists.

Learn more at: <https://apni.net/p-fellowship-apply>



**Dr. Benjamin Karikari**

Department of Crop Science,  
Faculty of Agriculture, Food  
and Consumer Sciences,  
University for Development  
Studies, Tamale, Ghana

.....  
**PROJECT**

The potential for genetic  
improvement of P use  
efficiency in soybean.

.....



**Dr. Matheus Barreto**

AgroBiosciences Program,  
Mohammed VI Polytechnic  
University (UM6P)  
Benguérir, Morocco

.....  
**PROJECT**

Molecular-scale  
investigation  
of organic P sorption-  
desorption on soil mineral  
phase and its hydrolysis  
by phosphatase.

.....



**Mr. Daniel Mjinja**

Einstina Company Limited  
/ School of Mines and  
Geosciences, University  
of Dar es Salaam, Dar es  
Salaam, Tanzania

.....  
**PROJECT**

Production of bone  
meal from animal bones as  
an alternative source of P in  
agriculture.

.....



**Dr. Anthony Oyeogbe**

Faculty of Agriculture,  
University of Ibadan,  
Ibadan, Nigeria

.....  
**PROJECT**

Influence of P  
on microbial nitrogen  
transformation and nitrous  
oxide emission.

.....



**Mr. Guta Amante Sanbe**

Ethiopian Institute of  
Agricultural Research, Teppi  
Agricultural Research Center,  
Jimma, Ethiopia

.....  
**PROJECT**

Potential of modified biochar  
to remove phosphate from  
liquid manure and re-use as  
alternative P fertilizer.

.....





## Phosphorus Fellowship – Ongoing Research



**DR. PATRICK MUSINGUZI**, Young African Phosphorus Fellowship Award recipient, inspecting on-farm rainfed maize study site in Masindi (western Uganda).

Through the support of the Young African Phosphorus Fellowship, **DR. PATRICK MUSINGUZI**, Researcher at Makerere University in Uganda, is seeking a better understanding of the local factors involved in using residual or “legacy” P in the country’s maize production systems.

*“Farmers need to know when, and to what extent, they can rely on legacy soil P since this information can pay-off both in terms of reducing fertilizer costs and protecting the surrounding environment.”*

His investigation has found rainfed maize to be generally under supplied with P fertilizer, showing little to no P accumulation and soil test P values below critical concentration. Significant P accumulation was found in intensively irrigated maize systems.

Dr. Musinguzi plans to expand this research over a larger area, and dig deeper into the historical use patterns of fertilizer use in these vastly different maize production systems. Monitoring of soil P drawdown and application of maintenance rates of P optimizes farm resources and minimizes risks of environmental harm such as groundwater pollution.



**DR. PHIRI**, Young African Phosphorus Fellowship Award recipient (right), and Mr. and Mrs. Mwale in Chinguluwe EPA Salima district, central Malawi.

**DR. AUSTIN PHIRI**, Chief Agricultural Research Scientist, at Bvumbwe Agricultural Research Station in Malawi, is addressing the problems related to more frequent periods of intense drought and heat that have become more commonplace, and are challenging the viability of traditional practices for staple food crop production in the region.

Dr. Phiri’s pan-Malawi network of trials is working as a demonstration platform to encourage adoption of the ideas that evolve from the work by neighboring smallholders. He has started an innovative cropping system that involves intercropped pigeon pea and cowpea rotated with sorghum—a primary food grain crop that is proving to be productive under conditions of drought. Dr. Phiri also wishes to learn how best to manage the rates, of other nutrient sources (i.e., fertilizers/ composts/animal manure) within this intercropping system.

*“This trial will provide a base understanding on how P and N is best managed within this system.”*

The overall goal is to establish important benchmarks while optimizing the sustainability for staple food-grain production through the creation of more resilient cropping/farming systems for Malawi’s smallholder farmers to adopt.





## African Plant Nutrition Outreach Fellowship Award

The African Plant Nutrition Outreach Fellowship Award was established to support researchers exploring innovative ideas for education, training and communication programs relevant to improving the use and efficiency of plant nutrients in African agro-ecosystems. Awards of USD \$5,000 were conferred to two African scientists.

Learn more at: <http://apni.net/outreach-fellowship-apply>



### Mr. Mustapha EL JANATI

Mohammed VI Polytechnic University (UM6P) /  
Institut Agronomique et Vétérinaire HASSAN II,  
Rabat, Morocco

#### PROJECT

Promotion and extension of best management practices for composting date palm residue within the unique desert oasis agroecosystems that are cultivated intensively in Morocco.



*Date Palm*



*Cassava*

### Mr. Mutiu Abolanle BUSARI

Federal University of Agriculture Abeokuta,  
Abeokuta, Nigeria

#### PROJECT

Expanded dissemination of AKILIMO technology to farmers in cassava-producing states of Nigeria





## Outreach Fellowship – Ongoing Research



Participants at the Focus Group Forum listening and responding to questions raised by the field team.

**PROF. KWAME AGYEI FRIMPONG**, Associate Professor in Soil Science and Soil Fertility at the University of Cape Coast, Ghana, is supporting farmers' need to better understand the link between soil fertility and the diverse set of challenges faced daily.

These issues include the effects of climate-change related impacts such as less reliable and predictable rainfall, and more frequent extreme weather events such as drought or flooding.

*“ We intend to continue to generate evidence-based data and information about their perceptions, socio-economic orientations and indigenous knowledge, which will inform the design of fit-for-purpose soil fertility interventions and to serve as input into future research. ”*

His outreach program organized focus group discussions and personal interviews with farmers, extension agents, and local leaders. The discussion facilitated exchange on key interventions including the extension of Integrated Soil Fertility Management (ISFM) and 4R Nutrient Stewardship.

The sessions provide effective co-learning models able to help smallholder farm communities identify a set of best practices that were realistically achievable in their fields, while also improving extension staff's understanding of the capacity for, and barriers against, sustained adoption of such practices.



Prof. Bosede Lawal at an on-farm demonstration site testing ISFM technology.

