An experimental approach to farmer valuation of African rice genetic resource conservation

PHOTO: Neil Palmer/Crop Trust

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Introduction

Genebanks serve as both providers of valuable traits to breeding programs as well as repositories of diverse crop genetic material representing society's agricultural heritage. Using a lab-in-the-field experiment, we investigate in this study how smallholder rice farmers in Côte d'Ivoire (Figure 1) value having access to both new, advanced rice varieties containing genebank materials as well as landraces or farmers' varieties of African rice (*Oryza glaberrima*) maintained in the genebank of the Rice Biodiversity Center for Africa (RBCA).

HIGHLIGHTS

- Genebanks both provide genetic resources as inputs to crop breeding programs and also serve as repositories of diverse collections of farmer varieties of crops representing society's agricultural heritage.
- We use a lab-in-the-field experiment to investigate how smallholder rice farmers in Côte d'Ivoire value having access to both new advanced rice varieties bred with genebank materials as well as landraces or farmers' varieties of African rice.
- Using a Becker-DeGroot-Marschak valuation mechanism, we demonstrate that the farmers in our sample are willing to pay approximately the same amount to have access to African rice landrace seed (around $0.47 for a small bag of 35 grams of seed) as for seed of advanced rice varieties.
- These results highlight the importance of the "cultural value" provided by genebanks, in terms of conserving landrace varieties that can be used directly by farmers in the future.

AfricaRice's genebank, the RBCA, maintains the largest collection of African rice landraces in the world and is the largest collection of rice accessions in Africa, with a total of almost 22,000 accessions. The collection represents a strategic resource for breeding new, advanced rice varieties that are well-adapted to

BOX 1 Rice Biodiversity Center for Africa (RBCA)

AfricaRice's genebank currently contains almost 22,000 accessions, 85% of which originated in Africa. In addition to the two cultivated rice species, these include the five African crop wild relatives. Long-term conservation is carried out at its new genebank at Bouaké, Côte d'Ivoire.

Characterization and evaluation of crop diversity are major activities at AfricaRice, with special attention being given to screening for resistance to major diseases and environmental stresses. As a result, genes for resistance to diseases and pests such as rice yellow mottle virus (RYMV), blast and African rice gall midge are now identified.

The RBCA is collaborating in studies to use high-throughput precision phenotyping to identify further useful traits. Early flowering and tolerance of stagnant flooding are traits that are also being explored in the collections.

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Other important activities include the restoration of lost crop diversity to countries affected by war, provision of conservation services to NARS, and training and capacity building.

