CPWF Innovation Funds Project Completion Report

Project Title: Implementing community level water management in coastal Bangladesh – a case study in polder 30

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for submission to the

CGIAR Challenge Program on WATER & FOOD

Andes • Ganges • Limpopo • Mekong • Nile • Volta

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Introduction

The goal of this Innovation Grant project was:

To work with the community in a pilot "watershed" area to demonstrate the potential crop production benefits through improved management of water in the polders of the coastal zone of Bangladesh, and to demonstrate how to achieve these benefits.

Our hypothesis is that the key to increasing food production and improving rural livelihoods in the coastal zone of Bangladesh is improved water management, specifically: (i) improved drainage to reduce the depth of inundation during the rainy season, (ii) improved drainage at the end of the rainy season to allow timely establishment of rabi (dry season upland) crops, and (iii) increasing the availability of freshwater for irrigation during the dry season for cultivation of rice and rabi crops.

Crop production in the polders of coastal Bangladesh is constrained by: (i) too much water (too deep) in the rainy season, (ii) waterlogging at the end of the rainy season (aman) rice crop resulting in delayed establishment of winter (dry) season (rabi) crops and poor yields, and (iii) lack of fresh water for irrigation, further constraining the productivity of rabi crops and limiting the ability to grow boro rice crops.

Strategic management of the sluice gates to enable drainage of excess water (as a result of rainfall) at low tide during the rainy season would create the possibility of growing modern varieties of aman rice with much higher yield potential than the traditional local varieties currently grown by farmers in the coastal zone. The earlier maturity of the high yielding modern varieties (HYV) would allow earlier drainage of the rice fields (or avoid the need to bring in additional water after the rainy season ends). This would allow the soil to dry enough for timely establishment of rabi crops. Management of the sluice gates in the dry season to continue to intake water from the river until it becomes too saline would increase the availability of water for irrigation during the dry season.

The specific objectives of the pilot watershed project included:

1) obtain the agreement of a group of farmers to create a hydrologically separate pilot watershed area on polder 30;
2) obtain the agreement of the farmers and the local community water management organisation to operate the sluice gate in a systematic way to enable drainage when desirable, and train and mentor them in implementation of good drainage management;
3) create a hydrologically isolated pilot watershed through construction of small levees where needed;
4) construct small drains and a drainage outlet to enable drainage from the pilot area
5) separate higher land from lower land through construction of a small levees inside the pilot area;

6) obtain the agreement of the farmers to grow high yielding varieties (HYV) of rice on all the land in the watershed (seed provided), and to use recommended management practices;
7) train the farmers in recommended management for HYV and provide coaching during the season;
8) operate the sluice gate systematically to quickly drain out excess water during the rainy season;
9) drain the fields a couple of weeks before maturity of the HYV, to allow the soil to dry for timely establishment of the rabi crops;
10) work with some of the farmers to demonstrate the performance of a range of high yielding and/or high value and traditional rabi crops, with timely establishment (much earlier than the current practice), improved varieties of traditional rabi crops, and using improved management;
11) monitor the activities of the farmers during the 2012 rice and 2012/3 rabi seasons, and the performance (biophysical and economic) of the rice and rabi crops.

1. Achievements, Project Implications/Impacts

The project was **successful in achieving most of the above objectives, including improved water management during the aman crop**.

However, **it was not successful in achieving the overall goal** of demonstrating the potential crop production benefits through improved management of water, for both the aman and rabi crops. There were several aspects to this:

a) establishment of the 2012 aman rice was delayed by a couple of weeks beyond the target date because of a delay in preparing the seedling nurseries because of lack of water in the canal; the sluice gate remained shut because harvest of the sesame crop was not yet complete in the entire polder area (because of late planting in the 2012 season due to delay in land preparation which was in turn due to the time it took for the soil to dry down to a suitable moisture content).