**PROF. BOSEDE LAWAL**, Researcher at the South West Farming Systems Research and Extension Programme within the Institute of Agricultural Research and Training (IAR&T) at Obafemi Awolowo University, is working to reverse trends of soil nutrient mining, low soil fertility and poor crop yields through more widespread implementation of sustainable Integrated Soil Fertility Management (ISFM) technology and practices amongst the smallholder maize farmers of south west Nigeria.

Through the promotion of integrated use of improved varieties, good agronomic practices, site-specific fertilizer recommendations through a variety of popular outreach channels, Dr. Lawal's on-farm demonstrations, farmer field schools coupled with communication tools such as text messaging, radio jingles, and knowledge products form an effective information dissemination program to extend the widely needed ISFM technology.

*“ Farmers were directly involved in demonstrations that served as learning plots, which gave farmers the best opportunity to observe the merits and demerits of the ISFM technology and make informed decisions. ”*

Each farmer is expected to train other farmers on the ISFM technology through the establishment of their own ISFM maize plots thus accelerating adoption beyond the project sites. This project is empowering farmers, and Prof. Lawal expects this will ultimately contribute to food security, poverty reduction, and the improvement of livelihoods within south west Nigeria.





## African Plant Nutrition Research Fund – 2021 Recipients

The overall aim of the African Plant Nutrition Research Fund is to enable scaling of improved nutrient and soil fertility management by synergistically extending research conducted within strategic priority research areas of APNI. The fund was created through a partnership between APNI and Mohammed VI Polytechnic University (UM6P).



**DR. PATRICK MUSINGUZI**, Principal Investigator –  
School of Agricultural Sciences, Makerere University, Kampala, Uganda

**PROJECT:** Enhancing Rice Productivity through Adaptation of Climate-Smart Agricultural Options and Market Responsive Business Strategies in Uganda

### OBJECTIVES

- 1 Evaluate nutrient and water use efficiency under adaptable nutrient, water and agronomic management packages to variable weather and climate change for increased rice production.
- 2 Determine the economic viability of climate smart options for improving rice productivity and mitigating risks and shocks.
- 3 Strengthen the farmer-market institutions for improved efficiency in the production and marketing of rice.
- 4 Enhance the uptake of adaptable business and agronomic options for increased resilience to climate change and price risks among rice farmers in Uganda.

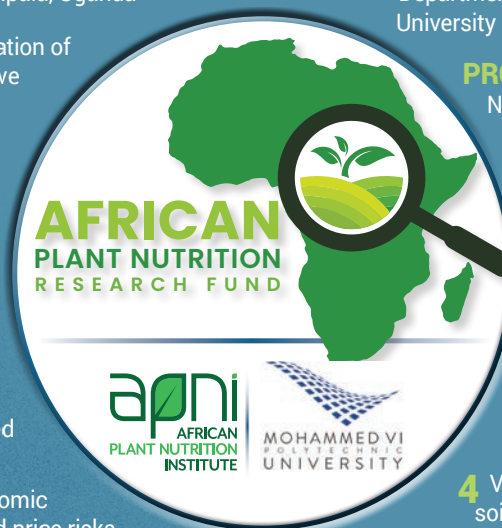


**DR. ONESMUS KITONYO**, Principal Investigator –  
Department of Plant Science and Crop Protection, University of Nairobi, Nairobi, Kenya

**PROJECT:** Fine-Tuning Climate-Smart Nitrogen Management Practices in Maize-Based Crop Systems of Eastern Kenya

### OBJECTIVES

- 1 Characterize business models that support adoption and scaling of weather-sensitive nutrient management technologies, innovations and management practices.
- 2 Identify and map maize stress patterns.
- 3 Benchmark upper limits for water and nitrogen use efficiency of maize.
- 4 Validate and promote best management practices for soil moisture conservation and N use efficiency.
- 5 Develop and validate an easy-to-use water and N budget calculator.



*Maize*



## African Plant Nutrition Research Fund – 2021 Recipients

The overall aim of the African Plant Nutrition Research Fund is to enable scaling of improved nutrient and soil fertility management by synergistically extending research conducted within strategic priority research areas of APNI. The fund was created through a partnership between APNI and Mohammed VI Polytechnic University (UM6P).



**DR. ABDELAZIZ BOUIZGAREN,**  
Principal Investigator – Institut National de la Recherche Agronomique (INRA Maroc), Marrakesh, Morocco



**PROJECT:** Improving Water and Nutrient Use Efficiency to Increase Moroccan Olive Climate Resilience

### OBJECTIVES

- 1 Determine the optimal compromise between fertilization and deficit irrigation of olive trees.
- 2 Identify critical phenological stages of olive nutrition through analyzing nutrient dynamics under irrigated system.
- 3 Evaluate the impact of the optimal compromise between fertilization and deficit irrigation of olive on the quality and purity parameters of olive oils.
- 4 Determine the most relevant biomarkers linked to water resilience and nutrient uptake efficiency in olive under the effects of climate change.
- 5 Elect a set of genotypes with high drought tolerance and nutrient use efficiency.
- 6 Build comprehensive models based on drone images for monitoring olive tree hydromineral status under deficit irrigation.
- 7 Improving farmers' incomes and competitiveness through reducing water and nutrient inputs and/or improving agricultural practices.



**DR. EDWARD YEBOAH,** Co-Principal Investigator – CSIR-Soil Research Institute, Kumasi, Ghana

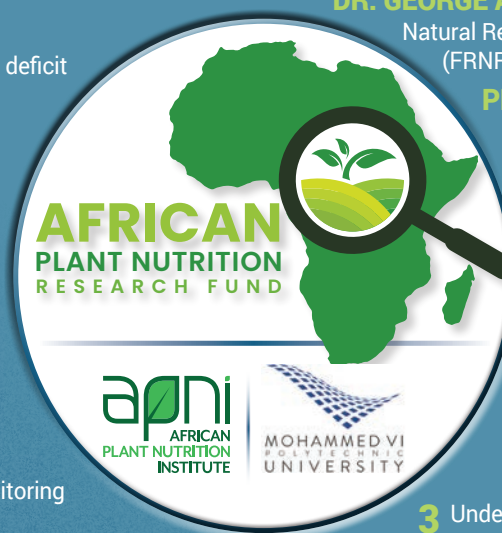


**DR. GEORGE ASHIAGBOR,** Co-Principal Investigator – Faculty of Renewable Natural Resources, Kwame Nkrumah University of Science and Technology (FRNR-KNUST), Kumasi, Ghana

