



The Real alternative: Marketing bio-technologies with smallholder farmers across Tanzania

A case study of Real IPM in Tanzania

Who we are

AECF (Africa Enterprise Challenge Fund) is a leading non-profit development organisation that supports innovative enterprises in the agribusiness and renewable energy sectors with the aim of reducing rural poverty, promoting resilient communities and creating jobs.

AECF has raised over US\$ 400 million to provide catalytic funding and technical advisory support to enterprises that struggle to meet traditional risk-return standards for commercial investors. In just over a decade, we have supported over 375 businesses in 26 countries in Sub-Saharan Africa, impacted more than 30 million lives, created over 27,000 direct jobs, and leveraged US \$771 million in matching funds.

We surface and commercialize new ideas, business models and technologies designed to increase agricultural productivity, improve farmer incomes, expand clean energy access, reduce greenhouse gas emissions and improve resilience to the effects of climate change while also addressing the crosscutting themes of women, youth, and fragility. AECF is committed to working in frontier markets, fragile contexts, and high-risk economies where few mainstream financing institutions dare to go. In 2021, the AECF launched a refreshed strategy with the objective to build resilience and sustainable incomes for rural and marginalized communities in Africa.

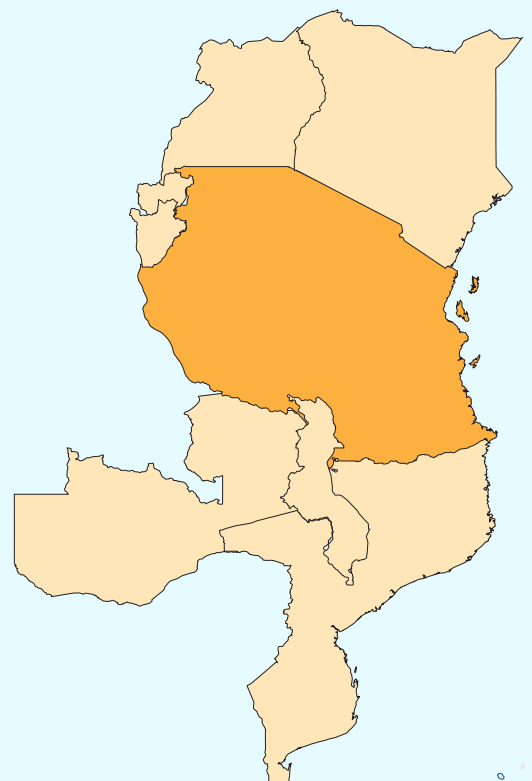
The Tanzania Agribusiness Window (TZAW)

The Tanzania Agribusiness Window (TZAW) is a US\$ 38M ten-year programme funded by the Foreign Commission Development Office (FCDO) and the Swedish International Development Cooperation Agency (Sida).

The programme seeks to address challenges of the availability, acceptability, affordability, and accessibility of agricultural produce and products by making food supply chain dynamics more efficient and effective to serve the poor; increasing the availability of agricultural inputs such as improved seeds, agrochemicals, fertilizers, veterinary services, transportation, and information; and enabling access to processing infrastructure in both rural and remote areas. The programme also seeks to increase the production and productivity of smallholder farmers thus increasing the availability of food, stabilizing prices, and ensuring a healthier population.

AECF has invested in more than 50 agricultural-oriented companies in a wide range of value chains ranging from seed companies, horticulture, fruit and vegetables, potatoes, fertilizer, and cashew nuts. The program has impacted tens of thousands of rural people, introduced innovative technologies, and changed how markets work for the poor.

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Introducing biological control to smallholder farmers in Tanzania

Real IPM¹ was founded in Kenya in 2003 and mainly focused on servicing fresh produce exporters, including flower producers, with biological plant protection products such as predatory mites. AECF supported the company with scaling its production processes to enable it to more effectively reach smallholders.

In 2016, Real IPM established operations in Tanzania to provide biological products for smallholder farmers and was further supported by AECF in the development of innovative bio-coatings for seeds.

The business model aims at improving smallholder agricultural productivity, reducing production costs, ensuring food safety and sustainability by introducing bio-agents as solutions to address agricultural challenges faced by smallholder farmers in selected agricultural value chains of fresh fruits and vegetables, grains/cereals (especially rice and maize) and flowers. The innovation addressed crop protection, crop nutrition, and sustainable climate-smart agricultural (CSA) challenges through solutions that work for smallholder farmers.

1. Crop protection

Seed dressing with bio-agents to strengthen pest and disease resistance; application of beneficial living organisms (Bacteria/fungi) to control pests and diseases; and insect traps to manage field or migratory pests which are becoming more common as climatic conditions change. These low-cost technologies reduce the cost of pest and disease control and reduce field and post-harvest losses

suffered by farmers.

