Deployment of Combined Technologies to Smallholder Farmers in Kenya

TAAT Clearinghouse

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Deployment of Combined Technologies to Smallholder Farmers in Kenya

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Front cover photographic credit: Left to right, youth training in Vihiga County, technology introduction to Kenyan agrodealers, contract service provision for Fall Armyworm control by Kenyan youth. *Photos by Ms. Welissa Mulei and Ms. Josephine Ongoma.*

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Deployment of Combined Technologies to Smallholder Farmers in Kenya

A Report by the TAAT Clearinghouse Team, Nairobi, Kenya

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Summary

The Clearinghouse has identified opportunities to better respond to the needs of smallholder farmers who always plant multiple crops in mixed cropping systems and integrate them with animal enterprises. Agrodealers serving them must also stock several technologies. However, the work program of TAAT has been designed around Compacts focusing on single value chains or single cross-cutting themes. As the Coordinators of the Maize, Bean, Sweet Potato, Small Livestock and Policy SupportCompacts, and the Technical Adviser of the Youth in Agribusiness Compact are all located in Nairobi, Kenya, the Clearinghouse encouraged the design of combined toolkits to respond to the needs of small-scale farming customers, and for youth groups to capitalize upon agribusiness opportunities from these technologies.

Negotiations were held with a network of agrodealers serving over 2,000 farmers in Western Kenya to package mixed technologies recommended by Compacts and have them deployed to their farmer clients, with the Compacts providing training and supervision. Six such opportunities were identified and codenamed "Kenya Quick Wins". They include a combined maize-bean-FAW technology toolkit that involved 12 products from seven input suppliers with these products placed on the shelves of an agrodealer network for test marketing. This effort was linked to a sweet potato relay crop, following farmer maize-bean intercropping, and the OFSP Compact provided the technologies (improved varieties rich in Vitamin A).

Another quick win consisted of designing a new fertilizer blend (RFC-ROOT, 5-13-21++), a fertilizer blend that MEA Fertilizers agreed to mass produce a quantity of 40 tons and bag into different sized bags for test marketing. This new blend is intended for top-dressing cassava, sweet potato and other root (and even fruit) crops. Another timely Quick Win involved the development of a Fall Army Worm (FAW) Rapid Response that established youth as first responders to FAW invasion, a curative strategy that is now being expanded to four more countries and adopted by other projects. This response offers farmers an immediate control option while IPM-based approaches are being developed against this new pest to African agriculture. Another Quick Win brought together the Youth and Small Livestock Compacts where an Agripreneur youth group assumed control over an abandoned government poultry facility to initiate commercial chicken and goat fattening enterprises.

In all, nine TAAT Compacts are involved in the Kenya Quick Wins. These interactions between Compacts to deliver technologies are being considered by the Clearinghouse to demonstrate how in-country collaboration and coordination could be managed to create synergies between TAAT Compacts and all categories of national partners. A conceptual model is under development to better characterize the process of combining technologies in view of deploying this approach to other TAAT intervention countries and scaling up the delivery of multiple technologies to farmers.

Background. The TAAT Clearinghouse authorized a Technical Mission to develop and advance technology toolkits in Kenya. This was borne of the recognition that TAAT is expected to develop "Quick Wins" during Year 1 and owing to delays in project launch, only the East African August-to-December "short rains" remained in 2018 for a complete cycle of technology deployment and assessment. Kenya was selected for this action because several Value Chain Compact Leaders are located there, and most of their accompanying technologies are commercially available in Kenya. This technology intervention focuses upon six Quick Win opportunities:

1. Modernized maize and bean production in west Kenya;
2. Promotion of dryland production technologies in east Kenya;
3. Fall Army Worm Rapid Response in Kenya as a profitable contract service;
4. Establishing poultry and goat fattening enterprises by Youth Agripreneurs;
5. Entry point participation of youth in the Vihiga County Fish Park in west Kenya; and
6. Development of the RFC-ROOT (5-13-21++) fertilizer blend in conjunction with MEA Fertilizers Ltd. (Kenya).

A Concept Note, workplan and budget were developed by the Clearinghouse team posted in Nairobi and a request for $99,950 was quickly approved through the Program Management Unit to the IITA Office in Nairobi. A strategy where each Quick Win was linked to Compact technology providers, farm organizations, youth groups and extension agents was devised. A summary of activities for each of these six Quick Wins follows.

