

Progress Report BMZ Project Funding

Including sections for the *Phase 2* project pipeline

General Information

Implementing Organisation and Contracting Partner	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH Friedrich-Ebert-Allee 36 + 40 53113 Bonn Tel. +49-(0) 228-44600 Internet: www.giz.de
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Closing date	January 15, 2020
Reporting period	The previous calendar year (here 2019)
Submit by e-mail to	beaf@giz.de

1. Basic data

The IARC applicant	The International Potato Center (CIP), Lima, Peru
Project title	Strengthening food system resilience in Asia's mega deltas with salt-tolerant sweetpotato and potato
Funding type, GIZ Project Number and Contract Number	International Agricultural Research, GIZ Project No. 17.7860.4-001.00, Contract No. 81219432.
Reporting Period	March 2019–December 2019
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Project Partners	University of Hohenheim (UoH), Germany Prof. Dr. Folkard Asch Bangladesh Agricultural Research Institute (BARI) – Tuber Crops Research Center (TCRC) Dr. Abul Kalam Azad (DG-BARI) Dr. A.K.M. Shamsul Hoque (Director-TCRC) Dr. Horidas Chandra Mohanta (PSO-TCRC) Dr. Bimal Chandra Kundu (PSO-TCRC) Prodipan Md. Ferdausur Rahman, Executive Director Durgapada Sarker, Project Officer ACI Seed Ltd Sudhir Chandra Nath, Head of Business Supreme Seed Ltd Md. Mokfor Uddin Akond, Vice-Chairman
Research for Development (R4D) Continuum Phase as per proposal	Proof of Concept Phase (Outputs 1, 2) Piloting Phase (Outputs 3, 4)

2. Progress Report

State of Project Implementation	
<p>Purpose key indicators: More than 5,000 farmers (>100% target) utilize improved varieties. Seed value chain reaching 33% of farmers in selected communities. Three new salt-tolerant potato (P) varieties released and 50 P clones and 17 sweetpotato (SP) clones moved to advanced evaluation.</p> <p>Output 1: Improved breeding and evaluation methodologies. Ongoing</p> <ol style="list-style-type: none"> Complete germplasm evaluation and release of varieties: <ul style="list-style-type: none"> National Seed Board (NSB) released salt-tolerant P varieties BARI Alu-87 and BARI Alu-88 from CIP clones. Identify advanced evaluation methodologies for salt tolerance at UoH and BARI: <ul style="list-style-type: none"> Student research at UoH and training of scientists on track: 3 BSc projects, 1 PhD 	

project, and 1 postdoctoral training (Annex 1).

3. Continue evaluation of P and SP breeding lines for salt tolerance:
 - 40 Zn- & Fe-rich and 10 late blight-resistant P germplasm transferred to BARI for evaluation for salt tolerance.
 - 11 SP genotypes from CIP-Mozambique and 6 from CIP-Peru selected for further evaluation for salt tolerance.
 - 125 genotypes selected from SP seed from CIP-Peru to assess their suitability for saline conditions.
4. Train breeding teams at BARI in breeding evaluation methods:
 - 4 BARI scientists trained in accelerated breeding schemes; field trials prepared for training 6 additional scientists.

Output 2: *Improved methodologies and capacities in the seed value chain.* Ongoing

1. Strengthen germplasm management within government and private sector:
 - BARI-TCRC produced 3 tonnes (t) of breeder seed and 7 t of foundation seed of salt-tolerant P varieties for multiplication by private seed companies.
 - Supreme Seed Ltd (5 t) and ACI Seed Ltd (4 t) produced certified seed of BARI Alu 72 and included this variety in their business portfolio.
2. Provide training for efficient multiplication and marketing of seed:
 - 55 women were trained and established SP nurseries to serve demand from initial 5,000 farmers.
3. Facilitate marketing and distribution of seed of improved varieties:
 - Sourced from 12 nurseries, SP planting material and vegetable seed distributed to 5,000 women farmers for home garden production.
 - Seasonal income for women nursery managers of BDT8333 (\$100) from sale of SP vine cuttings.
4. Establish socioeconomic baseline database:
 - Baseline study of 450 households (HH) completed by consultant from Bangladesh Agricultural University (Annex 2).
 - Report on stakeholder workshop on P and SP seed systems completed (Annex 3).

