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Paving the Way for the Spread of a New Rice Thresher - A contribution to improved rice quality in Nigeria

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AfricaRice and its partners are developing technologies to address the mechanization bottleneck in African rice production, particularly for labor-intensive activities such as weeding, harvesting, threshing and winnowing. In collaboration with national partners and local manufacturers. AfricaRice has been adapting and introducing small-scale thresher–cleaners to various sub-Saharan African countries since 1997. In December 2013, AfricaRice introduced the Agricultural Transformation Agenda thresher–cleaner (ATATC) into Nigeria. A survey was carried out in October 2015 to assess the diffusion of the ATATC in Nigeria.

The need for improved technology

Rice consumption has been growing faster than domestic production in sub-Saharan Africa since the early 1960s, resulting in a decline in continental rice self-sufficiency from 112% in 1961 to 60% in 2005. The gap is filled by imports. However, the dangers of depending on imports for a staple food commodity were clearly highlighted in the food crisis of 2007–2008, when rice prices rocketed.

Since the food crisis, many governments have initiated programs to increase domestic rice production. Area expansion has been a popular option for many years, but its impact is hindered by the fact that almost two-thirds of the sub-Saharan African rice area is rainfed (compared to a little over a third worldwide). Rainfed rice crops produce much lower yields than irrigated ones, yet yields in all African ecosystems (upland, lowland, irrigated and mangrove) have been mostly stagnant for decades. Newer, higher-yielding varieties (particularly those introduced in the wake of the development of NERICA and NERICA-L varieties in the late 1990s and 2000s) have provided a much-needed boost to production.

Improved varieties alone are not a panacea, however. Across the continent, locally produced rice suffers from an image problem for various reasons. Most importantly, local rice is heterogeneous: it is typically sold unsorted, and poorly milled and cleaned; it contains a lot of impurities (such as stones) and a high proportion of broken grains; and it frequently consists of a number of varieties mixed together. In short, local rice often requires more time for cleaning and sorting, and often cooks unevenly (because of the mixture of grain-fragment sizes and varieties). Consequently, many consumers prefer to buy clean, homogeneous imported rice. The solution to this is not simply higher-yielding varieties, but also encompasses harvesting and postharvest processing methods. The improved threshing and cleaning using the ATATC responds to the issues of impurities, uniformity and broken grains.

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Introduction of an improved thresher–cleaner

The importance of postharvest activities has been overlooked in crop production systems in West Africa in general, and in rice production programs in particular. This is despite the fact that harvest and postharvest constraints have been identified by research and development partners as major factors in the profitability of domestic rice value chains. Losses of up to 35% have been attributed to inefficient manual threshing alone.

An improved rice thresher was first introduced into the region by the International Rice Research Institute (IRRI). The work was picked up in 1997 by AfricaRice, Société d'aménagement et d'exploration des terres du delta du fleuve Sénégal (SAED) and Institut sénégalais de recherches agricoles (ISRA), who developed the first ASI (**A**fricaRice–**S**AED–**I**SRA) axial-flow thresher–cleaner in Senegal. Subsequently, the ASI thresher–cleaner design has been taken across the sub-region and adapted to new locations. By design, the ASI and its variants are adapted to West African rice farming conditions and farmers' needs. The IRRI prototype had originally a capacity of 300 kg/h but was modified into the ASI with a capacity of 2.5 tonnes/h.

The **Agricultural Transformation Agenda thresher–cleaner** (**ATATC**) was introduced into Ilorin, Kwara State by AfricaRice in December 2013. The ATATC separates grain from straw, recovering a higher proportion of paddy than manual threshing, resulting in fewer losses and reduced labor requirement.