2. Crop nutrition

The use of biofertilizers and biopesticides either in seed dressing or foliar sprays to improve crop growth and nutrition are CSA solutions that are safe and healthy and meet internationally recognized food safety standards. These solutions increase yields, reduce residue levels in produce to the minimum, reduce costs incurred on synthetic (inorganic) fertilizers, and enable organic production practices that conserve the soil, water, and the environment, while attracting premium prices in niche and export markets.

3. Sustainable CSA solutions that work for smallholder farmers

While agricultural value chains are inundated with synthetic inputs which create chemical and biological imbalances in the soil, water, and environment, the model adapts and promotes practices that are affordable to smallholder farmers, organic and climate-smart, thus sustaining the agricultural productivity of smallholder farmers in the long-run.

Since bio-agents technology was new in Tanzania, it required targeted sensitization and promotion approaches that recognize the significance of on-farm demonstrations with smallholder farmers, patience with the adoption of technologies, and building a trusted base of smallholder farmer champions in selected value chains to facilitate technology transfer with their farmer counterparts.

The innovation challenge and Real IPM Tanzania mitigation strategies

Real IPM's innovation in Tanzania was predicated on the use of bio-agents for nutrient improvement, pest and disease control to reduce the use and effects of agro-chemicals in crop nutrition and protection, while improving productivity and environmental sustainability.

Real IPM Tanzania pursued strategies that capture the potentially large market of smallholder farmers

in grains/cereals (especially rice and maize), and vegetables.

The bio-agents investment pilot for rice originally targeted Shinyanga, Morogoro, Mwanza, Tabora, and Mbeya which account for 69% of the total rice production in Tanzania, while the focus for fresh fruits and vegetables for was initially based in Arusha and Kilimanjaro regions.

How the Real IPM model and innovation addresses the challenge

The AECF Investment:

Real IPM's expansion into Tanzania required minimal investment capital in the production aspect of Bio Control Agents (BCAs) since this was already done by their Kenya based production plant. However, being a new investment in Tanzania, market entry and establishment resources were required, facilitating networks and knowledge/skills for the adoption of technologies, promotions, marketing, and distribution mechanisms.

The AECF grant support targeted the establishment of operations in Tanzania, including staff recruitment and training, capital expenditures for field promoters' motorbikes, the establishment of farmer demonstration plots and field days. The investment's purpose was two-fold:

- Initial leverage for expansion of Real IPM's scope into more crop varieties and regions in Tanzania,
- Increased focus on smallholder farmers and diversification out of the previous focus on export horticulture.

The model risks and mitigation strategies:

The business model is primarily agro-input supply; however, it integrates aspects of bundled services including extension support and agri-business marketing and distribution of climate-smart bio-technologies to farmers.

Real IPM Tanzania had identified the following key business risks, which attracted context responsive strategies to mitigate towards greater adoption of bio-agents technologies by smallholder farmers:

The Investment risks	The situation in Tanzania	The mitigation strategy adopted
Nascent Bio-agents policy and regulatory environment	Nascent, unstructured, with low availability of bio-agents (except for cereals/grains and tubers) and cumbersome registration processes.	A diversification strategy pursuing regulatory trials & approvals for multiple crop/seed varieties in SAGCOT corridor & Mwanza, & horticulture (Arusha, Kilimanjaro & Morogoro), while addressing emerging challenges of greenhouse export crops.
Low adoption of bio-technologies by farmers.	Little knowledge of the value and benefits of bio-agents and IPM in crop nutrition, protection, productivity and cost-effective climate smart and safe production systems.	Market strategy put the farmer at the center of technology adoption and promotion through identifying promoters and Village-based Advisers ² (VBAs/Lead farmers), using (community) demonstration plots in collaboration with recognized partners ³ , while understanding the limited shelf life of bio-agents and adapting to market demands.
Unpredictable and volatile market in targeted crop value chains.	Significant market disruptions due to unpredictable trade restrictions and bans on cereals/grains; fluctuations in the production and prices of FFVs due to overdependence on rainfed agriculture, quality standards that sometimes do not meet export standards.	Patient demonstration and introduction of bio technologies at affordable prices and with high economic benefits, getting early adopters who are agri-business oriented to experience the value of reduced costs of production, extension support, and improved productivity. Using these bio-products' champions, while also servicing greenhouse farmers and large-scale export farmers in the flower industry.
Predominant haphazard use of synthetic agro-chemicals	Fertilizer subsidies with the expectation to catalyze use, and extensive access to agro-chemicals, with very little skills safe use of agrochemicals and effects on environment and food systems.	Demonstrating to farmers, the concept of zero-residues, adoption of organic and climate-smart agro-practices for higher productivity, environmental sustainability, and safe and sustainable food systems and markets.
Climate change effects on agricultural production	Climate change has disrupted rainfall patterns across Tanzania, leading to flooding, droughts, and disease and pest burden for predominantly rainfed agricultural production systems.	Agility to learn through demonstration plots established in each of the sites. Drought (dry conditions in 2017) affected the establishment and colonization of Real IPM bio-fertilizers while excessive rainfall on its part affected greenhouse production and caused water-logging or flooding.