Output 3: *Participatory selection of P and SP varieties and agronomic practices.* Ongoing

1. Design and implement on-farm trials to determine best P/SP varieties:
 - 28 demo and trial plots of variety BARI Alu-72 established show 20–44% yield increases over local potato yields.
 - 12 demo and trial plots of 5 SP varieties in Khulna and Satkhira districts.
2. Implement focused agronomic research on P and SP:
 - Next reporting period
3. Develop and disseminate agronomic guidelines and extension material:
 - 2 field days held (91 male, 27 female farmers; Department of Agricultural Extension (DAE); BARI; Prodiplan; seed companies; print media) (Annex 8)
 - 6 field days to demonstrate SP agronomy (124 male, 162 female farmers; DAE; BARI; Prodiplan) and consumer tasting event held. SP varieties BARI SP-4 and BARI SP-12 selected by farmers
4. Conduct economic feasibility, profitability, and gender analysis:
 - Next reporting period

Output 4: *HH-level utilization of SP and P improved.* Ongoing

1. Implement community nutrition scholars (CNS) model:
 - 50 young women trained as CNS in nutrition and food production and utilization: Trained more than 5,000 women.

2. Introduce SP in home gardens and assess outcomes for nutrition:
 - 5,000 farmers trained in home garden production; received 50 cuttings of 4 SP varieties and vegetable seed. Research on postharvest completed.
3. Operational research to understand constraints to utilization of SP and P:
 - April 2020
4. Evaluate dietary changes for young children and women participating
 - April 2020

General Achievements and Problems encountered	
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General Achievements

- The project successfully demonstrated the competitiveness and added value of salt-tolerant P and SP varieties and advanced clones in terms of yield and farmer preferences. Beneficiary satisfaction is high and adoption rates are ahead of targets.
- CIP germplasm from Peru and Mozambique breeding hubs provided a strong genetic basis for salt tolerance. This applies to both available varieties and new clones under evaluation.
- BARI is actively investing physical, financial, and human resources toward the project's agenda; participation in training has been strong. BARI is adopting new breeding and evaluation methodologies.
- UoH training of postdoc fellow generated critical capacity that is being conveyed onward to national agricultural research systems (NARS) scientists. An additional PhD position for a Bangladeshi scientist has been established and three BSc student projects are on track, despite adjustments due to security concerns.
- In the case of P, the project could catalyze interest by commercial seed companies and harness their resources. ACI Seed Ltd and Supreme Seed Ltd provided the bulk of P seed and invested in improved seed management and marketing as part of the project and beyond.
- For SP, as expected commercial incentives for investment are more fragmented, but community demand for improved varieties provides a basis for local entrepreneurs to establish seed nurseries and market vine cuttings together with vegetable seed for home garden production. Young women provide community extension services in food production and utilization that complements and reinforces delivery and uptake of improved varieties.
- P and SP have separate delivery pathways, yet the project has strengthened both and has created mutually reinforcing technological, commercial, and social incentives for expanding adoption of varieties that contribute to beneficiary wellbeing.

Problems encountered

- UoH student research had to be adjusted as security regulations did not allow student field research in Bangladesh. Thus the three BSc projects were implemented at UoH without the planned field components.
- Similarly, additional restrictions on importation of P clones into Germany determined a shift in UoH-based research to SP solely rather than both crops. German P clones proved unsuitable as a substitute for imported clones from Bangladesh.
- Following varietal demos, demand for seed of salt-tolerant P and SP quickly outpaced available supplies. For example, male farmers are keen to shift SP production from home gardens managed by women to their larger fields. This potentially risks gender equity and nutrition outcomes.
- Some work has been delayed, including the completion of the baseline report and the implementation and analysis of agronomic research. This will be intensified in year 3 (Y3).
- Cyclone Bulbul (Nov. 2019) destroyed some SP nurseries and delayed activities in