The ATATC can thresh 6–7 tonnes of paddy rice per day — much more than other mechanical threshers and much more quickly than traditional manual threshing. It can give a grain–straw separation rate of 99%. The ATATC both threshes and cleans the grain, resulting in grain that needs no winnowing and that can be bagged directly from the machine. Straw losses are minimal, at 1–2% of total output. The average purchase price of an imported ATATC is around US$ 5000 (NGN 1,111,000), while the domestically fabricated type is about US$ 2950 (NGN 650,000). More than 50% of the total paddy produced in Senegal is now threshed with the thresher–cleaner. Farmers in Senegal acknowledge that the ASI decreases the arduousness of labor and significantly reduces labor demand for threshing, alleviating major labor constraints at harvest time and averting frustrations and delays. The ATATC reduces the postharvest losses associated with delays in preparation of harvested paddy for sale, because of the high labor demand of manual threshing and winnowing. In Senegal, where the thresher–cleaner has been in use for a long time, owners charge 10% of the processed paddy output, whereas manual threshers charge about 19–20%. By improving rice quality and productivity and alleviating the burgeoning high labor-demanding postharvest work, which was already too much for women who were the main threshing labor, the thresher–cleaner (ASI) won the special President of Senegal Prize for Science Research in 2002.

The thresher-cleaner has been demonstrated to achieve high technical performance and financial profitability. Farming in the Senegal River valley relies on the coexistence of rice and vegetable growing, which leads to frequent shortages of labor during rice harvest and postharvest periods. In Senegal, the thresher–cleaner releases rice labor to enable farmers to work on their vegetable crops. More generally, however, the use of labor-saving machines is expected to boost labor productivity for increased agricultural production. Further research has confirmed that farmers perceive the thresher–cleaner as a time-saving (it saves 7–9 work-days per hectare), high-grain-recovery and moderate labor-saving device. As many as 50–70% of irrigated-rice farmers in Senegal stated that the private thresher–cleaner operators provided a good quality service. Variations of the thresher–cleaner have been released in Burkina Faso, Cameroon, Chad, Côte d'Ivoire, Ghana, Mali, Mauritania and, most recently, Nigeria.

Diffusion of the ATATC in Nigeria — Results of the survey

At the national level, two main fabricators were trained to manufacture the ATATC and to train other fabricators. These were the National Centre for Agricultural Mechanization (NCAM), Ilorin and private engineering company Hanigha in Kaduna State.

Adoption and use of the ATATC

Within 2 years of its introduction, it is reported that over 100 ATATCs have been produced in Nigeria by government and private fabricators. Only a total of 10 ATATCs have been produced by the Federal kijuhgGovernment.

The 10 ATATCs provided by the government were used for demonstrations in 2014 and then handed over to the appropriate state ministries (Table 1). Details of the locations of privately owned machines and their adoption are not yet available.

Table 1. Distribution of ATATCs fabricated for the Federal Ministry of Agriculture

State	Local government area
Kebbi	Suru
	Argungu
Sokoto	Wurno/Goronyo
	Gada
Zamfara	Gumi
	Talata Mafara
Niger	Wushishi
	Katcha
Jigawa	Auyo
	Hadeija
Kano	Kura
	Bagwai
Bauchi	Bauchi
	Gamawa
Nasarawa	Lafia
Ekiti	Awo
	Igbemo
Ebonyi	Abakaliki
	Ikwo

"One good thing about ATATC is that we fabricate with locally recycled materials."

— Charles Frimpong, fabricator, Hanigha, Kaduna

Rice producers in Nigeria are desperately waiting for the ATATC. The thresher–cleaner was demonstrated in 10 rice-producing states in 2014. Diffusion has been constrained by change in government and low level of awareness among actors. Strengthened synergy between the government and other actors is required as a matter of urgency. Relevant actors include various research institutions and extension agents of the state Agricultural Development Projects (ADPs), private stakeholders and producers.