Quick Win 1. Modernized Maize and Bean Production. This Quick Win builds upon the widespread but underperforming farmer traditional maize-bean intercropping systems of west Kenya. It is conducted in conjunction with the Maize, Bean, FAW and OFSP Compacts. A modernizing toolkit was designed, commercial products assembled and a mechanism for product testing and sales initiated. This maize-bean-FAW-OFSP toolkit consists of pre-emergent herbicides, pre-plant and top-dressed fertilizers, improved maize and bean seed, legume inoculant, and FAW control products (Figure 1). These products were purchased through commercial bids and assembled at the OSSOM Agrodealer Network warehouse in Luanda, west Kenya. Member agrodealers met to become familiarized with the toolkit products, and means of product demonstration and testing were devised. After signing a partnership agreement with OSSOM these products were dispatched to six

Figure 1. Quick Win 1 toolkit products (above) and dissemination team (below)

members' shops with several more agrodealers ready to participate. The intervention also includes promotion of small-scale machinery including hand tractors, paddle weeders and power sprayers as accompanying technologies. An M&E system reporting toolkit sales and customer preference was developed and distributed, and reporting is ongoing. The Vihiga County Director of Agriculture visited the warehouse, was impressed by the toolkit and pledged extension support. Follow up visits were made by the Clearinghouse Technical Assistant. OSSOM then organized product display and customer open houses in November 2018 that saw 662 participants (52% women) across five counties of west Kenya (Bungoma, Busia, Kakamega, Siaya and Vihiga Counties). Participants included government extension officers, agrodealers, farmers, farmers' associations, youth groups, input suppliers, private extension agri-service providers, and representatives of other Compacts.

Quick Win 1 had participation by 1304 households producing an estimated additional 288 metric tons (MT) of maize and 70 MT of beans worth about $146,000. Some OSSOM agrodealers elected to bundle the toolkit and extend it to trusted customers on credit. A preliminary database developed for 374 of these farmers shows that 58% of them are women with clients investing $33 each on an average 0.14 ha of modernized maize-bean production system. Thus, modernized maize-bean production requires an average investment of $230 per ha. This effort is expected to increase household food supply by an average 306 kg each (47 kg bean and 259 kg maize) resulting in $136 of value and a return on investment of 4.1:1. Produce is being packaged in branded woven polythene bags bearing the TAAT logo that allows for Farm-to-Buyer tracking. Currently, OFSP is being promoted as a relay crop following bean harvest. Mechanisms are in place to multiply the needed vines. Overall, reaching farmers with improved maize-bean technologies using this approach cost $17.76 per household.

Quick Win 2. Dryland Crop Production. This Quick Win was originally intended to assist the Maize Compact distribute drought-tolerant maize to isolated farm communities in semi-arid Kenya. A maize production toolkit was assembled and introduced to the farming communities through agrodealer networks and IITA Youth Agripreneurs. This toolkit included 854 kg of DTMA var. 1101 recently approved by the Kenya Plant Health Inspection Service. An accompanying technology maize production toolkit consisting of pre-emergent herbicide, pre-plant fertilizer and FAW control products was assembled and, together with these seeds dispatched to two locations, one in east and another in west Kenya. These technology packages are being deployed in east Kenya by the KHYG Agripreneur group and the University of Nairobi Dryland Station, and the OSSOM agrodealer network in west Kenya. But the expected 2018-2019 rains in east Kenya were very poor, instead causing the Quick Win to shift direction in favor of bulking the newly-released, drought-tolerant OFSP varieties Delvia, Irene and Sumaia. A prototype, virus-free vine multiplication greenhouse was constructed (Figures 2 and 3) and vine multiplication is under way. The tent-style design greatly reduces construction costs (to about $3.40 per m^2) and permits production of additional crops under pest- and disease-free conditions. Early indicators suggest that selling sweet potato tubers and leafy vines are worth about $4 per m^2 and intensive cutting production yields $9 per m^2 but the depth of these markets remains uncertain. Already vines are being provided to the surrounding farming communities but the intention is to commence marketing of vines in bundles of 100 cuttings for $8 each during the 2019 long rains (starting in April). It is difficult to calculate the investment cost of each maize-producing household reached because of the failed rains, but the costs for establishing a sweet potato vine production enterprise was $6,590, or about $7.66 per m^2 inclusive of construction materials, cuttings, transport, labor and training. This investment can be recovered within five months through sales of vines and tubers.

