Orange Fleshed Sweet Potato as a Bio-Fortification Initiative in Bangladesh: A Case Study

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Abstract

Vitamin-A deficiency is a major cause of night blindness among children. Growth hampering and lower resistance to infections are also symptoms of vitamin-A deficiency. In Bangladesh, the National vitamin-A Plus campaign has helped to reduce childhood blindness of the country. Coloured vegetables and fruits, (including orange fleshed sweet potato (OFSP)) are good sources of vitamin-A. This case study is based on the "USAID Horticulture Project CIP/AVRDC, Bangladesh" titled "Improving Incomes, Nutrition and Health in Bangladesh through Potato, Sweet potato and Vegetables". The study was conducted to assess the value chain of OFSP as a fortified food initiative in Bangladesh. It was found that children and their parents were interested to have different types of bio-fortified products like OFSP. Parents were not much concerned about the fortification but more concerned about the nutritional improvement of their children's health. The mothers of the community were economically benefited by growing OFSP in their garden. The study identifies different channels from producer to consumers. But there is scope to work on every step of the channels. This kind of attempt needs to start for the whole country in a holistic approach with proper value chain. Appropriate market linkage is necessary for this kind of initiative. The study figured out the scope of marketing from the rural area to the urban super market. Nutritional awareness was created among the community through the initiative. Engaging rural women in every step of value chain and introducing OFSP in urban super markets were innovative approaches of the initiative. The study also found the necessity for storage and processing infrastructure for OFSP so that the producers may have the interest to cultivate the product. A major demand of quality OFSP seed in the market was observed and there was a lack of getting fair price for the product. The initiative created some impact on value chain development, women empowerment, increasing school attendance, children's health and nutritional awareness. It was a pilot approach but the initiative is being continued by the community. Appropriate training on production technology of the bio-fortified crops is necessary to empower the producer groups. Government should take necessary steps to make the seed available.

Introduction:

Poor nutritional status is an area of concern in Bangladesh. Thirty six per cent of preschool-age children are stunted, 33% are underweight and 14% are wasted (acute malnutrition). Malnutrition among women is also high with 31% of ever-married women age 15-19 undernourished (BMI <18.5) (BDHS, 2014).

Deficiencies in key micronutrients continue to be a public health challenge in Bangladesh. It is reported that 43 per cent non-pregnant women of reproductive age and around 56 per cent of preschool children are anemic (WHO 2015); 30 per cent population is at risk of inadequate zinc intake (Wessells and Brown 2012). Vitamin A deficiency is also widespread. The

deficiency increases children's risk to common illnesses, impaired growth, development, vision, and immune systems, and in severe cases results in blindness and death. In women, vitamin A deficiency increases risk of dying during pregnancy, as well as giving birth to low weight children, and may increase the spread of HIV infection (Rahman *et al.* 2013).

Low dietary diversity remains a problem in Bangladesh and deficiencies in vitamin A, iron, zinc, iodine, vitamin B12 and folate are wide-spread, with the poorest people most affected. The Bangladesh Poverty Assessment (2013) by the World Bank showed no significant change in dietary diversity even as the country experienced a significant decline in poverty. The National Micronutrient Survey concluded that "the population of Bangladesh is still well short of the Daily Recommended Allowance of food intake for key micronutrients."(WFP 2013).

Vitamin A deficiency was identified as the single most important preventable cause of night blindness in children and a public health problem in Bangladesh in the 1960s. More importantly, subclinical vitamin A deficiency among pre-school aged children was classified as a public health problem in rural Bangladesh. High levels of vitamin A deficiency are associated with increased risk of child mortality. Since the past 25 years, a vitamin A supplementation program targeting children 9-59 months of age has been implemented by the Institute of Public Health Nutrition (IPHN), health services and NGOs with coverage reaching over 80%. This has contributed to a reduction in night blindness in children 12-59 months of age living in rural areas from 3.5% in 1983) to 0.62% in 1998. To sustainably eliminate vitamin A deficiency in the population, supplementation needs to be complemented with more effective and sustainable improvements in dietary vitamin A. Fortification of edible oil and other foods is one of the means of achieving this. However, long term solution through dietary diversity needs to be promoted for sustainable reduction in Vitamin A and other micronutrient deficiencies (Anonymous 2011). Diagram 01 in Annex 2 depicts two strands of fortification.

