



RESEARCH
PROGRAM ON

Grain Legumes and
Dryland Cereals

CRP-GLDC Science Meeting 2019

Nairobi, Kenya
25-29 November 2019

Acronyms and abbreviations

AGRA: Alliance for a Green Revolution in Africa

AVISA: Accelerated Varietal Improvement and Seed Delivery of Legumes and Cereals in Africa

BGM: Botrytis Grey Mould

BMGF: Bill & Melinda Gates Foundation

CERASS: Centre d'Etude Régional pour l'Amélioration de l'Adaptation à la Sécheresse

CIRAD: Centre de Coopération Internationale en Recherche Agronomique pour le Développement

CNGs: Crop Network Groups

CoA: Cluster of Activities

CoPs: Community of Practices

CORAF/WECARD: Conseil Ouest et Centre Africain pour la Recherche et le Développement Agricoles

CRP-CCAFS: CGIAR Research Program on Climate Change, Agriculture and Food Security

CRP-GLDC: CGIAR Research Program on Grain Legumes and Dryland Cereals

CRP-PIM: CGIAR Research Program on Policies, Institutions and Markets

CRP-RTB: CGIAR Research Program on Roots, Tubers and Bananas

CRP-WLE: CGIAR Research Program on Water, Land and Ecosystems

CSAT: Climate Smart Agricultural Technologies

CSIRO: Commonwealth Scientific and Industrial Research Organisation

EiB: Excellence in Breeding

ESA: Eastern and Southern Africa

FARA: Forum for Agricultural Research in Africa (FARA)

FP: Flagship Program

Fe: Iron

GS: Genomic Selection

IAC: Independent Advisory Committee

IBP: Integrated Breeding Platform

ICARDA: International Center for Agricultural Research in the Dry Areas

ICIPE: International Centre of Insect Physiology and Ecology

ICRAF: World Agroforestry

ICRISAT: International Crops Research Institute for the Semi-Arid Tropics

IISD: Integrated Seed Systems Development

IITA: International Institute for Tropical Agriculture

ILRI: International Livestock Research Institute

INRAN: Institut National de Recherches Agronomiques du Niger

IWMI: International Water Management Institute

IRD: Institut de recherche pour le développement

MABC: Marker-assisted backcrossing

MARLO: Managing Agricultural Research for Learning and Outcomes

MEL: Monitoring, Evaluation & Learning

MELIA: Monitoring, Evaluation, Learning, and Impact Assessment

MISST: Malawi Improved Seed Systems and Technologies

MPAB: Markets and Partnerships in Agri-Business
NARS: National Agricultural Research System
NENA: Near East and North African
NGOs: Non-Governmental Organizations
PPs: Product Profiles
QC: Quality Control
QTLs: Quantitative Trait Loci
RGA: Rapid Generation Advancement
RGT: Rapid Generation Turnover
SA: South Asia
SI: Sustainable Intensification
SLU: Swedish University of Agricultural Sciences
NP: Single Nucleotide Polymorphism
SRF: Strategy and Results Framework
SSA: Sub-Saharan Africa
SAT: Semi-Arid Tropics
SDG: Sustainable Development Goals
ToC: Theory of Change
TPE: Target Population of Environments
USAID: United States Agency for International Development
WCA: West and Central Africa
Zn: Zinc

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Background

The CGIAR Research Program on Grain Legumes and Dryland Cereals (CRP-GLDC) organised a 'Science Meeting' in Nairobi, Kenya from 25-29 November, 2019. It witnessed the participation of Scientists and Researchers from its partner institutions to brainstorm various issues concerning agriculture within the semi-arid and sub-humid dryland agro-ecologies of Sub-Saharan Africa and South Asia. Consequently, it not only engaged the partners in a participatory way to lay the ground for more actions towards achieving the GLDC outcomes, but also provided an opportunity to work collaboratively across various flagship programs of CRP-GLDC to facilitate scaling up of GLDC innovations and activities.

At the meeting, the leaders of Flagship Programs and cross cutting initiatives, including gender and youth, MPAB (Markets and Partnerships in Agri-Business) and capacity development, provided a detailed overview of various activities that are currently underway in 13 priority countries in Sub-Saharan Africa and South Asia and held discussions to review and identify their research priorities and the portfolio of activities for next years.

Objectives of the Meeting

1. Set Research Priorities for 2020
2. Evaluate the progress towards milestones

Science Meeting Sessions

The Science Meeting was facilitated by Dr Kiran Sharma (main facilitator), Director, GLDC and DDG-Research, ICRISAT. The meeting sessions alternated between presentations, plenary and group work sessions. Emphasis was given on maximizing the sharing of experiences between participants and for joint planning. The IAC members of GLDC also attended the meeting and shared their views with the participants.

Day 1: Inaugural Session

In his opening remarks, Dr Kiran Sharma stressed on the need for integration between various flagships of the programme and cluster of activities. Underscoring the need for communication, he further stated that as the programme is about to complete two years, it's necessary to generate greater impact using more efficient approaches in communicating for scaling.

In his inaugural address, Dr Peter Carberry, Director General, ICRISAT emphasized on leveraging the work done by earlier CRPs. He stated that this is the most successful CRP programme as it was built on multiple commodities delivering the farming system and bringing in partnerships from varied sectors. He also said that this integration should reflect the impact of the added value these partnerships bring in. He laid emphasis on prioritisation of GLDC crops in the country and said that we should ensure that the nine crops along with other crops in legumes and in dryland cereals continue to deliver into the mission of elimination of poverty, hunger and environment constraints going forward.

In his address, Dr Etienne Hainzelin, Chair, Independent Advisory Committee (IAC), summarised the proceedings of the IAC meeting and called for more cross FP work so that a shared view and shared vision can be presented. He said that this CRP would be judged by this added value which has to be documented and expressed. He also emphasised on documenting the impact pathways while achieving the ambitious targets set for the CRP.

Session 2: The GLDC Imperatives

During this session, the speakers gave a detailed overview of the milestones achieved along with the progress vis-à-vis the milestones. The speakers highlighted the key impacts from 2018 and 2019 and stressed on the relevance of GLDC research through improved targeting and priority setting.

For the cross-cutting areas, it was highlighted that gender research should establish the roles of gender norms and social change in technology adoption. It was also mentioned that modelling

frameworks are being considered to evaluate the trade-offs and co-design farming systems for enhanced resilience and income, besides looking at portfolios of household activities, enterprises and management practices that enhance livelihoods while minimizing negative externalities.

Under Capacity Building, many activities supporting the growth of future research leaders through MSc and PhD programs, scholarships, and exchange programs was discussed at the Science Meeting.

Under the theme on Markets and Partnerships in Agri-Business (MPAB), the participants were briefed about the activities launched to researchers to unlock market opportunities for GLDC. This theme also explored innovation in GLDC agri-food systems.

Given below are the presentations made by the Flagship Programs (FP).

FP1: Priority Setting and Impact Acceleration

Presenters: Arega Alene, Michael Hauser and Karl Hughes

Arega Alene presented a brief on strategic objectives and cluster of activities. He further briefed the participants on the status and the updates of the milestones under Flagship 1. It was informed that one of the milestones has already been achieved and rest are on track. Under CoA1.1, foresight, climate change analysis, and priority setting were presented. He also presented the ranking of GLDC technologies vis-à-vis Benefit-Cost Ratio, poverty, and malnutrition. The participants were also briefed about the impacts of improved cowpea varieties in Nigeria and impacts of improved soybean varieties and agronomic practices in Malawi.

[Presentation](#)

Scaling up the impact of legumes and cereals in the drylands

Presenter: Michael Hauser

Michael Hauser spoke about scaling up of the impact of legumes and cereals in drylands. He highlighted the challenges in scaling up the technologies and gave examples of how others are also struggling with this challenge. He further spoke about the “right approach” and said that throughout scaling phases, adaptive socio-technical innovation rather than technology development prevailed.

[Presentation](#)

GLDC Impact Evidencing Strategy

Presenter: Karl Hughes

Outlining the contribution to CGIAR System Level Targets, Karl Hughes mentioned that 8.9M farm households have adopted improved GLDC varieties and 4.4M people have been assisted to exit poverty (50% women). Highlighting a three-pronged approach, he suggested to compile and synthesize existing evidence, particularly on adoption, and estimate adoption of GLDC technologies (including consumption) in key countries and in areas where evidence is missing.

