

Senior Expert Contributions to OneCGIAR Program Development Supporting inclusive breeding and seed system transformation Netherlands-CGIAR Partnership



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The aim of this two-pager¹ is to provide input for the OneCGIAR investment plan. Notably to identify key research challenges within the OneCGIAR impact areas, how these areas interact with Dutch policy priorities and how the challenges could be addressed / strengthened.

Relevance

Governments and donors have heavily invested in breeding and seed systems to increase agricultural productivity in the Global South in an equitable and sustainable manner to feed the world now and in the future. Breeders have realized genetic gains for traits like productivity, stress tolerance and micronutrients in the most important staple crops, but the success of capitalizing on these genetic advances in farmers' fields has however been mixed. While there is considerable variation in crops and contexts, overall the adoption and variety renewal by farmers as well as the supply and use of quality seed are experiencing significant hindrances (Thiele et al., 2020; Alwang and Walker, 2015). This means that there is an overall discrepancy between supply and demand for varieties and seeds. As is elaborated below, inefficient data collection methods and an absence of functional information feedback loops play an important role in reproducing this mismatch. Adequate information collection and sharing are needed for effective investments in and optimal contribution to global food security and the Sustainable Development Goals (SDGs).

Key research challenges

The experienced informational problem has several dimensions which are interacting and asking for an

interdisciplinary system approach to generate an integrated set of responses which can result in inclusive seed system transformation at scale.

A Breeding. Breeders have made significant genetic gains capitalizing on germplasm collections. However, the mixed impact and the need to anticipate on future stresses and challenges require increased breeding efforts to achieve adoption of improved varieties and higher varietal turnover. This requires further improvement of the targeting and the scaling of data collection and procedures that are able to adequately capture farmers' demands. Current practices still result in the promotion of varieties that are sub-optimal, excluding in particular groups of farmers (including women) with limited resources, as well as farmers in agro-ecological and/or market niches. There is need for **methods and practices** that generate socially and agro-ecologically differentiated feedback about candidate varieties and/or user preferences at a larger scale than before, and exploring among other the use of new ICT-supported opportunities for data collection and data analysis (e.g. v Etten et al., 2019) which can support the definition of product and client profiles in a stage-gated set up as (will be) used by CGIAR breeding programs.

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B Seed supply and delivery. In the current breeding and seed systems of the majority of the major food crops, (CGIAR/national public) breeders still “hand over” their products to public and private sector actors for seed multiplication and delivery. However, seed multiplication and delivery also face a series of challenges that result in inefficiencies and/or in inadequate volumes of seed of possibly relevant varieties being available to different type of farmers (McEwan et al., 2021). The challenges involve questions around **seed business models**: the organisation of the different actors in the value chain in terms of partnerships and their information exchange (Rutsaert & Donovan, 2020). It also asks for information about preferences and needs of different groups of farmers in the sourcing and acquisition of seeds, and their access and willingness/ability to pay that better reflects their contextualized reality (Almekinders et al., 2019). This knowledge gap requires development of methods and approaches that tie in with the need of information for the definition of product and client profiles that breeders can use to be more demand-oriented and serve the definition of effective seed delivery pathways for farmers in different agro-ecologies and of different social categories (McEwan et al., 2021).

C Seed quality and degeneration. Quality of seed planted by farmers is often sub-optimal, in particular of vegetatively propagated crops, due to the build-up of pests and diseases that are carried over to the next generation, resulting in seed degeneration. While this process and its impacts on yield have been widely studied, particularly for potato, many unknowns remain on the biophysical relations and the interactions with farmers’ decision to invest in seed replacement and quality seed. This knowledge is also crucial for developing effective interventions and the definition of strategies to limit the spread of invasive pathogens. These, in turn, provide entry points for scaling the introduction of new varieties and trait prioritization for breeding programs. **Novel approaches** need to be further developed to combine biophysical data on plant health, plant performance and contextualized socio-economic considerations of different type of farmers.

D Responsible seed system transformation, governance and institutional change. Addressing the challenges on information collection and sharing can only lead to higher impact of breeding

and seed system interventions when the new insights are acted upon and bring changes of practices at scale. From studies about system innovation we know that systems are likely to change only if they are confronted with sufficient pressures and when there is sufficient learning in and around the system to arrive at ready and mature alternatives for the standard way of operating. Daily decision-making dynamics are embedded in existing governance structures and practices, shaped by cultural norms and values. Seed system transformation implies the scaling of changes in the decision making dynamics. Supporting responsible transformation processes ask novel engagement and advocacy strategies to catalysing learning and change of practices which are congruent with the key dimensions of responsible research and innovation (MacNaghten, 2020). Action research and scaling of capacities play a key role in arriving at envisioned system transformations.

Approach

To address the challenges we propose one or more coherent research programs combined with the capacity development.

The **research** would have as **overarching research question** *What combinations of methodological and system learning strategies enable inclusive transformation of breeding and seed system at scales?* It would count with the following areas of activities:

- a developing and testing methodological and analytical approaches for generating feedback at scale that is more sensitive to socially differentiated demands.
- b developing and testing methodological and analytical approaches for generating and integrating biophysical and socio-economic information on seed quality related processes and human behaviour.
- c developing and testing engagement and advocacy strategies through which the feedback can be leveraged and made to count in breeding and seed systems.
- d conducting comparisons across breeding and seed systems.

The research would have to following features:

- Involve a ranges of crops, allowing for comparative analysis of breeding and seed systems

- Be highly interdisciplinary in nature, involving genetics, modeling and statistics, social sciences
- Use a system approach to understand trade-offs between goals, priorities and system levels
- Build around PhD/MSc training and research, addressing
- Action research to ensure the institutional transformative nature of the research and
- Linkage with relevant partners of public and private sector in developing countries where activities should take place and involve Dutch private sector plant and seed expertise

A **capacity development** program/platform would aim to:

- Scale the developed (research) methodologies and practice in R4D, building on the research findings so far
- Build capacity of NAREs partners to support seed system development, with support from Dutch Educational and vocational training and private sector

Linking to CGIAR priorities and Dutch policies (who should work together)

The above described key challenges/knowledge gaps align closely with the formulated priorities of the CGIAR described in the Action Area on Genetic Improvement (CGIAR Research Strategy, november 2020): it aims at more rapid adoption of new varieties and breeds, and will work with partners to increase smallholder farmers' access to quality seeds by supporting the strengthening of national and regional seed supply systems. The CGIAR will also engage in capacity development in-house and of partners, connecting seed system actors and NARES and supporting the learning and capacity development needed to fill their roles sustainably (ibid).

Proposed research also aligns with several other key initiatives, i.e. Excellence in Breeding and Seed System development (supported by NWO-WOTRO) and already earlier expressed the interest of CGIAR partners (CIMMYT, Bioversity-Alliance, CIP, IITA).

A capacity building component for NAREs partners can support and fold into the CRP RTB initiative around the "GERMINATE" platform, which is reaching out to Excellence in Breeding, AGRA, etc. The research and capacity building with CGIAR and NAREs partners would involve Dutch natural and social science knowledge partners (e.g. WUR, UU, UT,

KIT) and link with the Dutch Educational and vocational training and private sector partners (e.g. CHS Dronten and HAS Den Bosch, Solynta, East-West) and Universities and NGOs in relevant countries or regions. Collaboration with the CGIAR and its partners strengthens Dutch expertise and international networks.

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