Khulna and Satkhira districts.	
Progress towards Outcomes (and Goal)	
<p>Goal: Increased system productivity and healthier diets in the delta region</p> <p>Indicators:</p> <ul style="list-style-type: none"> • More than 5,000 HH have adopted salt-tolerant P and SP varieties, >100% end-of-project (EoP) target • 68 ha under new varieties and improved management (68%) • 20,793 individuals with improved diet quality (83%) <p>The project has already exceeded its EoP target of 5,000 HH adopting salt-tolerant P and SP varieties. On this basis, efforts in Y3 will emphasize expansion of production area following farmer demand for P and SP in both home garden and field production systems. Second, the cascading CNS delivery approach will reach larger numbers of HH for utilization and nutrition training in Y3.</p> <p>Purpose/outcome: Strengthen farmer access to and utilization of improved salt-tolerant P and SP</p> <p>Indicators:</p> <ul style="list-style-type: none"> • 3 new salt-tolerant P varieties released (37%) • 50 P clones and 17 SP clones under advanced evaluation (670%) • Seed value chain strengthened to reach more than 12,000 HH (direct and indirect beneficiaries), equivalent to 33.7% of population in participating communities and 2.2% of population in target districts (44%). • More than 5,000 HH have adopted salt-tolerant P and SP varieties (>100%). <p>The project has accelerated the official release of three new salt-tolerant P varieties to date and has advanced larger numbers of P and SP clones (67) to the latter stages of the evaluation process. And though the release of varieties is ultimately outside the control of the project, the large number of advanced clones and the commitment of the government to diversify crop varieties, including those of P and SP, make it likely that the target of 8 releases can be achieved by EoP or shortly thereafter. Strong investments by commercial private sector in P seed companies and by local women entrepreneurs in SP nurseries have strengthened the seed system for both crops, reaching almost half of the ambitious target of supplying seed to 5% of the total population in Khulna and Satkhira districts at this stage.</p>	
BMZ Outcome Target and IDO Contribution	
<p>By end of Y2, 5,000 HH (100% of EoP target) have received SP planting material along with summer and winter vegetables seeds; 556 HH also received salt-tolerant seed P; 20,793 individuals (83% of target) participated in nutrition training; and 68 ha (68% of target) are under salt-tolerant varieties and improved management.</p> <p>This initial adoption yielded 204 t of sweetpotato and vegetables and 5.8 t of salt-tolerant P. The project has so far focused on 70 villages with a total population of 179,220. It has directly reached 20,793 individuals and a further 39,606 indirectly equivalent to 33.7% of the population in target villages.</p> <p>In Y3 the project will initiate seed production, marketing, and trainings in additional villages to build capacity for broader scaling. Although the beneficiary targets have already been achieved or will likely be achieved in Y3, emphasis will shift to strengthening capacity in the seed supply chain and among training providers who can reach larger populations beyond this project phase.</p> <p>The project has implemented extensive trainings of service providers (extension agents, seed multipliers, and nutritionists) and farming HH, using a training of trainers approach; it is on track to reach the target numbers. Through UoH the project provides advanced training</p>	

for five BSc students and one postdoctoral fellow as planned. In addition a Bangladeshi scientist PhD has been trained.

A detailed breakdown of beneficiaries and trainings is attached as Annex 4.

The main IDO contributions worth highlighting are:

3.3.1 Increased resilience of agro-ecosystems and communities. Salt-tolerant P and SP varieties have proved to strengthen resilience in target communities.

A.1.4 Enhanced capacity to deal with climate risks and shocks. Training of seed suppliers and farmers has enhanced agri-food system capacity to deal with salinity.

2.1.1 Increased availability of diverse nutrient-rich foods. P and biofortified SP, as well as vegetables, are more widely available in target communities.

2.1.3 Optimized consumption of diverse, nutrient-rich foods. Nutrition training and messaging help improve their utilization and consumption.

B.1.3 Increased capacity of women and young people to participate in decision-making. Women and young people have participated as adopters and have been prioritized as seed multipliers and extension agents.

D.1.4 Increased capacity for innovation in partner development organizations and in poor and vulnerable communities. BARI and private sector partners participate actively and invest in development and marketing of salt-tolerant varieties. Communities are expanding the CNS approach to promote nutritious and climate-resilient food production and utilization.

