

127 Provide more affordable high-yielding varieties of staple crops for food-insecure farmers in fragile environments

The Solution: Providing more affordable high-yielding varieties of staple crops (millet, sorghum, teff) that food-insecure farmers in fragile environments rely on.

Source(s) of the Solution: The idea draws on public submissions to AT1 through a Google Form, experience of the leadership of AT1, and members of the action track's 'Zero Hunger Working Group.'

Problem addressed within food systems: Many smallholder farmers in fragile environments, such as the [Sahel](#) and [Horn of Africa](#), are unable to obtain adequate yields to meet the caloric requirement of their families because they do not have access to or cannot afford higher-yielding varieties of traditional crops such as sorghum, millet, and teff that they rely on for food. The global average yields of these crops (sorghum = 1.4 mt/ha, millet = 0.9 mt/ha) are much lower than those of other cereals like maize (5.5 mt/ha), rice (4.5 mt/ha), or wheat (3.3 mt/ha).¹ The higher global average yields of maize, rice, and wheat seem consistent with their importance in global consumption of cereals, where they together make up 94% (rice = 45%, wheat = 38%, maize = 11%) of the total global cereal consumption between 2014 and 2018 [[FAOStat \(FAO 2021\)](#)]. However, such analysis at the global level can be misleading in identifying solutions for local-level food insecurity where other crops are prevalent. In Africa, for example, sorghum, millet, and teff jointly make up 18% of the total cereal consumption. But in the Sahel and Horn of Africa, where food insecurity is also very high, these crops make up much more of the diet. In the Sahel, for example, sorghum and millet make 32% and 28% of total cereal consumption, respectively. In the Horn of Africa, teff and sorghum make up 20% and 15% of total cereal consumption, respectively [[FAOStat \(FAO 2021\)](#)].² Thus, it is difficult to see how global food insecurity can be solved without improving the productivity of the crops that those in the Sahel and the Horn of Africa rely on for food.³

Many of the world's food-insecure people are farmers with small farmlands (less than 0.5 acres in many cases). They will be able to grow and consume more food if they have access to higher-yielding seed varieties that are available in their communities, adapted to their environments, and that they can obtain from their neighbours, extension officers, or previous harvest. Because these traditional crops are rich sources of macro- and micro-nutrients and health-beneficial compounds (e.g., [Xiong et al. 2019 on sorghum](#), [Gull et al. 2014 on millet](#), [Baye 2014 on teff](#)), addressing the problem will be important for achieving the nutrition, diversity, and sustainability goals of food systems beyond hunger.

How this solution will address that problem:

Theory of change: If farmers have access to improved cultivars/seeds of the traditional crops that perform better under their local production environments, then they will be able to acquire and use them to obtain higher yields to meet their food needs.

Inputs: The priority-setting framework for research in the CGIAR, for example, includes several criteria comprising baseline factors (geography, agroecology, value of production, poverty, and area under production) and modifiers (alternative sources of research, strength of NARS, yield gap, nutrition, equity, sustainability, etc.), it does not determine funding targets for or resource allocation to specific centres/commodities ([Gryseels et al., 1992](#)). Thus, even though sorghum and millet, for example, are

¹ Averages for 2010 to 2019 based on [FAOStat \(FAO 2021\)](#).

² The countries used in the analysis are those with relevant data in the respective subregions. These include Chad, Mali, Mauritania, Niger, and Sudan for the Sahel; and Djibouti and Ethiopia for the Horn of Africa. Teff is included in the "Cereals, other" category of the FAOStat database.

³ A similar global versus Africa subregional analysis applies to other starchy crops and staples (e.g., cassava, plantains, sweet potatoes, yams, and other root crops excluding potatoes) that are important food sources in the same subregions of Africa.

favoured when more weight is given to the modifiers, they have attracted less than then 10% of the total budget on cereals. Currently, the [CGIAR commodity research portfolio](#) is dominated by rice and maize followed by livestock, wheat, and fish. So, it is critical to revisit the CGIAR priority-setting framework and resource allocation process⁴ to increase public resources going to the traditional crops (sorghum, millet, teff) on (1) genetic improvement and seed systems on the production end of the system and (2) nutritional value and product development on the consumer demand end of the system. The project on [Harnessing Opportunities For Productivity Enhancement \(HOPE\) on sorghum and millets](#), led by ICRISAT with several partners in Africa and South Asia, is a good example to build on and take to scale.⁵

Assumptions: Farmers know their production environments and can assess profitability or suitability of different cultivars/seeds.

Solution's alignment to the 'game changing and systemic solution' criteria:

Impact potential: In the [HOPE project](#) for example, productivity increases for these crops are substantial: Eritrea (sorghum 60%), Ethiopia (sorghum 45%), Mali (sorghum 129%, pear millet 50%), Nigeria (sorghum 21%, pear millet 150%), and Tanzania (finger millet 17%). The large variation in productivity increases reflects differences in the production environments and especially soil health and fertility management practices; so complementary extension and farm investments in soil health will be needed.

Actionability: It seems that the limited research on these crops has been focused on quality improvement rather than yield because their growers are mostly poor subsistence farmers growing them for their own food rather than for economic reasons. However, with increasing pressure (population growth, climate change) to make the most of the land and water resources available for growing food, the need to increase research on yield seems inevitable. This solution is particularly actionable when linked to other solutions on underutilised or orphan crops.

Sustainability: These traditional crops are already well adapted to the harsh environments under consideration. By raising their consumption demand beyond the production areas (through public-supported research on their nutritional value and product development), it will attract private-sector investment in the seed development and distribution systems.

Existing evidence: See evidence under impact potential.

Current/likely political support and contexts where this is well suited: Countries in the Sahel region, Horn of Africa, and parts of South Asia where these crops are important in the production system.

⁴ The [new OneCG strategy to 2030](#) also emphasises the various dimensions of geography, agroecology, efficiency, nutrition, poverty, equity, sustainability, etc., but is not clear how the commodity research portfolio will change.

⁵ The [HOPE project](#) was implemented in Africa and South Asia. It released 47 cultivars of sorghum, finger millet, and pearl millet and raised productivity of the 183,421 households reached.