Figure 2. Constructing the tent-style screen house: 1) erecting posts, 2) installing cables, 3) sinking the anchors, 4) anchor, cable and connector close up, 5) stretching the screen, 6) framing the antechamber (entrance), 7) burying the edges, 8) exterior screen house view.

Figure 3. Completing and planting the screen house: 1) screen house interior with raised beds, 2) installing drip irrigation, 3) receiving cuttings and RFC-ROOT fertilizer, and OFSP ready for cutting.

Quick Win 3. Fall Army Worm Rapid Response. The biological invasion of Fall Army Worm across maize croplands throughout Africa, including Kenya, represents a major threat to food security. This Quick Win focused upon the establishment of youth-led FAW Rapid Response units operating out of OSSOM agrodealer shops and Agripreneur Youth Incubations. A toolkit was devised consisting of a customized cargo tuk-tuk, power sprayers, safety equipment, commercially recommended pesticides, farmer information materials and communication tools. These products were purchased through commercial bids from four suppliers and assembled at IITA-Nairobi for shipment to two locations, KHYG in east Kenya and OSSOM in west Kenya. Next, a one-day training course on FAW Rapid Response was developed that contains seven modules:

1) Fall Army Worm control as a business opportunity;
2) Understanding the Fall Army Worm invasion;
3) Control options and access to rapid response equipment and supplies;
4) Operation and maintenance of control equipment;
5) Commercial partnership and enterprise establishment;
6) Costs and expected returns; and
7) Agripreneur youth as rapid responders within local communities and agrodealer networks.

Figure 4. Technology introduction to agrodealers in west Kenya (above), announcement of FAW control services (below).

CIMMYT provided copies of a recently published guideline on FAW management and a pilot course was conducted by OSSOM and the Vihiga County extension service. Training was provided to 40 participants drawn from agrodealers, farmer associations, youth groups, and extension providers. A similar training was conducted in east Kenya by IITA Youth Agripreneurs, Syngenta, and the University of Nairobi; and brought together an additional 89 participants, resulting in total 129 stakeholders trained in FAW control services.

This course has proven to not only prepare operators for efficient and safe FAW control, but also to galvanize local commitment and investment in this toolkit. Early indicators are extremely promising. A central warehouse was established to service twelve operators in eight locations. An analysis was performed among the first 227 clients subscribing to spraying services of eight operators in five counties (Figure 4). These services treated an average of 0.20 ha per client at a cost of $5.68 each. This amounts to 43 ha treated at an average cost of $28 per ha. Overall curative benefits are estimated at 9.7 tons of maize worth $3,769 at current

prices, or 45 kg of rescued maize per household worth about $18. Subscription to this service results in a return to investment of 4.1:1. Of the insecticides sprayed by the operators, 98% conformed to approved agro-chemicals with Syngenta MATCH (Lufenuron) being the most frequent (66%) followed by Amiran PROVE (Emamectin benzoate)(25%). Concerns that these rapidly mobilized operators would fail to follow approved practice appear unwarranted. It is important to note that 54% of the clients were women farmers, and that 68% of clients were engaged in Quick Win 1 intervention. It is also observed that the service is accessible to women-led households and that participation in one technology toolkit can lead to access to another. This approach has so far created additional employment for 28 youth in Kenya.

As mentioned under Quick Win 2, the onset of rains in east Kenya arrived nearly two months late delaying FAW RR operations there, but services by KHYG in Kibwezi commenced in December as well. Two scientists from the University of Nairobi (Drs. Kilalo and Nzuve) are working with KHYG to assist in FAW diagnosis and operator calibration. In all, this Quick Win required a modest investment of $7,452 providing benefits to over 1048 direct beneficiaries at an average cost of $7.11 per beneficiary. This includes the cost of agrodealer open houses that promotes FAW agro-chemicals, equipment and contract services, reaching an unknown number of indirect beneficiaries as future customers and advice-seekers. This approach appears very promising for deployment to other countries beyond Kenya.

Quick Win 4. Integrating Small Livestock Enterprise by Agripreneurs. This Quick Win focused upon poultry production and goat fattening enterprises at the Kibwezi Dryland Research Station. It is under development by the KHYG Agripreneurs, the Small Livestock Compact led by ILRI and the University of Nairobi Dryland Research Station. This station has several poultry houses that were idle and sought to place them into production as part of its larger community service and knowledge management mandate. The leader of the Small Livestock Compact, Dr. Samuel Adediran, visited this facility to offer practical advice on its rehabilitation and ensure that this activity pursues technologies as described within the Small Livestock Compact. Rehabilitation of the termite infested poultry facility is underway but admittedly is taking longer than expected.