**PROJECT:** A Remote Sensing Supported Framework that Incentivizes Site-Specific Agronomic Management of Smallholder Cocoa Farms in Ghana

### OBJECTIVES

- 1 Develop site specific crop performance indicators based on soil fertility, crop management including nutrition, existing soil map information, and weather data.
- 2 Assess the feasibility of remotely sensed information technology to characterize crop performance.
- 3 Understand gender-specific opportunities to adopt site-specific fertilizer interventions elaborated through diagnostic surveys.
- 4 Document a proof-of-concept that structures opportunity for change around clearly articulated business models that explain the details of innovation and identify the options for sustainable scaling-up of interventions.



*Cocoa*



Learn more at: [www.apni.net/research-fund](http://www.apni.net/research-fund)





Dr. Scott Murrell,  
Principal Scientist,  
visiting farmer  
wheat fields in  
Morocco.

Dr. Steve Phillips,  
Principal Scientist,  
(right) working with  
UM6P Executive  
Masters in Precision  
Agriculture students near  
Benguérir, Morocco.



## APNI Staff in the Field

Mr. Mahdi Dahane,  
Agronomist, sampling  
lentil field trials in  
Khemisset province,  
Morocco.



Ms. Youssa Moujtahid, Communications  
Specialist, visiting with olive tree manager near  
Marrakech, Morocco.

Mr. Josés Muthamia,  
Agronomist, explaining  
potato research trial results  
to farmers in Kenya.







APNI Nairobi Staff (left to right) Jeremiah Okoth, Driver, Dr. Samuel Njoroge, Program Coordinator, Angela Gitonga, Research Assistant, Ann Otero, Operations Manager, Esther Mugi, Research Assistant, Dr. James Mutegei, Senior Program Manager, Dr. Ivan Adolwa, Farming Systems Scientist



Dr. Kokou Amouzou, Program Coordinator, and Dr. Thérèse Agneroh, Program Manager, selecting field sites in Northern Côte d'Ivoire.

Dr. Mohamed Boutfirass, Consulting Agronomist, at a farmers' field day training event in Morocco.



23.03.2021 11:43



APNI Staff with Scientific Advisory Committee members at Benguerir, Morocco.



Dr. Kaushik Majumdar, Director General and Dr. Mohammed El Gharous, Senior Consulting Scientist, planting olive trees near Benguéir, Morocco.



APNI Staff (left to right) Dr. James Mutegi, Senior Program Manager, Dr. Thomas Oberthür, Director Business & Partnerships, Dr. Pauline Chivenge, Principal Scientist, and Dr. Shamie Zingore, Director Research & Development, visiting a banana plantation in Kenya.



Mr. Steve Couch, Director of Operations, visiting an olive orchard near Marrakech, Morocco.



Dr. Pricilia Marimo, Socio-economist (right) and Dr. Hakim Boulal, Program Manager, discussing goat milk production with farmers in the Rehamna region of Morocco.



APNI Headquarters staff participating in olive tree planting event near Benguéir, Morocco.

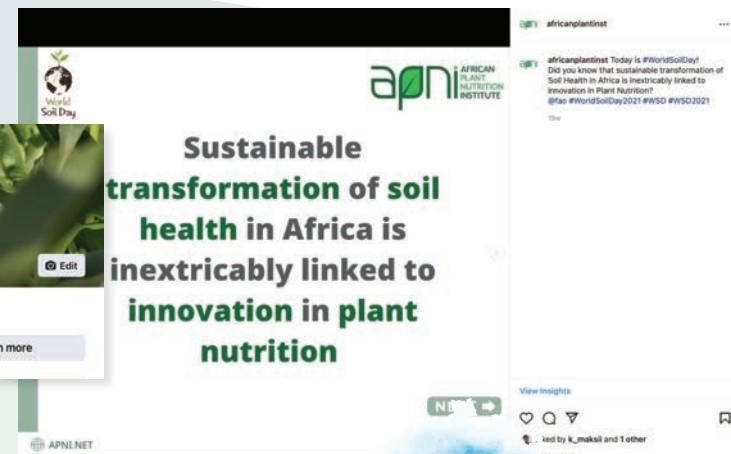




# APNI in the Media



click the social media icons to take you to our sites.



## African Plant Nutrition Institute

@PlantAfrican

The African Plant Nutrition Institute (APNI) is a not-for-profit research and education organization based in Benguerir, Morocco on the UM6P campus.

📍 Morocco 🌐 [apni.net](https://apni.net) 📅 Joined September 2019

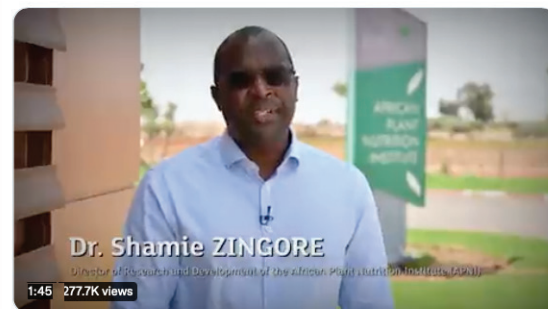
887 Following 994 Followers



"Effective management of nutrients supports sustainable crop productivity improvements. This reduces the pressure to expand agricultural area to increase food production."

Dr. Shamie Zingore from @PlantAfrican on soil best management practices.

