



# 2018

## ANNUAL REPORT

CSIR-CROPS RESEARCH INSTITUTE





Centre of Excellence  
in agricultural research,  
innovation and capacity  
building for development

# 2018 Annual Report

**CSIR-CROPS RESEARCH INSTITUTE**





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# CSIR-CRI MANAGEMENT BOARD

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## Member

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(Ag. Director, Extension  
Directorate MoFA, Accra)



## Cognate Member

Alhaji Dr. Moro M. Buri  
(Director, SRI)





# List Of Acronyms

ACMV	-	African Cassava Mosaic Virus
AFS	-	Aquaponic-based Food Production System
AGRA	-	Alliance for a Green Revolution in Africa
ARPPIS	-	Africa Regional Postgraduate Programme for Insect Science
AWARD	-	African Women in Agricultural Research and Development
BCRs	-	Benefit Cost Ratios
BMGF	-	Bill and Melinda Gates Foundation
BPA	-	Bui Power Authority
CABI	-	Centre for Agriculture and Bioscience International (CABI)
CAY-Seed	-	Community Action in Improving Farmer Saved Seed Yam
CBSD	-	Cassava Brown Streak Disease
CIDA	-	Canadian International Development Agency
CIP	-	International Potato Centre
CMD	-	Cassava Mosaic Disease
COTVET	-	Council for Technical and Vocational Education and Training
CRI	-	Crops Research Institute
CSIR	-	Council for Scientific and Industrial Research
DM	-	Dry Matter
DWT	-	Dry Weight
EACMV	-	East African Cassava Mosaic Virus
EEA	-	Engineers Excellence Award
EMBRAPA	-	Brazilian Agricultural Research Corporation
EPF	-	Entomopathogenic Fungi
FABS	-	Food and Agricultural Budgetary Support
FAW	-	Fall Army Worm
GAP	-	Good Agricultural Practices
GBC	-	Ghana Broadcasting Corporation
GES	-	Ghana Education Service
GhIE	-	Ghana Institution of Engineering

GNA	-	Ghana News Agency
IAIP	-	Innovation Agribusiness Incubation Programme
IEC	-	International Electrotechnical Commission
IR	-	Institutional Repository
ISO	-	International Organization for Standardization
KNUST	-	Kwame Nkrumah University of Science and Technology
MAG	-	Modernizing Agriculture in Ghana
MESTI	-	Minister of Environment, Science, Technology and Innovation
MoFA	-	Ministry of Food and Agriculture
NABCO	-	Nation Builders' Corps
NVRRC	-	National Varietal Release and Registration Committee
OPV	-	Open-pollinated Variety
PFJ	-	Planting for Food and Jobs
SANAS	-	South African National Accreditation Systems
SDF	-	Skills Development Fund



# FOREWORD

Dear friends

Once again, we are very pleased to present to you an overview of our activities in 2018. In our quest to become a Centre of Excellence in agricultural research, innovation and capacity building for development, the Institute continued to engage in numerous research activities in 2018. We gracefully report on a few “success stories” here.

We continue to operate within the seven thematic areas of the Council for Scientific and Industrial Research (CSIR) as well as the Institute's own 5-year strategic plan which also identifies with these thematic areas. Our research activities fall under three of the seven thematic areas namely; Food Security/Poverty Reduction, Biomedical/Public Health and Science/People.

Our mandate crops continue to be roots and tuber crops, cereals, legumes, horticultural crops, tropical fruits and vegetables as well as industrial crops. However, scientists have started researching into “non-mandate” crops such as sugarcane, ginger, tiger nuts, sunflower among others.

We continue to improve upon our infrastructure and building capacity of our human resource as well as increasing commercialization activities to generate more internally generated funds.

Funding is huge factor in our research activities and we acknowledge the support we have received from all our donors, sponsors, development partners and collaborators; without which there would be no “success stories” to tell.

Our heartfelt appreciation also goes to all those who have in diverse ways contributed to our success. We are very grateful to our entire staff, whose hard work and dedication have brought us here. Together we've made progress towards attaining our vision and we hope to continue working hard as we take advantage of every opportunity presented to us.



**Dr. M. Abu Sakara Foster**  
*Board Chairman CSIR-CRI*



**Dr. Stella A. Ennin**  
*Director CSIR-CRI*

## ACKNOWLEDGEMENTS

Our sincerest gratitude goes to all stakeholders and collaborators for their continuous support. There is no way we would have any successes without you all. We hope we can continue working together for a long time to achieve all of our aspirations.

As the largest of all 13 institutes under the Council for Scientific and Industrial Research (CSIR), the Institute partners with all “sister” institutes, universities, non-governmental organisations (NGOs), civil society, farmers, ministries and other research institutions, all of whom we owe a great deal of indebtedness.

We are most grateful to all our donors and funding agencies such as the Bill and Melinda Gates Foundation (BMGF), the West African Centre for Crop Improvement (WACCI), SEEDCO International, the International Institute of Tropical Agriculture (IITA), the Centre for Agriculture and Bioscience International (CABI), the Council for Technical and Vocational Education and Training/Skills Development Fund (COTVET/SDF), CALLI-GHANA, the World Bank, YARA-GHANA, the Korea-Africa Food and Agriculture Cooperation Initiative (KAFACI) among others.

We also acknowledge the Management Board for their direction, guidance, ideas and their oversight responsibility over the Institute.

Finally, a big “ayekoo” all our scientists, technical and support staff who continue to work tirelessly year after year.

God richly bless us all.

# About CSIR-Crops Research Institute

## History

CSIR-Crops Research Institute (CSIR-CRI) is one of the 13 institutes of the Council for Scientific and Industrial Research (CSIR) of Ghana. It was established in 1964.

## Vision

To be a Centre of Excellence for innovative and quality agricultural research and development.

## Mission

To develop and disseminate appropriate technologies for high and sustainable food and industrial crop production.

## Core values

Our core values are Excellence; Fairness; Commitment; Transparency and Accountability and Teamwork.

## Mandate crops

### Cereals

(maize and rice)

### Legumes and Oil Seeds:

(cowpea, soybean, groundnut, bambara groundnut & canning beans)

### Roots and tubers

(cassava, cocoyam, sweet potato, yam & Taro)

### Horticultural crops

*Plantain and banana:*

### Tropical fruits:

(citrus, mango, avocado, pineapple, pawpaw)

### Vegetables:

(pepper, garden eggs, tomato, onion and leafy vegetables)

### Industrial crop:

(rubber & sugar cane).