Sweet potato (*Ipomoea batatas* L.) is a traditional root crop in Bangladesh. It is known as a 'poor man's crop as it is consumed by a majority of poor households of the country. Orange-fleshed sweet potato, a biofortified variety of the crop, has emerged as one of the most promising plant sources of beta-carotene, the precursor to addressing vitamin A deficiency. Bio-fortification is the process by which the nutritional quality of food crops is improved through agronomic practices, conventional plant breeding, or modern biotechnology. Bio-fortification differs from conventional fortification in that bio-fortification aims to increase nutrient levels in crops during plant growth rather than through manual means during processing of the crops (WHO 2016).

A 100-150 g serving of boiled tubers of orange-fleshed sweet potato can supply the daily requirement of vitamin A for young children which can protect them from blindness. Along with the beta-carotene, pro-vitamin A, the young children and adults can also consume an adequate amount of calories, vitamin C and other micronutrients through increased consumption of orange-fleshed sweet potato (Mitra 2012). Moreover the yield of sweet potato is high and the cost of production is low. Poor people can easily grow the crop and reduce their vitamin A deficiency by regular consumption.

Foods that have been industrially fortified with micronutrients are becoming important in poor people's diets. However, even after all this, millions of children from low-income rural families who subsist on the food they grow often find these health-giving tools are out of reach.

This paper is based on a case study using a qualitative approach undertaken to assess the value chain of Orange Fleshed Sweet Potato (OFSP) promoted to improve nutrition among poor households under a USAID funded project in Bangladesh. The project activities addressed the implementation of a school nutrition program along with value chain development on OFSP. The objectives of the case study were to:-

a) Assess the sustainability of the consumption of the bio-fortified product
b) Identify the marketing strategies adopted in the initiative.
c) Evaluate the community involvement and women participation in the initiative.
d) Identify the rules and regulations that hinder or accelerate the initiative.
e) Assess the scope of improvement in the value chain.

Orange Fleshed Sweet Potato as a nutrient dense bio-fortified food fulfils the first outcome in the conceptual framework of Henson and Humphrey (2015) viz. "Food must be nutrient-dense at the point of consumption". The target food is a significant source of the vitamin A in which consumers especially the children are deficient. School nutrition program was delivering that in an adequate amount, in an acceptable and affordable way and on a sustained basis.

Project Summary

A three year USAID funded project for "Improving Incomes, Nutrition and Health in Bangladesh through Potato, Sweet potato and Vegetables" was implemented by International Potato Center (CIP) and World Vegetable Centre (AVRDC) in the South-West, South-Centre region and Northern part of Bangladesh from 2011 to 2015 with BRAC, Proshika (a national NGO) and Bangladesh Agricultural Research Institute (BARI) as partners. . Besides work on crop development and extension, there was a market linkage with efforts aimed at increasing school-level nutritional awareness and developing the value chain for enhanced consumption.

Beneficiaries of the project were selected through a household survey. In Bangladesh one of the major constraints of potato cultivation is lack of good quality seed. To ensure supply of good quality seed to farmers, 3200 women farmers from Jessore, Barisal and Rangpur were selected to produce seed potato through seed plot technique. The farmers were selected through survey conducted by BRAC field staff. After selecting the beneficiaries, they were given training on "seed potato production through seed plot technique." The training was conducted with the assistance of experts from Tuber Crop Research Centre (TCRC), BARI. There were 30-35 farmers in each training batch and 33 batches of training were arranged both in Jessore and Barisal.

The farmers then prepared their land and raised nurseries with seed and other technical support were provided under the project.

A total 2.4 million vines were distributed among 2000 beneficiaries. A portion of vine were collected from own source of multiplication by the beneficiary and some others were collected from the nursery of previous year's beneficiary those are also trained at previous year.

From survey to market linkage there was a proper dissemination and distribution strategy of OFSP by the project Diagram 02 in Annex 2. School gardens were established with the involvement of school management committee, school teacher and students. The objective of school gardening was to promote nutritional awareness and encourage students to get involved in gardening and consumption of Orange Fleshed Sweet Potato and other vegetables.

