Chapter 15
Adoption of Stress-Tolerant Rice Varieties in Bangladesh

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Abstract This chapter presents results of analyses of survey-based data on the rate of adoption of modern stress-tolerant rice varieties by the beneficiary farmers of the Cereal Systems Initiative for South Asia (CSISA) and compares that with non-CSISA rice farmers who cultivated the CSISA-promoted rice varieties. The study reveals that the adoption of such varieties has been very low. Just 27 % of the farmers in the CSISA beneficiary survey and 9 % of non-CSISA rice farmers grew at least one of the CSISA-promoted rice varieties. Though our survey did not specifically ask the farmers for reasons for non-adoption, education plays a key role in new rice technology adoption and diffusion. Moreover, the role of complementary technologies should not be overlooked when analyzing the adoption of new/modern technologies.

Keywords Technology adoption • Improved seed • Education • Complementary technologies • South Asia

Introduction

Technology is the basis for sustainable agricultural growth. Enhanced agricultural productivity and growth depend, to a large extent, upon the widespread adoption of appropriate technologies by farmers.

Seed, fertilizer and irrigation technologies known as "Green Revolution technologies" have long played major roles in the growth of agriculture production in Bangladesh. The country has made commendable progress in domestic rice production through farmers' adoption of these technologies. In the early 1970s, Bangladesh was a seriously food-deficient country with a population of about

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75 million. Today, the population is more than 160 million, and Bangladesh is self-sufficient in rice production, which has tripled over the past three decades.

Upon request from the US Agency for International Development (USAID), the International Food Policy Research Institute's Policy Research and Strategy Support Program in Bangladesh (IFPRI-PRSSP) developed and began a study on the adoption of agricultural technologies in USAID's Feed the Future (FTF) zone of influence in the south and southwest regions of the country. FTF is the US government's global hunger and food security initiative to support country-driven approaches to addressing the root causes of poverty, hunger, and undernutrition. In Bangladesh, FTF's collective efforts aim to improve the livelihood and nutritional status of households through: (1) increased on-farm productivity, (2) increased investment in market systems and value chains, (3) enhanced food security policy and planning capacity, (4) enhanced agriculture innovation capacity, and (5) improved nutritional status of rural poor.

The agricultural technology evaluated in this study is modern stress-tolerant varieties of rice promoted by the Cereal Systems Initiative for South Asia in Bangladesh (CSISA-BD), which is funded by USAID and implemented by the International Rice Research Institute (IRRI) in partnership with CIMMYT and WorldFish, two other CGIAR centers. Bangladesh is one of the countries worst affected by climate change, and cultivating stress-tolerant rice varieties have the potential to become very important in the near future. The CSISA-BD started its operations in the country's 'Feed the Future' zone of influence in 2010. Focusing on rice-based farming systems, the project also promotes the cultivation of cereals such as wheat and maize during the dry season. Moreover, it advocates for rice-fish cultivation, which is a practice of raising fish in conjunction with rice farming.

This study presents results of analyses of survey-based data on the rate of adoption of modern stress-tolerant rice varieties by the CSISA beneficiary farmers and compares that with non-CSISA rice farmers who cultivated the CSISA-promoted rice varieties in the FTF zone.

The report is organized in six sections. Section "Data" describes the surveys that provided the data used in the empirical work. Section "Profile of Survey Farmers" gives a profile of survey households. Section "Usage of Modern Rice Varieties" discusses the findings of analyses of farmers' usage of modern varieties of rice technology. Section "The Determinants of Farmers' Adoption and Duration of Farm Technologies" provides an analysis of the determinants of farmers' adoption of rice technology and the duration of adoption. Section "Conclusions" provides policy conclusions.

Data

The data for the study came from two IFPRI-PRSSP surveys of rice farmers in the FTF zone: (1) a zone-level survey of 2400 rice-farm households, and (2) a CSISA beneficiary farmers' survey of 500 farm households.

