

Affordable, Accessible, Asian (“AAA”) Drought-Tolerant Maize

Overview of a collaborative program between CIMMYT and Syngenta, supported and coordinated by Syngenta Foundation for Sustainable Agriculture

Website reference document, Syngenta Foundation, January 2023

This Public-Private Partnership (PPP) was designed to develop a specific breeding program for maize (corn). Its aim was to make hybrids of tropical maize accessible at an affordable price to Asian smallholders. The intended hybrids were to be drought tolerant. The partners targeted yields significantly higher than those of widely used OPVs (open pollinated and other non-hybrid varieties), and at least 80% of some low-priced hybrids popular in rain-fed but drought-prone parts of India.

In central India, hybrid maize cultivation has increased significantly over the last 15 years thanks to the private sector. (The rate of increase has varied considerably between Madhya Pradesh, Rajasthan and Gujarat). Farmers nonetheless still plant OPVs on some 1.3m hectares, about half of the total maize area. Very little maize there is irrigated. The program partners saw potential for growing AAA maize locally on about half a million hectares. That translates into some 10,000 tons of seed.



Drought and heat stress are two major factors limiting maize productivity. In Central India, rain is becoming increasingly erratic and average temperatures are rising.

Seed plays a crucial role in smallholders’ resilience, i.e., their ability to farm successfully under increasingly difficult climatic conditions. Enabling them to do requires two important steps: first breeding improved varieties and then producing and selling them to smallholders. CIMMYT and Syngenta are both strongly committed to maize improvement through R&D. The Syngenta Foundation funded the program that led to AAA maize.

Field-testing of several promising three-way cross hybrids pointed to the best choice for AAA maize. Hybrid TA5084 was first sold during the 2018 *Kharif* (monsoon) season. Around ten Indian seed partners are now promoting the hybrid in the three targeted states. Out of a typical 2.2ha total area per smallholding there, farmers devote about 0.75ha to maize. Average AAA maize yields are 2.5t/ha, compared to OPVs’ 1.5t/ha. This difference gives smallholders additional net income of \$100 on a full hectare. The extra 75 dollars from their planted area represent a very valuable boost to total household income: Smallholder families in the AAA maize area net about \$1000 per year, including government subsidies.

The current seed partners are either small companies or NGOs. To enable smallholders’ informed adoption and repeat purchases of AAA maize, these partners need to conduct appropriate marketing and provide support. Syngenta Foundation training for them began before commercialization and continues in the classroom and field. Seed partners learn about technicalities of production, and receive education on business opportunities and scoping, product positioning, pricing, promotional activities, sales and production planning, legal frameworks, and registration licensing agreements. This extensive training program helped the local seed partners to sell 18 tons of AAA maize in 2018 and 50 tons the following year. This rose to 120 tons in 2020, despite Covid. In 2022 the partners sold 210 tons. The number of smallholders using AAA maize has risen correspondingly, from some 900 in 2018 to 14,000 in 2022.

The AAA initiative is a rare example of a PPP delivering products to smallholders in central India. The chosen region is drought-prone and includes several ‘backward’ areas. It is thus a difficult environment both for farmers and suppliers. Seed marketing there is risky, unpredictable, and unattractive; multinationals and large seed companies typically keep away.

Key dates and milestones (India)

2012 & 2013	→	CIMMYT x Syngenta hybrids were evaluated in both wet and dry seasons in natural and managed-stress environments in India and elsewhere.
<i>Kharif</i> season 2015	→	Testing and evaluation of shortlisted hybrids from the first program wave
<i>Kharif</i> 2017	→	Limited launch of hybrid TA5084
April 2018	→	CIMMYT evaluates AAA hybrids in drought and favorable conditions.
<i>Kharif</i> 2018	→	Commercial launch of TA5084
August 2018	→	TA5084 seed production training with help from Syngenta experts
<i>Rabi</i> season 2018	→	Distribution of parent seed to qualified seed partners
<i>Kharif</i> 2019	→	Permission received to sell the hybrid in all three intended states
<i>Kharif</i> 2021-2022	→	Testing and evaluation of shortlisted hybrids from the second program wave
December 2022	→	Two new varieties promoted to stage 6.2 after Product Advancement Meeting

As the word 'Asian' in its name suggests, this maize is also designed to benefit smallholders outside India. The second country to introduce AAA was **Myanmar**. Local seed partner Ayeyarwady Seeds Co. (ASC) registered TA5084 in 2021. Called 'ASC 108' in Myanmar, the variety is primarily intended for the central dry zone. The focus is on Shan, Sagaing and Chin states. Smallholders there have not previously had access to hybrid maize. Their yields have therefore been much lower than would be possible. ASC sold two tons in 2022. Our Foundation's survey of farmer satisfaction continues into 2023.

Business and availability model

Considered as International Public Goods, AAA maize hybrids are made publicly available to the seed partners. CIMMYT owns the male parent, which it licenses to seed partners royalty-free. Syngenta licenses its female parent for a greatly discounted royalty.