BRAC ensured the establishment and plantation of vegetable seed of School Garden with due permission of school committee and school teacher. A school management committee was formed to monitor the project. Vegetables were distributed among the students regularly. Five field days were conducted at Jessore and Barishal region and there were about 500 participants in each session. To popularize consumption of Orange Fleshed Sweet Potato, BRAC conducted school feeding program at Jessore and Barishal district where more than 1500 students participated.

Methodology:

The initial information for the case study was collected through review of literature, published and unpublished documents of the project, annual project reports, journals, and other unpublished documents of BRAC. Different websites relevant to the intervention were also visited to collect the information and to find out the answers of the research questions. Taura Uttar Para Govt. Primary School, Jhikorgasa, Jessore, a school under the project was visited in 2015 and three Focus Group Discussions (FGD) were conducted at separately with groups of students, their parents and teachers. Twelve students in the age group of 4 to 12 years were pre-selected randomly with the assistance of school head teacher. It was decided to discuss with the student group first during the tiffin break, with break time extended by half an hour that day. Usually parents come to the school at the time of closing. Discussions with the parents group were held half an hour before school closing. All teachers were gathered in teacher's common room after school closing for the discussion with the teachers group. All the participants were entertained with snack and sweets after completing FGD.

The FGDs were conducted to answer pre-selected research questions (Annex 1).

The Parents group comprised 12 randomly selected mothers. They shared their opinion on positive and negative understanding on Fortified Foods as a school meal Initiative and also gave comments on alternatives to the food provided in the programme.

The FGD with teachers had four members participating

The Students group of 12 participants was a mixed group with students from classes one to five present.

Interviews of Senior Sector Specialist (USAID Horticulture Project coordinator from BRAC) and Regional Manager of BRAC were taken for clear understanding of the initiatives and the value chain along with the market linkage.

Results and Findings:

Value chain of the intervention:

It was found that farmers usually preferred local sweet potato variety. A report on sweet potato value chain in Jamalpur and Netrokona districts of Bangladesh found that consumers purchased local (red skin & white fleshed) variety because of traditional practice and they were not aware of nutritional value of the crop (Sorwar et al. 2015). The price of the OFSP was almost the same as the local variety in the rural area but it was higher in the urban super market because of the transformation cost.

Table: Price variation in OFSP and Sweet potato (SP) in different areas

Areas	Time of cultivation	Price (taka per Kg)	
Rural market		OFSP	SP
	Season	7-10	7-10
	Off season	10-14	10-14
Urban Floating market	Season	20-25	25-30
Urban super shop	Season	40-45	Not available

Source: Interview with USAID Horticulture Project staffs

The USAID support Horticulture Project coordinator said that BRAC promoted OFSP in different levels like rural government, rural consumers, retailers, wholesalers, other government officials through workshop, field demonstration, school day, result demonstration etc. Initially BRAC promoted OFSP focusing on vit-A deficiency. Day by day demand was created in the locality and people were interested to consume OFSP in spite of availability of local sweet potato variety.

Under this project, Bangladesh Agricultural Research Institute (BARI) produced the potato seed. The seed was distributed to the nursery owner through BRAC. Root producers got the potato root from the nursery owner and they sold the product in the market to the retailer or wholesaler. BRAC also surveyed the super market in the urban areas, where also there is demand for nutritious OFSP. The shop owners agreed to purchase OFSP from the participants of this initiative. Diagram 03 in Annex 2 shows the Value chain for OFSP as a food fortification initiative in Bangladesh.

The sweet potato growers were to link with the local market with the assistance of the implementer group. The linkage with urban super shop was maintained through the project. Both the nursery owner and the root producers were women participants and were closely associated with the school feeding programme. BRAC initiated public awareness sessions and school day events to distribute the message of nutritional importance of OFSP. Diagram 03 presents the value chain of OFSP.

The findings from the FGDs are given below answering the research questions: Who is the target? Are they nutritionally vulnerable?

Sorwar, looking after the project said “The school feeding initiative was targeting school going children to overcome vitamin A deficiency. Project will not measure the health status improvement and consumption behavior of the children but it will increase the vitamin A

uptake of the children. The students of the target area are nutritionally vulnerable. The project was targeting the local poor women to empower them by producing vegetables in their own homestead. It was also linking the producers and the market both in rural and urban."

How this target is achieved? Is it regularly consumed and sustainable?