## Goals

To develop and disseminate appropriate technologies that are demand driven and acceptable to end users

To promote and strengthen strategic partnerships with relevant stakeholders to enhance the generation of solutions to challenges in agricultural research, technology development and transfer

To improve institutional capability to undertake effective research and service delivery to enhance agricultural productivity

To enhance research and technology delivery through efficient mobilization and management of funds

To improve the management and operating procedures and systems as a means of ensuring efficiency in research delivery

## Services we offer...

1. Production of breeder seeds for the National Seed Industry
2. Supply of healthy planting materials of citrus, avocado, mango, plantain and banana.
3. Development of crop varieties for food and industrial uses.
4. Establishment of farms (tree crop plantations)
5. Integrated management of crop diseases, pests & weeds.
6. Production of extension materials
7. Advise on tuse of appropriate experimental designs for field studies

## EXECUTIVE SUMMARY

The CSIR-CRI Annual Report for 2018 summarises all the Institute's achievements within the year under three main thematic areas: Security/Poverty Reduction, Biomedical/Public Health, and People/Science. These three (3) thematic areas are part of the seven (7) developed by the Council for Scientific and Industrial Research (CSIR).

To address the issues of food insecurity and poverty reduction, a number of crop varieties were developed and released by the Institute. These comprised four (4) varieties of sweet potato, five (5) varieties of maize and two (2) varieties of soybean. Following the release of two (2) sweet potato varieties in 2017, the Institute responded to consumers' demands for highly nutritive sweet potatoes with dry mealy flesh and low sugar content by developing and releasing *CRI-Vern Gracen*, *CRI-AGRA SP09*, *CRI-AGRA SP13*, *CRI-AGRA SP01* and *CRI-Kofi Annan* (named after the late UN Secretary-General). All four released varieties not only meet the desired attributes but are also tolerant to the sweet potato weevil as well as the sweet potato viral disease and can be used of various domestic and industrial purposes.

Vitamin “A” deficiencies (VAD) are serious forms of malnutrition that retard growth, weaken the immune system and may also cause blindness. As a result, the Institute has been advocating for the consumption of yellow and orange maize which contain very high levels of vitamin “A”. Furthermore, two of the five maize varieties released in 2018, *CRI-Abebe* and *CRI-Nkwagye* are yellow maize with very high levels of bio-available vitamin “A”.

The other three (3) varieties, *CRI-Apraku*, *CRI-Nkomo* and *CRI Akomapa* have excellent grain qualities and are also tolerant to the maize streak viral disease as well as multiple stresses. “*CRI-Apraku*” especially possesses a potential yield of 5.5 t/ha and will play a unique role in filling the hunger gap in July. It will bring its advantages to bear during late planting times when the rains are delayed.

Although, soybean is one of the crops currently being promoted by the Government of Ghana through the “Planting for Food and Jobs” programme, leading to an increase in industrial processing and utilization, local production has declined. Hence, with funding from CSIR/CIDA – Food and Agricultural Budgetary Support (CIDA-FABS) and RMG Ghana Limited, the Institute researched into and released two (2) high-yielding varieties, namely *CRI-Anigyee* and *CRI-Toondana*. These varieties are resistant to pod shattering, lodging and the soybean rust disease.

After successfully introducing a special package (positive selection, planting on ridges, minisets and neem leaf powder application) to yam farmers in Ghana and Nigeria under the CAY-seed project in 2017, the Institute brought various stakeholders together to share results and achievements. The workshop revealed that various achievements had been realized and targets exceeded.

After introducing and implementing the aquaponics-based food production system (AFS), a project which integrates crop production (especially the cultivation of vegetables and other common staple food crops), poultry and small ruminant rearing

with the rearing of fish in simple raised tanks, the Institute has since trained over six hundred (600) farmers, entrepreneurs, and agriculturists in the pond construction and management. This has yielded over 40 adopters of the fish pond technology across the country.

With support from the Modernizing Agriculture in Ghana (MAG) programme, the Institute produced 6.42 tonnes of maize, 7.20 tonnes of soybean, 2 tonnes of rice and 0.02 tonnes of pepper planting materials for the Government of Ghana's Planting for Food and Jobs programme.

As part of activities to mark the 60th anniversary of the Council for Scientific and Industrial Research, the Institute hosted an “Open Day” and the “African Renaissance Day” to showcase various technologies and interact with stakeholders. The Minister of Environment, Science, Technology and Innovation, Professor Kwabena Frimpong Boateng and the Deputy Minister of Food and Agriculture, Dr. Sagre Bambangi graced the occasion.

Three senior members of the Institute, Dr. Shadrack Kwadwo Amponsah, Dr. (Mrs.) Priscilla Francisco Ribeiro and Dr. Patricia Oteng-Darko were deservedly awarded by various institutes and organisations for their contributions towards research. In addition, the Institute's molecular biology laboratory was ISO-accredited for the detection of the African Cassava Mosaic Virus (ACMV) by

the South African National Accreditation System (SANAS).

Scientific publications are a key part of agricultural research and the CSIR-CRI continues to make sure that research findings are always available to the scientific society by publishing in very reputable journals and books. In 2018, we recorded one hundred and sixteen (116) publications comprising refereed journal papers, conference papers, training manuals, production guides and book chapters.

#### Research Themes and Support Functions

The institute's five strategic thrust areas fall under three of the seven thematic research areas of the CSIR. These are the key areas selected to drive the institute's focus in achieving its vision of becoming a Centre of Excellence for agricultural research, innovation and capacity building for development. The thematic areas inter-relate to achieve the desired results which will satisfy its mission of developing and disseminating demand-driven technologies and build capacity for sustainable food and industrial crops productivity to enhance livelihoods for development in Ghana. The support functions which involved the non-core research activities provide the needed anchor for effective delivery of the research activities.

# RT 1: Food Security And Poverty Reduction

## Crop Varietal Releases

### Output 1: *CSIR-CRI Names New Sweetpotato Variety after the Late UN Secretary-General Kofi Annan*

Sweet potato (*Ipomoea batatas* [L.]) is the fourth most important root and tuber crop in Ghana (after cassava, yam and cocoyam) in terms of production. It is a very important food security and income generation crop. It is a very versatile crop and can be used in various food preparations in place of rice, cassava, yam, plantain and other well-integrated staples in Ghana. Despite this great potential for food security and poverty alleviation, its level of utilization in Ghana is very low as compared to the other root and tuber crops.

In addition to flavour which is a primary determinant in consumer acceptance, sweetness, dry matter and beta-carotene content are the major end-user preferred traits. Most consumers in Ghana prefer sweet potatoes with dry mealy flesh, low sugar content, and high nutritive value. However, available local clones have very sweet taste, limiting their consumption as a staple food. Recently introduced orange-fleshed sweet potatoes to combat vitamin A deficiency at relatively cheaper cost, have low dry matter content. These factors have made sweet potato unpopular and led to the very low adoption rate of the improved varieties released in Ghana.



The need to improve upon the consumer and farmer preferred traits of the crop led the CSIR-Crops Research Institute to release four (4) new sweetpotato varieties namely; *CRI-Vern Gracen*, *CRI-AGRA SP09*, *CRI-AGRA SP13* and *CRI-Kofi Annan* (named after the late UN Secretary-General in recognition of his contribution towards increased sweet potato (orange-fleshed sweet potato) production and utilization in Ghana through funding of the Alliance for Green Revolution for Africa, AGRA). The attributes of the varieties are presented in Table 1.