@FoodSystems  
#UNFSS2021



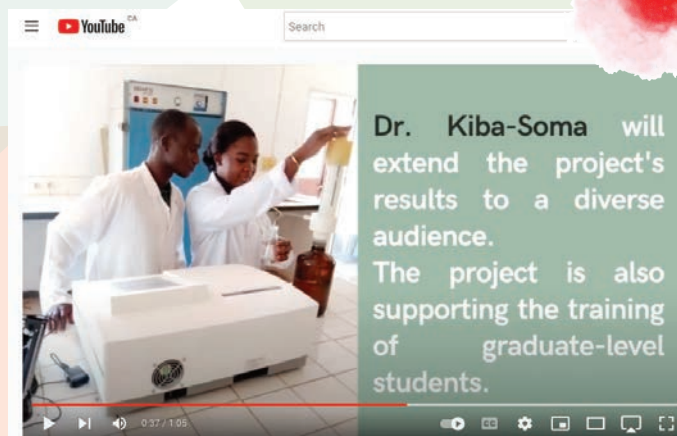
10:00 AM · Sep 14, 2021 · Twitter Web App

60 Retweets 2 Quote Tweets 285 Likes

**African Plant Nutrition Institute**  
Published by Hootsuite · 26 May 2021 ·

A study coordinated by Young African #Phosphorus Fellowship Recipient, Dr. Austin Phiri, is using cropping system innovation to target improved sorghum productivity for climate change adaptation amongst #Malawi's smallholders.

Learn more in the video 📺 <http://ow.ly/VEy150EVRlt>



Burkina Faso Research Examines the Role of Crop Management on Soil P Dynamics

## African Plant Nutrition Institute (APNI)

Innovating plant nutrition through evidence-based practices for a resilient and food-secure Africa.  
Research Services · Benguerir · 2,499 followers

**African Plant Nutrition Institute (APNI)**  
2,499 followers  
4mo ·

In line with Dr. [Shamie Zingore](#)'s speaking about "Achieving Impact with 4Rs in Africa" at [4R Solution](#)'s webinar, Dr. [Samuel Kinyanjui](#) takes us on a tour of Nakpayili's Nutrient Omission Trial Site in Nanumba South District of Northern #Ghana  
<https://lnkd.in/eQfxSird>



4R Nutrient Stewardship Project - Nakpayili's Nutrient Omission Trial ...  
youtube.com

Amanuel Alemu and 60 others

4 comments





الهيئة الاستشارية العلمية لتعميد الأفراسي لتكنولوجيا البنية التحتية لإحدى صدمات الريفون المصرية برافان



Repsal. Photo by Sandy Dorkaan on Shoghaish



زيرة لةقبة لبعض التعاريف الفلاحية المتوجة لإبان الماعز بالإرحامة وتخصيص أراضيها الحالية

## ينظم المعهد الإفريقي للتغذية النباتية.. ورشة عمل مع التعاونيات النسائية



العالم 24  
13/42 - 21 ديسمبر 2021

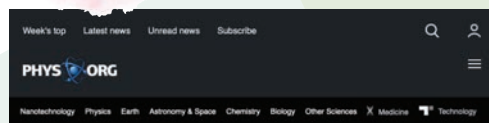
ينظم المعهد الإفريقي للتغذية النباتية والجمعية المغربية للبحث والتطوير ورشة عمل مع التعاونيات النسائية في منطقة الرحامنة كجزء من مشروع "تعزيز قدرة المزارعين أصحاب الحيازات الصغيرة على الصمود في وجه تغير المناخ في شمال وغرب أفريقيا من خلال تطوير سلسلة قيمة الحبوب التي تديرها المرأة" الممول من طرف مركز البحوث الكندي للتنمية الدولية. نظم المعهد الإفريقي للتغذية النباتية بشراكة مع الجمعية المغربية للبحث والتطوير ورشة عمل تبادلية مع التعاونيات النسائية في منطقة الرحامنة بحضور فاعلين وخبراء في سلسلة قيمة منتجات الألبان.

تم تنظيم ورشة العمل هذه تحت شعار "تعزيز قدرة المزارع الصغيرة في شمال وغرب إفريقيا: تحسين سلاسل قيمة منتجات الألبان التي تديرها النساء" يوم الأربعاء 15 دجنبر 2021



## Digital tools transform farming

Digital precision agriculture tools are helping Nep maximise the yield potential of their rice crops. Researchers rice farmers in Terai, which lies at the are using tech to bridge the growing rice field gap 'actual and attainable' yields.



Home / Biology / Plants & Animals  
Home / Biology / Agriculture

## Implementing sustainable nitrogen use in smallholder rice

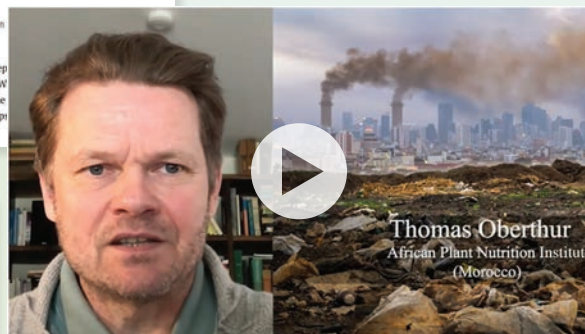
by African Plant Nutrition Institute



Credit: CC0 Public Domain

Frontiers in Sustainable Food Systems has published the results of a "mini-review" examining 46 peer-reviewed studies that compared site-specific nutrient management (SSNM) approaches for rice against existing farmer fertilization practices. The study's scope included research examples extracted from 11 countries conducted between 2001 and 2020—using 43 studies from Asia and 3 from Africa.

Editor Janet Kanters spoke with APNI Director General Dr. Kaushik Majumdar.



## APNI Joins SAM Consortium: Guiding Pathways to Agricultural Sustainability in Africa

APNI involvement in the SAM Consortium will guide the development of key indicators of agricultural sustainability within the target countries of Kenya and Tanzania.

The Sustainable Agriculture Matrix (SAM) Consortium represents a highly interdisciplinary team of experts presently operating in national and sub-country-scale initiatives tasked with describing how best to define appropriate pathways towards sustainable agriculture (SA). Establishing SA benchmarks and regularly tracking progress remains critical to ensuring countries can make informed decisions and be accountable to their UN commitments towards SA.



## Africa Plant Nutrition Scholarship Program 2021 for African Students

By Mr le Bénédicte 14 mai 2021



## Africa Plant Nutrition Scholarship Program 2021 for African Students

Awards of USD \$2,000 each will be conferred to ten deserving African graduate students in sciences relevant to plant nutrition and management of crop nutrients.