Progress, challenges, and lessons

Investment Implementation progress

1. Despite initial challenges with bio-agents' regulatory frameworks, 13 bio-products were registered, expanding access in Tanzania

Real IPM entry into the Tanzanian market required a significant investment of resources into the establishment of operations and registration of bio-agents. Tanzania Pesticides Research Institute (TPRI) had registered some bio-agents in the cereals/grains and tubers sector, however, being new, the regulations governing bio-agents registration were not clear to guide the Biological Control Agents Committees (BICAS) through their mandate. TPRI and Tanzania Fertilizer Regulatory Authority (TFRA) did not have clear guidelines or criteria.

Real IPM Tanzania facilitated registration and adoption of bio-control products with small- and large-scale farmers, expanding from zero in 2016 to 13 bio-products in 2021, spanning seed dressing/treatment, crop nutrition, and crop protection⁴, duly certified and registered by responsible regulatory authorities. Being the first to register a long list of bio-agents, Real IPM provided additional impetus in establishing the novel bio-agents registration systems.

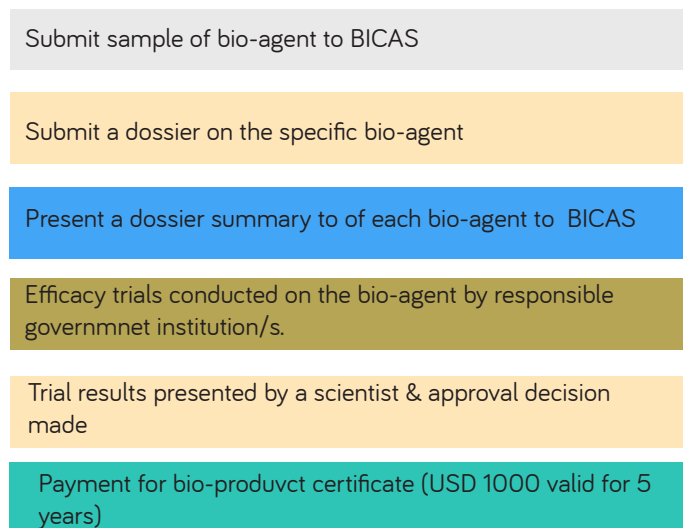


Figure 2. Bio-agents registration process in Tanzania

In 2017, implementation deepened knowledge through training of staff and demonstration plots and promotional activities with farmers; partnerships with government and private input and business development services' (BDS) providers; and marketing

and setting up distribution outlets through promoters and champion farmers.

Real IPM developed partnerships with TPRI⁵ and TFRA⁶; research institutions like The World Vegetable Center (AVRDC); and Tanzania Horticultural Association (TAHA)- a network of horticultural farmers. The partnerships with TAHA and AVRDC were especially helpful as they enabled advocacy with government to fast-track development of the regulatory frameworks and reduced the time taken for registration of bio-agents. It also allowed for multiple and concurrent registration procedures for bio-agents, an opportunity that Real IPM capitalized on. Despite the prevailing regulatory environment, Gro Plus was taken through laboratory trials at TFRA and efficacy trials in two maize cropping seasons at Tanzania Agricultural Research Institute (TARI-Selian) and after successful trials, became registered in 2017 as a bio-fertilizer. Similarly, Real Trichoderma and Real Bacillus were registered by TPRI, as fungicides, although they work best as bio-fertilizers⁷.

In 2018, seed dressing initiatives were topped up with the expansion of crop protection products to allow farmers to produce for a long time without negatively affecting soil fertility, while also reducing pest and disease resistance and improving crop nutrition. This was intended at assuring safe and healthy produce and building sustainable business relationships with farmers. The expanded focus saw the registration of seven additional bio-agents for crop nutrition and protection. With an improved and better organized regulatory environment in place, Real IPM was able to continue registering more products in 2019 and 2020, thereby expanding their scope of products, and crop value chains to engage smallholder farmers and serve in different regions of Tanzania (See Table 1).

Real IPM now has five categories of bioproducts currently available and in use in the Tanzanian market: 1. Beneficial bio-agents (Wadudu Rafiki), 2. Bio-pesticides (Dawa za wadudu), 3. Bio-fertilizers (Mbolea), 4. Bio-seed treatment (Dawa za mbegu) and 5. Insect traps (Mitego ya wadudu), in addition to vertical bags for home gardening and urban agriculture.

Year	Number of BCA products registered	Milestones and description
2016	No products registered	The period involved the establishment of operations in Tanzania, however Met 69, Trichoderma and Bacillus were already registered.
2017	Four products registered	Gro-Plus (a bio-fertilizer) registered by TFRA Real Trichoderma, Real Bacillus and Mazao Achieve are registered as fungicides though work best as bio-fertilizers
2018	Seven products were processed for registration	Amblyseius (Real) swirskii, Amblyseius (Real) Californicus, Amblyseius Montdorensis (Real Monty), Beauveria bassiana (Mazao Prevail). (Real) Phytoseiulus persimilis and (Real) Metarhizium anisopliae ICIPE 78
2019	Eleven products are fully registered	Full registration certificates for the 11 products received and 6 more awaiting approval with TPRI
2020	Thirteen bio-products fully registered	Full registration for 13 products and 6 more awaiting approval from regulatory authorities

Table 1. Timeline of Real IPM BCAs registration in Tanzania

2. Significant expansion in the scope of operations i.e., regions, smallholder farmers reach, active partnerships, and crop value chains.

