Adoption and impact of an award winning post-harvest technology: The ASI rice thresher in the Senegal River Valley (SRV)

Mandiaye Diagne[a], Aliou Diagne[b], Matty Demont[a]

[a] *Africa Rice Center (AfricaRice), B.P. 96, Saint-Louis, Senegal*
[b] *Africa Rice Center (AfricaRice), B.P. 2031, Cotonou, Benin*

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Introduction

- In the past, postharvest activities have been neglected from international research organizations despite its important role for income growth, food security, poverty alleviation and sustainable agriculture in developing countries (Goletti and Wolff, 1999)

- In the Sahel, the second half of the 90s marked a turning point in rice research with the development of improved Integrated crop management (ICM) options
    - suitable soil and land preparation;
    - high yielding varieties (the named Sahel varieties);
    - optimal seeding and fertilizer rates;
    - weed and water management;
    - efficient thresher/cleaner (the ASI);
    - appropriate timings of operations (sowing, fertilizer, weeding, etc.).

Introduction

- On-farm evaluations shown that yields obtained with ICM were more than 2 t/ha higher than with farmer practices
- Harvest and post-harvest constraints were identified by the R&D partners as major factors in the profitability of irrigated rice production in the SRV (Wopereis et al., 1998)
- Post-harvest losses of up 35% were attributed to the inefficiency of manual threshing

Introduction

- The release of the ASI thresher in 1997 was aimed at improving rice quality and productivity and to relieving farmers from labor-demanding, post-harvest work, from time wasting.

- As the major improved post-harvest technology achieved in the SRV, the ASI thresher won in 2003 the special President of Senegal Prize for Science Research (2002 edition)

- Some experimental studies have shown evidence of the technical performance (Kanté, 1997) and financial profitability of the ASI thresher-cleaner (Donovan and Douthwaite, 1997)

Introduction

- And more than 10 years after the release of the ASI we identify the determinants of its adoption and derive from its impact on labor use and threshing time ways of building on existing knowledge
- In the context of the SRV, the coexistence of rice and vegetable growing leads to frequent shortage of labor during rice harvest and post-harvest periods
- And while the Senegalese GOANA program is based on double cropping, the use of labor saving machine is expected to be of great importance

ASI development

- Before the ASI, there were imported machines, the combine harvester and the Votex thresher

- The main drawbacks of the combine
  - expensive mainly after the devaluation of the Franc CFA in 1994
  - lack of spares equipments frequent breakdowns and delays in harvesting
  - not adapted to small-scale schemes in the SRV

- The main drawback of Votex
  - required 11 to 15 workers for both the threshing and sieving operations
  - Grain loss

ASI development

- The ASI thresher: A result of a collaborative and adaptive research involving
  - AfricaRice and IRRI;
  - two National Agricultural Research Systems (NARS), ISRA (Senegalese Institute for Agricultural Research) and SAED (Senegal River Valley National Development Agency);
  - and other partners: artisans, one agricultural machinery factory, farmers and farmers' organizations).
- IRRI supplied the TC800 thresher/cleaner systems in 1995 with specific technical assistance
- AfricaRice and its partners identified the necessary modifications after field tests for adaptability in the SRV irrigated rice conditions
- The service charged to farmers for threshing is set at a tithe of ten percent of the paddy production

ASI development

- Labor intensive and expensive harvest processes
- Poor grain quality
- Need for appropriate small-scale thresher equipment

- AfricaRice, IRRI
- SAED, ISRA
- Farmer organizations

- Adaptation of prototype for SRV
- Field evaluation and testing
- Training and capacity development


IRRI prototype


ASI thresher-cleaner

Data and methods

- Panel survey on Rice Integrated Crop Management (RICM) practices in the SRV during 2002/03- 2006/07
- A survey on the perception of the ASI by farmers
- A total of 458*seasons observations
- Surveys conducted with AfricaRice partners (SAED, UJAK and PO) in the Delta and the Middle Valley, the two main rice production zones in the SRV

Data and methods

Adoption model

- Average Treatment Effects (ATE) estimation of adoption rates and determinants
- Specification of a probit population potential adoption function

