INITIATIVE ON
West and Central African Food Systems Transformation

Innovative Digital AgroClimate Solutions for Effective Agricultural Risk Management

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a) KNOWLEDGE PRODUCTS

Parameter	Description for TAFS-WCA
Title	**Customizing Digital AgroClimate Advisory Mobile Application for Ghana**
Description	Recent development in technology have facilitated the development of Digital Agro-climatic solutions to reach millions of agricultural value chain actors with location specific information, services and products that are tailored to user's needs. One of these digital solutions is a global and private led Digital AgroClimate Advisory (DACA) developed to support agricultural value chain actors with bundled Agro-climate advisory service. DACA uses global, regional, national and local climate and weather data integrated with crop characteristics with potential for other parameters such as crop fertilizer recommendations. There are three major processes: (1) service creation, (2) integration of data and contextualization and (3) service delivery, which involves customization of the systems to different conditions such as country or agro-ecological contexts. Service creation involves two steps: (1) collecting data on three major parameters (weather and climate data, Soil data and crop characteristics) followed by (2) analysis of data that includes the analytics and climate/weather models, etc. Service delivery involves two steps: (1) the bundling weather and climate information together with the crop information (such as crop water requirements, days to maturity, etc.) and crop fertilizer recommendations, and (2) delivering through DACA mobile app. This process is summarized in Figure 1 that illustrates the steps from data collection, analysis up to delivery of the products through DACA app.

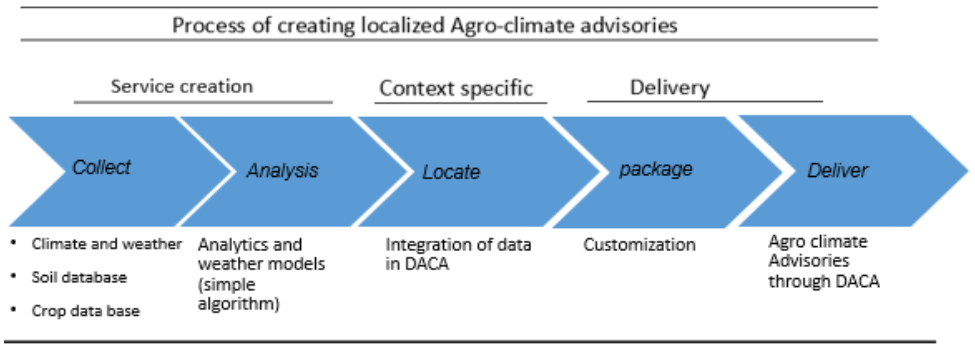

Figure 1: Process of creating localized agro-climate advisories

Table 1 depicts the methodology being used across Africa to customize DACA for crops and others variables such as fertilizer recommendations. In Ghana, DACA was customized for three major agro-ecological zones (Forest Transition and Guinea Savannah and forest zones) by profiling 10 priority crops based on food security, economic value and cultivation area. The prioritization of crops used the range of importance (1: low importance, 2: medium, 3: high) of each crop on food security, economic value, cultivation area and number of farming households. Then sum up the score for each crop.

Table 1: Steps sequence in the process of customizing DACA for crops across Africa.

Steps	**1 Defining crop profiling and prioritization framework and method**	**2 Validation of the crop profiling**	**3 Mapping of crops per AEZ**	**4 Validation of the final results**
Results	Definition of priority crops, units of analysis and regions to be assessed		Digitalizing and Mapping major crops with their specific descriptors through DACA	
Methods	1. Scientific and grey literature review 2. Consultation meetings with stakeholders from organizations such as National Agricultural Research Systems, Universities, Agricultural Extension Services, etc. 3. Organize GIS analysis and other weather/climate analytics		1. National participatory mapping of crops based on agro-ecological zones 2. Digitalization of crop maps produced during participatory workshops/meetings 3. GIS-Attribute tables of crops 4. Creation on NetCDF files 5. Digital automation of agro-advisory services through a mobile app	
Activities	4. Contacting organizations and data acquisition 5. Database compilation 6. Identification of agro-ecological regions of analysis and data collection 7. Prioritization of crop priorities per Agro-Ecological Zone 8. Produce a list of major crops specific descriptors such as days to maturity, water requirement, Growing Degree Days (GDD), crop suitability tied to geographical coordinates of their growing areas/regions—"this could be a range not a fixed GPS point". (https://glistest.planttreaty.org/glis/static/en/cropdesc.html and https://www.bioversityinternational.org/fileadmin/_migrated/uploads/tx_news/Developing_crop_descriptor_lists_1226.pdf)			