Figure 5. Injecting young goats (above), wet season grazing of improved breeds (below).

The KYHG team has also established a goat fattening enterprise, constructed animal pens and purchased the first 15 “Gala” breed goat kids for fattening. This breed of white goat is well known in Kenya for the quality of its meat and its resistance to disease (Figure 5). Each goat was

purchased for about $20 at a nearby livestock market. Upon arrival the goats were de-wormed and vaccinated (Figure 5). Additional goats will be acquired in early 2019 when post-holiday prices are expected to be lower. This enterprise interacts with the OFSP Compact as leaves of sweet potato provide nutritious fodder.

The University of Nairobi that hosts KHYG insists that this Quick Win link to its training mandate and a response to this condition is being formed. The Livestock Compact has recently developed an agreement to buy into this Quick Win, offering $5,000 for restocking, health care and feed, and providing training of 50 local women and youth. Once this renovation is complete, the facility should produce about 6000 broilers and 100 fattened goats worth approximately $22,000 over the next 12 months as well as train 120 university students, local youth and women through three outreach programs.

Quick Win 5. Innovative Fish Farming by the Vihiga Aquapreneurs. This action has resulted in the establishment of a new Agripreneur agribusiness incubation in west Kenya, the West Kenya Youth Agripreneur Group (Figure 6). This incubation is hosted by the Vihiga County Fish Farming Project to provide experiential learning in pond construction, fish farming, fish feed production and value addition. They are also producing Orange Fleshed Sweet Potato and High Iron Beans. The group includes 15 members and has registered with the Ministry of Social Services. AWE Ltd. offers mentorship in business development and marketing. The group is currently developing a complex of seven fish ponds totaling 2,100 m^2 able to produce 25 tons of fish worth $38,000 every six months. The group will also provide contract support to 120 neighboring fish farmers under funding from ENABLE TAAT. It recently presented a comprehensive agribusiness plan to the ENABLE TAAT Compact and was awarded an additional $15,000 by Ekimiks Ltd. to further its efforts. The group leaders subsequently received Agripreneur orientation by ENABLE TAAT officers concerning reporting procedures. This Quick Win serves as an example of how motivated youth may be quickly and cost-effectively mobilized toward enterprise development, and how this process may be linked to both private sector mentorship and local (county) government development efforts.

Figure 6. Members of an "Aquapreneur" youth group in west Kenya (above) and constructing fish ponds (below).

Quick Win 6. RFC-ROOT: A New Fertilizer Blend for Root Crops. On 12 June 2018, a meeting was organized by the TAAT Clearinghouse in Cotonou, Benin to discuss opportunities for stronger alliance with the African Fertilizer Industry. One outcome of that meeting was the conclusion that more and better fertilizer blends must reach African small-scale farmers. During the process of preparing for the ENABLE TAAT Food Basket Outreach activity in Kenya, that includes OFSP and improved cassava, it became apparent that there were no specialized fertilizer blends for root crops available on the Kenyan market and that potassium (K) was difficult to access. This stands in contrast to rice, coffee, tea, grains, vegetables and grain legumes that all have established commercialized blends available to farmers. Consequently, the TAAT Clearinghouse Technical Adviser approached MEA Fertilizers Ltd. to collaboratively develop a new fertilizer blend, named "RFC-Root" to correct this shortcoming, and the company agreed. MEA operates a fertilizer blending plant in Nakuru, Kenya and distributes its products throughout East Africa (Figure 7). To date, a NPK 5:13:21 with MgO 5.8%, CaO 4%, S 3% and Zn 0.4% blend was formulated based upon locally available ingredients and MEA was contracted to produce the first 40 ton batch, matching the capacity of its smallest blender. A product label was designed and East Africa Bagging (EAB) was contracted to produce an assortment of 5, 10, 25 and 50 kg bags for dissemination and test marketing (Figure 7 insert). The Compact Leaders for cassava and sweet potato were contacted about the opportunity to include this product into its Technology Toolkits being promoted in East Africa, and the fertilizer blend will be test marketed through the OSSOM Agrodealer Network similar to the approach within Quick Win 1. The first 40 ton batch of RFC:ROOT was blended by MEA at its Nakuru factory on 21 November and a marketing strategy around this new product is being devised. In all, this effort required about $0.71 per kg to negotiate, design, mix and package this new fertilizer blend, with additional resources earmarked for dissemination and test marketing during the upcoming long rains growing season. This Quick Win demonstrates that new fertilizer products may be mobilized by TAAT through commercial partnership.