b) only 50% of the farmers grew the high yielding aman rice varieties (on 45% of the land area); the rest of the area was planted with local varieties, which are later maturing. This meant that the area was kept flooded until early December, by which time the weather was too cool and foggy for the soil to dry sufficiently for timely establishment of the rabi (dry season) crops. Establishment was delayed until mid-February-early March, as usual. Such late crop establishment greatly increases the risk of crop damage due to early rains, and this is what is happened in 2013. There was heavy rain in May (Cyclone Mohasen hit the Bangladesh coast on 16 May 2013), and the farmers traditional rabi crops (mostly sesame, some mungbean) and the late sown introduced crops (maize, sunflower, HYV sesame and mungbean) were severely damaged with resultant low yields (~0.3 t/ha for the 50% of farmers who retrieved those sesame pods that were nearly mature, ~1.5 t/ha for the sunflower with many immature seeds because of the late planting). Therefore it was not possible to demonstrate timely establishment and its benefits, except for two

demonstration sunflower which were dibbled into the moist soil (dry enough for sowing, but too wet for tillage) on 31 December 2012 and 01 January 2013 to enable timely establishment, and which were harvested prior to the May rain. The dibbled sunflower yielded 1.4 t/ha because the farmer did not take care of the crop. The farmers did not attempt to drain their rabi crops because they knew that the damage had already been done. However, two farmers on higher land near the drainage outlet drained their maize and sunflower fields. The maize crop yielded 5.4 t/ha and sunflower 1.5 t/ha (the sunflower farmer took proper care of the late sown crop, except for fertilizer application, and got this yield despite being affected by Mohasen).

The farmers gave several reasons for not growing HYV, despite the fact that they were provided with free seed. These included:

- reluctance to apply fertiliser with HYV (the cost of fertiliser) which they understood was required with HYV, whereas they normally don't apply fertiliser, or very little, to local varieties
- lower price of HYV rice than local varieties in the market
- the fact that tenant farmers have to give two thirds of their harvest to the land owner while having to bear all cultivation costs [so some (3) planted the HYV on their own land which was outside the pilot area, and some gave their HYV seeds to neighbours or relatives]

Another reason appears to be the fact that there are a number of projects in the area giving the farmers cash or in-kind support, and they were waiting to see what support they could extract from the Innovation Grant project.

c) there was huge weed infestation due to late weeding, presumably due to the high cost of labour and lack of cash.

d) most of the farmers growing HYV did not adopt the recommended practices, in particular the narrower plant spacing than they use for their local varieties, and they applied very little fertiliser. The reasons are probably the higher labour requirement/cost for narrow plant spacing and the cost of fertiliser. Some farmers also felt that fertiliser is bad for the soil (makes it "hard").

e) there was no response of the HYV to fertilization using recommended practice, compared to farmer practice (very low amounts applied) —possibly because the fields were not drained prior fertiliser application (water depth was 3-5 cm), and movement of the fertiliser in the water beyond the field being fertilised.

f) yield of HYV with recommended practice (6 fields) was similar to yield of the local varieties.

g) once the soil was dry enough for tillage, the small tractor owners doubled their price because they knew that we wanted to prepare the land quickly to establish the crops as early as possible, so the farmers had to wait for about two weeks until larger tractors reached the area. The tractors come from Jessore once there are sufficient

lands ready for tillage, hence almost all farmers sow their rabi crop (sesame) late every year, regardless of whether their soil is dry enough to start tillage and sowing earlier.

Therefore, it was decided that in future, a better approach would be to work with a smaller number of farmers in a smaller area, and provide all the inputs needed for HYV aman and rabi crops, to be able to demonstrate the potential production through improved water management, germplasm and management. We plan to continue beyond the end of the Innovation Grant project (June 2013) with a smaller pilot for the 2013 aman and 2013/4 rabi crops. Five farmers growing crops in a contiguous area of 1.2 ha have agreed to collaborate. We will also work with all the farmers of the original pilot watershed as in the previous year and will observe whether they change their practices so that they can establish their rabi crops earlier, to avoid the crop devastation that occurred due to late sowing of rabi crops in the 2012-13 season. We are also planning to release small indigenous fish species that can grow well in shallow water as in paddy fields, in collaboration with WorldFish (WF will fund). The objective is to examine the possibilities of rice-fish integration in small watersheds. If possible, that would add extra incentive for upscaling of the mini-watershed concept.