Application Deadline: 31st May 2021.

About the Award: The African Plant Nutrition Institute (APNI) has released the details of the 2021 Plant Nutrition Scholar Award program that is available to graduate students enrolled in programs specializing in the sciences of plant nutrition and management of crop nutrients.

## Improving soil fertility and plant nutrition in African farming systems





# New Resources

All our resources are freely accessible.

Learn more at: [www.apni.net/resources](http://www.apni.net/resources)

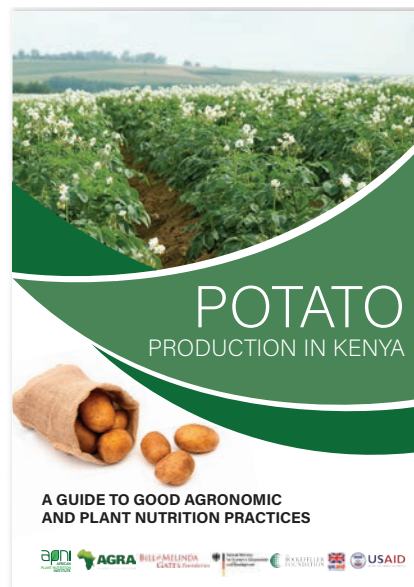




Table 3.1. Potato nutrient deficiencies, visual diagnosis, and causes.

Nitrogen (N)	
Functions	How to recognize the deficiency
<ul style="list-style-type: none"> <li>• Component of all proteins, enzymes, and metabolic processes required for synthesis and transfer of energy in the plant.</li> <li>• Component of chlorophyll, the green pigment responsible for photosynthesis.</li> <li>• Promotes rapid growth and increases tuber production.</li> </ul>	 <p>Plants have a generally uniform pale green/yellow (chlorotic) appearance. Lower leaves first appear lighter green than normal, but this gradually spreads up the plant. Leaf yellowing progressively worsens and leaves become more erect than normal. Eventually plant growth stops and the leaves fall off.</p>
Phosphorus (P)	
Functions	How to recognize the deficiency
<ul style="list-style-type: none"> <li>• Boosts bulking, promotes production of tubers of uniform size, and increases tuber yield.</li> <li>• Increases tuber dry matter content and starch levels.</li> <li>• Improves storage potential of tubers and reduced disease during storage.</li> </ul>	 <p>Plants may first develop leaves that are smaller and lighter green than normal. Over time, the lower leaves darken, have less shine, start to curl, and develop small grey patches along the edges. Plants are stunted with shortened internodes and poor root systems, which can be observed at the early growth stages.</p>

Potato Production in Kenya

31

Table 3.4 Fertilizer materials suitable for application as foliar sprays to correct nutrient deficiencies in potato plant.

Nutrient	Source/s	Comments
Boron	Sodium borates, Solubor®, Boric acid	Apply at growth stage 2 or 3, or 40 to 60 days after planting; repeated applications may be necessary; soil application is a more preferable option.
Copper	Copper sulphates, Copper chelates	Apply at growth stage 2 or 3, or 40 to 60 days after planting; one application may be sufficient.
Iron	Iron sulphate, iron chelates	Repeated applications are necessary to correct most deficiencies.
Magnesium	Magnesium sulphate	One application may be sufficient.
Manganese	Manganese sulphate, Manganese chelates	Effective method for correcting deficiencies; two or three applications may be necessary.
Molybdenum	Sodium molybdate, Ammonium molybdate	Effective method for correcting deficiencies; very low rates are sufficient.
Zinc	Zinc sulphates, Zinc chelates	Apply at growth stage 2 or 3, or 40 to 60 days after planting; one application may be sufficient.

Adapted from Rowe RC (1993)

## 3.8.5 Micronutrient Use in Potato

Certain micronutrients must be supplied for high potato yields in some soils. Zinc (Zn) and manganese (Mn) may be needed in calcareous alkaline soils. Some fungicides contain significant amounts of certain micronutrients and can be significant sources of micronutrients. For example, the fungicide Mancozeb is a source of Zn, and copper (Cu). Copper may be needed in peat soils but is usually sufficient in most mineral soils. Boron (B) may be needed where the soils are deficient in it. Iron (Fe), chloride (Cl) and molybdenum (Mo) are generally not deficient in soils that are used for potato production. The most effective application method depends upon the micronutrient, soil conditions, and the point in the growing season at which a deficiency is observed.

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CHAPTER 3: Potato Crop Nutrition

# Crop Production Guides

Our guidebooks provide agronomists with in-depth reference sources on best nutrient management practices for key crop production systems.

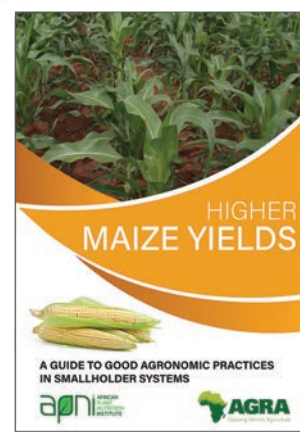



Table 5: Nutrient and water content of organic manures commonly used in sub-Saharan Africa.

Material	N	P	K	Ca	Water content (%)
kg/t of manure					
Farmyard manure	10-15	8-12	12-21	8-20	25-50
Goat manure	6	7	15	8	50
Sheep manure	10	7	15	17	80
Pig manure	7-10	2-3	5-7	12	80
Poultry manure	14-16	2.5-8	7-8	22	55

Adapted from Wangji et al. (2014)

► If the farmer does not have livestock and plans to buy animal manures, it is worthwhile to compare the cost of nutrients in fertilizers and animal manures and then select the most appropriate source. The value of added organic matter on soil improvement is difficult to measure.



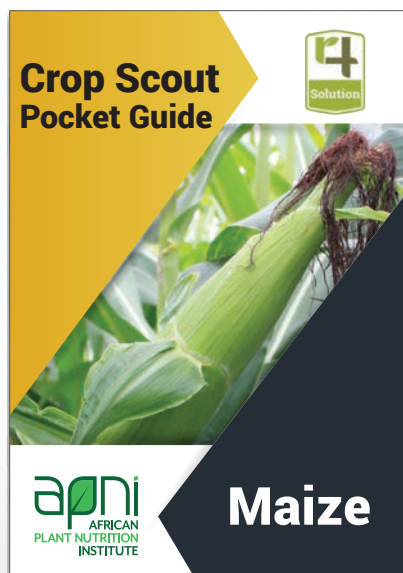
Spreading manure improves water retention and the soil with useful nutrients to soil when it decomposes.