Figure 7. Blending the RFC-ROOT fertilizer by MEA Ltd. In Nakuru, Kenya (inset: fertilizer bag design).

Conclusion. Note that these six different Quick Wins have several important elements in common. While they directly relate to Clearinghouse responsibilities within TAAT to guide technology deployment, they also involve several TAAT Compacts led by IITA, AATF, CIAT, CIP and ILRI. These CGIAR partners are clustered in Nairobi and all have bought into this effort in one way or another. This Technical Mission capitalizes upon the newly formed Clearinghouse Liaison Office formed in Nairobi as well, and serves as a test of its incoming staff to assist in technology deployment. The Technical Adviser was able to rapidly identify several promising opportunities via the Technology Toolkit approach (see Clearinghouse Technical Report 001)

and forge multi-stakeholder partnerships around them. The Clearinghouse Technical Assistant then developed reporting mechanisms around these quickly assembled activities. These databases were adapted and expanded into the TAAT Monitoring, Evaluation and Learning Strategy (forthcoming). Clearly, this Clearinghouse Mission directly contributes to the goals of TAAT, serving as an early Proof of Concept of working with the private sector to design specific technology products for smallholder farmers, and illustrates how the Program offers tremendous potential to modernize agriculture in a transformative manner.

A "champion-based" conceptual model is under development to better characterize the process of combining technologies in view of deploying this approach to other TAAT interventions; particularly where scaling of complex and multiple technologies to farmers is needed. (Figure 8). This model relies upon toolkits being included within larger technology outreach agendas and readily accommodates private sector participation based upon their business interests. In this case, "National System Champion" may refer to parties beyond national governments such as local and private extension mechanisms (as with Quick Wins 1 and 3), the private sector (as with Quick Wins 1, 3, 5 and 6), or existing NGO, farmer and youth groups (as with Quick Wins 2, 4 and 5). A quick route of success involves empowering champions as they emerge and working with them in an iterative problem-solving manner without preconceptions and overly-formalized procedures.

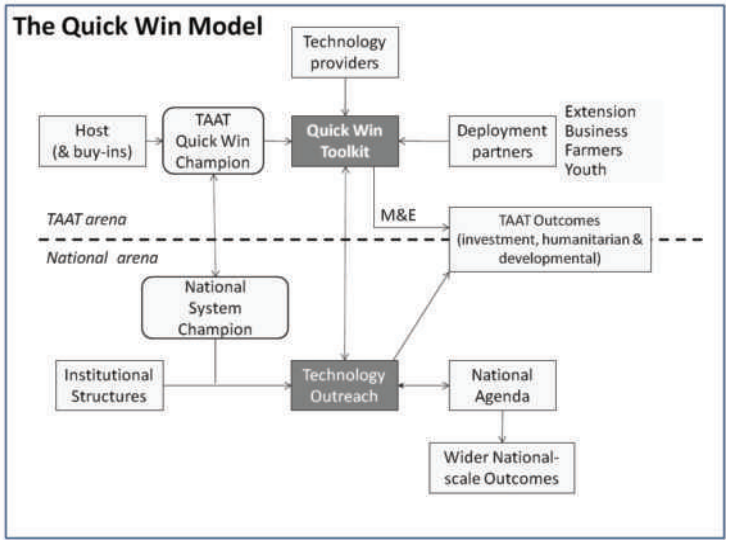

Figure 8. A "champion-based" approach to technology dissemination developed during the course of the Kenya Quick Wins.