2. Activities Completed

1) *obtain the agreement of a group of farmers to create a hydrologically separate pilot watershed area on polder 30*

✓ A suitable area of approximately 6 ha, bounded on two sides by a regional highway and a rural road, adjacent to a canal with a sluice gate, and close to the sluice gate, was identified. There were 37 farmers growing crops in this land, 9 of them tenant farmers. All of the farmers agreed to participate in the pilot.

2) *obtain the agreement of the farmers and the local community water management organisation (WMO) to operate the sluice gate in a systematic way to enable drainage when desirable, and train them in implementation of good drainage management*

✓ After five meetings with the farmers and the local WMO explaining the concepts and their implementation, all the farmers growing crops in the watershed area agreed to participate in the pilot, and the community agreed to implement the proposed water management (drainage) strategy.

3) *create a hydrologically isolated pilot watershed through construction of small levees where needed*

✓ The levees were successfully constructed by the farmers, who were paid by the project to undertake this work.

4) construct small drains and a drainage outlet to enable drainage from the pilot area

✓ The drains were also constructed by the farmers, and a drainage outlet installed into the canal under the guidance of a Bangladesh Water Development Board engineer.

5) *separate higher land from lower land through construction of a small levees inside the pilot area*

✓ The farmers identified the higher and lower lands and constructed a small levee/drain to separate them.

6) *obtain the agreement of the farmers to grow high yielding varieties (HYV) of rice on all the land in the watershed (seed provided), and to use recommended management practices*

✓ The farmers agreed to grow the HYV and all collected enough seed from the project team to be able to plant HYV on all the land that they are farming within the pilot watershed area.

7) *train the farmers in recommended management for HYV and provide coaching during the season*

✓ The farmers received training in recommended management, and field staff visited the fields at the times of key activities (e.g. transplanting, fertiliser application) to coach them in the recommended management practices. The time of transplanting was satisfactory —the farmers generally transplanted the rice slightly later than the target planting date, but earlier than they would normally transplant. However,

- × only 50% of the farmers planted HYV of rice, resulting in only 43% of the pilot watershed area growing HYV. The rest of the farmers grew local varieties, which mature several weeks later.
- × only 19% of the farmers growing HYV used the recommended plant spacing.
- × none of the farmers were prepared to apply fertiliser at the recommended rate.

Therefore, the project provided the seven farmers who used correct plant spacing with fertiliser, and provided guidance to them to ensure that fertilisers were applied at the recommended times and rates. This was done to be able to demonstrate the potential yield gains with HYV managed using recommended practice.

8) *operate the sluice gate systematically to quickly drain out excess water during the rainy season*

✓ There were two heavy rain events (in excess of 250 mm) in August (shortly after transplanting, when the HYV plants were almost completely submerged) and September, and the farmers systematically operated the sluice gates to drain the excess water from the fields within 3-4 days after each rain event. As a result, the crop did not suffer damage from the excessive rainfall.

9) *drain the fields a couple of weeks before maturity of the HYV, to allow the soil to dry for timely establishment of the rabi crops*

At the beginning of November, about two weeks before maturity of the HYV, there were about 80 mm of water ponded in the watershed area. This would have been the ideal time to drain the fields to allow the soil to start to dry.

- ✗ However, instead, more water was brought in because the rainy season had ended and the local varieties were only just at the heading stage and needed more water to see them through to maturity. It was not until the first week in December when the water had been consumed and the area was no longer ponded. However, by then, the weather had become cold and foggy, and the soil did not become dry enough for tillage for rabi crops until February.