Real IPM registered rapid expansion in scope between 2017 and 2019. However, with the onset of Covid-19 which disrupted trade and markets, the strategy changed to cut down on operations and regulate institutional cash flows. During this period, Real IPM expanded from three regions in 2016-2017 (Arusha, Kilimanjaro, and Mbeya), to a total of nine regions by 2019, of which five (Mwanza, Morogoro, Zanzibar, Dodoma, and Dar-es-salaam) were added in 2018 and one (Iringa) in 2019. In 2021, Real IPM was forced to reduce its presence in Mbeya due to COVID-19 but continued to maintain direct support to lead farmers as points of sale, demonstrations, and promotions. Even in places where Real IPM do not enjoy a direct presence, such as Mtwara and Ruvuma, they continued to receive orders.

Prioritizing the strategy of building sustainable business relationships with smallholder farmers through the establishment of permanent demonstration plots overseen by lead farmers, coordinating field training, extension, product distribution services through field promoters⁸, and promotions through word-of-mouth, the network of smallholder farmers consistently grew from a nascent base of only 100 in 2017 to around 8000 in 2021. Similarly, the annual increase in the

number of lead farmers increased more than ten-fold to 5000, to serve an average of more than 10 smallholder farmers each. This trajectory reflects the focus on market consolidation in 2021, and deepening uptake of new technologies, while pursuing strategic expansion informed by lessons from Covid-19.

The initial partnerships Real IPM Tanzania entered into were meant to serve registration and establishment purposes, before rolling out the approach to identify lead farmers and smallholder farmers as early adopters. Initial partnerships in 2016 were established with TPRI, TFRA, and AVRDC which hosted Real IPM's first permanent joint vegetable demonstration and exhibition center in Arusha and Kilimanjaro regions. The partnership with TAHA supported successful advocacy for improved bio-agents' regulatory frameworks and provided access to its network of members. In 2017, additional partnerships⁹ targeting the rice apex groups and irrigation technology providers in the Southern Highlands were established. In 2018, Real IPM-Iringa was hosted in the USAID Matunda na Mboga (MnM) centers of excellence, opening more partnership opportunities with seed companies, Tengeru Horticultural Research Center, and NGOs, expanding its reach in the horticulture sector. The MnM partnership provided Real IPM opportunities in free promotion, logistical support and sales agreements on seeds and bundled services

including smallholder drip irrigation services. The year 2019-2020 saw more partnership inroads with agricultural input companies, greenhouse technology providers, natural extracts and networks including DFID's AGRITEC and ICIPE's PROSAFE, to reach more smallholder farmers. Whereas the private

sector operations were affected in 2019, leading some partners¹⁰ to crowd-out, the partnerships provided impetus for Real IPM Tanzania to expand its scope of operations, venture into a wide array of sectors, increase reach to smallholders and contribute to improving bio-agents regulatory reforms in Tanzania.

Investment challenges and lessons

The investment faced challenges, and lessons were learnt and adapted to inform Real IPM strategy.

- 1. Knowledge gap:** Owing to a significant lack of knowledge on bio-control agents and the predominant (and often haphazard) use of synthetic agro-chemicals, facilitating uptake was a slow and patient endeavor with farmers. It was learned that adoption is easier with farmers who are engaged in agri-business, GAP or organic-certified, eventually consolidating a market of trusted farmers for the long-term.
- 2. Nascent bio-control agents' regulatory environment:** Whereas lack of clarity in the registration of bio-agents contributed to delays in products' registration, TAHA and AVRDC partnerships advocated reforms that culminating into more clarity regulatory frameworks, reduction in time taken for trials¹¹ and multiple and concurrent registrations of bio-agents.
- 3. Unpredictable government policies/changes:** Trade bans on cereals affected cross-border regional trade in rice and maize, reducing

domestic market prices. Labor import conditions of 2018-2020 had significant effects on the flower and horticulture industry in Tanzania, forcing closures or relocations of operations to neighboring countries. This affected the export market farmers - a key segment for Real IPM, causing significant income losses. There were tensions in cross-border trade between Tanzania and Kenya during the implementation period causing unpredictability in the cross-border taxation elevating the dangers¹² of loss of bio-products. While the tensions between the two countries were resolved in 2019, they affected Real IPM's capacity for forward planning, logistics management, and business decisions.