Review of Impact Pathway

The theory of change (ToC) diagram is attached as Annex 5.

The main assumptions have been verified, though progress from research outputs to research and development outcomes has varied across the different components:

Feasibility of technologies

The project demonstrated that P and SP varieties can be adapted effectively to saline conditions in the delta. CIP-derived varieties already outcompete local varieties (by over 20%). Advanced clones under evaluation again promise to deliver further yield gains. Farmer and market demand for seed is high and has outpaced current supply chain capacity. Research at UoH indicates that methodologies for salt-tolerance breeding of SP can be further improved to accelerate developing new market competitive varieties. The new breeding platform at BARI, with CIP's support, makes it more likely that this potential will be realized over the coming 3–5 years.

NARS commitment and policy support

BARI have shown strong commitment to the project and made staff and facilities available. New international research collaborations provide additional momentum and/or risks: (1) CIP's new biofortification project will help strengthen the breeding team and facilities at TCRC and (2) TCRC's genetically modified organisms (GMO) potato project (USAID funded) competes for institutional attention. In this context, the project is recognized as instrumental for achieving salinity adaptation, which continues to be a national policy priority.

Private sector demand and market strength

The original ToC underestimated the positive role of the private sector in building the seed supply chain for salt-tolerant varieties. Although P and SP have divergent seed chain pathways, entrepreneurs are keen to invest in both crops. This increases the likelihood of reaching a significant part of the smallholder population in the delta (5% of all HH) with salt-tolerant P and SP.

Farmer demand and HH benefits

P and SP provide complementary benefits and are adopted for different reasons: P mainly for farm income managed by men, and SP for nutrition from home gardens managed by women. The project's intentionally inclusive delivery models seem so far to mitigate the risk

of marginalizing poor HH and women, yet demand growth starts to result in competition between men and women for SP planting material for different production systems.

Additional risk emerging

In October 2019 the government delisted P for an initial 3 years from its previous status as a government-controlled crop, thereby permitting the commercial agriculture sector to import exotic P varieties to Bangladesh. This poses the potential risk that seed companies may reprioritize their investments toward imported varieties and may neglect the smallholder market in more marginal environments. BARI and private sector project partners have, however, reaffirmed their continued commitment, emphasizing the value of the project in support of an inclusive and diversified P and SP sector.

Conclusions for the following Reporting Period

The objectives and design of the project continue to be relevant and have proven to respond effectively to genuine demand among farmers, private sector, and the government. Specifically, the project goal and purpose—to strengthen resilience at “system level” through complementary P and SP technologies and capacities—look achievable and demonstrable. Progress has been strong in most components, driven by partner interest and market demand. Where there are gaps at this stage, the project will be able to re-allocate effort in order to lay a strong foundation for broader scaling during a possible Phase 2. Specific considerations and proposed adjustments for Y3 are as follows:

- **Collaboration with BARI.** Evaluation of P and SP clones will continue with stricter prioritization of those clones in the last stages of the release process. To date only P varieties have been released, so SP clones will be further prioritized. Project activities will be further aligned to the recently started CIP-BARI collaboration to establish a breeding platform at TCRC, to include salt tolerance as a mainstream long-term priority.
- **Private sector co-investment.** Both main commercial partners (ACI Seed Ltd and Supreme Seed Ltd) have integrated salt-tolerant P into their medium-term business plans and have approached CIP for broader collaboration. In the case of the former, through their food processing branch, this also includes contract farming production of SP in the target districts. In Y3 the project will leverage this interest and adjust the role of these partners to facilitate co-financing of seed multiplication and distribution.
- **Agronomic research.** The project will expedite the conclusion of ongoing agronomic research on both field and home garden production systems and the publication of guidelines for farmers and extension services. Additional resources will be allocated to this component.
- **Evidence base of adoption and dietary changes:** The project has strengthened its monitoring and evaluation (M&E) competency in Y2 and be able to solidify the evidence on P and SP adoption through a timely endline survey. Additional social research will assess achievement of diet quality outcomes and identify any constraints in this regard.
- **Policy engagement.** Although there is overall strong policy support for the objectives of the project, in Y3 CIP will more specifically document the policy changes the project is contributing to and any new risks emerging (e.g., from the delisting of P).
- **Publications and dissemination.** The project will increase its publications output and contribute to a national P and SP workshop, co-convened by CIP and BARI.
- **UoH advanced training and student research.** Security concerns permitting, student research and training will be linked to field components in Bangladesh.