**Table 1: Attributes and Uses of the Released Sweet Potato Varieties**

<i>Variety</i>	<i>Attributes</i>	<i>Uses</i>
<i>CRI-Vern Gracen</i> (Cream-Fleshed)	Tolerant to sweetpotato weevil; Tolerant to SPVD; Tolerant to Alcidodes; <b>Potential root yield:</b> 22.4t/ha; <b>Storage root DM:</b> 42.4%; <b>Starch content(DWT):</b> 76.6%; <b>Total sugars (raw):</b> 15.29%; <b>Beta-carotene content:</b> 7.25(mg/100g)DW; <b>Benefit-Cost Ratio:</b> 6.79	Fufu flour, French fries, Chunk-fried, Boiled/Steamed, Crispy chips, Bread, Pastries, Gluten-free noodles
<i>CRI-AGRA SP09</i> (White-Fleshed)	Tolerant to sweetpotato weevil; Tolerant to SPVD; Tolerant to Alcidodes; <b>Potential root yield:</b> 26.4t/ha; <b>Storage root DM:</b> 40.3%;	Fufu flour, French fries, Chunk-fried, Boiled/ Steamed, Crispy chips,

	<b>Starch Content (DWT):</b> 77.0%; <b>Total Sugars (raw):</b> 14.47%; <b>Beta-carotene content:</b> 2.85; <b>Benefit-Cost Ratio:</b> 7.99	Gluten-free noodles.
<b>CRI-AGRA SP13</b> <b>(Yellow-Fleshed)</b>	Tolerant to sweet potato weevil; Tolerant to SPVD; Tolerant to Alcidodes; <b>Potential root yield:</b> 39.2t/ha; <b>Storage root DM:</b> 39.7%; <b>Starch content (DWT):</b> 74.6%; <b>Total sugars (raw):</b> 16.56%; <b>Beta-carotene content:</b> 11.38(mg/ 100g)DW; <b>Benefit-Cost Ratio:</b> 11.8	French fries, Chunk-fried, Boiled/Steamed, Crispy chips, bread, pastries, Yoghurt, Baby foods, Juice, Potential enzyme source for breweries and other industries
<b>CRI-KOFI</b> <b>ANNAN</b> <b>(Orange-Fleshed)</b>	Tolerant to sweet potato weevil; Tolerant to SPVD; Tolerant to Alcidodes; <b>Potential root yield:</b> 19.2t/ha; <b>Storage root DM:</b> 35.5%; <b>Starch content (DWT):</b> 70.4%; <b>Total sugars (raw):</b> 18.12%; <b>Beta-carotene content:</b> 28.46; <b>Benefit-Cost Ratio:</b> 5.80	French fries, Chunk-fried, Boiled/Steamed, Crispy chips, Yoghurt, Juice.

Benefit Cost Ratios (BCRs) of 6.79, 7.99, 11.87 and 5.80 indicate that all the released varieties will generate huge profits for farmers. In 2017, the Institute released, two (2) other varieties *CRI-Gavana* and *CRI-Yiedie*

## Output 2: *High-Yielding Soybean Varieties Released by the CSIR-CRI*

**Soybean** (*Glycine max*) is one of the few food crops with great potential to provide employment and generate income in rural communities. The soybean industry provides numerous opportunities from the seed stage through to the grain production stage. The crop can be grown in all the agro-ecological zones in Ghana especially in the Savannah and the Forest-Savannah Transition zones. Although, it is one of the few crops currently being promoted by the Government of Ghana through the “Planting for Food and Jobs” programme, leading to an increase in industrial processing and utilization, local production has declined.

Average yields in Ghana have generally been low, with farmers' yields ranging from 700kg/ha to about 1200kg/ha depending on the particular variety, the environment, and management practices used.

However, research has shown that potential yields can be as high as 3500-4000 kg/ha in Ghana with improved varieties. Farmers attribute these low yields to lack of improved varieties and other production constraints such as inadequate supply of improved seeds, poor seed storability, pod shattering, susceptibility to diseases, lodging and poor soil fertility. With funding from CSIR/CIDA – Food and Agricultural Budgetary Support (CIDA-FABS) and RMG Ghana Limited, the Legumes and Oilseeds unit of the CSIR-CRI has researched into and released two (2) high-yielding varieties, namely *CRI- Anigyee* and *CRI-Toondana*.



*CRI- Anigyee* ("Happiness" in Akan)



*CRI-Toondana* ("The Best" in Dangbali)

*CRI- Anigyee* matures in 101 days, is resistant to the soybean rust disease and other diseases. It has good field emergence with yield potential of 3.4t/ha. It is moderately resistant to pod shattering with promiscuous nodulation. It has stay-greentrait, making it appear tolerant to drought even in the face of severe droughts.

*CRI-Toondana* has larger seed sizes with desirable yield component traits such as high number of branches per plant, high number of pods per peduncle. It is resistant to lodging and the soybean rust disease. It has promiscuous nodulation with soil rhizobia and a potential yield of 3.5t/ha

Economic analysis of both *CRI- Anigyee* and *CRI-Toondana* resulted in Benefit-Cost ratios (BCR) of 3.6 and 3.7 respectively. This implies that every GHS 1 invested in the production of these varieties will yield a profit of GHS 2.6 and GHS 2.7 respectively.

### **Output 3: *New Maize Varieties Released by CSIR-CRI***

Maize (*Zea mays L.*) is a major cereal crop and an important component of human and animal diets as well as raw material for industry. It is a widely grown cereal in the tropics and plays a major role as a food security crop in both rural and urban communities. It is the second most important crop after wheat in terms of area cropped and number one in terms of production. Maize is so important that in most of sub-Saharan Africa, maize yields are usually linked to food shortages and famine.

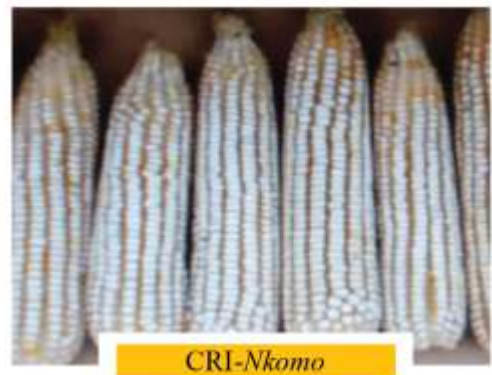


In Ghana, maize production is estimated at 1.87 million MT from an area of one million hectares, giving a farmers' average yield of 1.88 tons per hectare. This is generally low compared to the global average of 4-5 ton/ha and over 8ton/ha in the United States of America. This low production may be partly attributed to frequent biotic and abiotic stresses including disease outbreaks, drought and poor farming practices. Other factors include continuous use of unimproved landraces,

poor soils and erratic rainfall patterns. Despite increases in production over the years, Ghana is still not self-sufficient as the country experiences shortfalls in domestic supplies of about 12 percent which are off-set by imports which impact negatively on foreign exchange reserves. The demand for maize in Ghana is increasing and is projected to grow at a rate of 2.5 percent per annum. This increasing demand is driven by expanding populations and rising incomes where 45% of agricultural income is realized from maize with a per capita maize consumption of 45 kg being reported.