10) *work with some of the farmers to demonstrate the performance of a range of high yielding and/or high value and traditional rabi crops, with timely establishment (much earlier than the current practice), improved varieties of traditional rabi crops, and using improved management*

✓ The project team encouraged two farmers to establish sunflowers by dibbling once the soil had dried to optimum moisture for seeding (if too wet the seeds will be damaged). We provided them with seed and fertilizer and they dibbled it on 31 December 2012 and 01 January 2013, about two months earlier than other farmers' rabi crops in 2013.

✗ The project team also established 11 demonstration plots in 6 farmers' fields (total area 0.68 ha) of a range of rabi crops (sunflower, maize, sesame and mungbean) with recommended fertilizer, water and cultural management practices. Sowing of these crops was delayed until mid- February 2013 while waiting for the soil to dry sufficiently. Most of the watershed farmers completed sowing seeds of sesame and mungbean in the second half of February 2013.

11) *monitor the activities of the farmers during the 2012 rice and 2012/3 rabi seasons, and the performance (biophysical and economic) of the rice and rabi crops*

✓ The activities of the farmers, crop performance and yield, and input costs and returns were determined for aman HYV and local varieties, and for the rabi crops.

3. Lessons Learned

The main lesson learnt from this project is that we cannot expect a community will easily adopt a particular technology, which for this case is improved crop production technology, just because we know that they can improve their work by doing so. There are many constraints to adopting technology, some of them obvious. However, undertaking this exercise helped us to identify learn many lessons and identify many issues in attempting to implement both improved community water management and improved crop production practices. These include:

1) They community was willing to implement improved water management, and did so successfully during the aman crop.

2) The community was willing to provide labour and other non-cash demanding support for implementation of the pilot watershed project.

3) However, giving farmers seed of HYV rice and instruction on how to cultivate HYV rice does not mean that farmers will plant it in some or all of their fields, even if they say that they will.

4) The land tenancy system (2/3rd to owner and 1/3rd to tenant, and the tenant has to shoulder all production costs) is not conducive to adoption of HYV. The tenant farmers prefer to cultivate traditional rice, in which no fertilizer and pesticides are applied and less labour is needed to transplant (due to wider spacing).

5) The price of HYV rice in the local market was much lower than the price of traditional rice, and this was probably a strong disincentive to growing the HYV. The price gap is showing signs of narrowing, and HYV will be needed for future food security of the growing population.

6) The production costs of properly managed HYV are much more than that of traditional rice in order to gain the potential yield benefits, mainly due to increased labour, fertiliser and pesticides. The farmers who owned their own land were also unwilling to make the investment; these farmers are possibly already food secure.

7) The yield of the local rice varieties with no inputs was surprisingly high.

8) Our inability to achieve and demonstrate higher yields of HYV with recommended fertiliser rates in comparison with HYV with little fertiliser and wide plant spacing, and in comparison with the local varieties was a big surprise, and we don't really

know the reasons why this happened (we plan to study this further in the 2013 aman season).

9) There are many projects providing various forms of in-kind and cash support in the area, and this is probably another reason why the farmers were reluctant to invest in the improved technology —they were holding back in the hope of getting more support from the project. Similarly, the local 2-wheel tractor owners put up their price as they knew that the project wanted earlier tillage and they expected that the project would come up with the funds.

As a result of this initial experience, we consider that it is necessary to provide financial support for input costs to the all the farmers in a pilot watershed. The community expects some financial support as many organizations (GO and NGO) are working in this mode in the locality, the community is reluctant to invest when they see the support provided to others. Because of the cost of implementing a pilot watershed with a greater level of support, we have decided to scale down to a smaller area and fewer farmers, to be able to properly implement and demonstrate the potential of the concept.