[Presentation](#)

FP3: Integrated Farm and Household Management

Presenter: Jules Bayala

Jules Bayala presented the updates on FP3. He highlighted the work done under three cluster of activities namely innovations for managing abiotic and biotic stress, cropping systems management and testing & adapting and validating options. He also highlighted the activities done under the Norway-funded CSAT project in Niger. He stated that under this project 5,500 adult specimens of the parasitoid (*Therophilus javanus*) have been successfully released. The releases occurred on 29-30 Aug 2019 on unsprayed cowpea fields around Maradi and Zinder. An initial colony rearing of the parasitoid has also been established at INRAN Maradi station. He further mentioned that in Benin the team was able to recover adults of the Parasitoid *Therophilus Javanus* from parasitized caterpillars collected from cowpea pods. A breakthrough, indicating that this parasitoid is still well established 3 years after the first experimental releases in the region.

[Presentation](#)

FP4: Variety and Hybrid Development

Presenter: Janila Pasupuleti

In her presentation, Janila Pasupuleti mentioned that 73 cultivars of nine GLDC crops in 16 target countries of Africa and Asia were released in 2018. She highlighted the chickpea revolution in Myanmar during the past two decades where production increased nearly eightfold due to 300% increase in area from 101,000 ha resulting in doubling of productivity (660 to 1,400 kg/ha). Further, 96% of the chickpea area in 2017-18 was under the five improved varieties developed through ICRISAT-DAR partnership research. She explained the impact of early maturing and high yielding lentils into rice-based systems of Bangladesh. She also elaborated on the work done towards building sustainable public-private business-oriented sorghum and groundnut seed systems in Uganda and Tanzania. As part of adopting best practices from Industry, the Seed Inventory Management System was highlighted. She talked about the imaging technologies for phenotyping being developed in partnership with a private sector company and with engagement with EIB platform. In her presentation, she also spoke about the biofortification, speed breeding and capacity building initiatives.

[Presentation](#)

FP5: Pre-Breeding and Trait Discovery

Presenter: Rajeev Gupta

Rajeev Gupta highlighted the progress in FP5. Significant progress has been made in trait discovery, markers and applications, and molecular assisted breeding products. Major strides were made in upstream trait discovery areas resulting in several publications (~100 in 2018) in high impact factor journals. He elaborated on public private partnerships (e. g., ICRISAT-Corteva) for significant advances in traits discovery, enabling tools & technologies and the capacity development initiatives of the flagship. As an important breakthrough, it was informed that the first ever high-yielding chickpea variety was released in Ethiopia which was developed using MABC.

[Presentation](#)

Markets and Partnerships in Agri-Business (MPAB)

Presenter: Andy Hall

Andy Hall explained the vision and purpose of this new cross-cutting theme whose main purpose is to explore market opportunities for GLDC crops and the responses and impact pathways needed to leverage these opportunities for SDG relevant impacts. MPAB will facilitate the development of new partnerships with market actors and those engaged in the development of market opportunities for GLDC crops. MPAB will also support other FPs with market and agri-food system expertise, with a focus on working with partners and stakeholders in specific country and value chain contexts.

[Presentation](#)

Gender & Youth

Presenter: Esther Njuguna-Mungai

Esther talked about the youth engagement in the GLDC program and presented insights from Tanzania drylands on emerging gender issues. She explained the findings in the field and stated that youth transition is a cultural process and there are clear norms that guide the process. She said that the transition pathway for the 'boy child' and the 'girl child' are very different and unique. She also briefed the participants about the activities undertaken in gender in the seed systems in FP4. She stressed on the behavior change approaches in popularizing improved varieties, besides providing an overview of the capacity building initiatives undertaken in this cross-cutting theme.

[Presentation](#)

Capacity Development

Presenter: Thomas Falk

Thomas Falk presented the status of capacity development initiatives of GLDC and briefed the participants about how the eLearning platform is being developed for online courses. He also mentioned about the contributions of the CapDev Task Force and RuForum collaboration.

[Presentation](#)

Day 2: Field Visits

As part of this meeting, CRP-GLDC organised a one-day exposure visit to the Plant Transformation Laboratory (PTL) at Kenyatta University and Groundnut Processing Unit of Greenforest Foods Limited at Embakasi in Nairobi. The short briefs on the visits are given below.

CRP-GLDC team and the partners visit the Plant Transformation Laboratory (PTL) at Kenyatta University, in Nairobi

In a day-long exposure visit, the participants visited Plant Transformation Laboratory (PTL) at Kenyatta University in Nairobi, Kenya. The team visited the highly successful research centre, housed in the Department of Biochemistry and Biotechnology of the University, and interacted with Professor Steven Runo and his team on *Striga hermonthica*, one of the major parasitic weeds, also called the 'witch weed', and a major parasite to GLDC cereals- sorghum, finger millet and pearl millets. Led by Professor Steven Runo, who is also the Department Chairman, the research focus is on the biology of parasitic weeds. Accompanied by one of the postgraduate students, Prof. Runo impressively summarised the research activities of the lab. Supervising over 20 postgraduate male and female students, Prof. Runo executes his research through training and mentorship. He referred to *Striga hermonthica* as a "cereal killer" in his recent review, published in one of the highly cited scientific Journals, PloS Pathogens

(<https://journals.plos.org/plospathogens/article?id=10.1371/journal.ppat.1006731>).

His determination to eradicate the "cereal killer" is evidenced by the number of publications on *Striga hermonthica* biology in different crops, ranging from maize, rice and sorghum, with more publications on finger millet and pearl millet in preparation. The visitors were also taken around the facility, which included a histology lab, a growth room and greenhouses. A tour through the glasshouses clearly demonstrated Prof. Runo's passion for research on GLDC crops, with most of the experimental crops growing in the greenhouses being finger millet, pearl millet and sorghum.

For quick observation of plants showing resistance to the witch weed, the postgraduate students grow the crops through portable rhizotrons, small growth cassettes enabling clear observation of the plant roots. "These rhizotrons make it possible for us to detect resistant plants within a few weeks, as they allow the introduction of *Striga* into the roots of the cereals, and subsequent observation of the *Striga* establishment or lack thereof, in the case of resistance", said Prof. Runo. At the back end of the greenhouse, the participants also saw two students opening up rhizotrons containing finger millet seedlings, and introducing a known number of pre-germinated *Striga* into the roots.

"The finger millet varieties they are working on were provided by ICRISAT-Nairobi", says Dr. Damaris Odeny, a genomics scientist. "We make use of this facility for millets and sorghum screening against *Striga* since Prof. Runo has a well-established system, and there would be no reason for us to duplicate this effort", Dr. Odeny explains further. At the end of the visit, Prof Runo highlighted the benefits of collaborations with ICRISAT, with support from CRP-GLDC, which included access to ICRISAT-genomics lab for his students, access to germplasm, evaluation fields, as well as germplasm.

CRP-GLDC team and the partners visit the Groundnut Processing Unit of the Greenforest Foods Limited

As part of this meeting, the participants of GLDC Science Meeting also went to the Groundnut Processing Unit of Greenforest Foods Limited at Embakasi in Nairobi, Kenya. Mr Matheka Athanas, Founder and CEO of Greenforest Foods Limited demonstrated the entire process to the delegation, right from shelling to packaging. "This sheller can shell five tons of groundnuts in an hour," he said, pointing towards the big sheller. Recently, during his visit to Germany he met buyers who have expressed a desire to buy 1000 metric tons of groundnuts.

"When you walk inside this place, there is not much space. Embakasi is very congested. I started here with two employees, today I have forty", Athanas Matheka says, smiling from ear to ear. Embakasi is a tiny division in Nairobi which is not only famous for its Kenyan celebrities, but is also known for lots of factories and godowns. Mr Athanas Matheka started Greenforest Foods Limited from Emayian

Godowns at Embakasi, quitting his cushy marketing job at Unilever. Today, Greenforest Honey is one of the leading brands in the country and their Greenforest Groundnut brand is fast catching up.

Mr Athanas procures most of his honey from rural Kenya and Tanzania. It was during one of these travels he realized that there is a huge potential waiting to be unearthed in groundnuts as well. He can do to groundnuts, what he has been doing with honey. Buy raw honey from the farmers, process it in his factory at Embakasi and sell it in the market. "The market is very big and there is a real opportunity to work with the Institutions, Universities and other organizations doing research on groundnuts. Everybody should come on board as everyone wins, including farmers and consumers," Athanas Matheka stressed.