	DACA provides value-added and geo-located automated agro-climate advisory services specific to crops and their varieties, including when to plant, which crop (variety to grow), when to harvest, crop fertilizer recommendations, etc. It further provides tailored and location specific reliable information about onset and cessation of the rain season, seasonal length and total seasonal rainfall that are critical in managing agricultural risks associated to climate. ***More importantly, DACA enables people to bundle several agro-climate advisory services for informed decision making mainly for agricultural value chain actors and enhances sustained collaboration among agricultural value chain actors.***
Geographic location	Africa
Partners	National Agricultural Research Systems (NARS) and National Meteorological and Hydrological Services (NMHS)
Participating Centers	Alliance of Bioversity International and CIAT and Pan Africa Bean Research Alliance (PABRA)
Impact area tagging	**Ghana**
Evidence	Digital activities of TAFS-WCA in Ghana leverage on AICCRA program where a series of Participatory-DACA training works were conducted in various districts or municipalities in the Greater Accra, Central, Bono East, Northern, Upper East and Upper West regions (Figure 1). A total of 20 experts and 106 master trainers were trained, originating from different institutions including CSIR-Crops Research Institute, IITA Ghana, Centre for Agriculture and Biosciences (CABI), Ministry of Food and Agriculture, Biotechnology and Nuclear Agricultural Research Institute (BNARI), Ghana Atomic Energy Commission, University for Development Studies (UDS), Esoko, Ghana Meteorological Agency. Building on the above achievements, a 3-days workshop of stakeholders was conducted and participants were mainly from institutions that are already working with AICCRA. The workshop covered in details the activities of: (1) developing a template to gather information on crops (days to maturity, crop water requirement, fertilizer recommendations, etc.) with respect to their specific locations. This was a key part of this workshop, (2) Mapping the top 10 major crops/varieties per Agro-ecological zones using Ghana land use/cover map, (3) Producing a list of major crops specific descriptors such as district, altitude, base temperature, max and min temperature, fertilizer recommendations, crop coefficient (K_C) per crop stage and the seasonal average of K_C for every crop, days to maturity, water requirement, Growing Degree Days (GDD), crop suitability, etc… tied to their growing areas/regions, and (4) Evaluate and validate crop-specific descriptors.

A template to gather information on crops (days to maturity, crop water requirement, fertilizer recommendations, etc.) in specific locations from Ghana was developed. 10 major crops per AEZ were mapped and these crops were chosen through methodology (Table1) where crops were based on their importance vis-a-vis to (a) food security, (b) earning economic income, (c) cultivation area and number of farming households. Figure 2 depicts priority crops for each Agro-ecological zones.

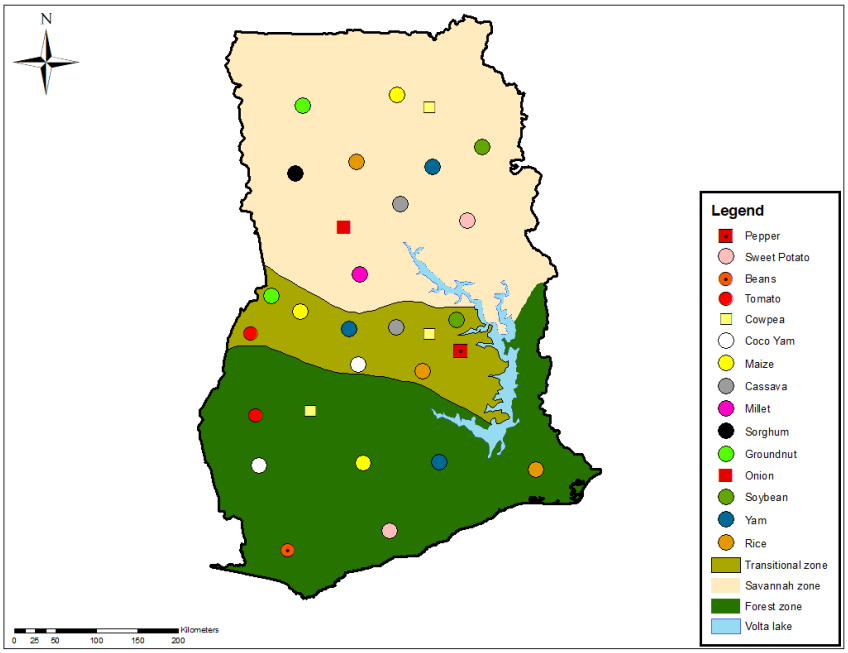

Figure 1: Map showing major crops in the 3 major Agro-ecological zone

Elsewhere in Africa and in Ghana through AICCRA, DACA through its participatory approach component has achieved tremendous results as highlighted in the section below.

Through different projects mainly Improving Bean Production and Marketing in Africa (IBPMA), the project of Alluvial Master Card in Nigeria under the component of Climate Information Services (CIS) and the Accelerating Impacts of CGIAR Climate Research for Africa (AICCRA), a series of cascading trainings of experts and ToTs on Participatory Digital AgroClimate Advisory (P-DACA) were conducted to rollout bundled CIS and CSA innovations/practices. This approach involved a series of face to face trainings where participants were allowed to acquaint with DACA by accessing, understanding and learning how to use bundled CIS and CSA in crops, livestock, fisheries and livelihood activities. People trained as experts will train ToTs, who in turn will provide training to the lead farmers. This rollout approach has been conducted in 10 countries including Ghana, Guinea, Mali, Senegal, Zambia, Zimbabwe, Burundi, Rwanda, Tanzania and Uganda. Participants trained as Experts were mainly selected from National