To meet this challenge will require dramatic increases in the productivity. Therefore, increasing maize productivity is a key priority to reduce poverty and hunger. The CSIR-CRI has contributed to such efforts by releasing five (5) new maize varieties with various attributes. These varieties when presented to the National Varietal Release and Registration Committee (NVRRC) were all accepted and approved for release.

Two of the newly-released varieties, *CRI-Nkomo* and *CRI-Akomapa* have yields of 6.5t/ha and 7.0t/ha respectively and mature within 105 days after planting. They have excellent grain qualities and starch granules with tolerance to the maize streak virus disease. They also have the capacity to perform in most of the agro-ecologies in Ghana. They possess a high protein content making them ideal for both poultry and human consumption. Benefit cost analysis revealed that these varieties would give higher returns compared to the varieties grown by most farmers currently.



Vitamin “A” deficiencies (VAD) are serious forms of malnutrition that retard growth, weaken the immune system and may also cause blindness. Since maize is a major staple in Ghana, a feasible approach to minimize vitamin “A” deficiencies (VAD) is to develop and promote the production and utilization of maize varieties that have high levels of bio-available vitamin “A”. There is, therefore, the need to make such varieties available to farmers. Furthermore, there is growing demand for maize cultivars with industrial suitability and most of these varieties are also suitable for purposes such as poultry and gritting.

Two of the release varieties *CRI-Nkwagye* and *CRI-Abebe* are pro-vitamin “A” hybrid varieties. They are both tolerant to the maize streak virus disease and mature within 110-115 days after planting. *CRI-Nkwagye* has a yield potential of 6.0 t/ha while *CRI-Abebe* possesses a yield potential of 6.3 t/ha.



Biotic and abiotic constraints mitigate maize production and productivity efforts in Ghana and West Africa. Prominent among the constraints are *striga hermonthica*, low soil nitrogen (Low N) and recurrent drought. The combined effect of these stresses could reduce yield by between 25 and 100%. The release of *CRI-Apraku*, a variety tolerant to multiple stresses, therefore, has great potential to enhance production and increase farmers' productivity. *CRI-Apraku* possesses a potential yield of 5.5 t/ha and will play a unique role in filling the hunger gap in July in the Sudan Savannah and the Northern Guinea Savannah zones after the long dry season. It will bring its advantages to bear during late planting times when the rains are delayed.

**Output 4: *Dissemination of the CAY-Seed (Community Action in Improving Farmer Saved Seed Yam) Results to Stakeholders.***

In 2017, the CSIR-Crops Research Institute introduced a special package (positive selection, planting on ridges, minisetts and neem leaf powder application) to yam farmers in Ghana and Nigeria.



This was under the Community Action in Improving Farmer Saved Seed Yam (CAY-seed) project which was sponsored by the Bill and Melinda Gates Foundation (BMGF) and implemented in Ghana and Nigeria. Positive Selection is an environmentally friendly strategy that has the potential to increase the productivity of seed and ware yams and re-vitalize the yam industry in Ghana.

Consequently, the Institute organised a 2-day workshop in June, 2019 for one hundred (100) participants selected from three (3) major yam-growing regions in Ghana. The workshop was meant to share results and achievements made by the CAY-seed project.

Some major achievements from the project included the 81.5% adoption rate of at least one of the many improved strategies introduced to farmers. This was beyond the expected target of 50% set at the beginning of the project.

Secondly, the project had targeted to train about 560 yam farmers on the positive selection strategy but ended up training 892 farmers-a 60 percent increase on the set target.



*A section of participants at the 2-day workshop*

Six (6) seed growers who presented viable proposals to the project, signed contracts with the project. Each grower was supported with funding of ten thousand dollars (US\$10, 000.00). Several scientific publications have also been made from various aspects of the project. Three (3) students on the project also had their post-graduate studies sponsored by the project.

### **FARMERS' IMPRESSIONS ON THE PROJECT**

I thank the initiators of CAY-SEED for the opportunity and empowerment given to vulnerable peasants like me from a hinterland called “Kramokrom”. We have gathered here today not to drink and dine or a for funfair, but to learn. And I am bold to say that those of us from “Kramokrom” have already learnt so much through CAY-seed. We were practicing our usual indigenous method of cultivating yam until CAY-SEED came to our rescue about three and half years ago with their technologies; planting on ridges, minisetts cuttings, neem applications, and good agronomic practices. We doubted the technology initially because we were used to planting on mounds but reluctantly, we adopted the innovation and the difference is clear. It is way better than what we anticipated.



Madam Adwoa Owusuaa  
(Kramokrom, Ejura)

Women have also been empowered; we own yam farms as women and men cannot maltreat us as they used to do because we are now assets not liabilities anymore. We manage our own farms together with our children. We are making money and don't have to depend on our men always. Now when you come to “Kramokrom” the women are “gentle”. I urge those who are yet to adopt the innovation should take it very seriously because it's really helpful.





Madam Beatrice Agyei  
(Abour, Atebubu Amantin)

We never knew yam could be planted on ridges until CAY-seed officials came to our community with their technologies. We have come to realize that planting on ridges yields better and in addition, the ridges are easy to construct compared to the mounds we were used to. Women can easily make the ridges since they don't require extra labour like the mounds do. We were surrounded by neem plants but didn't know their essence as an agricultural input. The CAY-seed intervention has taught us how to extract neem and use it for planting yam. Now, I can easily identify an unhealthy plant at a vegetative stage and tag it. Through CAY-seed, we can boast of improved family livelihoods. We can now afford better education for our wards. CAY-seed has been of immense help to us.

We used to recycle unhealthy yams as seed yams for the next farming season. We never knew that was the cause of our consistent poor harvest. This was our usual practice until the intervention of CAY-seed in 2015. Most of us thought ridges were only used to plant tomatoes and groundnuts but the project taught us to plant yam with ridges as well. Sincerely, we are enthused with the outcome from the ridges. We thank the facilitators for such a wonderful and productive technology.



Mr. Boakye, Agric  
(Extension Officer, Ejura)

## RT 2: Biomedical / Public Health

### Output 1: *Integrated Approach for Managing Fall Armyworm Infestation in Maize*



The continuous infestation of maize fields by the Fall Army Worm (FAW) in recent times has put agriculture and food security of the country at risk. This is due to the destructive nature of the pest. Following an outbreak of the FAW in 2017, a National Task Force was formed to coordinate the management of FAW in the affected parts of the country. The CSIR-Crops Research Institute was represented on the Task Force.

Various interventions were put in place to manage the outbreak of the pest. These included awareness creation and sensitization of farmers and the general public through the media. Training programmes were organized to build the capacity of farmers and Agricultural Extension Agents from the Metropolitan, Municipal and District Departments of Agriculture on FAW identification, monitoring and options for management.