Publications, Papers and Reports

1. E.M.H.S. Rahaman, A. Darda, and J. Andrade. 2019. Potato and Sweetpotato Seed System in Southern Delta of Bangladesh. International Potato Center, Dhaka, Bangladesh. 40p. (Annex 3)
2. A.K.M.S. Hoque, H.C. Mohanta, and B.C. Kundu. 2019. Annual Research Report on

Potato and Sweetpotato. A CIP-TCRC, BARI collaborative research report on potato and sweetpotato. 29p. (Annex 6)

3. Folkard, Asch. 2018. Annual Technical Report of University of Hohenheim, Germany. 20p. (Annex 1)
4. E.H.M.S. Rahaman, M.M. Hossain, D. Chanda, and S. Heck. 2019. A booklet on Improved Production Technology of Sweetpotato (in Bengali). 16p. (Annex 7)
5. Abu Hayat Md Saiful Islam. 2019. Project Baseline Study Report. 31p. (Annex 2)

Summary

Driven by genuine stakeholder demand, the project is on track to achieve its objectives. Several EoP targets have already been achieved, and others are likely to be achieved during the remaining year. Over 5,000 farming HH have adopted improved salt-tolerant varieties of either P or SP, improving the diets of more than 60,000 people. Currently, available varieties and advanced clones under evaluation have proved to increase productivity of salinity-affected farmlands and have outperformed local varieties in terms of yields and farmer preferences. In Y3 the area under these new varieties is expected to exceed the target of 100 ha from the current level of 68 ha.

BARI-TCRC has released three new salt-tolerant P varieties. More than 60 salt-tolerant P and SP clones are under advanced evaluation; additional releases are expected in Y3. Through participatory evaluation and demos, the project created demand for salt-tolerant varieties among P and SP growers based on the superior performance (by 20–44%) and consumer acceptance of the new cultivars.

Critically important, private sector seed companies have included salt-tolerant P varieties as part of their business model to diversify and expand P production in Bangladesh. Two large companies, ACI Seed Ltd and Supreme Seed Ltd, have produced and distributed the bulk of seed P within the project and have started to include salt-tolerant varieties in their regular business plans.

Less visibly at national level, local entrepreneurs—mainly women—have played a similar role for the promotion of salt-tolerant SP varieties for home garden production, though at an incipient stage also for field production. Over 50 SP nurseries have multiplied and marketed SP vine cuttings to over 5,000 HH through community groups, combining it with seasonal vegetable seed to serve local market demand through a more diversified business model. The project's CNS approach has empowered young women to provide important community-level extension and training services that help kick-start demand and reinforce community capacities for food security and nutrition.

Progress against specific outputs has been as follows:

Output 1 (varieties)

- NSB released salt-tolerant CIP P clones as varieties BARI Alu-87 and BARI Alu-88 following regional yield trials.
- Training of scientists and student research at UoH on track: three BSc projects, one PhD project, and one postdoctoral training.
- 40 Zn- & Fe-rich and 10 late blight-resistant P germplasm transferred to the Breeder Seed Production Center, BARI for evaluation for salt tolerance and yield.
- 11 SP genotypes from CIP-Mozambique and 6 from CIP-Peru selected at BARI for further evaluation for salt tolerance, early maturity, and other priority traits.
- 4 BARI scientists trained in accelerated breeding schemes; field trials prepared for training 6 additional scientists.

Output 2 (seed value chain)

- Supreme Seed Ltd (5 t) and ACI Seed Ltd (4 t) produced certified seed of salt-tolerant P variety BARI Alu 72 for marketing in salinity-affected areas.