Most of the groundnuts in Kenya are imported from Uganda, Malawi and Tanzania, even though the country has a very conducive climate to produce enough groundnuts to meet its internal demand. However, the production of groundnuts in the country is plagued with lots of challenges. The local varieties in Kenya are low yielding and are prone to diseases. Moreover, the farmers have very limited access to the markets and face tremendous hurdles in storing the harvested crop. Credit from the banks and other institutions is almost negligible.

"We have introduced high yielding varieties of groundnuts which are less susceptible to the diseases. One of the major issues in groundnut farming in Kenya is Aflatoxin contamination that prevents export of groundnuts outside the country. We are trying to address that as well," said Dr Ganga Rao, Principal Scientist (Breeder), ICRISAT. He further added that ICRISAT, with the support from GLDC, is trying to increase the production of groundnuts in the country by providing good quality seeds and promoting healthy ergonomic practices, that includes quality grain production.

As part of the partnership development within the value chain, ICRISAT linked the farmers with Matheka's Greenforest Foods Limited. "After meeting with ICRISAT, we are now working with lots of farmers in dry areas," Matheka added.

In this win-win situation, the partnership has given farmers assured market for their produce, while reducing the marketing and transaction costs. For Greenforest Foods Limited, it has ensured supply of groundnuts with quality, at the right time and lesser cost. Currently, Greenforest Foods Limited is selling their groundnuts to big retail companies, airlines and many other organizations. "We also realized that there were lot of issues regarding aflatoxin contamination as people were shelling with hands so we bought sheller," Matheka said. The processing unit is well equipped with automated sorting systems to packaging machines.

"We are also building the capacities of young people operating on our value chain as this will help us to enhance our returns," Matheka said. In near future, Greenforest Foods Limited is planning to buy their own place and build their own godowns. We will work with as many farmers as we can. We will expand the project, he added.

As the transformation continues, GLDC will also continue to support underperforming agri-food systems in the target ecologies of South Asia and Sub-Saharan Africa into well-functioning systems.

Day 3: Report Back Sessions on Research Priorities for 2020

At the Science Meeting, there was an agreed need to think more holistically to enhance the relevance and impacts of GLDC research through improved targeting and priority setting. As CRP-GLDC continues to be committed to an 'inclusive and equitable innovation system for accelerating impacts for women and young people' in the drylands, it was felt that the cross-cutting activities become indispensable part of the research priorities in the year 2020. Accordingly, the leaders of GLDC's four Flagship Programs and cross-cutting initiatives not only highlighted the different perceptions but ensured alignment towards the research priorities and activities for the year 2020. This session provided an opportunity to understand how different partners and institutions can contribute to achieving common GLDC outcomes, and to learn from and discuss examples of interventions to maximize impact. The main objectives of this session were:

- In view of the PoWB 2020, research priorities are identified in consultation with partners at the level of FPs and CoAs for delivery of planned activities
- Cross-cutting initiatives are embedded in research priorities

As this was one of the major activities of the Science Meeting, the report back sessions were held across Day 3 and Day 4. During these two days, FP leaders and their teams held group discussions and later shared the outcomes with the participants.

Day 3: Group discussions on Research Priorities for 2020

The FP Leaders held extensive group discussions on Day 3 within their Flagships for the research priorities for 2020. This session provided another opportunity to the participants to discuss, reflect and share their ideas and observations with their group to firm up the research priorities.

Day 4: Research Priorities for 2020 as outlined by FP Leaders

The outcomes of the group discussions as shared by the FP Leaders are given below.

FP1: Priority Setting and Impact Acceleration

Support to other FPs

FP1 will provide support to other FPs in developing product profiles (e.g for FP4). FP1 has been engaging with FP4 at the Center level and there is need to formally write the PP plans into the PoWB with W1/W2 funding as well as AVISA. However, lack of standardized procedure for developing PPs remains a challenge. GLDC crops feature poorly in IFPRI report for the Crops to End Hunger (CtEH) initiative except sorghum and groundnut. There is need for FP1 to prepare an updated regional priority assessment report and share with ICRISAT DG to try and make a case for GLDC crops with donors and other stakeholders as and when opportunities for dialogue arise. Capacity development initiatives will further enhance and strengthen the link between FP1 outputs and the GLDC theory of change. Moreover, the work on enabling policy environment and scaling will be very critical. A review of GLDC scaling evidence against idealized scaling approach can form the basis for further dialogue on this. There is also a need for strengthening extension systems for scaling and rural transformations.

[Presentation](#)

FP3: Integrated Farm and Household Management

FP3 group worked around the terms of references common to all groups, which are:

- Research priorities are discussed with partners and cross cutting themes to be aligned to deliver intended outputs/outcomes.
- Cross-cutting initiatives to be embedded in research priorities.
- Area identified for integration across FPs.

Research priorities

In line with the above-mentioned, the deliberations started by presenting the Plan of Work and Budget for 2020 (POWB2020) including the 2019 activities to be pursued and new ones which are linked. Based on the presentation, the participants have made the following comments:

- FP3 is a system flagship but the list of activities presented are largely technology focused.
- There is a need to connect with FP1 for activities which deal with institutional development.
- During the presentations of the first day, it appeared that the understanding of what is considered as an output was not the same for all FPs and that needs to be harmonized. One way of addressing this issue is to relook at the Theory of change (ToC) and analyze how each output fits in and contributes to it. This issue will be addressed during FP3 meeting planned early 2020.
- Make clear behavioral assumptions as well as about which actors (and their actions if not accomplished will jeopardize the next step) required to move from output to outcome. We should also question ourselves about what to do about these assumptions to get things move in the intended direction.
- Develop a clear research question on gender aspect in FP3 work. This will be done during FP3 meeting early 2020.
- Other issues discussed include mechanization for customized small machines for smallholder farmers for sowing, harvesting, threshing, etc., nutrient and water use efficiency and the associated trade-offs, bio-fertilizer and biocontrol of pests. On this last area, the participants wonder whether it will not be more cost-effective to evaluate the already existing products promoted by various actors/industry instead of trying to produce our own given the time constraints. FP3 was suggested to reflect more on this and consider adjustments to relevant activities when finalizing the POWB 2020.
- The need to start synthesizing the program findings. It was agreed, after discussing the possible forms including workshop to develop book chapters, organizing special issue of journal, to conduct a literature review on the impact of GLDC-based farming systems on natural resources management. The impact assessment will also have a field data collection component. The field work of such investigation will be done in former sites of the past phases of the CRPs on Dryland Cereals and Grain Legumes or sites of some of the mapped projects like The Drylands Development Program (DryDev) of World Agroforestry (ICRAF). The synthesis of research should be done in collaboration with Program Management Unit (PMU) for fund allocations. To realize this synthesis work, two new activities have been developed and included in the finalized POWB 2020 of FP3.
- FP3 was also encouraged to connect with commodity program like the CG center and FARA collaborative program funded by the African Development Bank (AfDB) on Technologies for African Agricultural Transformation (TAAT) and discuss ways to embed system approaches to deliver solutions that will sustain the natural resources. Similar discussions with the World Bank funded West African Agricultural Productivity Program (WAAPP), coordinated by Conseil Ouest et Centre Africain pour la Recherche et le Développement Agricoles (CORAF), was encouraged in the area of assessing the impacts of this program. FP3 could help with technical support on designing agro-ecological sustainable farming and by training PhD students in using the relevant tools and approaches. Similar complementarity would be explored with the project Recherche-Développement pour la Sécurité Alimentaire et l'Adaptation au Changement Climatique des Systèmes de production (RED/SAACC) in Niger.

Cross-cutting initiatives to be embedded in research priorities

Gender

The discussions with the leader of this cross-cutting area have generated the following two point of actions:

- Organize a two-day workshop on gender integration during FP3 activity leaders meeting in the first quarter of 2020.
- Develop gender researchable questions and identifying data needs particularly focusing on (1) Participation of women and age groups and (2) Women empowerment.

Capacity Development

Long exchanges with the capacity development (CD) leader concluded on the need to:

- Relook at the ToC and analyze how each output aligns with it. This will be done during FP3 workshop early next year.
- Populate the E-learning platform with training materials produced by PF3 actors.
- Define and report Cap Dev in view of CGIAR CD framework going beyond traditional training activities and include any action that contributes to strengthening the skills of partners. Involving NARS in research is one way of capacitating them but such activities are not reported.
- Identify actors who are important to achieve the outcome of FP3 activities.
- Identify what capacity development is needed for which actor.