Recent country-wide surveys by the National Task Force on FAW confirmed its presence in all maize farms visited. According to a survey, in the absence of appropriate control measures, the FAW is likely to cause losses in maize yields between 8.3 and 20.6 million tons per year. The potential cost to the country is calculated to come up to about US\$163 million. This will negatively affect farmers' incomes and national food security.

To avoid the further spread of the pest to unaffected areas and curtail its effect, the Institute engaged in a project that sought to find a holistic approach to solving the problem. The basic objectives of the project were to conduct efficacy tests for recommended pesticides, to conduct research and understand the pest's biology, behaviour and ecology as well as to explore appropriate bio-rational pesticides, semio-chemicals and devise a suitable pesticide management regime for fall armyworms. The study also set out to study the climatic relationships of the fall armyworm and to develop a credible integrated crop management system to mitigate fall armyworm infestation in maize cultivation in Ghana.

The project recorded the following achievements:

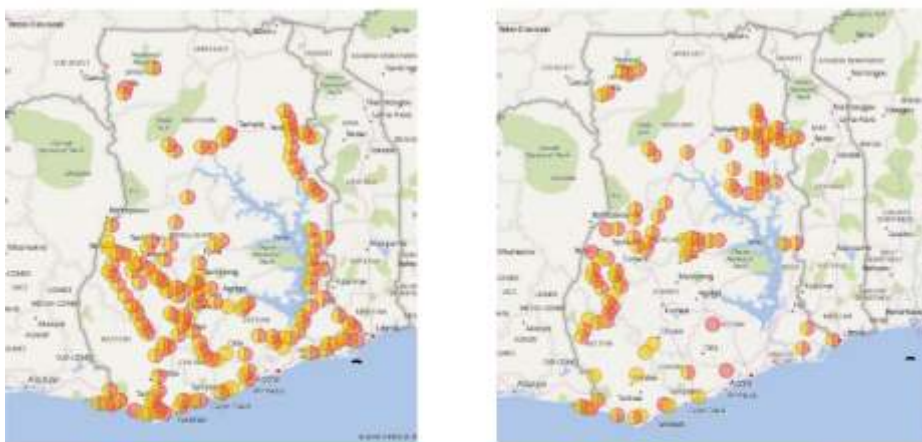
- Over 60 sampling locations for FAW species and natural enemies were picked and geo-referenced.
- Three (3) effective synthetic insecticides viz: Ampligo® 150 SC (Chlorantraniliprole + Lambda-cyhalothrin), Belt Expert®480 SC (Flubendiamide + Thiacloprid) Viper® 46 EC (Acetamiprid+ Indoxacarb) have been selected for further evaluation alongside microbial insecticides.
- Two biorational insecticide (botanical) consisting of the leaf extracts of Hyptis suaveolens and Jatropha curcas have been identified for FAW management and screening.
- Five (5) potential parasitoids have been sent to the Africa Regional Postgraduate Programme for Insect Science (ARPPIS), University of Ghana, Legon for identification.
- Indigenous Entomopathogenic Fungi (EPF) from FAW cadavers and agricultural soils isolated.
- Entomopathogenic nematodes incidence and community structure have been evaluated in selected communities in the country. Samples have been extracted and cultured prior to identification.
- Basic factors for developing early warning systems currently under investigation and traps for monitoring adult FAW currently installed and being monitored to generate required data.
- Maize-groundnut intercropping trials have been carried out to mitigate the effects of FAW. In collaboration with ICIPE the push-pull strategy of managing FAW is being validated.

## **Output 2: *Cassava Viral Disease Survey and Management of Cassava Viral Diseases in Ghana.***

West Africa produces about one-third of Africa's total cassava production. This notwithstanding, demand for cassava still exceeds supply due to losses through pest and disease attack. Diseases such as the Cassava Mosaic Disease (CMD) and the Cassava Brown Streak Disease (CBSD) can cause yield losses close to 100 percent. These diseases are very common in East African countries such as Kenya and Uganda. In order to forestall such occurrences in West Africa, the Bill/Melinda Gates Foundation is funding the West African Virus Epidemiology (WAVE) project to equip and prepare scientists, policy makers and other stakeholders to take pre-emptive steps at protecting citizens from famine caused by viral diseases. The CSIR-CRI are implementers of the project in Ghana.

In 2018, laboratory diagnostics of samples collected were done. A cassava viral disease map has been developed.

Ghana participated in a regional workshop organized by WAVE in Benin. The objectives of the workshop were to sensitize officials from the respective countries on the importance of cassava viral diseases in West Africa and also develop strategies that could be implemented to impede the spread of cassava viral diseases especially, Cassava brown streak virus (CBSV) disease into the sub-region. This has resulted in the development of a national response plan to impede the spread of cassava viral diseases into Ghana. This plan has since been endorsed by the Ministry of Food and Agriculture (MoFA).



*The distribution of ACMV and EACMV in Ghana between 2016 and 2017*



*Pictures from the Cassava Stakeholder consultative workshop held in Accra*

## RT 3: Science And People

### **Output 3: *CSIR-Crops Research Institute Promotes Integrated Food Production Systems in Ghana***

In countries like Ghana where agriculture is predominantly rain-fed, smallholder farmers are vulnerable to the unpredictability of the weather. Consequently, researchers are exploring different mechanisms to make agriculture sustainable. Agricultural researchers in Ghana are encouraging integrated farming systems; an economically and environmentally friendly activity in food production and income generation.

The CSIR-Crops Research Institute in collaboration with sister Institutes, the Ministry of Fisheries and Aquaculture Development and the Brazilian Agricultural Research Institute (EMBRAPA), has implemented the aquaponics-based food production system (AFS) project, which integrates crop production (especially the cultivation of vegetables and other common staple food crops), poultry and small ruminant rearing with the rearing of fish in simple raised tanks.

The objective of this integration is to ensure an all year-round food production for an enhanced income to the smallholder farmer, while attracting the youth to venture into agriculture. The integrated food production system employs vermicomposting to ensure all organic wastes from the various units within the system are beneficially utilised. This is helpful as it ensures that soil fertility is well maintained for sustainable crop production.

In such a closed loop system, there is no waste since every waste is ploughed back into the system, making the AFS environmentally friendly. The aquaponics system involves channelling fish waste (effluent) into crop production. Vermiculture (rearing of worms) is used to transform organic matter from crop residues and animal droppings into humus. The compost produced is used to improve the soil for crop production. This results in abundant yields of a wide variety of vegetables, fruits and grains at low cost.



*The circular-shaped AFS fish tank design*

The Institute has trained over six hundred (600) farmers, entrepreneurs, and agriculturists. This has yielded over 40 adopters of the fish pond technology across the country. In 2018, the Institute established ten (10) raised fish tanks for the Bui Power Authority (BPA) aquaculture project located at Bui in the Brong Ahafo region of Ghana. Six (6) more participants have been trained on pond construction and management. This was under the SDF Innovative Agribusiness Incubation Programme (IAIP).