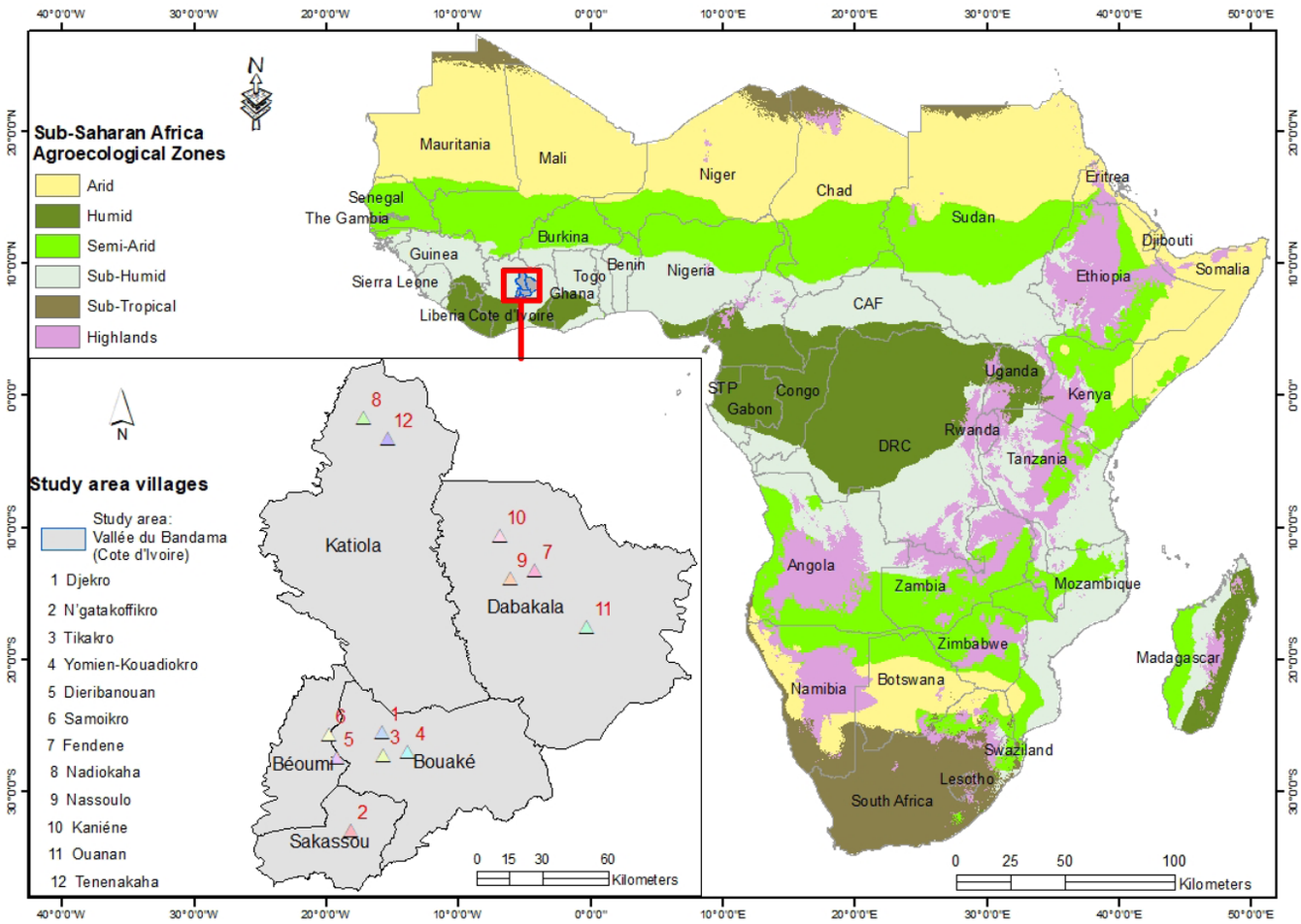

Figure 1. Map of the study villages.

growing conditions across Africa. The genebank also distributes samples widely, with a total of 113,083 samples having been distributed over the past 25 years to a total of 164 institutions across 57 countries. The majority of these samples were distributed to NARS institutions (~44.3%), other institutions within the CGIAR (43%), and to a lesser extent universities (10%). Only a single sample was provided to a farmer organization over this period.

Methods

This study approaches genebank valuation by focusing on two mechanisms through which genebanks provide value: first, by providing useful genetic variation to research programs with plant breeding activities; and second, by maintaining farmer varieties of crops for future use, that may possess diverse cultural, culinary, agronomic and nutritional values. In addition, we also investigate the extent to which option and bequest values provided by genetic resource conservation

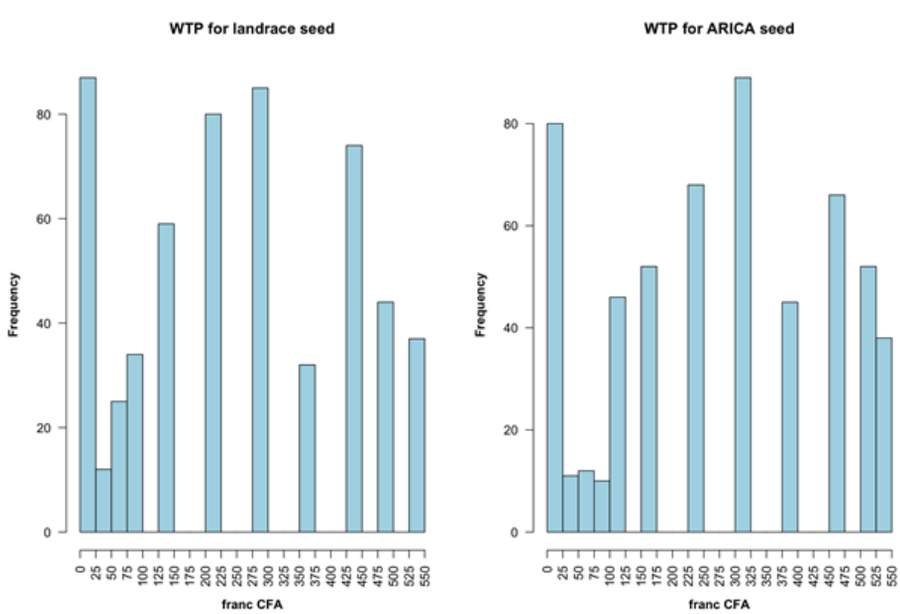

Figure 2. Histograms of farmer WTP for landrace and ARICA seed.