Market and partnership in agri-business (MPAB)

The key area of collaboration with this cross-cutting area is about identifying opportunities from the muddle around sorghum/millet utilization options for improving nutritional security and resilience of smallholders' households in SAT. MPAB team will support in this cross-cutting study.

Area identified for integration across FPs

FP1

Two main areas of collaboration identified include the work on the impact assessment and that on the institutions as discussed during our group work.

FP4 and FP5

Systems modelling scenarios developed in FP3 are intended to inform FP4 and potentially FP5 in understanding the relative importance of different traits/cultivars/crops in different regions considering climate change. This work will be jointly pursued with these two FPs. Similarly, the already started work in disseminating varieties will continue and better reported with feedback to FP4 and FP5.

[Presentation](#)

FP4: Variety and Hybrid Development

Flagship 4 team held consultations with NARS partners, other FP teams and cross-cutting themes to refine the research priorities for 2020 keeping in view the outputs of the GLDC. The consultations were held after identifying broad areas of research by FP4 team, and feedback was sought from the stakeholders. Besides, the FP4 team also provided feedback to the other FPs and cross-cutting themes on the needs of FP4 to deliver the overall outputs of GLDC. The FP4 team noted that the crop x country x trait prioritization done at the time of development of GLDC proposal holds good for 2020 based on the evidence provided by FP1.

Furthering the 'International Nurseries' emerged as a key research priority for FP4 in 2020 to enhance effective engagement with NARS. The centralized model of seed increase, receipt of indents, distribution, data receiving and analysis practiced at ICARDA, and the opportunity to further enhance it using digital tools were deliberated. The possibility of sharing nurseries developed by NARS in India under south-south collaboration, and embedding International Nurseries in their national trials are

opportunities to enhance CG-NARS germplasm exchange. It was agreed that sharing International Nurseries in a coordinated manner in a stage-gate system and focusing on receiving data would add value to the crop breeding programs. Both, NARS and Private sector noted the benefits from these nurseries and Hytech seeds cited their example where all the parental lines of Sorghum were received from ICRISAT. Crop Network Groups (CNGs) will act as platforms for exchange of nurseries, and sharing of knowledge on trailing, and data receiving and analysis.

The second priority area for FP4 was phenotyping platforms that can enable access of phenomics facilities at ARIs like INRA (Dijon-France) and ICAR-NIASM (India) to CG and NARS. Existing phenomics facilities at various ARI/CG/NARS can be leveraged rather than establishing new facilities. Grain quality phenotyping is critical for GLDC's work on biofortification and quality trait for markets, hence robust tools like NIRS and XRF are useful. Crop Breeders screen large number of lines and it would be more appropriate to hand-hold for initial screening, which would later be confirmed through precision phenotyping. FP4 team is also exploring drone-based Imaging technologies for use in phenotyping.

Capacity building on practical aspects of crop breeders at International Training course held in 2018 and 2019 by FP4 received a good feedback from trainees and resource persons. The training meets the expectations of practicing crop breeders and provides knowledge and networks to adopt best practices of crop breeding to enhance genetic gain and operational efficiencies. The third training in WCA will be conducted in 2020. Given the specific skill set required for genetic improvement of grain quality traits GLDC proposes to support capacity building of stakeholders on nutrient content analysis with the help of Harvest plus during 2020. As a good number of students from NARS institutes are trained in crop breeding program, GLDC can capture their work in the MEL.

FP4 plans to work with FP1 team to build evidence on contribution to nutrition of GLDC crops and/or biofortified cultivars. The 'adoption success' of new legume varieties in Myanmar (chickpea) and Bangladesh (lentil) resulting in >95% improved legume cultivar adoption, and seed hubs are incredible success stories of public sector seed systems. Understanding the ecosystems and the drivers for the 'adoption success' is a priority to FP4 seeds systems work and FP4 planned a study with MPAB team. Market studies to guide the design of crop Product Profiles is high priority for FP4 team and is expects FP1 team to conduct these studies for target crops in target countries. The crop breeders of CG centres with NARS organized stakeholder consultations to design the Product Profiles, and plan to further refine PPs in 2020 with feedback from market studies.

Characterizing Target Population of Environments (TPEs) is important for FP4 team to deploy the multi-location testing of GLDC crops. Deploying quality control (QC) in breeding pipeline is important to FP4 and is working with FP5 team, which is developing QC panels for GLDC crops. The deliberations identified the need to have the TPE and QC tools available to the breeding programs.

[Presentation](#)

FP5: Pre-Breeding and Trait Discovery

FP5 focuses on exploiting the untapped genetic resources of cultivated germplasm, wild relatives and landraces by developing and using cutting-edge tools and techniques for trait discovery, trait mapping, trait characterization/dissection and deployment in breeding process to accelerate the rate of realized genetic gains in GLDC crops. For this reason, in 2020, FP5 will focus on trait discovery, functional validation of traits and pre-breeding by exploiting natural and/or systematically induced variations for prioritized traits in combination with modern tools for accelerated, precise, cost-effective and efficient breeding of new varieties in future. Here is a brief summary of priorities for 2020.

CoA 5.1 (pre-breeding) will focus on advancing the prioritized traits for pre-breeding by use of already ongoing activities on exploring the natural diversity in wild/un-adapted germplasm. In 2020, the focus will be on advancing the work related to Botrytis Grey Mould (BGM) in chickpea and blast/heat tolerance in pearl millet by using the wild germplasm in ongoing activities partially supported by bilateral projects. In addition, the focus will also be on the characterization and advancement already created transgenic events for traits (such as Bt pigeonpea, Bt chickpea and HIGS induced resistance to aflatoxin) where natural diversity is not available. Advancing the next generation genetic populations such as Nested Association Mapping (NAM), Multi-parent Advanced Generation Inter-Cross (MAGIC), etc. will also be a priority.

CoA 5.2 (trait discovery) will focus on mapping and dissection of priority traits aligned with product profiles in each target crop. In 2020, major priority areas will be marker development, validation and deployment in forward breeding in some of GLDC crops. In 2020, 'QC panel' development, initial validation on germplasm/breeding lines panels will be priority in most of GLDC crops. Advancing the introgression (molecular breeding) lines harbouring the QTLs/genomic regions controlling the desired traits in elite lines will also be the focus. In addition, development and validation of genomic selection (GS) in two of GLDC mandate crops will be priority. The development of advanced genomic and genetic resources for current and future trait discovery will be continued. Refinement of reference genome assembly in pearl millet will be achieved in collaboration with Corteva. Multi-pronged strategies will be developed with various stakeholder from multiple partners for resource mobilization and addressing complex traits such as Striga.

CoA 5.3 (Enabling technologies) will be continuing in area of establishing the proof of concept in genome editing, proof of concept/deployment of second-generation transformation (QuickCrop from Corteva) in sorghum and pearl millet, systematic mutant population and rapid generation advancement (RGA) in at least a couple of GLDC crop.

Capacity development and cross cutting themes: FP5 will also work closely with other FPs and cross cutting themes to deliver on planned joint activities. In addition, FP5 will also be continuing activities in capacity development by supporting the training students and researchers (especially NARS partners), organizing training courses, seminars, workshops, symposiums, supporting exchange visits, data management etc. The bilateral funding will also be leveraged for these activities. The knowledge generated from FP5 activities will be disseminated in form of reports, datasets, scientific publications, presentations at various scientific platforms, sharing knowledge with partners etc.

[Presentation](#)

Research Priorities for 2020: Cross Cutting Themes

Market & Partnerships in Agri-Business (MPAB)

One of the most important and ongoing work for MPAB is to develop concepts and evidence for the effectiveness of the interventions to promote the use of GLDC crops by consumers and industry. The work is being carried out with FP1, CSIRO and ICRAF. Another important initiative will be to undertake pilot testing of food choices in urban low-income communities (food safety and ground nut). This is being done with FP3, FP4, FP5 and ICRISAT.

MPAB will be leveraging the flour blending policy changes in Kenya with FP3, FP4, FP5, ICRISAT, Bioversity and CSIRO. It will also be doing the scoping and the scaling of sorghum fodder enterprises in India with FP3/FP 4/FP5 ILRI. It will organize stakeholder consultation on study of future markets for functional foods in India with FP4, FP5, ICRISAT and CSIRO national partners.