Sampling

The FTF zone level survey is statistically representative of all rice farmers in the FTF zone, and its domain included all 120 FTF upazilas within the 20 FTF districts. The sampling process and survey administration included the following steps:

- List all villages in each of the 120 FTF upazilas from the 2011 National Population Census.

  Randomly select two villages in each upazila with probability proportional size (PPS) sampling, using the village-level population data from the 2011 National Population Census.

  Conduct complete census of each of the 240 selected villages.
- List all farm households that cultivated rice in the 12-month period prior to the survey, then randomly select ten farm households from village census list.
- Conduct interviews with selected rice-farm households.

The sampling process and survey administration for the CSISA beneficiary survey included the following steps:

- Randomly select 500 farm households from the USAID-provided list of CSISA beneficiary farm households.
- Conduct interviews with 500 selected farm households (within 344 different villages).

Post-sampling observation demonstrated that the FTF and CSISA samples are independent. That is, there was no overlap between the FTF and the CSISA sample beneficiaries.

Survey Questionnaire

The IFPRI-PRSSP team prepared a draft questionnaire for the rice technology adoption survey, received comments on the draft questionnaire from USAID, and revised the questionnaire by addressing the comments. The questionnaire included six modules: (1) sample household identification; (2) household composition, literacy, and education; (3) roster of land owned or under operation; (4) plot-level information on seeds, irrigation, and fertilizer usage; (5) information on usage of paddy varieties; and (6) information on use rate of paddy seed.

Training and Survey Administration

IFPRI contracted Data Analysis and Technical Assistance (DATA) Limited, a Bangladeshi consulting firm with expertise in conducting complex surveys and

data analysis, to implement the survey. DATA worked under the supervision and guidance of senior IFPRI researchers. DATA provided 100 experienced survey enumerators and 20 supervisors to administer the surveys. IFPRI-PRSSP provided the survey questionnaire to DATA for the training of the survey team. DATA translated the questionnaire into Bangla. IFPRI-PRSSP researchers and senior DATA staff pre-tested the questionnaire in the FTF zone and trained survey workers, in both a formal classroom setting and closely monitored practice fieldwork.

The DATA survey team completed the survey of 2900 farm households in 16 working days by engaging 20 teams consisting of 6 members (5 enumerators and a supervisor). The survey was carried out from November 1 to 19, 2013. The enumerators conducted one-on-one, face-to-face interviews with the respondents assigned to them, under the supervision of their field supervisor. To show appreciation for respondents' time, a gift of two plates and one bowl (a 200-taka value) was given to each household. Completed questionnaires were sent to the DATA central office in Dhaka on a regular basis for simultaneous data entry. IFPRI and DATA took extensive care to ensure the quality of the household survey data, and IFPRI researchers made field visits to supervise the fieldwork.

Data Entry, Cleaning, and Analysis

Staff at the DATA office in Dhaka carried out the data entry simultaneously with the data collection, with about 4 days of lag time. DATA used software specialized for data entry (Microsoft Access) that was programmed to identify out-of-range or inconsistent values.

After receiving the cleaned dataset from DATA, IFPRI-PRSSP researchers analyzed the data using Stata software. Senior IFPRI researchers provided guidance for data analysis.

Profile of Survey Farmers

Using household survey data collected through the three surveys, this section presents the profile of rice-farm households living in the FTF zone of influence. Much of the farmer-level analysis in this study disaggregates the sample farmers into four operated farm size groups: (1) marginal (farmers operating less than half an acre of land); (2) small (farmers operating 0.5–1.49 acres); (3) medium (farmers operating 1.5–2.49 acres); and (4) large (farmers operating 2.5 acres or more).

The four farm size groups match the cut-off points of the six operated farm size groups presented in the 2010 Household Income and Expenditure Survey (HIES) report of the Bangladesh Bureau of Statistics (BBS 2011) by aggregating the smallest two HIES farm size groups under the marginal farm category and the largest two groups under the large farm category.

Household Characteristics

Smaller rice-farming households tend to have slightly smaller household sizes than larger farm households; the average household size declines from 5.6 for the large farm group to 4.6 for the marginal farm group in the FTF zone.