- 4. Climate change and effects:** This was manifested in droughts and higher than usual rainfall in the Southern Highlands. Too much rainfall affected green-houses, flooding led to loss of produce, while drought required water-efficient and affordable irrigation technologies, all of which ultimately increased farmers' costs of production, affected incomes, and led to farmers

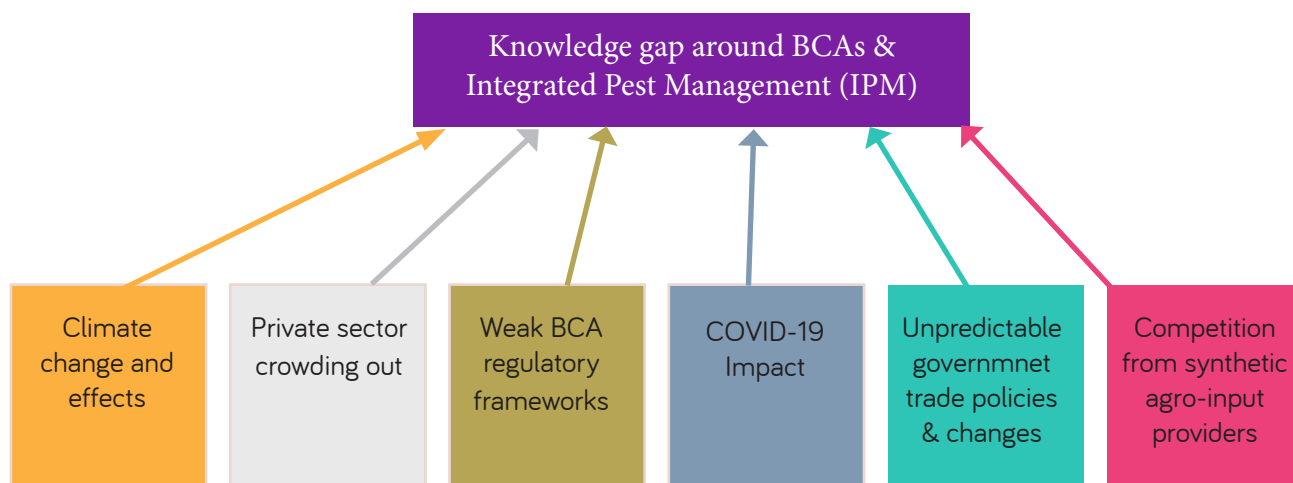


Figure 4. The Investments challenges

reducing their farm-sizes. Insufficient rainfall in the Mbeya region reduced the efficacy of Gro-Plus, Trichoderma and bacillus, affecting uptake and diminishing sales margins. However, it also fostered adaptations such as relocation of demonstration plots to wetter areas, changing product formulations from water-based to oil base, and promotion of climate-smart agricultural practices as additional services to farmers.

5. **Tendencies that crowd-out the private sector:**

Bio-agents technologies were new and initially depended on the importation of technical expertise and capacity building, mostly from the Kenyan office. During the previous regime¹³, labor policies were drawn-out, expensive, and unfriendly, which caused significant delays in operationalizing the Tanzanian market, delaying investment timelines and disrupting supply chains from Kenya.

6. **Competition from synthetic agro-input providers:**

The use of synthetic agrochemicals in agri-business farmers is a mindset that has been inculcated over time and these are the same farmers targeted by Real IPM. In addition, chemical companies like Crop Bio-Sciences and Balton were also selling bio-products thus supporting IPM's market establishment and expansion efforts.

7. **Covid-19 impacts:** One of the lucrative segments for Real IPM are large-scale horticultural farmers and flower exporters, however Covid-19, caused a closure of regional and international export markets as well as a collapse in the tourism sector. This reduced sales by 30% and delayed payments by clients, forcing Real IPM to scale down operations and focus more on internal markets. These informed the multi-pronged strategy, targeting retention of large-scale flowers and horticultural farmers for export markets as one market segment, deepening efforts to promote and market the technology with more smallholder farmers producing for the domestic markets, and expanding into organic and urban farming as emerging opportunities for women and youth taking up bio-technologies.

AECF Additionality

To support the entry into Tanzania, AECF organized forums and induction meetings bringing together old and new grantees in Tanzania, to interact and meet with other stakeholders. These platforms, enabled Real IPM to establish partnerships with value chain actors in the SAGCOT corridor including the USAID's MnM centers of excellence, and companies like Kokoa Kamili (Ifakara-Morogoro) and Natural Extract Industries (NEI in Moshi-Kilimanjaro).

The Innovation's development impact

The Real IPM model made certain assumptions for priority value chains towards accruing benefits to smallholder farmers in Tanzania (See figure 4).

The development impact

The net benefit per smallholder farmer growing tomatoes was found to be \$561 per acre or \$13 per crate of approximately 45Kgs. Real IPM products used by farmers included Trichoderma, Bacillus, Metarhizium, Gro plus, and insect traps. These products, reduced plant wilting in the field, increased production 4-fold from 11 crates per acre to 49 crates per acre and reduced the costs of synthetic fertilizer. The Bio-agents also improved quality: natural smell (absence of the smell of chemicals), no blemishes on tomato

skin, bigger size, good texture and sugary taste. Farmers are excited about the benefits of use of Real IPM bio-products and anticipate expanding their farm sizes from a mean of 0.91 acres to 2 acres in the next production season.