MPAB will start new workstreams for 2020 by including case studies highlighting how transformation works, mainly on lessons from India/ Bangladesh/ Myanmar on chickpea lentil seed systems adoption (framed by agri-food system perspectives). This will be done with FP1, FP4, ICRAF CSIRO and University of Sussex.

In capacity building, it will organize workshops on integrated design perspectives that will focus on capacity building for systems change, theories of change, partnership practice, youth and gender, innovation directionality and scaling logic.

This theme will navigate sorghum millet utilization options to strengthen coalitions and action in India. As far as game changing traits are concerned, it will undertake systems dynamics modelling to predict profit and pathways. Another important initiative will be to look at "Plant based meats -Potential or pipe dream" considering global demand and options for pigeonpea and cropping systems in Malawi and regional enterprise development.

[Presentation](#)

Gender & Youth

The GLDC gender research agenda was designed to be unique for each FP, aligned to the key issues on the impact pathway. The issues are assumed to be distinct enough to implement different activities in each FP. Accordingly, in 2020 following key activities will be undertaken.

- Gender responsive 'product profiles' 'customer profiles'.
- What has been the role of women/youth in the seed success in Myanmar/India/Bangladesh.
- Clarification of 'gender research question'; capacity enhancement on gender research/management of qualitative data for FP3 team. Institutional arrangements for delivery of gender research.
- Gender dynamics in seed systems, Integrating the youth participation, working on the corridor approach, processors/aggregators/BCC.
- Soybean in Ghana study.
- Impacts/outcomes of 'gender responsive traits' like rancidity, labor saving and iron/zinc among women/community.
- Plant-based meats: youth enterprise opportunity structures?
- Capacity building in capacity building – offering to be a guinea pig with the seed systems/youth/BCC study.

[Presentation](#)

Capacity Development

GLDC scientists across the flagships and the cross-cutting themes plan substantial capacity development activities in 2020. More than 18,000 beneficiaries are intended to be reached with field days, more than 17,000 with farmer field schools. More than 5000 people will participate in workshops or training courses. Another highlight is the training of 24 PhD students until the end of the program. The Capacity Development Task Force will on demand support these activities as required.

In addition, the Capacity Development Task Force will focus in 2020 on three critical activities:

- Conduct a workshop on integrated, impact and transformation oriented R4D design. This activity will be driven by all three cross-cutting themes and will target scientists of all flagships. The critical intention from a capacity development perspective will be to revisit specific sub-ToCs of the FPs to identify constraining capacity gaps in the ToC. We see this effort as a contribution to the development of integrated project proposals as facilitated by the Market and Partnership crosscutting theme. It can further provide impulses into the One CGIAR process.
- Populate E-learning Platform. The existing GLDC E-learning platform will be improved in design and functionality and will be populated with learning material provided by the flagship scientists. The Task Force will support the adaptation of existing training material to make them suitable for E-learning experiences. In addition, there will be exchange of content with the ICARDA E-learning platform as well as the agSKILLed platform.
- Support appropriate mapping of Capacity Development activities. The Task force will continue raising awareness for the diversity of types of capacity development and will support flagship scientists in adequately mapping their activities to capacity development.

[Presentation](#)

Monitoring, Evaluation, and Learning (MEL)

Data hosted in MEL widely covers information representing partner centers and programs and are neatly synthesized into visualizations that can be analyzed at a glance. MEL Dashboards present overviews of programs, and activities/project/products; generate interactive charts of CapDev sub-activity disaggregation according to type, and gender; presents maps of partnership geographic distribution for projects; maps out levels of investments at project level, and towards SLO's; analyzes portfolio based on outcomes; and presents comprehensive information and interactive charts of investments according to crop. At the CG-SMO level, data is further analyzed and synthesized at a more macro and consolidated perspective which would need individual platforms contributing information, i.e. MEL integrating to CLARISA to support the CGIAR Results Dashboard.

To enhance the implementation of program framework, and compliance to CG-level performance management standards, GLDC projects to be mapped starting in 2020 will undergo a documented, objective, and criteria-based mapping process. This will allow GLDC to maintain a transparent and logical process for selection, prioritization and inclusion of new projects and withdrawal of projects from program, based on the theory of change and factors such as comparative advantage, scientific merit, potential value for money; and promote regular review of program progress and priorities which will feed to logical and transparent decisions on (re)prioritizing W1/W2 funding, including expansion or cutback. Two materials: (a) Guidelines for inclusion and withdrawal of W1/W2 Activities, and W3/Bil Projects into CRP on Grain Legumes and Dryland Cereals, and (b) W3/Bil Project Mapping process template will facilitate processes to this end.

A GLDC Newsletter is in the works to promote public knowledge from GLDC and offer incentive for scientists to diligently update reports in MEL. The newsletter will be feature-type, hosting primarily materials uploaded to MEL, which will consist of sections including innovations, outcome stories, impact cases, and photo features among others. The first issue will represent year 2019 and would be produced monthly thereafter. This initiative would hopefully address the currently low volume reporting for planned outputs and deliverables within the GLDC community and support the upcoming 2019 annual reporting process.

Retrospectively, some experiences and insights include: (a) periodic changes on templates, and lack of clarity on the use of data, (b) limited plans and information flow from W3/Bilateral level, and at the CoA and FP levels, (c) late planning and reporting (single time) with no time to support in information enhancement, (d) long Quality Review process with limited transparency of reviewers, and (e) MEL platform maintenance and enhancement needs. Action plans for 2020 and beyond in response would include: (a) data usage promotion through research, visualization, and information sharing, (b) more efficient and proactive communication among W3/Bilateral managers and COA/FP Teams, and with SMO for updates (c) increased Centers M&E team involvement in planning and quarterly follow-up with scientists (skype) on reporting, and (d) conduct of internal review processes across CRPs.

[Presentation](#)

Day 5: Write-shops

One of the main highlights of the Science Meeting was the Write-shop session on various topics. This intensive exercise brought together a range of stakeholders including future potential partners who were special invitees to prepare tangible collaborative project proposals for submission to potential donors. Following topics were undertaken.

1. Systems research to transform agriculture for climate resilience in SAT: Legume intensification transforming agri-food systems for healthy landscapes and people in SSA.
2. Crop modernization: Leveraging partnerships to achieve greater economic value through advanced new crop development.
3. Biofortification: GLDC crops for nutrition sensitive agriculture.
4. Striga: From biology to applications.
5. Empowerment of 'non-youth': Identifying young women in scaling of GLDC technologies (She-Empower).
6. Fall Armyworm: Integrated approaches for sustainable management in smallholder farms.

The teams held group discussions on the above-mentioned topics. Below are the briefs from the group discussions.

Write-Shop 1: Systems research to transform agriculture for climate resilience in SAT: legume intensification transforming agri-food systems for healthy landscapes and people in SSA

The participants representing ICRISAT, ICRAF, ICARDA, IITA, ILRI, CORAF, and NARS partners from Niger, Burkina Faso, Mali, Tanzania, Kenya, Bangladesh, Myanmar and India had a very productive brainstorming to agree on the title, scope and approach for the proposal under discussion. This proposal considers that the legumes have potential and are key to transform agri-food systems to achieve SDGs in SSA and SA contributing to:

- Sustainable land management/ agricultural intensification/ healthy landscape (environment).
- Alleviating malnutrition and achieving zero hunger (Sustainable diets).
- Improved health and human well-being.