The following are additional highlights of household characteristics:

- Primary school-age children (age 6–11) from about 8 % of rice farm households and secondary school-age children (age 11–18) from 25 % of rice farm households in the FTF zone do not go to school.
- Educational attainment in terms of years of schooling of male household head and wife of household head is positively correlated with farm size.
- Educational attainment in terms of years of schooling of adult family members is positively correlated with farm size.
- In the FTF zone, 36 % of adult males and 43 % of adult females in rice farm households never attended school. The rate of no schooling of adults declines as farm size of households increases.
- A person who can read and write a sentence in Bengali is considered to be literate. Overall, the female population has a lower literacy rate than the male population. Literacy rates have strong, positive relationships with farm size.

Inequality in Distribution of Operated Land

Land is the most important factor in agricultural production. However, about one-fifth of the rice farmers in the FTF zone are pure tenants, that is, they do not own any cultivable land. These farmers have either sharecropping or cash-lease arrangements with landlords for their operated land. The sample rice farm households are divided into 20 equal groups and are ranked from lowest to highest according to the size of their total operated land. The survey results indicate that the distribution of operated land is highly unequal. The bottom 25 % of all rice-farm households own only 6.5 % of total operated land in the FTF zone. At the other extreme, the top 5 % of all households own 22.5 %.

Farm-Size Groups and Size of Operated Land

Figure 15.1 shows the distribution of operated land by each of the four farm size groups in the FTF zone and among CSISA beneficiaries as a percentage of all farmers. The distribution is quite similar across the two types of survey samples. Small farmers dominate the FTF zone—about 45 % of all rice farmers are small farmers.

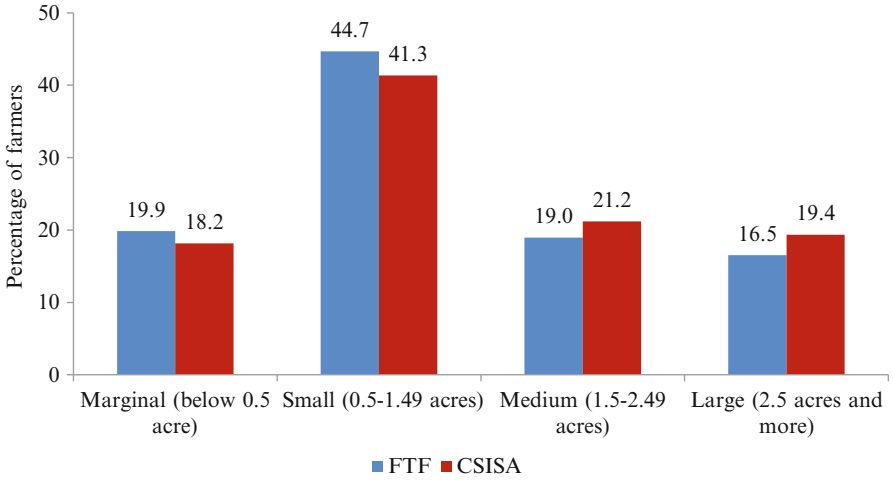

Fig. 15.1 Distribution of operated land, by farm size group. Note: *FTF* Feed the Future zone of influence survey, and *CSISA* Cereal Systems Initiative for South Asia beneficiary survey (Source: IFPRI-PRSSP Agricultural Technology Adoption Survey in the FTF Zone, 2013)

The average size of operated land per rice farm household in the FTF zone is 1.6 acres, ranging from only 0.3 acres per marginal farmer to 4.3 acres per large farmer.

Patterns of Land Tenure

About one-fifth of all rice farm households do not own any cultivable land. About 49 % of rice farmers cultivate only their own land. The proportion of mixed-tenant farmers—those who cultivate their own land and also take land in as sharecroppers and/or leaseholders—is 31 %.