Rice farmers increased incomes by \$152 per acre or \$26 per 120Kg sack. While the price of 1 bag of rice increased from \$21 to \$26 per sack, this was because farmers adopted the use of improved rice variety-Saro 5, which also slightly increased the cost of production, especially seed and harvesting. Although the Bacillus used reduced the costs of fertilizer and weeding frequency, it (in conjunction with the use Saro 5) also increased yields per acre more than 3-fold, from 10-11 sacks to 30-50 sacks.

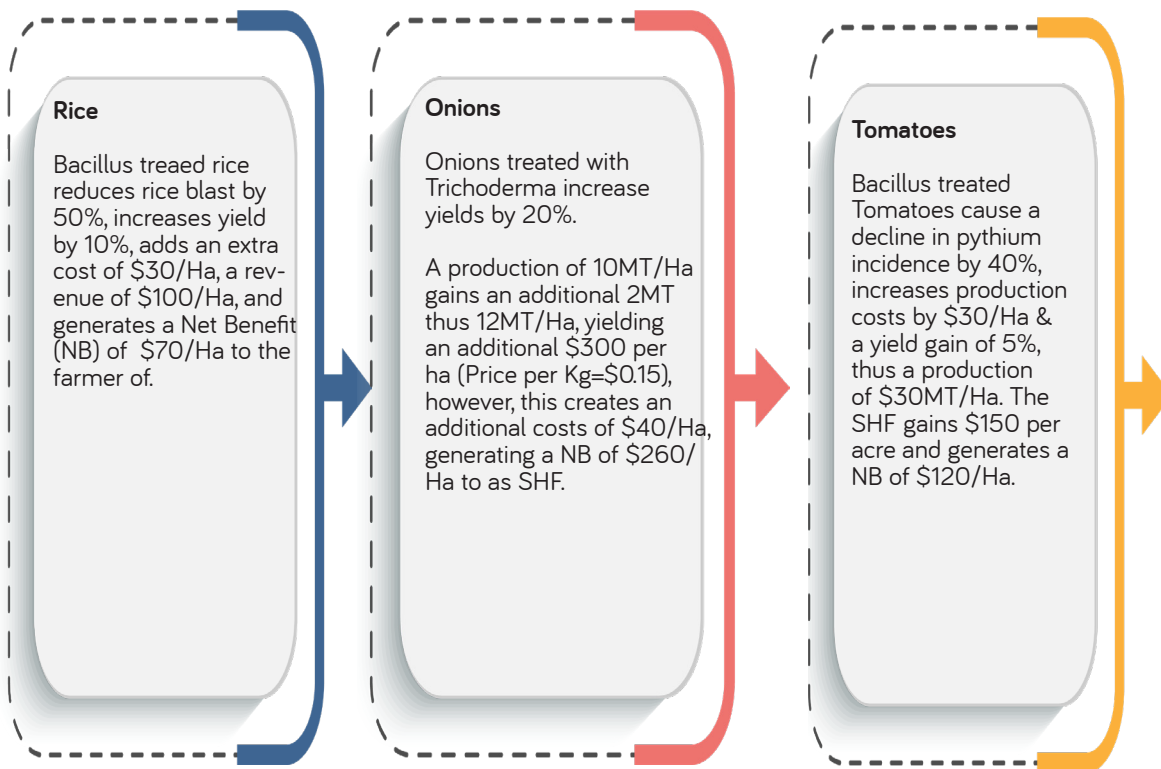


Figure 5. Real IPM model assumptions (Source-Business Plan, 2016)

