Bioversity International

Seeds for Needs

The challenge

Agriculture and food security is more vulnerable than ever. Climate change is estimated to reduce agricultural production by 2% every decade until 2050, with yields of major crops declining by an average of 8% in Africa and South Asia (IPCC, 2014). As extreme weather events become more frequent and unpredictable, smallholder farming communities will continue to be the hardest hit.

Diversification is one way to give farmers more options in times of need. With access to a diversity of crops and varieties, farmers are more likely to cope with the effects of climate change. But farmers do not always have the information or planting material to choose what diversity best suits their conditions.

How can we tap into the vast genetic diversity that exists in different countries to address farmer needs in a timely manner?

Bioversity International Research Approach

Bioversity International's 'Seeds for Needs' initiative works with >20,000 smallholder farmers in 11 countries to research how agricultural biodiversity can minimize the risks associated with climate change. Our focus is on deploying existing diversity to farmers from wherever it is found, whether in genebanks, plant breeding programmes or in their own fields. The farmers we work with are directly involved in evaluating and selecting varieties, providing valuable feedback on their preferred traits to scientists. By involving them as 'citizen scientists', we increase their first-hand knowledge of useful varieties and traits.

We then compare these experiences with our scientific data to identify important trends and map traits that inform farmer decisions and breeding. In each country, we work closely with national researchers and extension systems, making sure we build capacity and push for policies that support the use of biodiversity by farmers. These partnerships have helped us involve farmers at a scale that would not otherwise be possible.

In the field

Farmers evaluate varieties as 'citizen scientists'
Farmers provide feedback to scientists on preferences and traits throughout growing season
Crowdsourcing: involve more farmers by blind testing just 3 varieties from a larger selection
Record weather data in farmer's growing conditions with mini sensors, e.g. iButtons
Establish community seedbanks or release varieties to improve access to diversity

The science behind

Screen genebank accessions for climate suitability using GIS technology
Characterize accessions using next-generation sequencing techniques
Record agronomic and morpholgical traits in farms and research station trials to map traits in genome
Data analysis software development, e.g. ClimMob
App development to improve feedback through mobile technology

Photo: Participating farmer in a durum wheat field, Ethiopia.
Credit: Bioversity International/C.Fadda

Research highlights

SEEDS FOR NEEDS ETHIOPIA

Key Breakthrough

More than 20% of the traditional Ethiopian varieties (landraces) performed better than commercial varieties bred specifically for drought resistance, one variety yielded 61% better than the best commercial variety – an important discovery for food security in the country

Ethiopia is the first country where 'Seeds for Needs' was launched in 2009, winning a World Bank Development Marketplace award in the same year for its innovative and low-cost strategy to understanding the needs of farmers, particularly women, and improving access to crop varieties that could help them cope with climate change. From 2010 to 2013, varietal diversity increased by 23% across the sites where we worked, and more than half of the farmers still share these varieties within their seed networks. We now work with over 1500 farmers in the country who are planting better adapted material in their farms, an achievement that would have taken far longer through a formal plant breeding programme. We estimate that at just $5 per farmer, we could reach 10 million farmers over 3-4 years. To ensure farmers have a reliable source of quality seeds, we have also set up a community seedbank with the Ethiopian Biodiversity Institute.

Working with national partners, we characterized 400 wheat and barley varieties, and discovered that Ethiopian durum wheat germplasm has contributed very little to the genetic composition of commercial varieties. Through genetic analysis, we were able to find traits in the wheat genome that are important for both farmers and scientists such as yield and tillering capacity. In addition, we successfully created 7,000 stable wheat lines (a uniform population of seeds with predictable characteristics) that can be used for further participatory breeding or directly by farmers.

SEEDS FOR NEEDS INDIA

Key Breakthrough

Partnerships and word-of-mouth has helped increase participation from 30 to 15,000 farmers in just 3 years

Farmer field days, women's groups and collaboration with community-based organizations have tripled the number of districts we are operating in to 24. The Indian Council for Agricultural Research is now incorporating our approach in a national programme covering over 600 sites.

India is the first country where we installed iButton weather sensors in farmers's fields to compare how varieties perform under different local temperature and humidity conditions. This weather data also gives us the bigger picture of climatic trends in the states we are working in. Some varieties are actually performing better in areas they were not originally designed for. This is important information that could shape future government seed distribution.

Farmers are being trained in good agricultural practices and seed saving, which has led to the development of seed multiplication groups and community seed banks. We are also developing a mobile app to improve farmer access to climate information and communicate better with scientists.

SEEDS FOR NEEDS CENTRAL AMERICA

Key Breakthrough

Our crowdsourcing approach is estimated to be up to 78% more cost-effective than conventional participatory varietal selection

'Seeds for Needs' in Guatemala, El Salvador, Honduras, Nicaragua and Costa Rica are investigating how mobile technology can make farmer participation easier. We are also conducting randomized control trials to see how our approach compares with current participatory varietal evaluation practice. We plan to certify service providers to use the approach independently, and involve local governments in validating seed varieties for farmer use.

SEEDS FOR NEEDS PAPUA NEW GUINEA

Key Breakthrough

850 taro and 1,300 sweet potato accessions (plant samples) were characterized and evaluated for climate suitability

Farmers in Papua New Guinea have little or no access to improved varieties of important staples like taro and sweet potato. Through the initiative, farmers have been exposed to at least 30 varieties, including those sourced from their own farms. Using agricultural biodiversity has greatly increased yields and reduced pests and diseases.

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