Research into market-driven and climate smart crop varieties: tolerance to biotic and abiotic stresses

Outline Of Presentation

- Profile of CSIR-SARI
- Vulnerability of agriculture in the mandate area of CSIR-SARI
- Research approach
- CSIR-SARI’s crop improvement strategies
- Current climate smart product profiles
- Research to address industrial needs
- Improved crop varieties developed by CSIR-SARI
- Future research issues
PROFILE Of CSIR-SARI

• One of the 13 research institutes under the CSIR

• Based in Nyankpala with mandate over the five regions of northern Ghana

• The mandate area covers the Guinea and Sudan savannah ecologies of Ghana

• Characterised by a monomodal rainfall pattern which is erratic

• Intermittent drought is also common during the rainy season
CSIR-SARI conducts research into food and fibre crop farming in Northern Ghana for the purpose of introducing improved technologies that will enhance overall agricultural productivity.

Crops covered include:
- Sorghum
- Millet
- Rice
- Maize
- Cowpea
- Peanuts
- Soybean
- Bambara
- Pigeon pea
- Yam
- Cassava
- Sweet & Frafra potatoes
- Cotton
- Vegetables
Geographical Map of Mandate Area

41% of the land mass of Ghana
THE FARMING SYSTEMS RESEARCH (FSR)

• **NR-FSRG**  Northern Region Farming Systems Research Group, located at Nyankpala, the head office of SARI.

• **UER-FSRG**  - Upper East Region Farming Systems Research Group, located at Manga near Bawku

• **UWR-FSRG**  - Upper West Region Farming Systems Research Group, located at Wa.

• **SSG**  - Scientific Support Group based at Nyankpala, works mostly on-station.
Participatory research (PVS/PPB): design of product profile

Planning meetings

End-user group/market

Farmers, Consumers, Processors, etc

Scientific Support Group

The Farming System Research Approach (FSR)
Characteristics of agriculture in the mandate area

- Climate change; Intermittent and terminal drought conditions that disrupt the farming systems, etc
- Susceptibility of crops to diseases and pests
- Sporadic outbreak of pests; fall armyworms, larger grain borer, etc
- Low crop yields resulting from: Poor soils with low input use and use of low yielding varieties
- Poor market outlets
- High postharvest losses and mycotoxin contamination (aflatoxins), etc

Characteristics of agriculture in the Guinea and Sudan savannah ecology
The goal is to **develop end-user preferred crop varieties** that fit into the agro-ecologies of the mandate area,

- Crop varieties that can withstand the specific stresses of **low soil fertility**, **drought**, **pests** and **diseases** that characterize the farming environments of our mandate area

- **Produce breeder & foundation Seeds for mandate crops to enhance access**

- **Our varieties have high market demand**: cowpea, maize, rice, soybean and sorghum varieties are used in the National flagship programme
Current climate smart product profiles

Development of crop varieties resistant to **biotic stresses:**

- Fall Armyworm resistant maize varieties
- Aphid resistant cowpea varieties
- Cowpea varieties with resistance to macrophomina resistance
- Groundnut varieties that are resistant to early and late leafspot diseases
- Cassava varieties with tolerance to cassava green spider mite and mealybug damage
- Cowpea and maize varieties that are resistant to *Striga gesnerioides* and *S. hermonthica* respectively
Development of crop varieties with tolerance to abiotic stresses

- Neglected underutilized species that are climate resilient; fonio and frafra potatoes
- Heat tolerant tomato varieties
- Drought tolerant maize and cowpea varieties
- Nitrogen use-efficient maize varieties
- Early bulking and drought tolerant cassava varieties
- Early bulking sweetpotato varieties
- Sweetpotato varieties with stay-green attributes for dual purpose utilisation
Research to address industry needs

Development of industry-preferred crop varieties

• Sorghum varieties for premium brewing qualities for industrial use

• Dual purpose guinea and caudatum sorghum races for grain and biofuel utilisation

• Sweet sorghum varieties for ethanol production
Commercial maize varieties

• Sanzal-sima, Wang-dataa,
• Bihilifa, Kpari-faako,
• Suhudoo, Kunjor-wari,
• Wang-Basig, Denbea,
• Salin-kawana

• Key points to consider: Earliness, drought tolerance, Striga tolerance, high and stable grain yield,
Improved crop varieties developed by CSIR-SARI

Rice

• Gbewaa rice
• Gbewaa red
• Savanna rice
• Malimali
• Digan

Key points to consider: early maturity, Market demand, yield
Improved crop varieties developed by CSIR-SARI

Soybean

• Jenguma,
• Afayak,
• Favour
• Quarshie
• Suong Pungun

Key points to consider: Earliness, non-shattering, yield,
Sorghum
 • Kapaala,
 • Dorado

Key points to consider: Earliness, Resistance/tolerance to head bugs, striga and dry spells, brewing quality
Millet

- Akad-kom,
- Kaanati,
- Naad-Kohblug,
- Afribeh-Naara and
- Waapp-Naara

Key points to consider: Earliness, high yield, Resistance/tolerance to striga, dry spells etc
Improved crop varieties developed by CSIR-SARI

Cowpea

- Kirkhouse Benga 1 and
- Wang Kae are Aphid and Striga resistant cowpea varieties
- Padi Tuya,

- Key points to consider: Earliness, high yielding, striga resistance, resistance/tolerance to key insect pests (Maruca pod borer, thrips, etc) and diseases
Groundnut

- SARINUT 1
- SARINUT 2
- Nkatie-sari,

- Key points to consider: Earliness, high yielding, resistance/tolerance to key insect pests and diseases
- Selection for fresh seed dormancy

Improved crop varieties developed by CSIR-SARI
Improved crop varieties developed by CSIR-SARI

- **Sweetpotato**
  - CSIR SARI-Nan,
  - CSIR-SARI-JanLow
  - CSIR-SARI Diedi
  - CSIR-SARI-Nyoribegu

Key points to consider: Earliness, high yield, betacarotene, anthocyanins, resistance/tolerance to sweetpotato weevil, stay-green/drought tolerance, high dry matter content for industrial processing, etc.
Future research issues

- Development of crop varieties with extended shelf-life; tomatoes, garden eggs, yam, etc.
- Utilisation of speed breeding technique to maximize genetic gain.
- The use of high throughput phenotyping and genotypic techniques.
- Use of modern biotech tools; CRISPR, gene editing, GM, etc.
- Marker assisted breeding to improve existing farmer preferred crop varieties through addition of novel genes.
- Development and introduction of integrated crop, soil and pest management practices to minimize the effect of climate change yield and productivity of crops of interest.
Thank you for listening