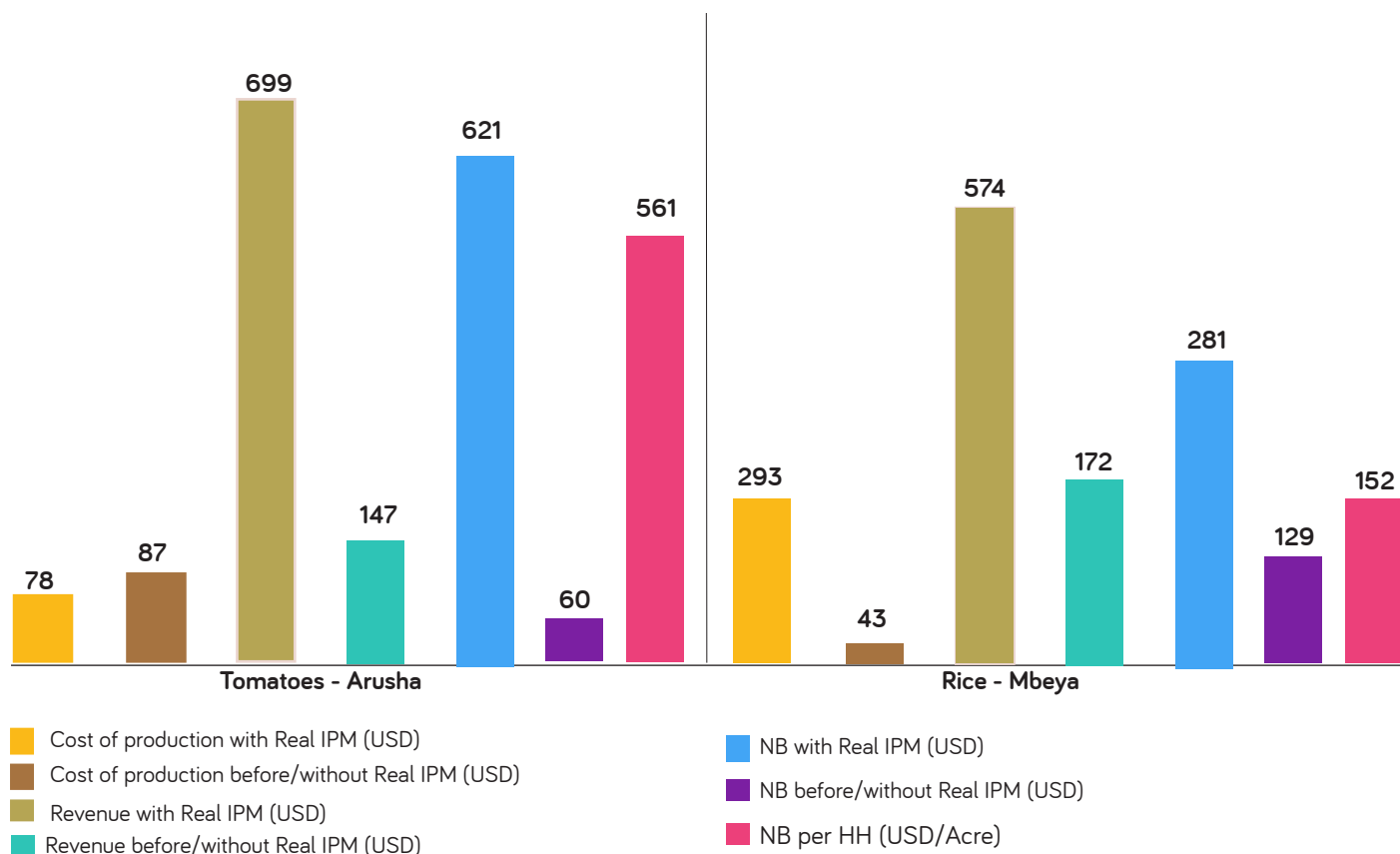


Figure 4. Calculated Net Benefit for Tomatoes and Rice (FGDs, 2022. Exchange rate: TZS 2,300=1 \$)

Smallholder farmers highlighted the common bio-agents they use, and their benefits (see table 3).

When farmers see significant increases in income, the greatest benefits farmers observe from the use of Real IPM bio-agents are:

- Cutting down the costs, especially on the use

of synthetic agro-chemicals (fertilizers and pesticides) and reduced weeding costs.

- Improved soil fertility and adoption of climate-smart agriculture.
- Higher germination rates.
- Reduced incidence and effects of pests and diseases, all of which are manifested in improved productivity (yield and quality).

BCA Category	Product Name	Use and verified benefits
Bio-fertilizer	Real Trichoderma, Real Bacillus Subtilis	Improves soil fertility, reduces costs of synthetic fertilizer, and improves yield and quality
Seed bio-treatments	Gro Plus, TriCoat	Improves soil structure, germination, seed resilience and resistance to pests and diseases, but also slightly increases the cost of seed
Integrated Pest Management	Real Trichoderma, Real Bacillus, Real Met 69, Mazao Achieve, Mazao Prevail & Real Bacillus Thuringiensis (BT)	These are bio-pesticides that are used to manage an array of crop pests and diseases.
	Insect traps (Roller traps, Monitraps, Entraps & Pheromone traps)	Used in pest management by drawing out and trapping common pests as well as scaring away other pests common with field crops

Table 3. Selected bio-agents and benefits as described by farmers (FGDs, 2022)

Investment's influence on market systems

Competition affected market share, but market still huge: Head-to-head competition from agrochemical companies engaged in bio-control agents, and new bio-agents' companies offer similar products to smallholder farmers. While the potential bio-agents market in Tanzania is still huge and untapped and the competitors ate into Real IPM's market share, they also helped to build overall awareness of biological products in the market.

Impact on bio-agents' regulatory frameworks: Real IPM entry into bio-control agents market catalyzed regulatory reforms in Tanzania. Initially, some bio-agents existed but partnership with TAHA and AVRDC facilitated the creation of the BCAs Committee (BI-CAS) to coordinate and regulate the whole continuum of trials and issuance of certificates in respect of crop

protection with TPRI and bio-fertilizers with TFRA; and fast-track of bio-agents registration with the government, faster and easier regulations for efficacy trials, especially for short-season crops including horticulture and cereals.