After the discussion with the parents group, it was found that the students took OFSP as a mid day meal on every alternate day for two weeks. The students preferred the meal very much and it was just boiled sweet potato. Shahida, one of the parents said, "My daughter remained hungry in the school period before the School Committee started the OFSP initiative. During the project period I had learned the benefits of the sweet potato consumption and found that my children are fond of it. I started to feed my children the OFSP and I am continuing this practice in my home after completion of the project."

The parents observed that their children were very much interested to attend school on those days. English teacher Sunanda Adhikary said "Many of the students were irregular in their class. But in those two weeks when the OFSP was being given, the school attendance increased. Mothers are also very much interested to grow this in their house."
Both parents and teachers groups said that the initiative has scope of sustainability as the meal is nutritious and children are interested to consume it regularly. The parents grew the OFSP in their home garden and they became aware of the nutritional value of the crop through training by the implementers.

To what extent the consumption is adequate?

To overcome vitamin A deficiency, a regular consumption is required. Nazim, the Regional Manager of BRAC said "Piloting for two weeks in a school is very minimum. This should be extended otherwise children will not become habituated with OFSP. There is no storage facility for sweet potato, and that makes the farmers uninterested to grow the product."

Is there any preference by the consumer groups?

Teachers were suggesting to offer different types of foods from sweet potato such as fried potato, potato curry, and vegetable khichuri with potato, potato with bread and potato cake. Some of the teachers and parents were interested for fortified biscuits or fortified cooked rice. Kabita Begum, one of the mothers said "I tried to make sweet items (Halua, Payesh) from sweet potato and my children like these very much. I think only potato will not fulfil the nutritional requirement so we need to include other nutritious items with sweet potato.

What are the marketing strategies adopted?

Women of the community were involved in the cultivation and local marketing of the biofortified OFSP. Amina, another mother said, "My 8 year old boy loves boiled sweet potato very much. I am growing the sweet potato in my homestead and we are taking it as a meal regularly in the potato growing season. I sold the additional amount of potato in the market and received some money from that." Sorwar said "Women of the community became trained on production technology of OFSP. After production, the project was linking

them with the local market to sell their product. They were also being linked with the urban supermarket where the Sweet Potato was being sold at a higher price than in the rural market." He also said "Sweet potato production is 40-45 ton/ha and its price varies from 7-10 taka in the local market. But the price goes up to 40-50 taka per kg in the urban super shop. There is good marketing scope for OFSP in the urban but that need to be produced largely in rural areas."

Is there any nutritional awareness strategy to increase the consumption?

A hand book in Bangla was developed by BRAC and USAID on nutritional information related to this intervention. The hand book was given to the parents from where they were able to learn about the nutritional benefits of OFSP. Training sessions were conducted by BRAC and for parents and students on the nutritional benefits of the Sweet Potato.

What is the level of community involvement with food fortification initiatives?

After getting the training, parents become involve in sweet potato production. The percentage of adoption was not measured by the project but almost all of the parents said that they have started to grow OFSP in their homestead. They also trained other people of the community. Mothers feel easy to make a food for the school going children with sweet potato. Moreover it is cost effective for the poor people of the community. Rahima Khatun said "I am a housewife and I had no income earlier. Teachers gave us sweet potato vine and we started to grow sweet potato in our homestead and that brought some money for us. We also teach the other mothers of the community and encourage them to grow sweet potato in their homestead.

Are there problems with signalling fortified foods from non-fortified alternatives?

There is not enough understanding on fortified and non-fortified foods by the local community. One mother named Sathi said "I do not know the term fortification. I only know that the potato is sweet in taste and my daughter likes this very much. I am interested to give her this regularly as a mid-day meal." Their major concern is removal of hunger with nutritious food. They is not enough concern about fortification. They are suggesting the other foods as a mid day meal but fortification was not their concern. They were rarely familiar with the term "fortification. They are considering the diversification of taste and nutritional food as a mid day meal.

What are the advantages/disadvantages of the initiative over market-based approaches?

In this approach the main advantages are empowerment of the women, local level awareness, and income generation of the poor and consumption of nutritional food by the poor. A parent named Parvina said "If the project started in the whole country then it will be so good. I am very much interested to grow the sweet potato in large scale if there is sufficient demand in the market.