The dominant tenurial arrangement in the FTF zone is sharecropping, where the produce is shared between the cultivator and the landowner in different proportions that have been agreed upon prior to cultivation. About 31 % of the rice farmers are sharecroppers. This group of sharecroppers includes those who do not own any cultivable land (that is, "pure tenant"), as well as those who own land and sharecrop other people's land. About 15 % of the rice farmers have cash-lease arrangements, either as pure tenants or as those with their own land plus cash-leased land. The proportion of rice farmers operating both sharecropped and cash-leased land (either as tenants or landowners) is about 5 %.

Approximately 56 % of all marginal farmers in the FTF zone do not have any land lease arrangements; they cultivate only their own land. This is perhaps a manifestation of their risk aversion. For the marginal farmers who are pure tenants (33.2 %), the sharecropping arrangements represent an overwhelming majority—about 70 % of all pure-tenant farmers are sharecroppers. Only about 13 % of the

large farmers are pure tenants, and 48 % of them opt for sharecropping as the mode of renting land. It is interesting to note that about 47 % of the large farmers supplement their own land with some form of sharecropping and/or cash leasing.

Irrigation

Irrigation is one of the most critical factors for agricultural production in Bangladesh. Tripling rice production in the country since the early 1970s would not have been possible without irrigation. It plays three crucial roles in increasing foodgrain production in Bangladesh: (1) irrigation enables farmers to grow an additional boro rice or wheat crop during the dry winter season, and thus increases cropping intensity and eases the land constraint; (2) irrigation complemented with fertilizers and modern high-yielding rice varieties significantly raises rice yields in comparison to rain-fed rice cultivation; and (3) supplemental irrigation can take much of the risk out of the two predominantly rain-fed rice seasons—aus and aman (Ahmed and Sampath 1992).

Bangladeshi farmers use both traditional and modern methods of irrigation. Traditional methods include *done* (a water-lifting devise), swing basket, and dug-well. Modern techniques include shallow tubewell, deep tubewell, low-lift pump, hand pump, and sophisticated canal gravity-flow irrigation schemes. Among these, *done*, swing basket, and low-lift pump use surface water while dug-well, shallow tubewell, deep tubewell, and hand pump use groundwater as irrigation sources.

The shallow tubewell is the predominant method of irrigation used by about 59 % of rice farmers in the FTF zone for boro rice cultivation. The second most important method is the low-lift pump, used by more than one-fifth of the rice farmers. About 5 % of the rice farmers cultivate boro rice without irrigation (Fig. 15.2).

Share of Rice Crops on Total Rice Land

Figure 15.3 shows the share of aman, aus, and boro rice crops on the total rice land of farmers in the FTF zone. Aman and boro rice show opposite patterns across the four farm size groups: while the share of aman rice area increases as farm size increases, the relationship is negative in the case of boro rice crops.

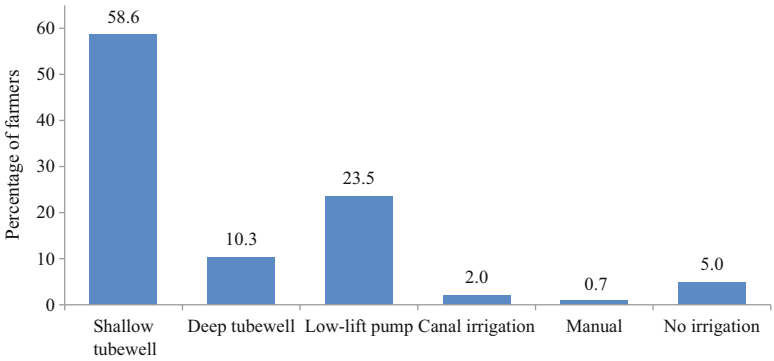

Fig. 15.2 Methods of irrigation used by farmers for boro rice cultivation in the FTF zone. Note: *FTF* Feed the Future zone of influence (Source: IFPRI-PRSSP Agricultural Technology Adoption Survey in the FTF Zone, 2013)