are important to smallholder farmers in Côte d'Ivoire. Our experiment contributes to a limited past literature on genetic resource valuation by focusing on a less explored area of the literature: how smallholder farmers themselves value having access to both improved varieties bred using genebank materials, and traditional, landrace varieties conserved as genebank accessions. We investigate this question using the Becker-De-Groot-Marschak willingness-to-pay elicitation method for 35 grams of each type of rice seed (landrace or advanced) for use value, and an open-ended elicitation method for option and bequest values.

As an outcome of the experiment, approximately three-quarters of all farmers (430, or 76%) obtained at least one bag of landrace or ARICA seed, with 138 obtaining no seed bag. Seventy-five farmers (13% of the sample) received just the landrace variety, but not the improved rice seed, while 91 farmers (16% of the sample) received only the improved rice (ARICA) variety, but not the landrace variety. The remaining 264 farmers (46%) received both seed types. On average, farmers in the sample were willing to pay 263 FCFA for the bag of ARICA seed (about $0.50) and about 257 FCFA for the bag of landrace seed (about $0.47) (Figure 2). Fifty-two farmers (around 9% of the sample) were not willing to pay anything for either type of seed; around 5% of the sample were willing to either pay for landrace seed but not advanced rice (ARICA) seed or for ARICA seed (and not landrace seed). Sixteen farmers were willing to pay the maximum amount (550 FCFA) for both types of seed. The provision of landrace accessions to more than 300 farmers as part of the experiment represents the largest distribution of African landrace seed to farmers in the past 25 years.

On average, farmers stated that they were willing to pay about $4.34 and $4.38 as an annual contribution towards a village seed bank that they themselves would be able to access (option value) for improved and landrace rice varieties, respectively, and $3.94 and $4.01 annually to a village seed bank if the varieties conserved would only be made available to the next generation of rice farmers (bequest value) (Figure 3). However, the median WTP for all four value types is 1000 CFA francs, approximately $1.85, and the mean WTP estimates are strongly influenced by some farmers who are willing to contribute much more annually than the average, reaching maximums of $47 per year for bequest values and $92 per year for option values. Most farmers state that they are willing to pay at least something towards the construction and maintenance of a village seed bank, with 85% of

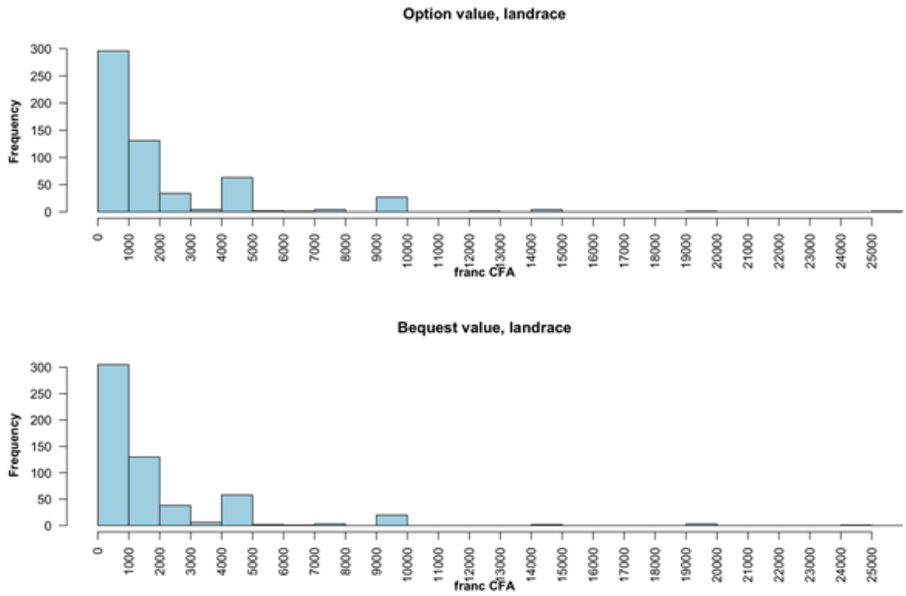

Figure 3. Farmer WTP for option/bequest values associated with village landrace conservation.