Impact models

- ***Matching estimation methods:*** based on the "**selection on observables" (or conditional independence or unconfoundenness)** identifying assumption:
- The idea is to find in a group of non-adopters individuals who are similar to the adopters in given pre-treatment characteristics.
- Two matching estimators are used:
  - Nearest-Neighbor Matching (Abadie and Imbens, 2006) (AI)
  - Genetic Matching (Diamond and Sekhon. 2008) (GM)

Results and Discussions

1. Descriptive statistics

- Wolof ethnic group predominates among irrigated rice farmers
- Relatively young population, 49 years on average
- High experience in rice growing (25 years on average).
- The ASI thresher is perceived by farmers as a high time saving and moderate labor saving device
- The ASI is as well considered by farmers as a high grain recovery thresher
- 50–70% of irrigated rice farmers stated that the private operators provided a good quality service

Results and Discussions

1. Descriptive statistics

- It takes two years on average between the first year of awareness of the existence of ASI and the year of release (0.65 year and 3.31 years for, respectively, the Delta and the Middle Valley

- The adoption gap, taken as the difference between the year of first adoption and the year of knowledge, is 2.13 years overall, but 2.66 years for the Delta Valley and 1.56 years for the Middle Valley

Results and discussion

2. Adoption

- The probability to be exposed to the ASI decreases in areas where a higher proportion of women is used during threshing and where off-farm activities are more important

- Irrigated rice farmers who received formal education are more likely to be exposed to the ASI thresher

- The ATE estimate of the true population ASI adoption rate during the period 2002/03-2006/07 is 86% if the entire population was exposed in the wet season 2006/07

Results and discussion

2. Adoption

- ASI thresher technology is not obsolete.

- Large farms, Wolof farmers or those who participated to ASI field experiments and/or in contact with service providers are more likely to adopt the ASI thresher.

Results and discussion

Estimates of ASI thresher adoption determinants in 2006/07

Description of variable	*Exposure*	*ATE model*
Age of farmer	-0.129	-0.134
Age square	0.002	0.001
Logarithm of mean farm size (ha)	0.152	**1.050
Experience in rice growing (years)	-0.130	**0.180
Experience in rice growing square (years²)	0.002	**-0.003
Education level (1 if literate, 0 otherwise)	*0.965	-0.853
Share of female labor in threshing (%)	*-0.038	-0.015
Off-farm activity (1 if yes, 0 otherwise)	*-1.080	-0.458
Wolof ethnic group (1 if yes, 0 otherwise)	-0.673	*0.931
Awareness of ASI through field experiment or service provider (1 if yes, 0 otherwise)		*1.435
Lag between ASI invention (1997) and first awareness		*0.293
Intercept	7.552	3.220
Pseudo-R²	0.29	0.54
Log likelihood	-25.88	-17.40

*** P <0.01; ** P <0.05; * P <0.10

Results and discussion

2. Impact on labor and time

- The ASI thresher consistently reduces the quantity of labor demanded by 7 to 10 man-days per hectare, compared with the non-ASI users in 2004/05, and by 7 to 9 man-days per hectare in 2005/06

- In 2006/07 there was no significant difference in man-days per hectare between the two groups

- In 2006/07 the ASI users saved only 2 days per hectare while they saved 4 days per hectare in the two preceding seasons unaffected by exogenous shocks

- The season 2006/07 was mainly characterized by important bird damage and disturbance in fertilizer supply

Results and discussion

2. Impact on labor and time

- Poor management of cropping due to internal or external constraints can cancel out the performance benefits of the ASI thresher, hence the importance of effective Integrated Crop Management

- The ASI users resort more to their family labor, with a supplement of 3 family laborers per day and per hectare

- An increasingly important role for women in threshing activity when the ASI thresher is used, ruling out the potential concern of sidelining women when the ASI is widely used in the SRV

- As for the external labor, there is no deviation between ASI adopters and non-adopters

Conclusion

- The potential demand for the ASI thresher is high and irrigated rice farmers who recently became aware of the ASI thresher have a high likelihood of adoption.

- Formal education has played an important role for exposure to the ASI and the participatory approach in extension has promoted adoption.

- The ASI technology saves time and creates private sector employment.

Conclusion

- It can contribute to double cropping targeted by the GOANA program to achieve rice self-sufficiency in Senegal.

- Training programs for service-providers need to be provided and private sector investment needs to be stimulated (credit provision, infrastructure, etc.).

Thank you! Merci!

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