*Participants being trained on fish pond construction and management*



*Fish pond construction at Bui in the Brong-Ahafo region of Ghana*

## **Output 2: *Development and dissemination of rice varieties in Ghana***

The consumption of rice in Ghana is increasing faster than any other crop due to rapid urbanization and changing dietary habits. However, there is big gap between the demand for rice and the volumes produced; resulting in a huge import bill. Even though, rice breeders at the CSIR-Crops Research Institute and other Institutes have developed rice varieties with very high yields, (six new rice varieties were released by the CSIR-CRI in 2017), there still exist a huge gap between potential yields and yields from farmers' fields. The huge yield gap is due to poor



agronomic practices practised by farmers as well as abiotic and biotic stresses in the environment that affect the stability of the varieties. The Institute therefore decided to use farmer field schools, demonstrations and field days to teach farmers good agronomic practices and the control of pests and diseases so that the full potential of existing varieties could be realized on farmers' fields.

Demonstrations, field days and farmer field schools were held at several locations. Four varieties *CRI-Dartey*, *CRI-Kantinka*, *CRI-Mpuntuo* and *CRI-AgraRice* were demonstrated to farmers. Good agricultural practices (GAP) including planting of one seedling per hill, good land development and timely application of recommended fertilizers were also demonstrated to farmers. A total of 345 farmers were enumerated across three districts.



*Focus group discussions on a demonstration field at Weta in the Volta Region*



### **Output 3: *Seed Increase Activities for the Planting for Food and Jobs (PFJ) Programme***

The Government of Ghana's Planting for Food and Jobs (PFJ) programme seeks to improve food availability for Ghanaians while providing jobs for the teeming unemployed citizens. In 2018, the programme contracted the CSIR-CRI to produce and supply early generation seeds (breeder and foundation seeds) of maize, soybean, rice, pepper and cassava to selected certified seed companies. With support from the Modernizing Agriculture in Ghana (MAG) programme, the Institute produced 2.41 tonnes of hybrid maize seeds, 2.30 tonnes of OPV maize seeds, 2 tonnes of OPV rice seeds, and 3 tonnes of soybean seeds. The Institute also took the opportunity to train several certified seed growers and seed inspectors in modern hybrid maize seed production. They were trained on various techniques and skills needed for successful hybrid maize seed production. The Institute hopes that the training will whip up interest in seed production in order to increase production in the country.



*A section of the seed growers who were trained by scientists from the Institute*

### **Output 4: *CSIR-CRI “Opens” its Doors to the Public during 2018 Open Day & Africa Scientific Renaissance Day***

The Council for Scientific and Industrial Research (CSIR) marked its 60th anniversary in 2018 and to mark it, the Institute organised an “Open Day” and an African Scientific Renaissance Day with the objective of showcasing CSIR-CRI technologies to the public and interacting with major stakeholders to highlight the importance of agricultural research to national development.

The Institute also wanted to remind all African governments and people about the critical role of innovation in national development. Both events saw several participants from both the private and public sectors visit the Institute. The occasions were also graced by the Minister of Environment, Science, Technology and Innovation (MESTI), Professor Kwabena Frimpong Boateng, the Deputy Minister of Food and Agriculture, Dr Sagre Bambangi and chiefs of the surrounding communities.



*Professor Kwabena Frimpong Boateng  
Minister of Environment, Science, Technology and  
Innovation (MESTI)*

The Director of the CSIR-CRI, Dr. Stella Ama Ennin, led participants to visit various crop fields, laboratories and exhibition stands where various technologies had been displayed.



*Dr. Kwadwo Adofo explaining a  
technology on sweet potato to  
participants*



*The Sector Minister, Prof. Frimpong Boateng  
being introduced to "aeroponics" a yam  
production technology by the Director, Dr.  
Stella A. Ennin.*



*Isaac Osei Bonsu of CSIR-CRI explaining a refuse separation technology to the Sector Minister*



*Among participants at the event were some traditional rulers*



*Director of CSIR-CRI Dr. Stella Ama Ennin, delivering an address at the function*



*A section of participants at the function*



*Several Junior High School Pupils also participated in the Open Day & African Renaissance Day*





*The Deputy Minister of Food and Agriculture, Dr Sagre Bambangi and the Director-General of CSIR, Prof. Victor K. Agyeman delivering their speeches at the event*



*Snr. Research Scientist of CSIR-CRI, Dr. Maxwell Asante explaining a technology to the Sector Minister*



*Some participants showing interest in some of the released legume varieties of the Institute*

### **Output 5: CSIR @ 60 Senior High School Quiz Competition**

As part of efforts to sensitize the general public on the importance of science education in national development, the Institute on behalf on the CSIR and in conjunction with the Ghana Broadcasting Corporation (GBC) and the Ghana Education Service (GES), organised a Senior High School quiz competition as part of the 60th anniversary celebrations of the CSIR. The quiz came off on 30th September, 2018 with Achimota Senior High School, St. John's Grammar Senior High School, West Africa Senior High School, Presbyterian Boys' Senior High School and Accra Girls' Senior High School as the participating schools. The quiz was won by Achimota School.



Contestants from participating schools with the quiz master, Mr. Dan Afari Yeboah (Host, WHAT DO YOU KNOW?)



Winners of the quiz were presented with plaques

## Output 6: Media Engagements



The Institute continued to engage with the media in order to inform the general public as well as various stakeholders of the numerous technologies it released. Various articles were published in the national dailies such as the Daily Graphic, the Ghanaian Times and the Chronicle. Various television and radio programmes were also held with scientists from the Institute educating the public on various technologies and scientific processes. The use of social media platforms also helped with the education of the general public especially the youth. Several articles were published on the various social media platforms as well as the Institute's website. The Institute will keep engaging with the public through the various forms of media to increase its visibility.

**Table 2: A Summary of the Institute's Media Engagements in 2018**

<b>DATE</b>	<b>MEDIA ORGANIZATION</b>	<b>TITLE OF PUBLICATION</b>
May 3, 2018	Joy News	<i>New Agric Technology App To Predict Crop Yield</i>
May 15, 2018	newsghana.com	<i>Dr. Dartey Recommends CRI's Rice Varieties For PFJ</i>
June 19, 2018	GNA	<i>Ghana to Sanitize Seed Yam Industry</i>
June 20, 2018	myjoyonline.com	<i>CSIR-CRI Wants Yam Included in Government's Planting for Food and Job programme</i>
June 20, 2018	GNA/modernghanaonline.com	<i>Quality Seed Yam Needed to Support Planting for Food and Job Programme – CRI</i>
May 22, 2018	LuvNews/myjoyonline.com	<i>Devouring Tomato Leaf miner Invasion Imminent – Scientists Warn</i>
July 2, 2018	LuvNews	<i>Fall Army Worm Invasion: Crops Research Institute Decries Lack of Support</i>
August 1, 2018	JoyNews	<i>AGI Urges Government to Reward Industry-Academia Collaboration</i>
Sept. 7, 2018	JoyNews	<i>CSIR Urges Scientists To Conduct Studies To Address Specific National Needs</i>
Sept. 14, 2018	Ghanaian Times	<i>CSIR Develops 10 New Varieties Of Non-Sweet Potatoes</i>
Sept. 25, 2018	The Chronicle	<i>CRI, Lancaster Varsity Research Into Sustainable Tomato Production</i>
Oct. 4, 2018	Ghanaian Times/GNA	<i>Achimota School Emerges CSIR Quiz Champions</i>
Oct. 18, 2018	Ghanaian Times	<i>CSIR-CRI Launches New Maize Variety</i>
Oct. 18, 2018	Ghanaian Times	<i>CSIR-CRI Finds Antidote to Army Worm Infestation</i>
Oct. 25, 2018	The Chronicle	<i>CRI Tutors 200 Stakeholders in Urban Vegetable Production</i>
Nov. 6, 2018	Ghanaian Times	<i>Give Us More Money to Deliver – CSIR Chair</i>
Nov. 13, 2018	Ghanaian Times	<i>Re: CSIR's Antidote to Armyworm Is Infested with Controversy</i>