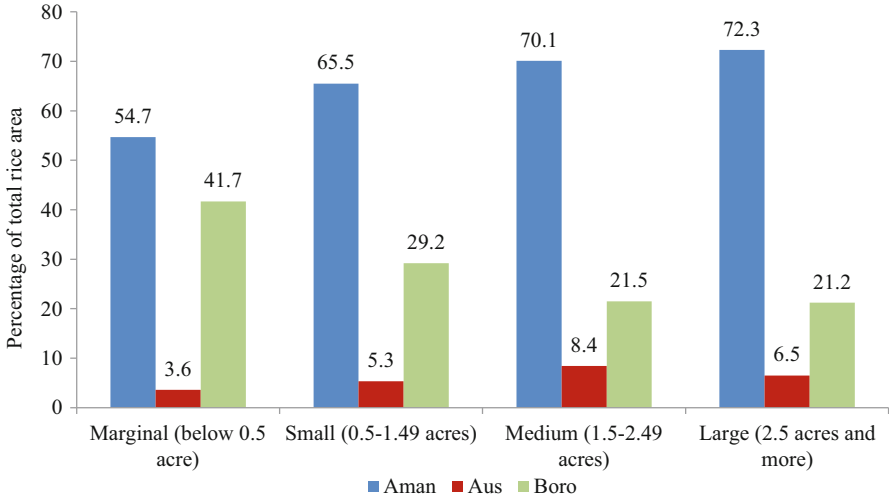

Fig. 15.3 Share of aman, aus, and boro rice crops on total rice land, by farm size groups among rice farmers in the FTF zone (Source: IFPRI-PRSSP Agricultural Technology Adoption Survey in the FTF Zone, 2013)

Usage of Modern Rice Varieties

In close collaboration with the Bangladesh Institute of Nuclear Agriculture (BINA), the Bangladesh Rice Research Institute (BRRI), and the Bangladesh Agriculture University (BAU), CSISA-BD produced large quantities of breeder seeds for different stress-tolerant varieties during the boro 2012, aman 2012, and boro 2013 seasons. The CSISA-promoted rice varieties include varieties that are salt-tolerant

(BRRI dhan 47, 53, 54, 55, and 61; BINA dhan 8 and 10), submergence-tolerant (BRRI dhan 51 and 52; BINA dhan 11 and 12), and drought-tolerant (BRRI dhan 56 and 57). Varieties with both high grain quality and high market value were also promoted, including BRRI dhan 50, BRRI dhan 61, BINA dhan 11, and BINA dhan 12. Two major approaches were adopted for varietal promotion: (1) seed production from demo trials and seed mini-kits (2.5 kg of seeds) to promote awareness among farmers; and (2) improving local availability of quality seed of new varieties for area expansion and farmer-to-farmer dissemination.

This section presents the results of the FTF zone level survey and the CSISA beneficiary farmers' survey on the usage by rice farmers in the FTF zone of the modern rice varieties promoted by CSISA.

More than one-fourth (27.1 %) of the farmers in the CSISA beneficiary survey grew at least one of the CSISA-promoted rice varieties in 2013. In the FTF-zone survey, however, less than one-tenth (8.8 %) of the farmers grew at least one of these varieties. Across the four farm size groups, adoption of CSISA varieties is higher among the medium and large farmers in both the FTF zone and the CSISA beneficiary surveys. Among the marginal farmers in the FTF zone, barely 5 % grew any CSISA-promoted varieties. The figure is much higher for the marginal farmers in the CSISA survey sample, with 26 % adopting them.

A plausible explanation for the relatively low adoption of the stress-tolerant varieties by marginal farmers could be that these farmers are risk-averse given their lack of a diversified portfolio, which severely constrains their ability to offset any crop loss. It is understandable that these farmers prefer to stick to time-tested varieties with assured yields rather than experiment with new ones.

In each of the three rice-cultivation seasons, a greater percentage of farmers in the CSISA survey sample cultivated one or more rice varieties promoted by CSISA than those farmers in the FTF survey sample. The most popular CSISA-promoted variety in the FTF zone survey sample was BINA 7, which is a short-duration transplant aman variety, grown by about one-third (34 %) of the farmers. The ones next in popularity included BR 49 and BR 41. Among CSISA beneficiaries, the most popular aman variety was BR 49, which is grown by one-quarter of the farmers. The second most popular aman variety is BR 52, followed by BINA 7.