Both the parent group and teacher groups said that the seeds are not always available in the market and there is a variation of price in the season and off season. One Sweet Potato

grower named Shirina Khatun said "The price of the sweet potato remains 7-10 taka in the season at local market and the sweet potatoes start reaching the major markets in March and April. We store a few amount of sweet potato in a traditional method and store that for one and half month. In that time we can sell it in a higher price and that is almost double." There is a lack of storage of sweet potato so that most of the farmers become not interested to take risk. Government should address this problem and should take initiative to prepare storage for sweet potato like the storage of potato. A teacher named Jakir Hossain said, "People cannot grow sweet potato in a large volume without ensuring the market. Still there is lack of awareness on nutritional benefits of OFSP in the rural level. Government should take initiative to increase the awareness. It may be through training, campaign, field demonstration, market linkage or launching any project where community people will engage to grow and market the OFSP." It was a suggestion to start the sweet potato cultivation all over the country. Potato farmers are interested to grow by themselves but market should be ensured first. There should have some processing industry where sweet potato will be processed in different types of food items like chips, cake, fries. This will create a market demand and farmers will be interested to grow sweet potato.

Is there any rules/ regulations that are affecting the initiative positively / negatively? What new rules required?

There are some strategies that are positively affecting the initiative. The project is targeting the women as a potato grower which simultaneously making them knowledgeable and economically sustainable. One mother named Tohmina said, "We are very happy that the project is targeting only women for root production. We produced the roots; fed that root to our children in different form and the excess amount we sold in the market." Linking to the urban market is also a positive strategy of the intervention. There are not any regulations found in the study that hamper the project activities rather than less area coverage, short project duration of the school feeding, lack of storage facilities and lack of market demand.

What are the existing regulations on selling the product in the market? If not any, what is required?

There are not any defined regulations to sell the product in the market. The study had found very few channels for sweet potato.

Channel 1: Input Suppliers – Farmers - Traders – Retailers (Local) – Consumers
Channel 2: Input Suppliers-Farmers – Traders-Large Trader–Retailers (Outside)–Consumers (National)
Channel 3: Input Suppliers – Farmers - Retailers (Local) – Consumers
Channel 4: Farmers - Retailers (Local) – Consumers

It is required to maintain a regulation in every level. Variety is not available in the market. Input supplier (Research institute, Donors, Governments etc.) should supply the variety as and when necessary. There are no specialized local traders for sweet potato trading. These traders basically sell seasonal vegetables and other seasonal horticulture crops. During sweet potato harvesting season the crop is mostly important for trader and they come from different location to purchase. They sell sweet potato along with other vegetables. It is require

maintaining the communication between farmers and traders. The local traders purchase directly from farmer by cash. Trading time remains only 3 month in a season mostly from February to April and they sell to big trader and retailer locally. Besides these there is another channel maintained in this interventions and that is-

Channel 5: Farmers –Retailers (urban)- Retailer (Supermarket) – Consumers.

This channel is more profitable for the farmers as they got relatively higher prices in this case. But it is difficult to maintain the urban channel without any supervision.

Is there any community participation or women involvement?

Women of the community are involved in different activities of the initiative. For vine multiplication, 100 per cent women are involved. At initial level when vines are multiplied, they use to do intercultural operation for better management of that vine. Sometimes they sell the vine to the neighbour. Women are also involved in vine preparation for field cultivation. They process the vine in better way for cultivation purpose. Women play a vital role for cleaning and grading of sweet potato after harvesting. They do grading according to size, quality, colour etc. to get premium price. Cleaning and grading according to size measured by eye vision is very much important for sales purpose. In the study it is found that women play a vital role for sales of sweet potato in the absence of their husbands. They negotiate with the buyers and also handle money. But most of the women handed over the money to their husband.

Innovations

Different bio-fortification initiatives are present in Bangladesh and Orange Fleshed Sweet Potato is one of them. Involving 100 per cent women was an innovative approach of the initiative. The nursery owner and the root producer were the two different groups and only women were engaged in these groups. Introducing OFSP in local market as well as urban super shop was an innovative idea. With a proper market linkage it is possible to supply OFSP in the urban market and farmers can get more benefit from that. Two types of model was also an innovative approach. One approach was to public awareness and distribution in market both in rural and urban. The other approach was to creating awareness through school nutrition programme. In school days different types of foods were prepared from OFSP such as cake, bread etc.