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# Diagnostic Field Guides

Supporting decision-making in the field with crop-specific diagnostic tools for extension staff and agronomic advisors.



## Questions to Ask While Scouting

- What is the field's cropping history? What were the previous crops grown?
- Was the weather too dry? Too hot? Too cold? Too wet?
- How were the crops fertilized?
- Have other management practices or inputs been applied? If so, which ones?
- When were the crops planted? Too early? Too late?
- Were insects, weeds, and diseases controlled?
- Is the disease regularly distributed in the field?
- What types of symptoms are found in the leaves? Are they entirely or partly affected? Are aphids present?
- How has the crop looked until now?
- What variety was planted? What was the source of seed?

## Symptoms of Nutrient Deficiency and Toxicity

Plant leaves are the most obvious indicator of nutritional problems. Experienced crop scouts can recognize the most common leaf traits as tell-tale signs of specific nutrient deficiency or toxicity.

Plants with dark-green healthy leaves, strong stems, and vigorous roots will maximize the work of gathering sunshine and nutrients needed for photosynthesis.

**Nitrogen-deficient soybean** plants appear yellowish or pale green, although the symptoms are seldom seen. However, on acidic soils where molybdenum (Mo) deficiency interferes with nodulation, or on soils where soybeans have not been grown before, N deficiency is more likely without seed inoculation.



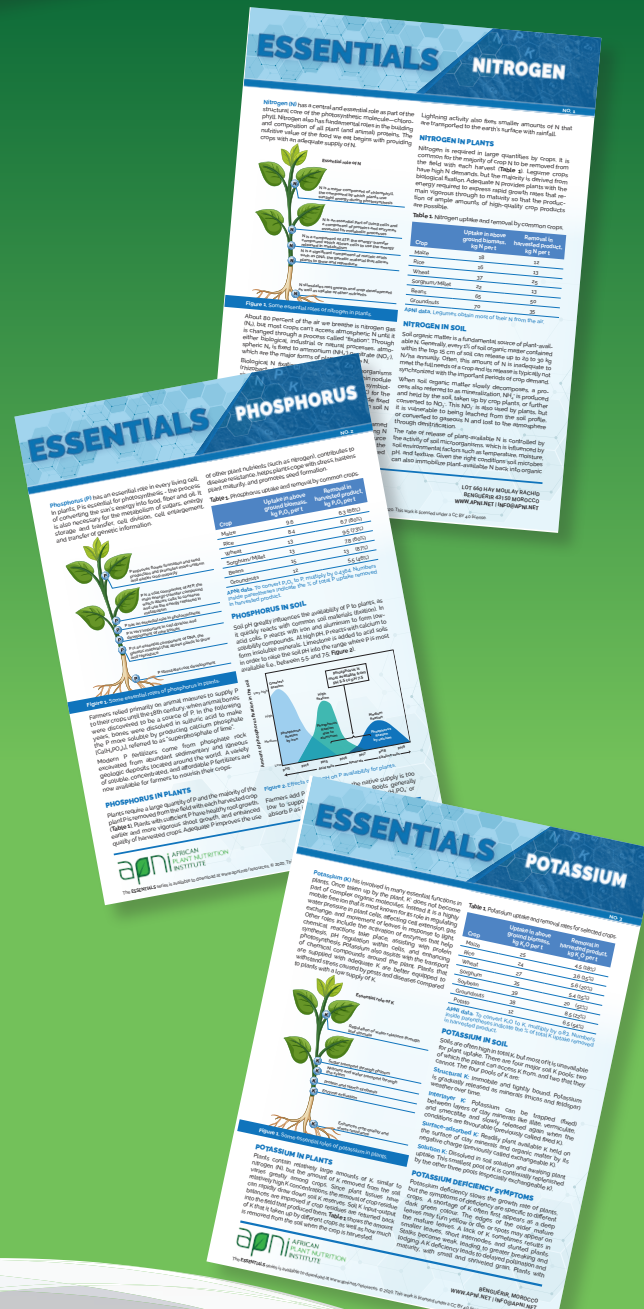
Nitrogen-deficient leaf (left); Healthy leaf (right)

**Manganese (Mn) deficiency symptoms** in soybean are seen more frequently in cool weather, during dry periods, and at relatively high soil pH. Interveneal areas of leaves become light green to white, while veins remain green. Symptoms appear first in the younger leaves and may initially resemble early signs of Fe deficiency. Necrotic, brown spots develop as the deficiency becomes more severe, and leaves may drop prematurely.



Manganese deficiency symptoms

**Molybdenum deficiency** in soybean is more likely in acidic soils that are highly weathered and leached, and in soils where the element is in unusable form. Symptoms of this deficiency resemble N deficiency. The young leaves are pale green or yellow, necrotic, and twisted. Necrosis is confined largely to the margins, midribs, and interveinal areas. Since Mo is essential for N<sub>2</sub> fixation, a deficiency can be confused with N.