- BARI-TCRC produced 3MT breeder seed and 7MT foundation seed of salt-tolerant P varieties for multiplication by private seed companies.
- 55 women were trained and established SP vine multiplication nurseries to serve demand from initial 5,000 farmers.
- Socioeconomic baseline study (450 HH in Khulna and Satkhira districts) completed by consultant from Bangladesh Agricultural University.
- Report on findings from multistakeholder workshop on P and SP seed systems completed.

Output 3 (agronomy)

- 28 demo and trial plots of newly released salt-tolerant P variety BARI Alu-72 established show 20–44% yield increases over local potato yields.
- 12 demo and trial plots of 5 SP varieties in Khulna and Satkhira districts.
- 8 field days held (215 male, 189 female farmers; DAE; BARI; Prodipan; seed companies; print media), sharing knowledge on use of quality seed (Annex 8).

Output 4 (HH-level utilization)

- 50 young women trained as CNS in nutrition and food production and utilization. Trained more than 5,000 women.
- 5,000 farmers trained in home garden production; received 50 cuttings of 4 SP varieties and vegetable seed. Research on postharvest completed.

The project has thus contributed to several sub-IDOs, notably to:

- *3.3.1 Increased resilience of agro-ecosystems and communities.* Salt-tolerant P and SP varieties have proved to strengthen resilience in target communities.
- *A.1.4 Enhanced capacity to deal with climate risks and shocks.* Training of seed suppliers and farmers has enhanced agri-food system capacity to deal with salinity.
- *2.1.1 Increased availability of diverse, nutrient-rich foods.* P and biofortified SP, as well as vegetables, are more widely available in target communities.

3. Outlook on Phase 2

Interest in a Phase 2 project

Yes No thanks

General Justification

During the current project phase, the initial assumptions about technical feasibility and demand for salt-tolerant P and SP varieties have been strongly confirmed. CIP-derived germplasm can indeed increase productivity in saline systems and smallholder farmers can reap livelihood benefits from new varieties. Partners from NARS and private sector have started to co-invest in accelerated technology development and dissemination to meet quickly growing demand among farmers. This momentum will enable the project to set longer-term goals and evolve its delivery approach to operating at larger scale in a subsequent Phase 2. At the same time, there is increased urgency for action from a deteriorating climate-change context. Salinity continues to jeopardize agricultural production and has more recently been

projected to reduce rice production in the delta area by 15.6% before 2050, raising major food security concerns.¹ In response, the government has again identified P and SP as tools of diversification toward climate-resilient agriculture.²

Specific indications of demand are:

- **Partner demand.** Private sector implementing partners ACI Seed Ltd and Supreme Seed Ltd have so far invested in producing and marketing of 9 t of certified seed of salt-tolerant P varieties. They have identified the target delta districts as an expansion area for potato production complementing the main production zones in northern Bangladesh. ACI Seed Ltd further requested CIP for additional P clones to be evaluated and registered by the company, and will partner with CIP for technical extension services for SP growers using their *Fosholi* mobile app (<http://bit.ly/FosholiYoutube>).
- **Beneficiary demand.** The project has already exceeded the Phase 1 target number of farming HH. Following varietal demos, demand for P and SP has grown quickly and is likely to reach larger numbers of adopters than planned. Second, units of production are expanding beyond the initial distribution of small seed quantities and are starting to move into field crop production for SP as well.
- **Policy demand.** The government pursues a policy of agricultural diversification to respond to new market demands and threats from climate change. Recent policy changes encourage private sector importation of European P clones for processing and export markets as well as development of disease-resistant GM P for commercial growers. The project provides important complementarity by prioritizing smallholder farmers in locations experiencing de-intensification due to salinity. This is in support of national policy priorities to increase access to salt-tolerant crop varieties for vulnerable communities in the delta region.

Outline

Phase 2 will seek to leverage the capacities and demand built in Phase 1 to deliver salt-tolerant P and SP varieties at a larger scale and stimulate sustainable rural enterprises that can generate livelihood improvements in salinity-affected communities. The project will pursue a facilitative approach, providing research services and knowledge products to stakeholders from private and public sectors while further strengthening capacity for scientific research and technology adaptation in NARS.

The project will deliver four research outputs and research outcomes:

Output 1: Methodologies, tools, and skills refined for both P and SP variety development for saline conditions through CIP, BARI-TCRC, and UoH collaboration.