Nigerian farmers' perceptions of ATATC

The unit cost of an ATATC is about NGN 550,000–750,000, depending on its size. At this price, it is not affordable to small-scale farmers unless they buy it for commercial farming or in groups. The government offered to subsidize the cost by 75%, which increased the farmers' interest — they are waiting for this promise to be fulfilled. Producers praise the efficiency with which the ATATC threshes its clean grain output and the reduced grain loss. The ATATC produces clean, whole rice grains, unlike drum threshing which leads to broken or shattered grain output. The ATATC-produced rice gains with premium price in the market. With ATATC, farmers are set to increase levels of production, since manual threshing is a major factor constraining increased production. ATATC has also proven to be multi-purpose, being able to thresh rice, soybean and sorghum.

"I have never regretted buying this machine; even when I don't have money, jobs can come for me."

— Ibrahim Musa, producer, Kano

"We have both the imported and locally fabricated ATATC. The locally fabricated ATATC is stronger than the imported one."

— Rahama Seed Producer company, Kano

Farmers' perception of constraints limiting ATATC adoption

Most respondents mentioned the change in government as the factor that has most limited ATATC adoption. Farmers are hopeful that the new government will continue with the ATATC project, and that the ATATC will be put into immediate use.

Adoption is ineffective without the actors in the value chain being well informed about the technology, but ATATC has not been given the publicity it requires to boost its adoption. There is clear lack of cooperation among the actors in the dissemination chain (see Table 2). It is therefore necessary for the government (Federal, state or local), research and extension units to take the responsibility to disseminate the ATATC.

Table 2. Farmer perceptions of adoption issues related to ATATC

Interviewee	Remarks	Adoption factors
Desk officer, Federal Ministry of Agriculture & Rural Development, Abuja	10 ATATCs fabricated and distributed to state ministries. ATATC has not been handed to end-users	Technology distribution is obstructed by change in government

Producer perspective	Used ATATC for rice, soybean and sorghum Hired out ATATC and made money ATATC is highly efficient Farmers still thresh rice using drum	Produces clean paddy, has high output and production efficiency ATATC is poorly publicized Had initial wear and tear of parts; produces clean paddy; has high output and production efficiency
Extension specialist, National Agricultural Extension and Research Liaison Services (NAERLS)	Lamented that ATATC has not been released to Kano State, where over 70% of domestic rice is produced	Had no good knowledge of ATATC
Office of the Director; Adopted Villages in Zaria — villages that serve as 'laboratory' for testing equipment	There are 34 villages across the country and they operate under a national mandate	Have not heard about ATATC
Leaders of Rice Farmers Association of Nigeria (RiFAN), Kano	ATATC has been demonstrated three times Farmers are desperately waiting for upscaling of ATATC	Distribution delayed by change in government; ATATC produces clean paddy, has high output and production efficiency
ADP, Kano Extension Training and Outreach Office	Farmers are interested in such machines	ATATC has not been officially introduced to ADP
Head of Women in Agriculture (WIA), Kano	Women need the machines	Extension Department, women group and ADP were not carried along
Fabricator, Kaduna	We have trained many fabricators and they are doing wonderfully well	We fabricate with local materials, which are always available; we are ready to meet the demand of our people

Conclusion

ATATC is one technology that is both greatly needed and appreciated by farmers on the basis of its clean output, time saving, increased scale of processing, diversity of uses, durability and affordability. ATATC is still at the introductory stage of adoption in Nigeria. Two main factors appear to constrain its adoption and spread: a political issue associated with the recent change in government; and poor synergy among the three important coordinating agents — Federal Ministry of Agriculture, ADPs and producers. Processors are eagerly waiting for the ATATC.

Recommendations

To intensify the adoption capability of farmers, awareness of the ATATC should be heightened. For this single reason, there should be a strong synergy between the Ministry of Agriculture, research organizations and ADPs of the respective states on the one hand, and stakeholders such as Women in Agriculture and producers on the other. More demonstrations of the technology should be made in areas where the exercise has not been done. The government should continue to subsidize the technology and ensure that the machines reach the end-users.