Associated Systems Change: There is increased uptake of bio-control agents among smallholder farmers because in the long run it is affordable, increases crop productivity, and reduces reliance on synthetic agro-chemicals which are also costly. This aligns with the Real IPM strategy on zero residues, growth promotion, and environmental sustainability, but also expands new and emerging opportunities in organic and GAP certified markets, important for both domestic niche and export markets for horticultural products.

Conclusions

Real IPM's bioproducts have led to important income gains for both large and small scale farmers as well as significantly reducing the use of inorganic pesticides and other plant products. Whilst the business is profitable, the concessional financing from AECF has been essential in both establishing operations in Tanzania and keeping the company going during the Covid-19 pandemic.

Significant opportunities exist for scaling the company and the biological control sector more broadly. The bio-agents regulatory environment has become more conducive and supportive of the introduction of more products to reach the huge market of smallholder farmers in Tanzania. Covid-19, despite the disruptions it caused, also opened opportunities for an increased and targeted focus on domestic, regional, and export markets, deepening engagement with smallholder farmers and expanding bio-agents for crop nutrition, protection, and leveraging climate-smart and organic farming practices and markets.

Three priority policy focus areas in Tanzania offer huge potentials for Real IPM's bio-agents and IPM growth: greater focus placed on improving and strengthening the horticulture value chains for smallholder farmers; the movement towards minimum-zero residues builds knowledge and practices for safe, healthy, and sustainable food systems, placing Real IPM at the center, and; climate-smart and environmentally sustainable agricultural practices which have been integrated into agricultural policies in Tanzania and the East Africa region.

End Notes

- 1 Real IPM was acquired by a Belgium based Biobest, in 2017
- 2 VBAs are given a commission based on the sales they make. To qualify for a commission, some criteria were used thus: (i) Their performance from previous projects with other stakeholders, (ii) Basing on the general performance of the farmer in the village through a survey carried out with farmers, (iii) Political power/convincing power of a farmer in the village, and (iv) The location of the farm – preferably easily accessible and not very remote.
- 3 Real IPM developed partnerships with TAHA based on their expansive network and influence on horticulture, with The World vegetable center (AVRDC) as a research center on vegetables (more so African indigenous vegetables), where they established their first demonstration center for farmers in the Arusha and Kilimanjaro regions, as well as Farm Input Promotions (FIPS) to support promotional activities around bio-agents as farm inputs.
- 4 Real *Phytoseiulus* has been used to control red spider mites mostly in large flower farms; Real *Metarhizium* in control of mealy bugs, thrips and larval stages of caterpillars; and Real *Trichoderma* & Real *Bacillus* as foliar spray to control powdery mildew in tomatoes.
- 5 TPRI is legally mandated to approve and register all pesticides in Tanzania
- 6 TFRA regulates all fertilizers registration, standards and distribution/use, including bio-fertilizers
- 7 Real IPM, extended the label, in line with the regulations-which allow for declaration on the product label of additional uses of the bio-agent, by paying 'label extension' fee, although farmers enjoy the dual benefits on crop nutrition and protection without any additional cost.
- 8 Field Promoters are Real IPM staff sourced from the regional level and facilitated with motorbikes to identify, train and provide extension and product distribution support through the Lead Farmers (village-based advisers who manage, with small holder farmers, the demonstration plots, facilitate uptake of technologies in SHF farming practices, market the products and place orders and requests to Real IPM Head Office who then coordinate supply and distribution logistics.
- 9 While APEX Group comprises more than 30,000 rice farmers in 39 groups (schemes) having 1-5 acres of land, Real IPM was working with about 100 of these farmers doing both cereals and vegetables. Wade Rain is an irrigation system provider, Afrisame is a quality hybrid seeds provider, IRRICO is greenhouse vendor and Equity for Tanzania Ltd (EFTA) provides equipment loans to small and medium scale farmers and enterprises. These were formed as a cluster in 2017 (AECF Narrative Report, 2017)
- 10 In 2019, the MnM partnerships had whittled down to include Real IPM, Rijkswaas, Afrisem and (Wade rain), Irrigation company, as others closed shop or changed their business strategy especially with the unfriendly business environment for the private sector at that time.
- 11 The trials used to take up to three years, however, with the improvements in the regulatory frameworks, crops which have shorter growing seasons such as flowers and vegetables can go through 2-3 trials before approval for registration.
- 12 Some of the Bio-agents marketed by Real IPM (Tanzania) and imported from Kenya, are delicate, have a short shelf life and require cold chain logistics for transportation and storage. The cross-border tensions elevated the risk of delays in transport and storage, but Real IPM also did not have adequate bulk cold chain logistics to import Bio-agents from Kenya into Tanzania. Moreover, the short shelf life determined the local distribution mechanisms to use, and it was not possible to use agro-vets as a distribution option, because of the potential risk of loss of capital and increased storage costs, a reason why Real IPM Tanzania prioritizes direct product orders from lead farmers instead.
- 13 This refers to the '5th government' of the late President Magufuli



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