During the 2013 boro season, the most popular variety in the FTF zone survey was a salt-tolerant variety, BR 47, with approximately 16 % of the CSISA-variety growing farmers using this variety. An aromatic rice variety, BR 50 (known locally as "Banglar Moti") came next, followed by another salt-tolerant variety, BINA 8. In the CSISA beneficiary survey sample, the three most popular boro varieties were BINA 8, BR 47, and BR 50, in decreasing order of popularity among farmers.

Among the CSISA-promoted rice varieties, Jessore, Magura, and Gopalganj districts have the highest rates of adoption of the CSISA-promoted stress-tolerant varieties among the CSISA beneficiaries, with 49–56 % of the farmers in these districts growing these varieties. Interestingly, in the Barguna, Madaripur and Meherpur districts, there were no farmers in the CSISA beneficiary survey sample growing any of the CSISA-promoted varieties. In the FTF zone survey, the uptake

of the stress-tolerant varieties promoted by CSISA is much lower, ranging from less than 1 % in the Shariatpur district to 19 % in the Magura district.

In both the FTF zone and among the CSISA beneficiaries, a wide variety of paddy is grown with no overwhelming majority of any one variety over another. We identified the ten most popular rice varieties. When looking at the percentage of farmers cultivating the ten most popular rice varieties in 2013, we find that the highest adoption for aman is Guti Shorna, which is of Indian origin and may have been introduced to Bangladesh through informal cross-border exchange. This is followed by Mukta BR 11. In the boro season, 39 % of the farmers grow BR 28, followed by BR 29 in the FTF zone survey. Among the CSISA beneficiaries, 52 % of farmers grow BR 28 during boro season and 17 % grow BR 29. Overall, in both the FTF and CSISA samples, BR 28 and BR 29 dominate. BR 28 and BR 29 are rice varieties that were first grown in Bangladesh 20 years ago, and, despite the introduction of many varieties since then, farmers continue to grow them, often preferring to do so. A reason for the continued popularity of these two varieties is their higher yield and shorter growth cycle (for BR 28), which allows farmers to increase their cropping intensity.

Since 2000, in both the FTF zone and the CSISA beneficiary surveys, most farmers have taken to growing BR 28 at different points of time. It is interesting to note that the uptake of BR 28 has been higher among the CSISA beneficiaries compared to the FTF zone, despite the promotional activities of CSISA in favor of the stress-tolerant varieties.

However, it's worth noting that about 2 % of the FTF zone survey farmers and 3.4 % of the CSISA beneficiaries gave up growing BR 28 from 2009 to 2013. The variety that the maximum number of farmers have given up since 2000, however, is BR 11 (Mukta). BR 11 is a first-generation high-yield variety (HYV) rice that was introduced into Bangladesh more than three decades ago. These HYVs, though effective in areas of high potential, do not perform well under stressful agro-ecologies as soil salinity or submergence conditions. Given that a substantial part of the FTF zone falls into these categories, it is understandable why farmers are giving up these varieties.

Usage of CSISA-Promoted Rice Varieties by Number of Rice Farmers in the FTF Zone

Since the FTF zone level survey is statistically representative of all rice farmers in the FTF zone, it is possible to estimate the number of rice farmers who cultivated CSISA-promoted stress tolerant rice crops harvested in 2013. According to the 2011 Population and Housing Census conducted by the Bangladesh Bureau of Statistics, there are 6,272,196 rural households in 120 FTF zone upazilas in 20 FTF districts. IFPRI-PRSSP conducted the 2011–2012 Bangladesh Integrated Household Survey (BIHS), which is a nationally representative survey of 6500 rural

households. The survey is also statistically representative of the FTF zone of influence. From the BIHS dataset, we have calculated that 51.9 % of all households in the FTF zone cultivated rice in 2011. Therefore, the total number of rice farm households in the FTF zone is 3,255,270 (that is, $6{,}272{,}196 \times 0.519$], of which 8.8 % or 286,464 households have grown at least one rice variety promoted by CSISA in 2013.