	Agricultural Research Systems (NARSs) who in turn trained participants as ToTs and these participants were mostly from national or sub national agricultural extension services and other partners of the agricultural value chains such as meteorology agencies and local NGOs. A total of 509 ToTs (including 33.2% of women) were trained (Fig.3) and these trained people are expected in turn to disseminate the same trainings to more than 22,500 people in their respective countries including 11,088 people in Ghana. P-DACA approach has been used in Rwanda to manage 750 bean demonstration plots in four agro-ecological regions. Bean demonstration plots were led by farmers who were prior trained on P-DACA and at least two decisions made based on P-DACA were tested in farmers' fields and the control plot was a farmer's traditional practice. Preliminary results from only 129 farmers show that avoided losses (t/ha or %) as a result of using P-DACA for men farmers is 0.57t/ha (equivalent to 52% of yield increase as compared to not use P-DACA)— while the avoided losses for women farmers is 0.52t/ha (equivalent to 48% of yield increase as compared to not use P-DACA). Another specific success story on the use of P-DACA is from Shakira Umutoni—from the Eastern Province of Rwanda - who was trained on P-DACA. She applied the knowledge to manage her bean farm. Shakira testified that before the training she used to only randomly plant her local bean, but afterward—she decided to apply recommended climate-smart practices as recommended by P-DACA, planted an improved bean variety (biofortified bean variety rich in zinc and iron) in rows, followed recommended planting spacing, applied crop residues as mulch, and made tied-ridging in her bean field. The results were heartwarming. "The first year, she harvested 200kg of beans, which is almost 10 times compared to her previous harvest of 25kg (Kagabo, et al. 2021).
Disaggregation (automatically generated from the evidence links provided)	Countries, regions

b) CAPACITY SHARING FOR DEVELOPMENT

Parameter	Description for TAFS-WCA
Title	Customization of digital agro climate advisories in Ghana
Description	Geographical mapping and profiling of major crop's descriptors for contextualizing Digital AgroClimate Advisory platform in Ghana
TOC match	To contextualize Digital AgroClimate Advisory app into Ghana context, different crops from the 3 major Agro-Ecological zones

	were mapped using Ghana land use map. Major crops for each AEZ that were ranked best were further subjected to a detailed analysis and find out their descriptors such as region, district, altitude, GDD, base temperature, max and min temperature, fertilizer recommendations, crop water requirement, crop coefficient (Kc) per crop growth stage and the seasonal average of Kc for every crop, etc. The main objective of this activity was to collect location specific information on crops and fertilizer recommendation for bundling them with climate information to digitally provide context and location specific sustainable and actionable recommendations along agricultural value chains in Ghana.
Geographic location	Ghana
Partners	Savannah Agriculture Research Institute of the Council for Scientific and Industrial Research (CSIR-SARI), Crop research institute of the Council for Scientific and Industrial Research (CSIR-CRI), Nuclear Agricultural Research Institute (BNARI), Ghana Atomic Energy Commission, and University for Development Studies (UDS).
Participating Centers	Alliance of Bioversity International and CIAT and International Institute for Tropical Agriculture (IITA)

c) INNOVATION DEVELOPMENT

Parameter	Description for TAFS-WCA
Title	**Digital AgroClimate Advisory app**
Description	DACA answers the question on how users can have access, understanding and usage of CIS for informing their decisions. DACA produces, translates and transfers CIS for informed decision making around agricultural activities such as livelihood, crops, livestock and fisheries, etc.
TOC match	(1) DACA is a set of digital solutions applicable to different conditions of internet penetration, mobile access and digital literacy of agricultural value chain actors. (2) DACA has been designed to significantly contribute towards closing the digital information gap and accelerate the access and use of Agro-Climate Advisories. (3) DACA promotes digital technologies through agricultural value chains' actors for informed decision making, it overcomes the challenge of integration of services by allowing agricultural value chains' actors to contextualize decisions and if necessary apply bundled services to respond to specific challenges that are climate related. (4) DACA's geographical scope or scale is unlimited, it only requires to be contextualized to regions or countries and it provides

	points or geo-location information. (5) DACA's usability and affordability has been confirmed through the dissemination of Climate Information Services for Beans (CIS4B) across Africa (Kagabo, et al. 2020). Since 2020, nearly 72 professionals from National Agricultural Research Systems in 10 different countries were trained as DACA experts to rollout Climate Information Services along crops value chains for informed decision making. Feedback from the users indicate that DACA as an innovation tool supports its users to have access, understand and use it to timely inform people's decisions on the timing of planting, which crop/variety to grow in a given season, when the season is expected to end, and more importantly it supports people to inform their seasonal and daily decisions on crop management activities.
Geographic location	Africa
Partners	National Agricultural Research Systems (NARS) and National Meteorological and Hydrological Services (NMHS)
Participating Centers	Alliance of Bioversity International and CIAT and Pan Africa Bean Research Alliance (PABRA)
Disaggregation	Countries, Regions
Impact Area and Target mapping	*Africa*
Innovation Team	*Climate Action Team*
New or existing innovation	*Existing innovation*