Syngenta India Limited (SIL) initially supplies both parents to seed partners, which then produce the necessary tonnage of commercial seeds. Thereafter, each partner at its own cost maintains and produces the CIMMYT male parent seeds needed for commercialization. SIL produces and sells the female parent every year. The seed partners market, sell and distribute the commercial seeds under the AAA logo.

The Syngenta Foundation (SFSA) supports progress by:

- Ensuring coordination between all partners
- Identifying and engaging with organizations interested in selling AAA maize
- Testing AAA varieties through a seed partners trialing network
- Elaborating the business plan and commercial / licensing agreements
- Consolidating market demand and setting-up the seed production plan

The seed partners:

- Test AAA varieties in the priority areas identified by SFSA (south Rajasthan, northwest MP, northeast Gujarat)
- Lay out a three-year business plan
- Confirm seeds requirement for launch & beyond
- Adhere to marketing guidelines provided by SFSA
- Collect and share technical data
- Produce and sell AAA in the targeted areas

Value proposition

“AAA Hybrid Maize” is a drought-tolerant variety specifically created for poorer smallholders. It has about twice the yield of widely used OPVs and is competitive with popular hybrids. AAA maize was bred to be Affordable, Accessible & Available in Asia.

- **Affordable** → Three-way hybrid with lower production costs. The farm-gate price is pitched between those for local double-cross and single cross hybrids.
- **Accessible** → Made available to smallholders who normally have limited access to hybrids. Indian seed companies and NGOs sell 4kg and 1kg bags under the AAA brand.
- **Asian** → Adapted to drought-prone regions; available in the parts of India and Myanmar mentioned above.

What is the impact?

The AAA program is specifically designed for poor smallholders. These notably include ‘Scheduled’ tribal populations in backward areas. A 2019 survey of 65 Indian farmers and 19 seed dealers indicated the following benefits:

- **Economic.** AAA variety TA5084 delivers consistently high yield in drought-prone areas. It performs very well in poor soils. TA5084 has excellent ‘output features’ such as high grain quality, semi-flint grain texture with good shelling, and an orangey-yellow color valued by traders. Farmers who have moved from previous local varieties to TA5084 are earning about \$100/ha more per hectare.
- **Environmental.** TA5084 needs less water than conventional maize. In dry conditions, farmers commented, it stays remarkably green and disease-free. They see AAA maize as a kind of guarantee when limited water is available, and with still satisfactory yield in wet conditions. See below for further information on drought-tolerance.
- **Social.** Additional income brings family benefits. For example: A surveyed farmer who bought AAA maize from the NGO Pradhan said the extra earnings had allowed him for the first time to pay for schooling (\$50 p.a. per child) and small healthcare expenses.
- **Meeting smallholders’ needs.** 81.5% of the users in Gujarat gave first preference to AAA maize. Figures in Madhya Pradesh and Rajasthan were even higher. Reasons for this vote of confidence included high yield, quality of grains, low input costs, disease resistance, stronger plants and better taste.

How tolerant to drought are the AAA hybrids?

- Evaluation trials in winter 2017/18 showed that under drought, all AAA hybrids achieved similar yields to popular single-cross hybrids such as PAC745 or NK6240 (more than 3 t/ha). Such yields are possible in small-scale trials ran under optimum conditions, but still without irrigation.
- TA5084 showed very good performance under drought with a yield of well over 3t/ha and notably less than five days’ Anthesis Silking Interval. “ASI” is the time between silk emergence and pollen shed. It lengthens under abiotic stress such as drought. An ASI of less than five days in dry conditions is a sign of good drought-tolerance.

Adoption and scale (India)

In a typical village, very few smallholders are early adopters, but by year two, this increases to 10%. In India, over 900 farmers used the hybrid in 2018, rising to 2500 in 2019. In 2020, some 8000 farmers planted the seeds on about 6000 ha.

- The seed partners have agreed with SFSA to promote AAA maize in the targeted areas only, and to focus on making it available to tribal populations.
- Seed partners have their own distribution channel (mainly local dealers). SFSA has provided marketing guidelines, mapping, and promotion tools. Seed partners must use the AAA logo on all their communication material (including packaging) and conduct farmer fields and demonstrations.
- Some of the seed partners such as Pradhan have empowered and trained their own farming communities to produce AAA maize seeds.

Key success factors of the AAA program

- Reliable large trial network to assess performance
 - Positioning of AAA maize in the selected areas with rigorous implementation of SFSA guidelines
 - Robust, precise, and carefully documented three-year plans: where to sell, how to deliver the seeds, by when, through which distribution channel, etc.
 - Rigorous planning of seeds delivery to farmers, one year ahead
 - Effective process to produce and deliver high-quality seed at low cost
 - Extensive farmer demonstrations: “seeing is believing”
 - Excellent coordination between all partners, public and private
 - Good governance and suitable internal and external communication
 - Meticulous budgeting of all activities
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Sources available on request

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