## Best Nutrient Management of Olive

**تقنيات التسميد الموضعي للزيتان**

المرحلة الرابعة  
تقدير الحاديات من الأسمدة

المرحلة الخامسة  
تقدير الحاديات من الأسمدة حسب مراحل نمو الزيتون

مرحل نمو الزيتون	جنفي	أفريري	مارس	أفريل	ماي	جوان	جويلية	أوت	سبتمبر	أكتوبر	نوفمبر	ديسمبر
نمو الشجرة												
نمو الثمرة	0	0	5	15	25	25	10	5	10	5	0	0
النيتروجين	0	0	25	30	30	30	10	5	0	0	0	0
الفوسفور	0	0	25	30	30	10	5	0	0	0	0	0
البوتاسيوم	0	0	25	30	30	10	5	0	0	0	0	0

**مثال**

ح احتساب الحاديات من العناصر الغذائية بقطعة أرض مغروسة أشجار زيتون حسب النمط المكثف (300 شجرة/هك) مع مطقة إنتاج ب 7,5 طن زيتون

ب يحتوي ماء الري على 10 مغل نترات و 5 مغل بوتاس ويقدّر الاستهلاك السنوي ب 3500 م<sup>3</sup> / هك

ح نوعية التربة رملية وتحتوي على 1% مواد عضوية

**مثق**

K <sub>2</sub> O	N	P <sub>2</sub> O <sub>5</sub>
53	83	16
130	39	16
183	122	32
-	25	-
25	7,4	-
25	32,4	-
153	89,6	32

أ - إنباتك العناصر الغذائية من طرف الأسمدة

ب - العناصر الغذائية الموجودة في ماء الري

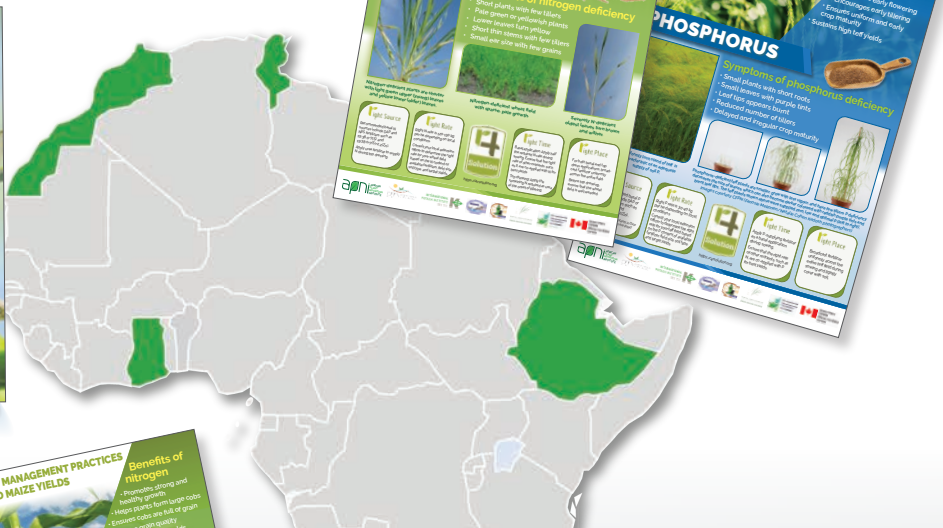
ج - إنباتك العناصر الغذائية الموجودة في التربة

د - إنباتك العناصر الغذائية الموجودة في التربة

هـ - إنباتك العناصر الغذائية الموجودة في التربة

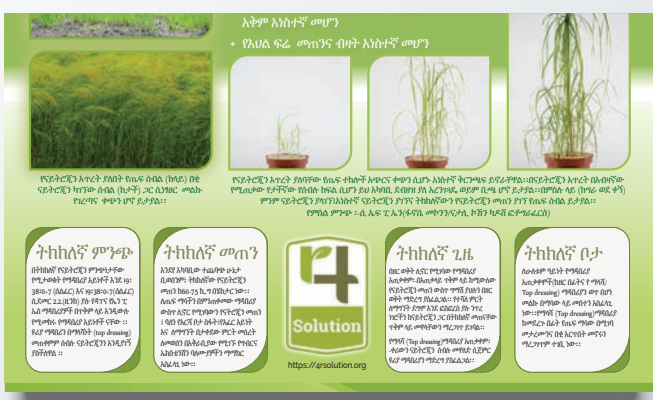
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## Regional 4R Guidelines

At the heart of 4R Nutrient Stewardship principles is the need to site-specific right source, rate, place, and time solutions to nutrient application.



A set of Amharic 4R recommendations for nitrogen application in Teff grown in Ethiopia.





# Partners and Collaborators

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MEA Ltd.  
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International University of Rabat (UIR)  
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National School of Agriculture of Meknes (ENA  
Meknes)

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International Society of Precision Agriculture (ISPA)  
Michigan State University

### Zambia

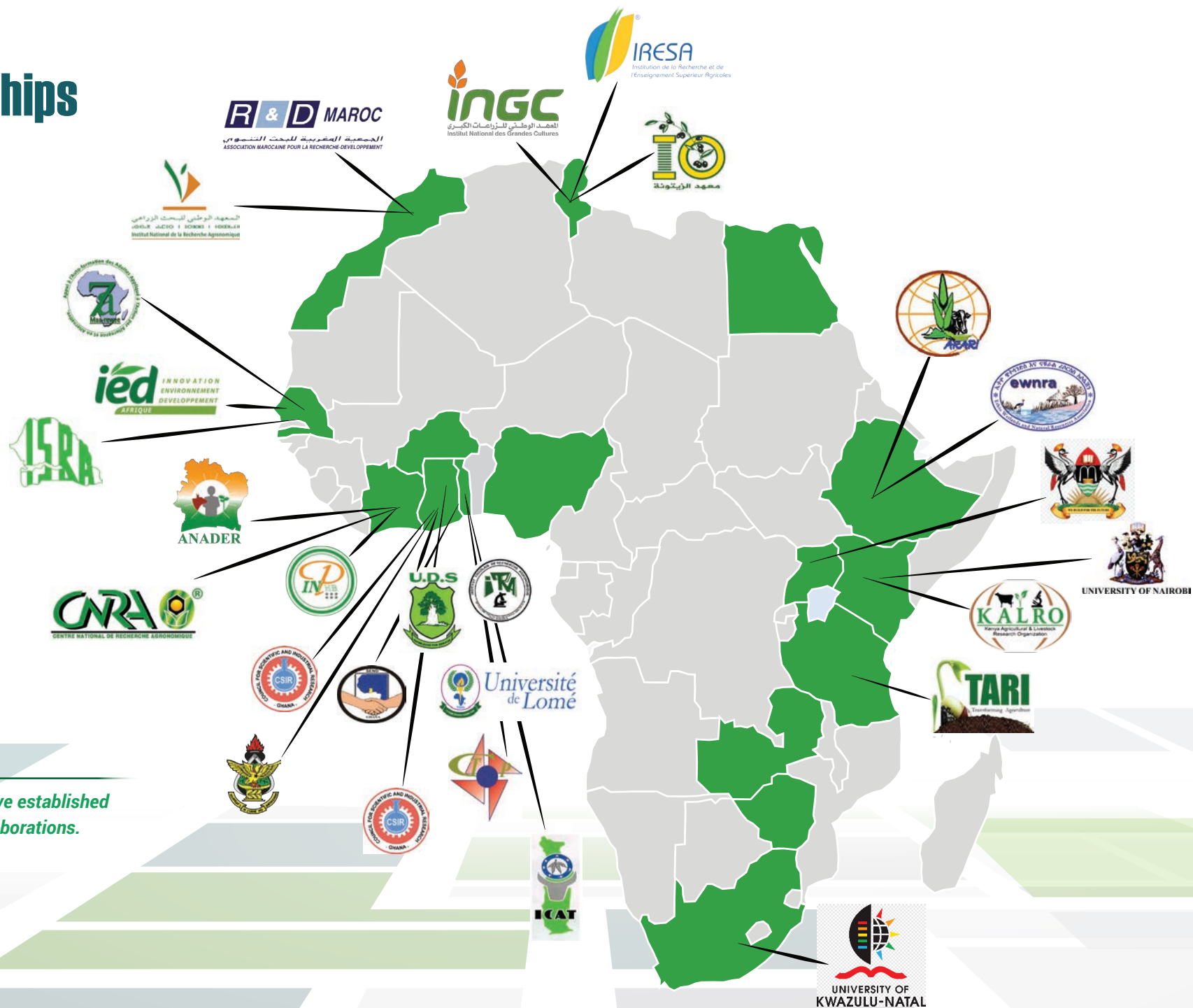
Zambia Agricultural Research Institute  
(ZARI)