Figure 4. Image of 1 kg bags of advanced rice varieties

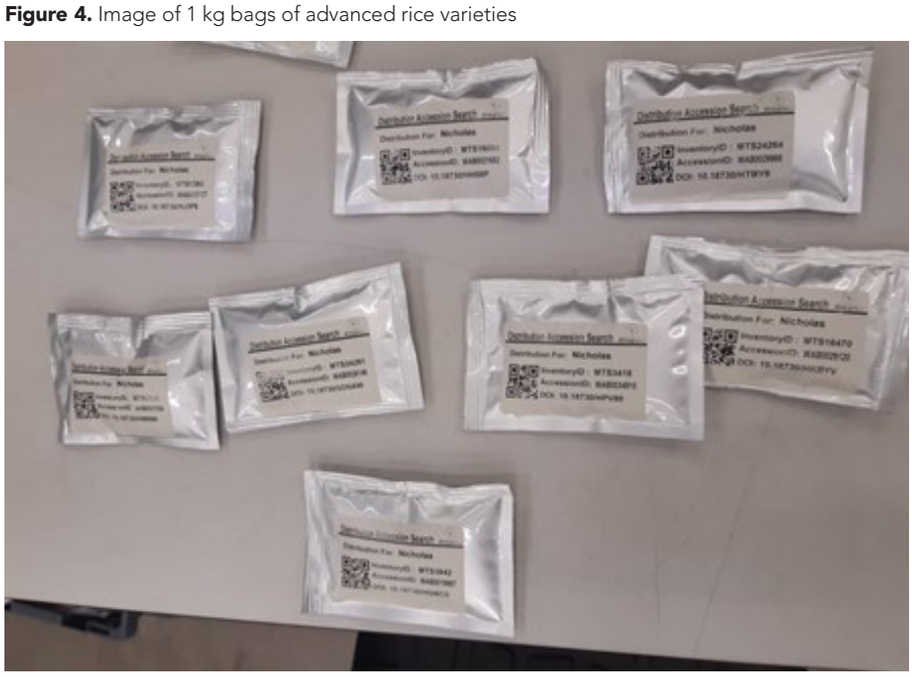

Figure 5. Image of 35 g bags of African rice landrace varieties

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farmers stating that they believed the construction of a village seed bank would be a good idea. Only 20 farmers (3.5% of the sample) stated that they would not be willing to contribute anything to such a project.

Conclusion

In this brief, we have demonstrated using an incentivized, revealed preference experiment that smallholder rice farmers are willing to pay not only for seed of improved rice varieties (Figure 4) developed by AfricaRice and its NARS partners through the Africa-wide Rice Breeding Task Force using diverse genetic resources maintained in genebanks, but also for heritage landrace varieties (Figure 5) of African rice (*Oryza glaberrima*). Most rice farmers in our sample were found to be willing to sacrifice financial gain to have access to the heritage rice varieties provided through the study – at around the same level as for improved rice variety seed. This is the most striking result of our experiment and suggests that the efforts of the Rice Biodiversity Center to conserve the agricultural heritage of African rice diversity provides economic value not only through the provision of inputs to the breeding process leading to the release of new, improved rice varieties such as NERICA and ARICA varieties, but also by maintaining the option to directly provide heirloom African rice varieties to farmers. In addition, we provide some evidence that farmers at least state that they are also willing to pay to maintain option and bequest values. Eighty-five percent of the farmers stated that they believed that the idea of constructing such a village seed bank would be a good idea, and just over half of the surveyed farmers thought that this would be most important for the next generation of rice farmers in the village.

These results, providing some confirmation of both of our hypotheses, represent an important contribution to a literature on the value of genetic resources that has tended to reduce the importance of genetic diversity to its use for research and development, and neglected the role of farmer preferences and the cultural and historical values of agricultural biodiversity. They further suggest that more attention should be given to the cultural value provided by landrace conservation, and the preferences of farmers for direct use of traditional varieties conserved by genebanks.

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Additional details can be found in the paper on which this brief is based: Tyack, N.; Arouna, A; Aboudou, R.; Ndjiondjop, M. 2021. An experimental approach to farmer valuation of African rice genetic resources. Genebank Impacts Working paper No. 17. CGIAR Genebank Platform, Africa Rice Center (AfricaRice), and the Crop Trust.

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