Area Covered by CSISA-Promoted Rice Varieties

In terms of acreage, the surveys revealed that the coverage of area under stress-tolerant varieties promoted by CSISA is very low. Only 3.29 % of the FTF-zone's area under rice is cropped with these varieties. According to the Bangladesh Bureau of Statistics, 2,794,571 ha were under rice cultivation in the 20 FTF districts in 2012/13. Therefore, the area coverage of CSISA-promoted rice varieties is estimated at 91,941 ha (that is, $2{,}794{,}571 \times 0.0329$) in the FTF zone of influence. Among the CSISA beneficiaries, the area coverage is about 11 %. In the case of the majority of varieties, the area coverage is less than even 1 %, except for BR 49, BINA 8, BR 47 and BR 52, for which the shares are 2.5, 2.0, 1.5 and 1.1 %, respectively.

Paddy Yields

Yields of CSISA-promoted varieties are 6–19 % higher than their non-CSISA counterparts in both the FTF and CSISA surveys. The yields for boro paddy are, in general, higher than those for aman, since most of the former is planted with HYVs. If we look at the yields of CSISA-promoted varieties, disaggregated by variety type, HYVs in the CSISA survey sample have higher yields than HYVs in the FTF survey sample. This is also true of hybrids. It appears that the CSISA promotional activities are being manifested in higher yields.

Patterns of Seed Use

The surveys showed that 91 % of the farmers in both the FTF and CSISA surveys make their own seedbed prior to transplantation of the seedlings. In doing so, the use of saved seeds from the previous harvest predominates for the summer and monsoon crops of aus and aman. For the dry season boro crop, a lower percentage of farmers use saved seeds and a higher percentage of farmers use purchased seed compared to farmers growing aus and aman crops.

Our survey results on seed rates for preparing seed beds for the top 10 popular rice varieties, and prices of seeds show that hybrid rice requires a substantially lower quantity of seed per-hectare compared to its inbred (HYV) rice, but the price of hybrid seeds is much higher than HYV seeds. The seed rate for hybrid variety Hira is about 41.7 kg/ha in the FTF survey and 43.4 kg/ha in the CSISA beneficiary survey. Hira is grown mostly in the boro season. The seed rate ranges from 59 to 72 kg/ha for inbreds.

The Determinants of Farmers' Adoption and Duration of Farm Technologies

This section presents an analysis of adoption, retention, and diffusion of a set of modern paddy varieties promoted by the CSISA project. It presents the cohort analysis, followed by the econometric analysis of rice technology adoption.

It is important to mention at the outset that, while CSISA has promoted many varieties within the FTF zone, as reported in the previous section, the analysis of adoption, retention, and diffusion that follows focuses on the top five varieties—BR 41, BR 47, BR 49, BR 50, and BINA 7— used by sample farmers.

Cohort Analysis and Survivor Functions of CSISA Varieties

The main results from a cohort analysis of CSISA varieties for both the FTF and CSISA samples are as follows:

First, farmers who used the CSISA varieties once continued on as consistent users of such varieties. In the FTF zone survey, the average annual retention rate of the new varieties is 98 %, which implies that once farmers adopt the new varieties, they continue to cultivate those varieties for a long period of time. This is a very encouraging result for CSISA, because it suggests a low dropout rate among farmers who adopt the new varieties. The CSISA sample similarly showed high retention and low dropout rates.

Second, in the FTF sample, 7.3 % of farmers included in the FTF sample and 12.8 % of farmers in the CSISA sample used the CSISA varieties at some point during the observation period (2009–2013). The diffusion was very slow, however. Farmers began using CSISA varieties soon after being exposed to the "possibility" of adoption, but this process has been quite slow. That result is to be expected when analyzing the adoption of new/improved crop varieties in developing countries.