Although the first complete cropping cycle of these Quick Wins is not yet complete, several important lessons are emerging:

- A technology toolkit to modernize maize and bean production is available from commercial sources in Kenya and may be assembled on agrodealer shelves. This toolkit costs about $230 per ha and provides approximately four-fold investment returns.
- Several agrodealers that were provided products embodying maize-bean technology toolkits, and were expected to test market them, instead chose to bundle and extend them to trusted customers on credit. A database of the participating farmers was compiled but cannot be interpreted until harvest of the short rain's crops and repayment is completed. This approach appears to have generated significant interest among local farming communities as evidenced by the large turnout at "last mile" agrodealer open houses.
- Promoting toolkits in dryland areas poses risks of poor rains as has occurred in east Kenya. Evaluation of DTMA maize var. 1101 during the east Kenya short rains was limited by the very late arrival of the rains as farmers typically await these rains before planting into moist

soil. However it was observed that this variety offers potential during the short rains in the drought-prone Lake Victoria Basin, including within complex intercropping systems.

- Enterprise opportunities based upon the Orange Fleshed Sweet Potato are becoming realized. Revenues are raised from both marketing vine cuttings and tubers. Three drought-tolerant OFSP varieties were recently released in Kenya and ENABLE TAAT youth are taking the lead in their popularization and availability. Technologies related to vegetable production may readily be applied to the production of virus-free OFSP cuttings. The skills developed by youth to construct cost-cutting, tent-style screen houses and advanced irrigation systems are also marketable.
- The Fall Army Worm Rapid Response provides valuable services to farming communities threatened by this biological invasion. Contract services consisting of approved insecticides, power sprayers and safety equipment costs an average $28 per ha offering increased yields of about 225 kg maize per ha, but clients usually elect to protect much smaller areas. FAW Rapid Response should become incorporated into the larger FAW Compact, particularly for providing protection against woms when the protective effect of Fortenza Duo seed treatment is over after a few weeks.
- Youth groups are ready clients for improved small livestock and fish production enterprises, and they have the necessary skill sets to adopt the technologies being offered through TAAT. In many cases, youth can renovate and restore production to failed businesses and development projects. Other Compacts appear ready to buy into this advantage. All of the technologies needed for animal and fish production are commercially available, but the high cost of poultry and fish feed remains a challenge.
- An established fertilizer company in Kenya readily agreed to partner in the production of a specialized fertilizer blend for root crops. This blend addresses the lack of potassium, a nutrient needed for root crop development, but also contains adjusted amounts of six other nutrients. RFC-ROOT will be included within the widely-recognized MEA Fertilizers Ltd. product line of blended fertilizers early in 2019.
- Women are well represented within these Quick Wins. For example, women form 52% of the participants in technology toolkit open houses, 58% of the subscribing clients in Win 1, 54% of farmers contracting FAW Rapid Response services and 44% of the larger Kenya Quick Wins team.
- The Quick Win approach links several technologies that effectively respond to the needs of smallholder farmers and opens participation of local extension agents and private sector input manufacturers and suppliers, thus offering a viable pathway to achieve rapid impacts from technology dissemination to smallholder farmers. One of its strengths is that it creates a network of champions who are instrumental in the deployment of technologies.

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Technologies for African Agricultural Transformation (TAAT) and its Clearinghouse Office

The developmental objective of TAAT is to rapidly expand access of smallholder farmers to high yielding agricultural technologies that improve their food production, assure food security and raise rural incomes. This goal is achieved by delivering regional public goods for rapidly scaling up agricultural technologies across similar agro-ecological zones. This result is achieved through three principal mechanisms; 1) creating an enabling environment for technology adoption by farmers, 2) facilitating effective delivery of these technologies to farmers through a structured Regional Technology Delivery Infrastructure and 3) raising agricultural production and productivity through strategic interventions that include improved crop varieties and animal breeds, accompanying good management practices and vigorous farmer outreach campaigns at the Regional Member Country (RMC) level. The important roles of sound policies, empowering women and youth, strengthening extension systems and engaging with the private sector is implicit within this strategy. The Clearinghouse is the body within TAAT that decides which technologies should be disseminated. Moreover, it is tasked with the responsibility to guide the deployment of proven agricultural technologies to scale in a commercially sustainable fashion through the establishment of partnerships that provide access to expertise required to design, implement, and monitor the progress of technology dissemination campaigns. In this way, the Clearinghouse is essentially an agricultural transformation incubation platform, aimed at facilitating partnerships and strengthening national agricultural development programs to reach millions of farmers with appropriate agricultural technologies.

Dr. Mpoko Bokanga, Head of the TAAT Clearinghouse

Back cover photographic credit: Members of the Kibwezi Hortipreneur Youth Group and farmers participating in a TAAT Open House in eastern Kenya*. Photo by Ms. Welissa Mulei.*

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