Outcome. Breeding for salinity tolerance mainstreamed in P and SP breeding programs at BARI-TCRC and shared with breeding programs in other SARC countries, generating at least 10 new salt-tolerant P or SP varieties that are adopted by seed companies or local multipliers.

Output 2: Methodologies, tools, and skills for seed propagation and marketing adapted to salt-tolerant varieties and their seed supply chains and disseminated to private sector companies and local multipliers.

Outcome. Seed companies profitably produce and market salt-tolerant P seed in salinity-affected communities reaching at least 30,000 farmers. Local vegetable nurseries produce and market SP vine cuttings to at least 20,000 farmers in target locations.

Output 3. Production technologies and practices, including soil and water management, adapted to saline conditions to increase P and SP productivity in both field and home garden systems.

¹ Dasgupta, S. et al. 2018. Climate Change, Salinization and High-Yield Rice Production in Coastal Bangladesh. World Bank: *Agricultural and Resource Economics Review* 47/1 (April) 66–89.

² Government of Bangladesh. 2018. *National Agriculture Policy*.

Outcome. P and SP farmers realize sustained yield gains of at least 20% over current local production from a combination of quality seed of improved salt-tolerant varieties and improved agronomic practices.

Output 4. Guidelines, tools, and metrics for promotion and assessment of marketing and utilization of P and SP to improve diets of vulnerable consumers, including women and children under 5.

Outcome. At least 200,000 consumers (100,000 women) in salinity-affected communities increase their consumption of P and SP and other nutritious foods.

The impact pathway toward development outcomes assumes that the momentum among current partners will continue to drive the development and delivery of salt-tolerant varieties and that farmers and consumers in the target districts will continue to demand for P and/or SP suitable for their locations. The project further assumes that technologies and markets for both crops will develop at pace and will complement each other at HH, community, and market levels so that P and SP can contribute in their respective ways to resilience of food systems. Finally, we assume that the policy environment will continue to support development and delivery of salt-tolerant crop varieties, irrespective of additional policy priorities placed on processing and export markets.

Beneficiaries

Phase 2 will contribute to the following BMZ outcome targets:

- **Smallholder HH adopting improved technologies.** At least 50,000 HH will adopt salt-tolerant P and/or SP varieties into their farming system—equivalent to 50% of all P- and SP-producing HH in Khulna and Satkhira districts. However, project beneficiaries may also include HH that have previously not cultivated P or SP. Adoption will be assessed after one season beyond initial planting of these varieties (i.e., one replanting). This target represents a significant but achievable contribution to strengthening salinity resilience in some of the most affected production zones.
- **People consuming nutritious food.** At least 200,000 people will increase the diversity of their diet through the (more frequent) consumption of P or SP from salt-tolerant varieties. This will include at least 100,000 women. Consumption will be measured through 7-day recalls. The target figure is based on an average HH size of 4 among the 50,000 P- and/or SP-growing HH. However, the local marketing of P and SP is expected to increase consumption of these crops in non-growing HH as well.
- **Area under improved management.** At least 2,000 ha will be under improved salt-tolerant P or SP varieties and improved management practices adapted to saline conditions. This is equivalent to 5–10% of the P and SP production area in Khulna and Satkhira districts. Given prevailing sizes of land holdings, the project will primarily promote P as a field crop and SP for home gardens (accounting for the comparatively small areas under SP). However, based on initial discussions with private sector partners, options of larger scale contract farming of SP for wider marketing and processing will be explored.

Research to Product / Services

The current project phase is generating and adapting a set of technologies and management practices that jointly strengthen the resilience of salinity-affected farming systems in the delta region of Bangladesh. The core innovation to be taken to scale consists of the most successful of these technologies and practices that have generated demonstrable demand to which private and public sector stakeholders are now responding:

1. Salt-tolerant P and SP clones evaluated and released as new varieties by the government for broad dissemination.
2. Technologies, methodologies, and capacities for seed multiplication and marketing of these varieties.
3. Accompanying methodologies and tools for sustainable P and SP production in saline conditions.