Attachments

1. Research publications and communication outputs

List (in the table below) all outputs produced within the scope of the innovation funds project. Please provide a copy of the output or the web link, including links to pre-prints of journal articles. Possible output types are:

a. *Books and Book Chapters*[1]
b. *Journal articles (include articles that have been submitted*[2]
c. *Research Reports (working paper, consultant's report, discussion paper, project reports, etc)*
d. *Student theses*
e. *Conference and Seminar Papers*
f. *Posters*
g. *Policy briefs, briefing papers*
h. *Reference materials (booklets and training manuals for extension agents, etc.)*
i. *Articles for media or news (radio, newspapers, newsletters, etc.*
j. *Social media outputs, including web sites, blogs, wikis*
k. *Videos*
l. *Data and information outputs, including datasets and databases*
m. *PowerPoint presentations (except the internal project presentations)*
n. *Other (specify)*

Output Type (see above)	Reference (Author, year, title/ output name, etc.)	Target audience	How disseminated / promoted / used	Any feedback on its use, or how monitored/ evaluated
Research progress report	Mondal, M K and E Humphreys 2013. Implementing Community Level Water Management in Coastal Bangladesh. Progress Report to CPWF Oct 2012	CPWF MT, Researchers and development organizations	Electronic copy	

[1] *Please indicate if these are peer-reviewed or not.*
[2] *Please indicate if these are peer-reviewed or not.*

	Progress Report October 2012-March 2013.			
Power point presentations	Mondal, M K and E Humphreys 2013. Implementing Community Level Water Management in Coastal Bangladesh. Presentations at: - the bi-monthly meetings June and August 2013 - reflection workshops in Nov 2012 and April 2013	GBDC Team members	Electronic copy	
Most Sig Change story	November 2012 – with progress report	CPMT, CPWF community	Electronic copy	

2. Capacity building of people engaged in the project

Please list any people engaged in the project whose capacity has been strengthened (students, trainees, fellows, project staff, key beneficiaries, etc.) built through your Innovation Funds Project.

FAMILY NAME, Given Name (if available)	Gender	Nationality	In case of students level (e.g., MSc, PhD), affiliated University/ type of training otherwise staff category (e.g. researcher, farmer, extension worker, government official)	Research / thesis subject	Outputs (if any)
Ray, Lincoln	M	Bangladesh	Project staff		Knowledge gain on the benefits of drainage for early establishment of rabi crops for higher yield and safe harvest
Mondal, Tanmoy	M	Bangladesh	Project staff		Knowledge gain on rabi crops establishment by dibbling method, (without ploughing) in saturated soil, and early harvest
Ray, Amal	M	Bangladesh	G2-BRRI Staff		Early established rabi crops can safely be harvested before the onset of the cyclone season (general trend from mid-April to November)
Pilot watershed and neighbouring farmers (50)	M (45) F (05)	Bangladesh	Farmers		

3. Outreach to targeted actors or actor groups

Please list any outreach activities carried out during your Innovation Funds Project.

Type of outreach activities (e.g. informal/ formal meeting, stakeholder consultation, seminar, training, forum)	What type of participants (e.g. farmer, researcher, extension worker, NGO, Priv. sector)? How many participants (gender/ diversity distribution)?	Dates, venue (location, country)	Any feedback or how monitored/evaluated? Any evidence that your outreach activities led to some positive change?
Organized 16 meetings on water management and crop production with particular emphasis on drainage for early establishment of rabi crops	Farmer, members of water users association, union parishad members, researchers, where both male and female farmers, UP members and researchers were participated. Participants: Male = 371 Female = 42 Total = 413 (Note: many farmers were present in all 16 meetings)	Venue: WMG office, Kismatfultola village, Batiaghata, Khulna, Bangladesh Date: In 2012: 23 Jan, 14 Feb, 7 Mar, 9 Apr, 16 Jun, 19 sep, 19 Dec In 2013: 13 Jan, 21 Jan, 30 Jan, 16 Feb, 21 Feb, 14 Mar, 27 Apr, 30 May, 26 Jun	WMG officials fully cooperated with our planned activities to drain out flood water twice (in August and September) in the aman season 2012.