Fragility

Generally sweet potato is considered as poor man's food in Bangladesh while it is considered as a main staple of many of the country like China, Philippine etc. The food is not commercially grown in Bangladesh as there is lack of demand in market. Farmers traditionally cultivate rice or other high value crops. There is no processing industry to process the food. So it is tough to make different types of food from OFSP. There is a requirement of processing industry. Government and private sectors should take different initiative to familiar the product as well as to aware on the nutritional benefits of the product. Area coverage of sweet potato production is not still very high to run a processing industry. More over the crop is seasonal and there is no storage capacity. But there is a scope of income generation by the poor farmer of the country after development of processing

industry. Private sector should take lead to develop a proper value chain of the fortified food.

Gender

In the value chain of the bio fortified OFSP, the nursery owners and the root producers were all women. The initiative highly encourages the women to concern them on nutritional message and also to generate income. Most of the women sold their product under the supervision of the project staffs but after completion of the project it was observed that they become trained on the technology and they also became familiar with the local market to sell their product in a fair price. In school nutrition programme the mothers are fully involved. The initiative is targeting the women as a farmer and tries to make them economically sustainable. It is also being conveyed the household level nutritional information among them.

Impact

Impact on value chain development:

It was observed that the scope of income generation of the poor women was increased through the initiatives. There was a good market linkage in between the sweep potato grower and the vendor. A local demand is created through the initiative and which has a positive impact to develop the market chain in the project area.

Impact on women empowerment:

Women of the community are being empowered through this initiative. They are being concerned about the health of their children. Simultaneously they are getting some benefit by producing vegetables in their homesteaded area.

Impact on School Attendance:

After discussion with parents and teachers groups it was found that the initiative has positive effect on school attendance of children that are enrolled in primary school. After the initiative the attendants remain almost 100 per cent. The students are very much interested about the mid day meal and it has a positive impact on going school regularly.

Impact on health:

From discussion with parents and teachers group it was found that the probability of disease is reduced after the school meal initiatives. Students are taking healthy meal regularly in their house in a disciplined way as the parents are aware of this after the initiative. This is making them healthier and this is also making a positive impact on their mental health.

Impact on awareness:

It was observed that the children are receiving nutritional message along with their daily academic learning. After discussion with the children it was found that they are being conscious about nutritional requirement of a child. On the other hand mother groups are also being aware about the nutritional requirement of their children.

Implications for policy makers:

Maestre *et al*. (2017) described different potential pathways for post-farm gate value chain interventions which can contribute in addressing nutrition for the poor. Those food value chains may be involve public and private sector enterprises, small and large firms, and social

protection programmes as well as commercial value chains. One pathway is by enhancing access to, and consumption of foods that are naturally rich in micronutrients such as OFSP. Creating and enhancing market based value chain was one the prime objective of the initiative. It was targeted to introduce OFSP as a fortified food for the students, the poor community, and also the urban community. There is lack of availability of the seed in the market and government should take initiative to make the seed available. It is necessary to develop proper marketing strategies to reach the poor.

The initiative creates a local demand for vegetable market where women are involved as a vegetable grower. It is necessary to empower the producer groups with the appropriate training on production technology of the bio-fortified crops. For selling the excess vegetables in the market it is also necessary to identify the proper market channel. There is a lacking of storage in the village level as well as gap on the transportation facilities to carry the product into available market. Government and private institutes should come forward to solve the problem. Processing industry should develop to process the orange fleshed sweet potato and to prepare various types of food from it.

GO-NGO level involvement is required for local level training and market linkage. Also some sort of initiative is required for the education and health improvement of the mothers' group.

Conclusion

Nutrients like vitamins and minerals are added to grain products primarily to prevent some disease. Fortifying wheat flour, maize flour, and rice is successful because it makes commonly eaten foods more nutritious without relying on consumers to change their habits. Bio fortification is also very much appreciated rather than adding the nutrients in the grains like rice or wheat. Enhanced nutrition makes stronger immune systems and improves growth and developments. Large scale extension of bio fortified Orange Fleshed Sweet Potato is required to reduce the nutrient deficiency of the vulnerable people of the country, especially the children.