The efforts in the past have mostly been on enhancing yields and capturing export markets, which are highly risky and do not incentivize farmers in the medium to long term. Here the idea will be to integrate context specific legume crops, fodders and trees in agri-food systems context through harnessing their existing and potential internal demand. The focus will be on:

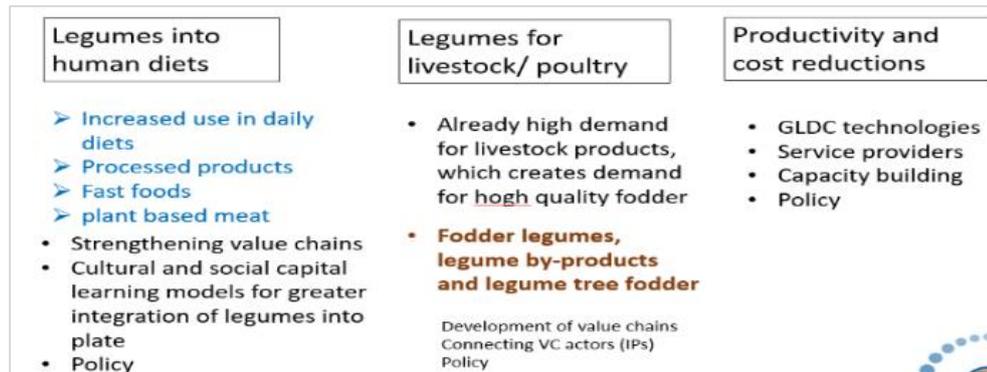
- Harnessing existing feed and food demand.
- Creating demand for nutrition (rural and urban) across regional value chains.
- Change in consumption behaviour.
- Competitively integrating legumes compared to alternative/existing crops into farming systems (yield and production cost).

Key research questions include:

- How the increased integration of legumes with cereals can viably supply fodder for livestock to meet a big existing demand meat?
- How create increased internal demand (countries/region) to promote legume intensification?
- How to reduce cost of production and risk through higher yield achievement and managing biotic and abiotic stresses?
- What would be enabling institutions and policies?

The agri-food systems approach would focus on integrating legumes into farming systems and peoples' diets utilizing GLDC technologies, improved cultivars, harnessing existing demand, developing regional value chains, cultural and social capital learning models and behaviour change communication for creating internal demand and policy and infrastructure interventions.

Major impact pathways



Collaborative partners and locations: Country/Countries from ESA, WCA, SA but also in others regions like NENA regions (depending on country priorities and donor's interest). We develop a globally shared framework hosted by FP3.

Tentative budget: US\$ 5 million per region and 10 million per country for implementation.

Write-Shop 2: Crop modernization: Leveraging partnerships to achieve greater economic value through advanced new crop development

The meeting was designed to start cooperation of multidisciplinary collaboration with the end in mind. Often breeding takes the push approach; if a better product is designed, people will take it. Although there are many important potential traits we could have covered, we primarily focused on forage characteristics for a potential product proposal. We looked at behaviour and then worked our way backward through the value chain to come to the technical points of selecting for increased fodder quality, which has tremendous potential to affect the economic and life quality standards of the farmers.

At the user end, trust needs to be built through last-mile agents who can influence deep behavioural changes. A data summary of the economic assessments (ILRI, ICRISAT) can estimate the added economic value and social impact by showing increasing fodder quality (affecting digestibility, milk production, etc.). This should be easy to compose with much of the information already available through the participating institutes.

There is an opportunity here to use a case study from India and develop a South-South collaboration. What has to be kept in mind are country policies and approval requirements to register these forage types if they don't deliver an increased grain yield. This could potential require process to have better variety descriptions and working with policy makers to help them understand the tremendous economic potential fodder traits can deliver to the end user.

Another important technical issue discussed in-depth was the need to develop a NIRS calibration network among all the participating contributors. Combined data from all locations will increase the reliability of individual instruments at each of the locations, especially when the NIRS equipment is networked. This should be a mandate for all participants in the network, the data can be shared and the consistency and confidence in the data being generated can increase. EiB is working with Intertec on pricing and developing standardized protocols for sending validation/calibration samples to their labs. Further standardized sampling and processing protocols have to be developed to ensure consistency throughout the network.

The plan is to develop a concept note to assess the social, gender, economic and value-chain potential of all the GLDC crops. In the first phase we want to focus on sorghum, groundnut and cowpea and in the second phase extend it to all other GLDC crops.

The partners for this project: CIRAD, IITA, ILRI, ICRISAT, IIAM, CIRAD, IAVAO, Makerere University (Uganda).

Outputs: Increase the fodder/feed value in addition to the food value of GLDC crops, considering the global economic impact, social implications and benefits, documenting the downstream nutritional impact (due to healthier, more productive herds and benefits to the farmers) and have increased capacity building.

Estimated cost of the initiative: \$ 9.5 million.

Potential funding sources: BMGF, IFAD, USAID, DESIRA (EU), DFIT and ADB

Write-Shop 3: Bio-fortification of GLDC crops to ensure healthy and nutritious food systems under climate change scenarios

The project goal is to reduce malnutrition for millions of people in South Asia, Sub-Saharan Africa and MENA by increasing availability to GLDC crops in daily diet, and provide sustainability to agri-food systems. The outputs of the project contribute to the Sustainable Development Goals (SDGs) 2 that aims to reduce poverty, achieve food security and improved nutrition, and promote sustainable agriculture.

Background: GLDC crops are important source of energy, protein and micronutrients to people, particularly to the vulnerable rural poor, and play an important role for sustainable agri-food systems. The genetic variability for nutritional quality traits among the GLDC crops offers scope to further enhance the nutritional content in grains and/or enhance the bioavailability of available nutrients. There is also need to understand climate change effects on the nutritional quality of the GLDC crop varieties and develop strategies to minimize the negative consequences of climate change on nutritional quality of GLDC crops. Given the need for nutritional security and opportunity, research has been conducted in GLDC crops to enhance the nutritional quality; high grain Fe and Zn sorghum and pearl millet were commercialized in Asia and Africa and other nutritional quality traits such as protein content and oil quality in other crops.

Objectives:

1. Enhance the nutritive value of GLDC crops without compromising productivity, climate resilience and other essential commercial qualities.
2. Assess climate change effects, particularly elevated CO₂ on nutritional content of GLDC crops.
3. Assess and/or document trade-off and trade-in of factors affecting bioavailability of the nutrients and enhance their bioavailability.
4. Understand the major factor of scaling ecosystem along the value chains and processing technologies that can enhance nutrition and market acceptability of GLDC crops and their processed products.
5. Enhancing capacities of stakeholders along the value chain of bio-fortified GLDC crop products.

Potential partners and donors identified: GLDC, Harvest plus, University of Pretoria, Clemson University, Cornell University, USDA, FtF Innovation Labs, ICAR, CSIRO, Nutrition International, NARS, Food industry (depends on local presence of industry), CCAFS – climate change modeling.

Proponents of the CN: Janila Pasupuleti (FP4 leader of GLDC, ICRISAT), Shiv Kumar Agrawal (CoA leader of GLDC, ICARDA), Meike Stephanie Andersson (CIAT-Harvestplus), John Taylor (University of Pretoria), Stephen Beebe (FP 6 leader of GLDC, CIAT), Andy Hall (Focal point of crosscutting theme on MPAB of GLD, CSIRO)

Write-Shop 4: Striga

The CRP-GLDC organized a write shop to bring together key experts in basic and applied research on host-Striga interactions to explore ideas and approaches to deliver towards Striga resistant sorghum, pearl millet and finger millet varieties to farmers.

Objectives:

1. Take a stock of ongoing activities within respective groups and to come up with a common strategy to understand fundamental/basic science and its application towards delivery of varieties.
2. Deliberate on where are we in terms of readiness to translate the lab results to practical solutions for pearl millet and sorghum.
3. Look at the repository of candidate genes known so far and opportunities for multiple stacking of resistance genes in farmer-preferred varieties.

Besides GLDC partners, biologists and subject matter specialists from UC Davis, USA, Univ. of Amsterdam, NAIST, Japan, Kenyatta university, BecA-ILRI hub participated in these deliberations. The group reviewed the current status of research being carried out in different labs, cross-learning across different hosts-parasite studies, potential solutions and contributions for Striga resistance in sorghum and pearl millet, based on potential for success, implementation efficiency, and current expertise. Key questions were formulated to encourage brainstorming across inter-disciplinary teams to have a holistic view of the “problem”.

What around "Striga resistance" would breeders like to see in their crop of interest?

1. Want resistance and not tolerance.
2. Do not want to see Striga attaching to their crop.
3. Multiple types of resistances need to be incorporated (Low germination, Low penetration, Low Striga development).
4. Scalable and transferable technology to be transferred to every elite variety.

Write-Shop 5: Empowerment of ‘non-youth’: Identifying young women in scaling of GLDC technologies (She-Empower)

As part of the CRP-GLDC background studies on youth strategy, qualitative studies were carried out in rural Tanzania among respondents of different ages (15 to 70 years old). Through life histories and focus group discussions, the respondents were asked about their experiences at the point of transition from being children to adults, the period described as youth. They were asked to describe ‘youth’ in their communities, based on their communities’ experiences. The question of ‘who are the youth that are likely to end up staying in the drylands’ was discussed extensively in the FGDs.