## **Output 6.1: CSIR-Crops Research Institute Organizes A Value-Chain Workshop on Strengthening The Domestic Rice Industry In Ghana**



Various actors along the rice value chain in Ghana have called for an increase in the import levy placed on rice importation in the country. Currently, importers of rice pay a 20 percent (20%) levy on the value of their imports. The Government of Ghana has been advised to increase this to 25 percent (25%) in order to support the local rice industry.

At a workshop organised by the CSIR-Crops Research Institute in collaboration with West Africa Centre for Crop Improvement, University of Ghana, Mr. Alhassan Imoro from the rice desk of the Ministry of Food and Agriculture (MOFA) informed stakeholders that the Ministry is working to attain rice self-sufficiency by the year 2025 despite the myriad of constraints within the sector.

He asked Government to use the proposed 5% increment in the levy to set up a “rice fund” for the local rice industry. This he hopes will increase the capacity of local rice producers to produce more in order to achieve the self-sufficiency target by 2025. Stakeholders from various levels of the rice value chain such as producers, processors, marketers, service providers as well as policy makers were all present at the workshop and deliberated on the challenges in rice production, processing, consumption preference and marketing. The workshop also identified key solutions in addressing the challenges and also develop public-private collaborations for the transformation of the rice value chain.

The Project Coordinator, Dr. Maxwell Darko Asante, a Rice breeder and Senior Research Scientist at the CSIR-CRI stated the enormous potential Ghana has of achieving rice self-sufficiency if the challenges in research, production, processing and marketing are alleviated. “We consume over 1 million metric tonnes of milled rice yearly.

However, 60 percent of this is imported and this is negatively affecting the economy”, he said. Other solutions the workshop suggested included an improved seed and land tenure system, formation and strengthening of rice advocacy groups, timely release of credit to actors and the creation of a National Rice Policy Co-ordination Committee which will review various rice projects in order to avoid duplication and ensure the effective use of resources.



*The Project Co-ordinator, Dr. Maxwell Darko Asante speaking to the media after the workshop*

The outputs from the workshop will be submitted as a policy brief to the Ministry of Food and Agriculture. The value-chain workshop is part of activities for an African Union and the European Union funded project titled “Crop and Soil Health Improvement for Sustainable Agricultural Intensification Towards Economic Transformation in Sub-Saharan Africa”.



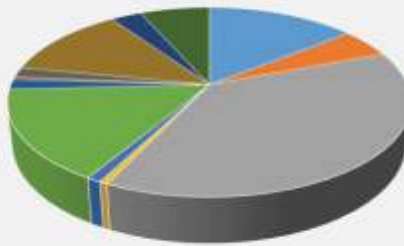
# RESEARCH SUPPORT ACTIVITIES

## Output 1: *Donor Support in 2018*



Donor funding is a key component of research activities at CSIR-Crops Research Institute. The Institute continues to receive grants from both local and international funding agencies. The total donor support received in 2018 was slightly higher than the amount received in 2017. Funding agencies such as the Bill and Melinda Gates Foundation (BMGF), WACCI, AGRA, CALLI-GHANA, SEEDCO, YARA, COTVET, MAG, CIP-POTATO and others were the key funding agencies that supported research activities in 2018.

**Key Donor Support to CSIR-CRI in 2018**

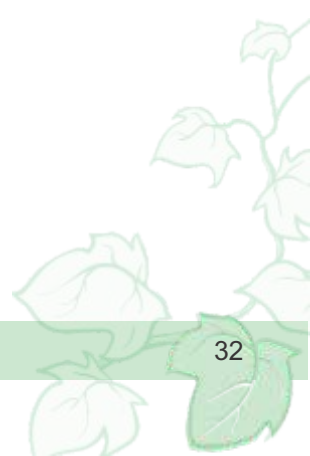


■ BMGF ■ WACCI ■ OTHERS ■ CALLI-GH ■ SEEDCO ■ AGRA ■ CABI ■ YARA ■ DG ■ IITA ■ COTVET SDF ■ MAG

## Output 2: *Increasing CSIR-CRI's Visibility Through the Use of Institutional Repository (IR)*



In 2017, the Institute set up a digital repository-an online tool used for scholarly research dissemination. The repository preserves the Institute's intellectual output digitally by collecting and managing information. The system also increases the Institute's online presence by making content available to the public. Since 2017, about 354 published journal articles have been uploaded and are available to the general public.



# COMMERCIALIZATION ACTIVITIES

Income generation is a key component of most public research institutes. The CSIR-Crops

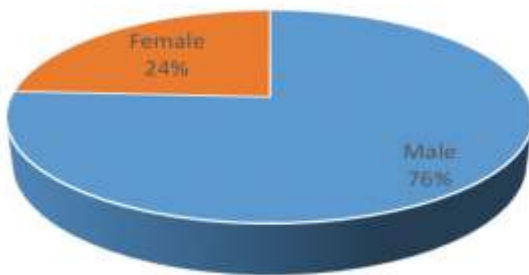


The CSIR-Crops Research Institute engages in a number of commercialization activities for income generation such as the production and onward sale of rubber seedlings, citrus seedlings, mango seedlings, cassava sticks, maize and pepper seeds. These activities not only generate income but also make planting materials constantly available to farmers and other stakeholders. The Institute also produces planting materials for the Government of Ghana's Planting for Food and Jobs programme. In 2018, we produced 6.42 tonnes of maize, 7.20 tonnes of soybean, 2 tonnes of rice and 0.02 tonnes of pepper planting materials for the programme.