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Annex 01.
Research questions:

- Who is the target for different food initiatives?
- Is it nutritionally vulnerable sections (children and/or adolescent girls)?
- How this targeting is achieved?
- Is it regularly consumed and sustainable? if not, how to make it sustainable?
- To what extent is the consumption adequate (quantity and frequency) to overcome nutrient deficiency? Is it sustained, and if not, how could it be made sustainable?
- Is there any preference by the consumer for the 'fortified' foods?
- What are the marketing strategies adopted to reach the poor (Distribution channels, Availability, Affordability and Pricing, Advertisements & promotions)?
- Is there any nutrition awareness strategy to increase the consumption? (community involvement, nutrition literacy and others) What initiatives are used to achieve this?
- What is the level of community involvement with food fortification initiatives? (Nutrition literacy and other)?
- Are there problems with signaling fortified foods from non-fortified alternatives?
- What are the advantages/disadvantages of the initiative over market-based approaches?
- Is there any rules/ regulations that are affecting the initiative positively / negatively? What new rules required?
- What are the existing regulations on selling the product in the market? If not any, what is required?
- Is there community participation for the initiative? How are women engaged?. If yes, what kind?
- What is the scope of improvement in the value chain (hygiene and food safety, cost effectiveness, increased outreach, and nutrient deficiency targeted distribution system)?

Annex 02.
Diagrams:

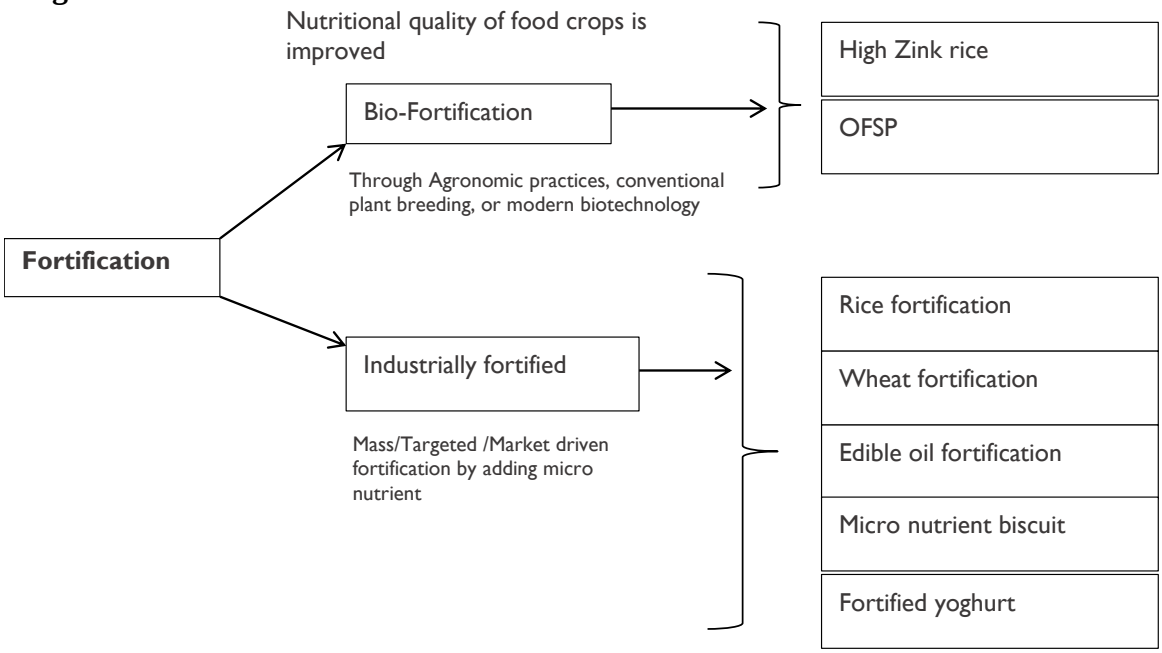

Diagram 01: Classification of fortification

Source: Authors' elaboration of
https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0ahUKEwiS4ouw9OLXAhUIso8KHaaHCbYQFggrMAA&url=http%3A%2F%2Fwww.who.int%2Fnutrition%2Fpublications%2Fguide_food_fortification_micronutrients.pdf&usg=AOvVaw2IpwR9ra8bwnVaaZTAkjLI, http://www.harvestplus.org/content/faq-about-biofortification And http://www.one.org/us/2015/08/17/this-orange-food-is-fighting-malnutrition/