For most countries and governments, the definition of youth is based on ‘age’. The standard definition of youth internationally is also based on age, from 15 to 35 years of age. United Nations define the youth as persons between the age of 15 to 24 years of age. Age has therefore been a factor of delineation/targeting for youth programs.

Among the communities in rural Tanzania, the definition of the youth is dynamic and gendered described more by the transition process the boy or girl goes through and the persons that they become out of their lived experiences. Culture and norms govern/guide the transition process as well as the opportunities, rights and privileges that are accorded the transitioning/transitioned boy or girl. Although age is an important aspect of the transitioning process, it’s not the only marker.

Early findings show that boys have a longer period for transitioning. From the age of 15 up to 40 years, as long as they are not married, boys can be described as youth. Boys transition out of choice and decisions e.g. demonstrating capacities for independence in decision making, entrepreneurship as well as getting married. When they do, communities will start accessing them resources like animals, farming land and tools among other enabling resources. The young men will tend to migrate to the urban areas (rural marketing centres or bigger cities like Dar Es Salaam or Arusha) for varying periods of time, with a certain number raising ‘capital’ and coming back to the rural dryland areas to invest in farming and other businesses, while a some stay in the urban areas. Attaining an education is a pathway towards exiting farming in the drylands.

On the other hand, girls have a much shorter transitioning period, which sometimes can be rapid and brutal if they get pregnant at an early age. Getting a child is the automatic transitioning factor for a

girl, whether they are married or not, in spite of the age at which they get a child. Once they have a child, they are not 'youth' anymore and they can't answer to the term 'youth' even when their age is within the 'youth bracket' according to the government/institutional definitions of youth. Since land and farming resources are inherited through the male lineage, negotiating access to land and opportunities for farming. The young women, either as married women, or casual laborer's or share croppers as have the highest probability of staying in the dryland farming. They are most likely the high percentage of clients that the CRP GLDC has in the drylands of Sub Saharan Africa with the largest responsibility of closing the gap between food production and food demand in the coming years.

If they are, is the CRP-GLDC cognizant of needs of these young mothers today, in order to target them and enhance their capacities for enhancing rural livelihoods in the drylands now and in the future? This was the question that the write shop on the She-Empower sought to deliberate on the last day of the CRP-GLDC write-shops. Fifteen delegates from the CGIAR, NARS, NGO's, Universities participated in the write-shop. One of the key questions that was asked in the meeting was 'do we have evidence of economic impacts/losses that justify country/GLDC investments on this issue? Even in a rough statistical based way?' 'Evidence generation' was therefore identified as a natural first step in which the CRP-GLDC will investing time and resources on in 2020. The title of the proposed project is HOME: Harnessing opportunities for young-mothers empowerment in dryland agriculture (HOME)

<https://gender.cgiar.org/webinar-youth-dryland/> is link to a webinar that was shared by the CRP-GLDC Gender team in December 2019 on the same topic.

Write-Shop 6: Fall Armyworm: Integrated approaches for sustainable management in smallholder farms

Description of Past and On-going Activities

Host plant resistance: Over the last few decades, CIMMYT, ICRISAT and IITA together with national partners and seed companies have developed and deployed an array of improved climate-resilient tropical sub-tropical maize varieties across SSA.

Low-Cost Agronomic Practices and Sustainable Agro-ecological Management: Earlier R4D initiatives led by ICIPE, IITA and CIMMYT, CABI with partners resulted in establishment of IPM strategies encompassing biological control and habitat management, such as Push-Pull, for management of stemborers and striga weeds.

Biological control and biorational pesticides: Initiatives for identification ICIPE, IITA, ICRISAT, CABI, CIMMYT and NARS partners.

Awareness Creation among Farming Communities: CABI, CIMMYT and USAID, together with several research and development partners, has recently published a comprehensive IPM-based Technical Guide on FAW management. CABI is very involved with farmer training in day to day activities.

Proposed technologies for FAW in Africa and Asia:

- Native host plant resistance for maize and sorghum
- Low-cost agronomic practices and habitat management for sustainable cropping intensification (including cereal-legume intercropping, push-pull strategy);
- Effective crop monitoring and scouting of the fields for timely detection and effective interventions.
- Biorational pesticides (including botanical pesticides such as Neem, Melia), and biopesticides (e.g., *Bt* and baculoviruses).
- Biological control agents (egg/larval/pupal parasitoids and predators); native trait-based conventional FAW resistant maize cultivars in Africa-adapted genetic germplasm; and other biopesticides within 1-2 years.

Activities:

- Developing baseline information on FAW damage, natural control, impacts, and how farming communities are managing the pest.

- Awareness creation on the best agronomic practices, and updating pest management decision guides to farming communities.
- Regional-level monitoring, surveillance and early warning system.
- Studies on weather/climatic parameters on the influence of FAW incidence.
- Capacity building of NARES, NGOs, private sector, farmers for institutionalizing the best practices through workshops, field days, and postgraduate training.
- Fast-track the registration of safer pesticides, biorational pesticides through regional policy harmonization.
- Testing of innovative IPM technologies (native resistance, agroecological practices, biological control, biorational pesticides, and chemical control).
- Validation of best bet IPM packages for specific agroecological zones/regions.
- Technology transfer and promotion for proven innovative management packages.

Outputs:

- Baseline information on FAW damage, natural control, impacts documented.
- Awareness created on the best agronomic practices, and pest management decision guides updated and published.
- Regional-level monitoring, surveillance and early warning system developed.
- Studies on weather/climatic parameters on the influence of FAW incidence undertaken.
- Capacity of NARES, NGOs, private sector, farmers strengthened.
- Registration of safer pesticides, biorational pesticides improved.
- Innovative IPM technologies (native resistance, agroecological practices, biological control, biorational pesticides, and chemical control) identified and tested.
- Best bet IPM packages for specific agroecological zones/regions validated.
- Proven innovative management packages transferred and promoted within the farming communities.

Appendices

Agenda CRP-GLDC Science Meeting 2019

Day I: Monday, 25 November 2019

Venue: Ivory Room

Time	Session	Presenter
13:00-14:00	Lunch at Café Kigwa/Nyama Choma restaurant	
14:00-14:15	Welcome and Introductions	Kiran Sharma, Director, CRP-GLDC
14.15-14.30	Independent Advisory Committee perspective	Interim Chair, IAC
14:30-14:45	GLDC - Situational analysis	Kiran Sharma, Director, CRP-GLDC
14:45-17:15	The GLDC Imperatives: Flagship Programs (FPs)	
The presentation must focus on:		
<ul style="list-style-type: none"> • Milestones achieved • Progress towards milestones • 3 Key highlights from 2018 & 2019 		
14:45-15:00	FP1: Priority Setting and Impact Acceleration	Arega Alene, FP1 Leader
15:00-15:20	Scaling up the impact of legumes and cereals in the drylands	Michael Hauser, Theme Leader (MIND), ICRISAT
15:20-15:30	Q&A	
15:30-15.50	GLDC Impact Evidencing Strategy	Karl Hughes, Co-Lead CoA 1.4
15:50-16:00	Q&A	
16:00-16:30	Tea Break and Group Photo	
16:30-16:45	FP3: Integrated Farm and Household Management	Jules Bayala, FP3 Leader
16:45-17:00	FP4: Variety and Hybrid Development	Janila Pasupuleti, FP4 Leader
17:00-17:15	FP5: Pre-Breeding and Trait Discovery	Rajeev Gupta, FP5 Leader
17:15-18:00	The GLDC Imperatives: Cross-Cutting activities	
17:15-17:30	Market & Partnerships in Agri-Business (MPAB)	Andrew Hall, Focal Point
17:30-17:45	Gender & Youth	Esther Njuguna-Mungai, Focal Point
17:45-18:00	Capacity Development	Thomas Falk, Focal Point
19:00-21:00	Dinner at Café Kigwa	

Day II: Tuesday, 26 November 2019

10:00-16:00	Field Trips
	Location 1: Plant Transformation Lab, Kenyatta University
	<ul style="list-style-type: none"> • Departure from Hotel Lobby at 10 am
	Location 2: Peanut Processing Unit, Green Forests Ltd.
	<ul style="list-style-type: none"> • Departure from Hotel Lobby at 10 am
12:00-13:00	Lunch
13:30	Depart for the Hotel
18:00-21:00	Cocktails and Dinner followed by Cultural evening Venue: Nyama Choma Ranch – African Restaurant