# HUMAN RESOURCE AND STAFF RECRUITMENT

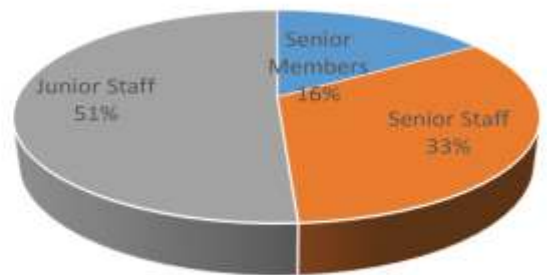
The current staff strength of the Institute is five hundred and seventy-two (572). This is a 5% decline from the number in 2017; which was also a 4% declined from the number in 2016. Yearly staff attrition continues to hamper activities of the Institute as the Government of Ghana's continuous freeze on public sector employment has prevented the Institute from recruiting new staff to replace those who retire yearly. This notwithstanding, the Institute was cleared to employ three (3) staff in 2018. The Institute therefore recruited two (2) principal technologists and one field staff. Additionally, fifty (50) national service personnel and eighty-four (84) members of the Nation Builders' Corps (NABCO) were allocated to the Institute in 2018. The Institute continues to encourage its staff to keep adding value to themselves by attaining higher qualifications and earning promotions. Consequently, as many as ninety-eight (98) members of staff were promoted in 2018 comprising 4 in the senior member grade, 24 in the senior staff grade and 70 in the junior staff and monthly-rated grades.

**STAFF DISTRIBUTION BY SEX**



■ Male ■ Female

**STAFF DISTRIBUTION BY GRADE**



■ Senior Members ■ Senior Staff ■ Junior Staff

## *New Staff Recruited by the Institute in 2017*



*Mrs. Mary Otiwa Asante Osei  
(Agronomist, MPhil  
Crop Science)*



*Mr. Kwame Obeng Dankwa  
(Plant Breeder, M.A.  
Crop Genetics and  
Breeding)*



*Mr. David Pukinka  
(Technical Officer,  
Diploma in General  
Agriculture)*

# TRAINING AND CAPACITY BUILDING

## *CSIR-CRI Staff Mentoring Programme*

Along with the Director's vision of encouraging young and up and coming scientists to achieve their potential by learning from more experienced ones, the CSIR-CRI has instituted a formal mentoring programme for its staff. Younger scientists (mentees) are paired with more experience scientists (mentors) and tasked to understudy them for a period of two years. They are to present progress reports every 6 months and a final report at the end of the program. It is expected that both mentors and mentees will grow and improve within their respective fields of study. Mentees especially are expected to make significant progress in their research, careers, scientific skills as well as people skills. A first batch of mentees has successfully “graduated” and some have even progressed to become mentors for others. A number of successes have been chalked under the programme such as the publication of fifty-six (56) referred journal article and the attendance of forty-one (41) trainings/workshops/short courses. It is our hope that a lot more scientists will take advantage of the programme.



*A mentor receiving a certificate after successful completion of programme*



*Group photograph of mentor/mentees*

# AWARD Proposal Writing Training

The African Women in Agricultural Research and Development (AWARD)- a fellowship dedicated to strengthening the production and dissemination of more gender-responsive agricultural research and innovation, in conjunction with management of the CSIR-CRI organised a 5-day proposal training workshop for scientists of the Institute. This was to equip scientists to improve upon their proposal writing skills in order to attract more donor funded projects to the Institute. The training came off between the 14th and the 19th of May, 2019 with over one hundred (100) participants. Participants were taken through various concepts such as gender-responsive research, the use of scientific electronic tools, pitching, presentation skills and research methodology.



*A section of participants at the AWARD proposal writing training*



*Some participants receiving their certificates from the Director of CSIR-CRI after the training*

# INFRASTRUCTURE



*The newly refurbished “cold room” (seed storage room) at the Institute’s Kwadaso station*



*Laboratory based rapid multiplication*

# AWARDS

Over the years, the Institute has won several awards as a result of the dedication and commitment of staff and 2018 was no exception.

## *ISO Accreditation*



*Staff of the Institute's Biotechnology division presenting the certificate to the Director, Dr. Stella A. Ennin*

## *CSIR-CRI Scientist Wins Award at the 20th Induction Ceremony of the Ghana Institution of Engineering*

Ing Dr. Patricia Oteng-Darko, a Research Scientist of the CSIR-Crops Research Institute won the best candidate award in the “**Mech/Agric/Marine**” Technical Division of the engineering professional examination during the 20th induction ceremony of the Ghana Institution of Engineering (GhIE).

Ing. Dr. Patricia Oteng-Darko is a Soil and Water Engineer with the CSIR-Crops Research Institute. Her research interest lies in efficient resource use (water, nutrient and energy) in crop production, irrigation and water management in agriculture, agricultural mechanization and aeroponics and hydroponics.



*Ing Dr. Patricia Oteng-Darko receiving the award at the ceremony*



### *CSIR-CRI Scientist Wins Best National Partner Presentation Award*



The National Co-ordinator for the Stress Tolerant Maize for Africa (STMA) project, Dr. (Mrs.) Priscilla Francisco Ribeiro, a research scientist with the CSIR-Crops Research Institute was awarded the best national partner presenter award after she gave a presentation on behalf of the Ghana team on the occasion of the annual STMA project meeting in Harare, Zimbabwe. The STMA project aims to develop improved multiple stress tolerant varieties that effectively address emerging and future production challenges.

Dr. Ribeiro is a plant breeder with the Institute and is researching into maize. She is currently working on a project that aims to breed new maize varieties resistant to all types of biotic and abiotic stresses. She also won the African Women in Agricultural Research and Development (AWARD) fellowship in 2013.

### *Ing. Dr. Shadrack Amponsah Receives Engineering Excellence Award*



A Research Scientist of the CSIR-Crops Research Institute, Ing. Dr. Shadrach K. Amponsah received the “Most Published Author in Engineering” award at Engineers Excellence Award (EEA) in 2017. Dr. Shadrach K. Amponsah has published works in a number of local and international agriculture-related journals and was deservedly awarded **“The Most Published Author (Engineering Publications) In The Practitioners/Project Category”**. Dr. Shadrack Amponsah is a PhD holder in Agricultural Machinery Engineering from the Kwame Nkrumah University of Science and Technology (KNUST), Kumasi-Ghana. He worked as an assistant field engineer on the West African Agricultural Productivity Program (WAAPP) project on Demonstration and Popularization of Mechanical Cassava Harvesting Technology in Ghana.

## *CSIR-CRI Obtains Licensing Agreements for Crop Varieties*



The Institute is very keen on protecting its intellectual property (IP) rights and as such an IP sub-committee was inaugurated in 2014 to sensitize and create awareness among staff and stakeholders on all IP-related issues such as patents, copyrights, trademarks, trade secrets, the plant breeders' rights among others. The committee is also tasked with identifying, assessing and collating patentable research outputs of the Institute. Since its inauguration,

the Institute has successfully negotiated licensing agreements for two (2) soybean varieties as well as two (2) hybrid Maize Varieties to two private seed companies. The Institute stands to earn royalties from these agreements. Additionally, the Institute has completed the filing of a patent on a “banana weevil attractant”, which was developed by staff of CSIR-CRI in conjunction with the Rothamsted Research, UK.

# LIST OF 2018 PUBLICATIONS

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