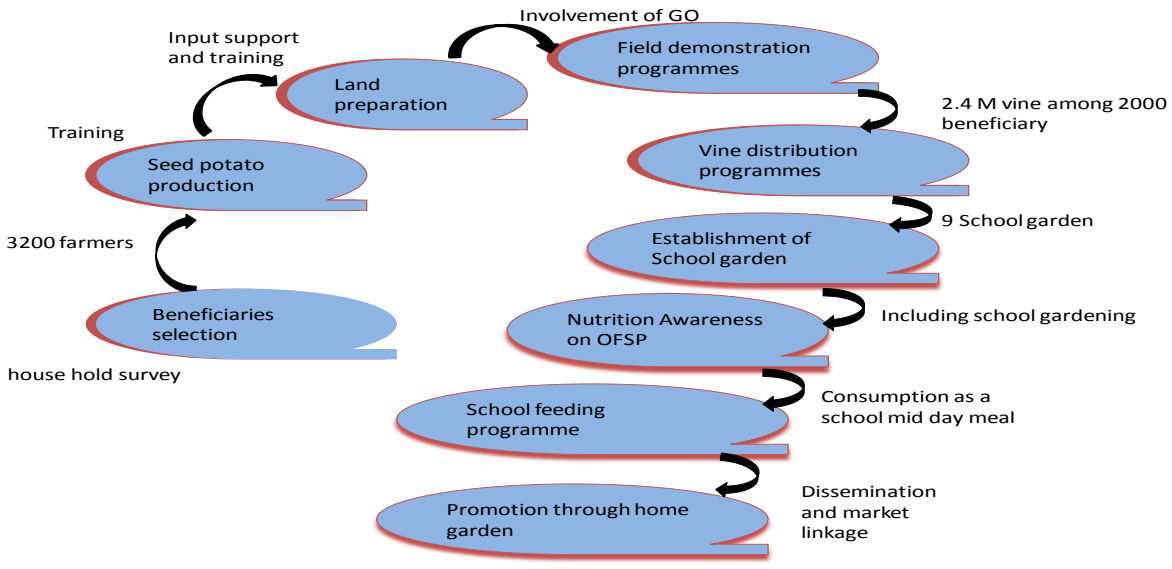

Diagram 02: Dissemination and distribution strategy of OFSP by the project
Source: USAID Horticulture Project

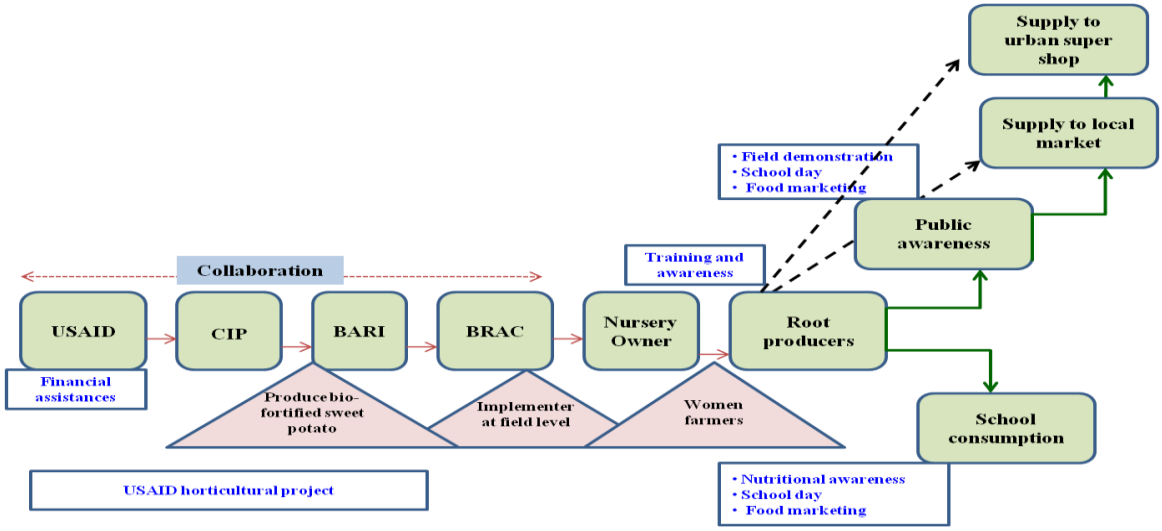

Diagram 03: Value chain for OFSP as a food fortification initiative in Bangladesh

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