Interestingly, once farmers use CSISA varieties, they continue using the new technology and do not withdraw rapidly. There is minimal evidence of dropout of CSISA varieties, which supports the results of the cohort analysis. By the fourth year of use, more than 95 % of the users have remained adopters of CSISA varieties

uninterruptedly. CSISA beneficiary farmers adopted CSISA varieties slightly faster than farmers in the FTF zone survey sample.

Determinants of Time-to-Adoption of CSISA Varieties

From the results of regressions explaining time-to-adoption and duration (time-to-withdrawal) models we discussed the statistically significant results and highlighted the variables we had expected to be significant that, in reality, were not. The likelihood ratio test of significance of the regressions (chi-squared statistics) and the *p* values associated with these statistics show the overall significance of both the adoption and withdrawal spell models to be significant at 1 % for the FTF survey results and 5 % for the CSISA survey sample.

Several results are noticeable for the determinants of time-to-adoption.

- Farm size (determined by operated land) plays a significant role in determining adoption of CSISA-promoted paddy varieties; larger operated land significantly shortens the time to adoption in the both the FTF and CSISA samples. Again, this result is to be expected, because farmers with more operated land tend to have more intensive productive systems and are, therefore, less risk-averse and more willing to try new farm technologies.
- Education of the head of the household reduces the time-to-adoption of CSISA varieties in the FTF zone survey and CSISA survey sample.
- Interestingly, female-headed households are *more likely* to adopt CSISA varieties than other sample households.

Determinants of Duration of CSISA Varieties Technology

The main findings for determinants of duration of CSISA-varieties use are presented below.

- The size of total operated land has a positive effect on duration of CSISA varieties use; it increases duration.
- Having access to irrigation increases duration of time using CSISA varieties. Similar to total operated land, this result is related to production system intensification.
- Being married also has a positive effect on CSISA-varieties duration of use.

Conclusions

Using data collected through two distinct household surveys, the IFPRI-PRSSP study analyzed modern rice technology promoted in USAID's Feed the Future (FTF) zone of influence in the south and southwest regions of Bangladesh. The technology assessed the uptake of a set of modern stress-tolerant paddy varieties promoted by the Cereal Systems Initiative for South Asia (CSISA) project.

The fragile agro-ecology of Bangladesh warrants that farmers grow more stress-tolerant rice varieties. Indeed, for Bangladeshi farmers who are largely risk averse, adapting to these new varieties alongside the more popular ones should be relatively easy. However, our study reveals that the adoption of such varieties has been very low.

Less than one-third (27.1 %) of the farmers in the CSISA beneficiary survey grew at least one of the CSISA-promoted rice varieties. In the FTF zone survey, less than one-tenth (8.8 %) of the farmers grew at least one of these varieties.

Across farm size groups, adoption of CSISA varieties is higher among the medium and large farms than among marginal and small farms in both the FTF zone and the CSISA beneficiary surveys. A plausible explanation for the relatively low adoption of the stress-tolerant rice varieties could be that small and marginal farmers are risk-averse, given their lack of a diversified portfolio, which severely constrains their ability to offset any crop loss. It is understandable that these farmers prefer to stick to time-tested varieties with assured yields rather than experiment with new ones. In terms of acreage, the surveys revealed that the coverage of area under stress-tolerant varieties promoted by CSISA is very low, and only about 3 % of the FTF-zone's area under rice is cropped with these varieties. Among the CSISA beneficiaries, the area coverage is about 11 %.

Though our survey did not specifically ask the farmers for reasons for non-adoption, education plays a key role in new rice technology adoption and diffusion. This is evidenced by the rate at which educated heads-of-household tended to adopt new rice technologies in comparison to less-educated heads-of-household. Those with more education also continued using the new technologies for longer periods of time.

The role of complementary technologies should not be overlooked when analyzing the adoption of new/modern technologies. Our survey shows that farmers who have adopted irrigation systems tend to adopt faster and continue, for longer periods of time, as adopters of the new rice varieties. Having an irrigation system might mitigate the risks resulting from aversion to the uncertainty related to the adoption of new rice varieties.

Projects and programs that promote new farm technologies should be strongly encouraged to monitor retention of those technologies.

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