Day III: Wednesday, 27 November 2019

Venue: Ivory Room

Time	Session	Presenter
Objective:		
<ul style="list-style-type: none"> In view of the PoWB 2020, research priorities are identified in consultation with partners at the level of FPs and CoAs for delivery of planned activities Cross-cutting initiatives to be embedded in research priorities At least 2 areas to be identified for integration across FPs 		
09:00-15:30	Research Priorities for 2020: Group Discussion	
10:15-10:30	Tea Break	
10:30-13:00	Group discussion to continue	
13:00-14:00	Lunch at Café Kigwa/Nyama Choma restaurant	
14:00-15:30	Group discussion to continue	
15:30-16:00	Tea Break	
16:00-17:30	Integration of Cross-Cutting activities within research priorities of FPs (Presentation should include priorities across FPs and expectations from FPs/CoAs)	
16:00-16:20	Gender & Youth	Esther Njuguna-Mungai, Focal Point
16:20-16:30	Q&A	
16:30-16:50	Capacity Development	Thomas Falk, Focal Point
16:50-17:00	Q&A	
17:00-17:20	Market & Partnerships in Agri-Business (MPAB)	Andrew Hall, Focal Point
17:20-17:30	Q&A	
19:00-21:00	Dinner at Winners, Chinese restaurant	

Day IV: Thursday, 28 November 2019

Venue: Ivory Room

Time	Session	Presenter
09:00-12:30	FPs to report back on research priorities for 2020 (The presentation must focus on identified FP-wise research activities for 2020 including cross-cutting initiatives)	
09:00-09:45	FP1: Priority Setting and Impact Acceleration	Arega Alene, FP1 Leader
09:00-09:30	Presentation	
09:30-09:45	Q&A	
09:45-10:30	FP3: Integrated Farm and Household Management	Jules Bayala, FP3 Leader
09:45-10:15	Presentation	
10:15-10:30	Q&A	
10:30-11:00	Tea Break	
11:00-11:45	FP4: Variety and Hybrid Development	Janila P, FP4 Leader
11:00-11:30	Presentation	
11:30-11:45	Q&A	
11:45-12:30	FP5: Pre-Breeding and Trait Discovery	Rajeev Gupta, FP5 Leader
11:45-12:15	Presentation	
12:15-12:30	Q&A	
12:30-14:00	Lunch at Café Kigwa/Nyama Choma restaurant	
14:00-15:30	Cross-cutting to report back	
14:00-14:20	Market & Partnerships in Agri-Business (MPAB)	Andrew Hall, Focal Point
14:20-14:30	Q&A	
14:30-14:50	Gender & Youth	Esther Njuguna-Mungai, Focal Point
14:50-15:00	Q&A	
15:00-15:20	Capacity Development	Thomas Falk, Focal Point
15:20-15:30	Q&A	
15:30-16:00	GLDC Communication Strategy <ul style="list-style-type: none"> Content <ul style="list-style-type: none"> Website 	Satish Kumar, Communication Officer, CRP-GLDC

	<ul style="list-style-type: none"> ○ Social Media ○ Policy Briefs ○ Research Outputs 	
16:00-16:30	Tea Break	
16:30-17:30	Monitoring, Evaluation, Learning and Impact Assessment (MELIA)	
16:30-17:10	<ul style="list-style-type: none"> ● MEL integration with CLARISA ● MEL dashboard ● Criteria for adding/withdrawing, prioritization and allocation for pooled funding 	Enrico Bonaiuti, MEL Focal Point, CRP-GLDC
	<ul style="list-style-type: none"> ● MEL newsletter 	Jake Carampatana, Research Fellow (MELIA), CRP-GLDC
17:10-17:30	PoWB 2020 & Annual Report 2019	
	<ul style="list-style-type: none"> ● Challenges and Lessons learnt from 2018 	Enrico Bonaiuti, MEL Focal Point, CRP-GLDC
	<ul style="list-style-type: none"> ● PoWB & Annual Report: Deadlines 2020 	Jake Carampatana, Research Fellow MELIA), CRP-GLDC
17:30-17:45	AOB and Vote of Thanks	Kiran Sharma, Director, CRP-GLDC
19:00-21:00	Dinner at La Piazzette, Italian restaurant	

Day V: Friday, 29 November 2019

Venue: Ivory Room

Time	Session	Champion
Write-shops Objective: To prepare tangible collaborative project proposals for submission to potential donors within a specified timeline		
09:00-13:00	(1) Systems research to transform agriculture for climate resilience in SAT: Legume intensification transforming agri-food systems for healthy landscapes and people in SSA	Shalander Kumar, Co-Lead CoA 3.3, CRP-GLDC
	(2) Crop modernization: Leveraging partnerships to achieve greater economic value through advanced new crop development	Jan Debaene, Co-Lead CoA 4.2, CRP-GLDC
	(3) Biofortification: GLDC crops for nutrition sensitive agriculture	Janila Pasupuleti, FP4 Leader, CRP-GLDC
	(4) Striga: From biology to applications	Pooja Bhatnagar, Co-Lead CoA 5.3, CRP-GLDC
	(5) Empowerment of 'non-youth': Identifying young women in scaling of GLDC technologies (She-Empower)	Esther Njuguna-Mungai, Gender & Youth, Focal Point, CRP-GLDC
	(6) Fall Armyworm: Integrated approaches for sustainable management in smallholder farms	Samuel Njoroge, Cereals and Legumes Pathologist, ESA, ICRISAT
13:00-14:00	Lunch at Café Kigwa/Nyama Choma restaurant	
14:00-16:00	Reporting back by Write-shop groups	
Presentation must include: <ul style="list-style-type: none"> ● Concept ● Collaborative Partners ● Outputs ● Action plan ● Tentative budget ● Identified donors 		

14:00-14:15	Systems research to transform agriculture for climate resilience in SAT
14:15-14:20	Q&A
14:20-14:35	Crop modernization
14:35-14:40	Q&A
14:40-15:55	Biofortification: GLDC crops for nutrition sensitive agriculture
14:55-15:00	Q&A
15:00-15:15	Striga from biology to applications
15:15-15:20	Q&A
15:20-15:35	Empowerment of 'non-youth': Identifying young women in scaling of GLDC technologies
15:35-15:40	Q&A
15:40-15:55	Fall Armyworm: Integrated approaches for sustainable management in smallholder farms
15:55-16:00	Q&A
16:00-17:00	Hi Tea
17:00	End of Science Meeting
19:00-21:00	Dinner at Chiyo, Japanese restaurant

Agenda CRP-GLDC Write-Shop 2019

Friday, 29 November 2019

Venue: Ivory Room

Time	Session	Champion
Write-shops		
Objective: To prepare tangible collaborative project proposals for submission to potential donors within a specified timeline		
09:00-13:00	(1) Systems research to transform agriculture for climate resilience in SAT: Legume intensification transforming agri-food systems for healthy landscapes and people in SSA	Shalander Kumar, Co-Lead CoA 3.3, CRP-GLDC
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	(5) Empowerment of 'non-youth': Identifying young women in scaling of GLDC technologies (She-Empower)	Esther Njuguna-Mungai, Gender & Youth, Focal Point, CRP-GLDC
	(6) Fall Armyworm: Integrated approaches for sustainable management in smallholder farms	Samuel Njoroge, Cereals and Legumes Pathologist, ESA, ICRISAT
13:00-14:00	Lunch at Café Kigwa/Nyama Choma restaurant	
14:00-16:00	Reporting back by Write-shop Groups	
Presentation must include:		
<ul style="list-style-type: none"> • Concept • Collaborative Partners • Outputs • Action plan • Tentative budget • Identified donors 		
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15:20-15:35 15:35-15:40	Empowerment of 'non-youth': Identifying young women in scaling of GLDC technologies Q&A
15:40-15:55 15:55-16:00	Fall Armyworm: Integrated approaches for sustainable management in smallholder farms Q&A
16:00-17:00	Hi Tea
19:00-21:00	Dinner at Chiyo, Japanese restaurant



RESEARCH
PROGRAM ON
Grain Legumes and
Dryland Cereals

<http://gldc.cgiar.org>