### Zimbabwe

University of Zimbabwe



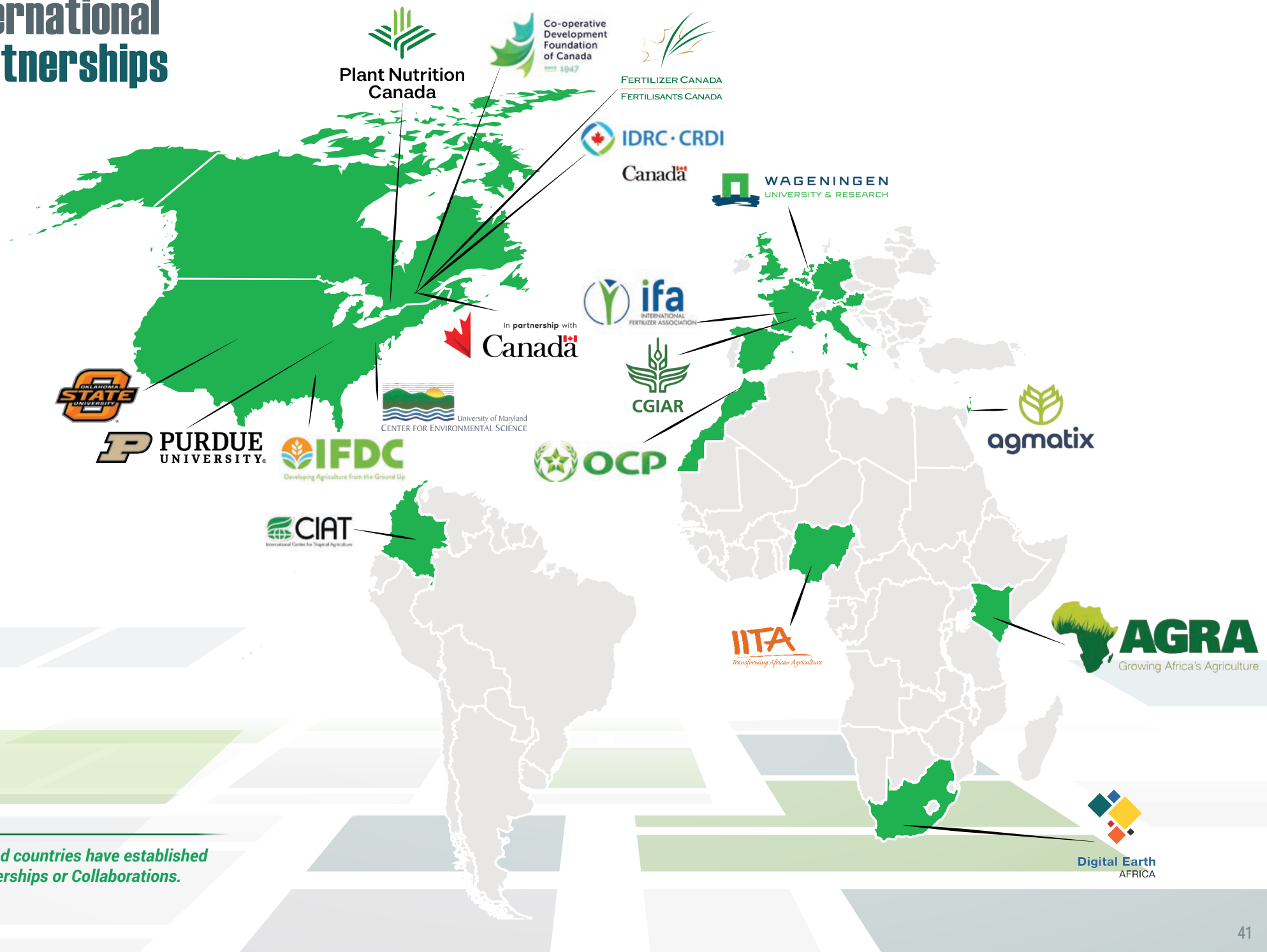
# National Partnerships



Shaded countries have established Partnerships or Collaborations.



# International Partnerships



Shaded countries have established Partnerships or Collaborations.



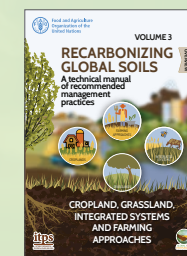
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