4. Accompanying methodologies and tools for improved utilization of P and SP production to support healthier diets.

These elements have been developed to the point where they can be commodified and delivered through commercial enterprises and/or public sector entities as follows:

1. **Varieties.** BARI has produced basic seed of salt-tolerant P and SP varieties that can be purchased and multiplied by private seed companies and/or by institutional programs pursuing nutrition or food security goals.
2. **Seed technologies.** Commercial seed companies have established capacities for multiplying seed of salt-tolerant P and marketing these in target districts. Local entrepreneurs have established SP nurseries. Both can be scaled up and replicated as profitable businesses to serve growing demand.
3. **Production practices.** Guidelines for P and SP production in saline conditions are being developed (completed in Y3) that can be disseminated broadly through mobile apps and conventional extension services.
4. **Utilization.** Guidelines and tools for food preparation of P and SP have been developed and a community delivery model validated that can be replicated either as part of public sector extension or linked to marketing of P and SP seed.

Partnerships

CIP expects to continue with the five main implementing partners from Phase 1 but update their roles and responsibilities and adjust CIP's own role accordingly for operating at larger scale:

Partner	Main responsibilities	Changes to Phase 1
<i>Science partners</i>		
BARI-TCRC	Lead breeding and evaluation of P and SP clones both on station and on farm; early generation seed production for SP (and P); training of extension staff	Greater lead responsibility as part of new breeding platform; utilizing training received in Phase 1
UoH	Lead breeding methodology development and adaptation to P and SP; student research and training (BSc, PhD); postdoc training	No major changes
CIP	Project management; training and mentoring of BARI scientists and technical staff from partners; co-supervision of student research; social science research; M&E and reporting; dissemination and communications	Stronger focus on facilitation of new linkages at scale, and research and training services, rather than field-level delivery
<i>Implementation partners</i>		
ACI Seed Ltd	Co-lead in P seed multiplication and marketing, possibly extending to SP production	Fully integrated in project design and implementation
Supreme Seed Ltd	Co-lead in P seed multiplication and marketing	Fully integrated in project design and implementation
Prodipan	Training of local SP nursery operators; training of farmers and community groups	No major changes

It is essential that the interests and capacities of private sector partners and BARI-TCRC alike be fully leveraged in Phase 2 to establish a critical scale of salt-tolerant P and SP production in the delta region that can sustain continued investments in seed supply and services. Concurrently, research and training at UoH needs to continue to improve the technology base and strengthen research skills for long-term adaptation capacity to increasing salinity levels.

Communication of Research Results

To inform and reinforce the scaling process, the project will broaden and diversify its communication to larger audiences both in science and non-science domains. Main modalities will include:

- Periodic face-to-face consultations with national stakeholders to disseminate and discuss project plans and results from research.
- Field days, demo plots, cooking demos, and other physical community-level events at strategic times during the agricultural year.
- In partnership with ACI Seed Ltd, specific P and SP modules developed for the popular Fosholi mobile phone app (<http://bit.ly/FosholiYoutube>) to reach farmers with information on seed, agronomy, and utilization.
- Social media platforms to stimulate demand for P and SP and provide market information to farmers and suppliers.
- In collaboration with related CIP/CGIAR programs, at least two annual conferences to present research findings and stakeholder perspectives to policymakers, private sector, and civil society organizations.

Funding	
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Total projected budget is €1.5m, with BMZ contributing €1.2m and partners as follows:

- **BARI-TCRC.** €50,000 toward operating costs of breeding facilities and trials. €100,000 project funds allocated as a co-investment in the breeding platform (was €130,000 in Phase 1).
- **ACI Seed Ltd.** €100,000 to cover staff and operating costs of seed multiplication and marketing. No allocation of project funds to this partner.
- **Supreme Seed Ltd.** €100,000 to cover staff and operating costs of seed multiplication and marketing. No allocation of project funds to this partner.
- **UoH.** €50,000 toward costs of supervising student and postdoc research and training. €60,000 project funds allocated toward costs of student research and postdoc training (same as in Phase 1).

Allocation and co-financing reflect increased role of private sector partners in seed chain; development of a co-financed breeding platform at BARI; and continued importance of co-financing student research and training at UoH.