Published with Open Access at Journal BiNET
Vol. 01, Issue 01: 01-13
International
Journal of Business, Management and Social Research
Home page: www.journalbinet.com/ijbmsr-journal.html

Potato Production and Management with Preference to Seed Potato Supply Chain, Certification and Actors Involve in Bangladesh

Siddique, M. N. A.[1], Sultana, J.[2], Huda, M. S.[3], Abdullah, M. R.[4] and Chowdury M. A.[5]

[1]Soil Resource Development Institute, Ministry of Agriculture, Bangladesh
[2]MSc in Organic Agriculture, Wageningen University, the Netherlands
[3]Bangladesh Agricultural Research institute, Gazipur, Bangladesh
[4]Dept. of Crop Botany, Bangladesh Agriculture University, Mymensingh, Bangladesh, and
[5]Energy and Urban Services Program, Practical Action, Bangladesh

ABSTRACT

Area coverage, production and yield of potato have increased in last few decades in Bangladesh. The average yield of potato is 18.08 t/ha. Its production can be increased up to 30-40 t/ha using high yielding varieties and improved production technology. Tuber Crop research Centre (TCRC) of BARI has so far developed 44 potato varieties which were selected from exotic varieties, foreign germplasm and germplasm developed in Bangladesh by introducing and crossing programme. The formal seed potato produced less than 10% seeds of the total requirement. But the supply of quality seeds through formal system is remarkably increasing. The seeds supplying through informal system is not recognized to be quality seeds because in the informal system seeds are not produced by following the steps of seed technology, rather tubers for food are used as seeds. The formal sector seed potato production is only 5-9% of the total requirement. The use of these poor quality seed is one of the major factors responsible for lower potato yield. Unless quality seed potato our challenge for achieving food security of the country cannot be fulfilled. In prioritizing different issues of agriculture, supply of high quality potato seed to the farmers should be essential concern. For increasing quality seed supply to the farmers, formal and informal sector need to work together with both contact grower and farmer level to produce seed potato by multiplication of foundation seeds or tissue culture seed or mini-tuber supply. The capacity and capability of both public and private sector should be strengthened for the improvement of seed potato system in Bangladesh.

Keywords: *Seed Potato, varieties, yield, supply chain, constraints and potentials*

Please cite this article as: Siddique, M. N. A., Sultana, J., Huda, M. S., Abdullah, M. R. & Chowdury M. A. (2015). Potato Production and Management with Preference to Seed Potato Supply Chain, Certification and Actors Involve in Bangladesh. *International Journal of Business, Management and Social Research* 01(01): 01-13.

Corresponding author email: biosinfonet@gmail.com (Siddique, M. N. A.)

I. Introduction

Most people in Bangladesh make their livings from the ever fertile flood plain land, either as smallholders with an average farm size of 0.76 ha (Ilangantilekel et al. 2000), or as landless agricultural laborers. The ever increasing demand for food for such a land scarce country has been addressed by agricultural innovations and crop productivity enhancement authority since last few decades. Food supply for the ever increasing population and poverty alleviation in the rural sector depends on increased productivity of major food crops such as rice, wheat and potato, using high yielding varieties (HYVs), irrigation, soil and pest-diseases management, and improved agro-techniques at farmers level by various researches and agricultural extension activities (Siddique et al., 2014 and Hossain et al., 2001).

Potato is the third most important crop in Bangladesh. In respect of nutrient, potatoes are comparable with rice and wheat. It can easily be digestible. Although potato is a temperate crop, it can be grown in most parts of the country during the winter season. Well fertilized, sunny weather with sufficient soil moisture is appropriate for potato plantation. The optimum growth and development require a temperature range of 15-21^{0} C. It is being cultivated in Bangladesh since 1960 from exotic varieties specially brought from the Netherlands. At present, potato is grown in about 4.61 lac hectares of land to produce 84 lac tons (Chowdhury and Hasan, 2013). The average yield of potato is 13.32-18.08 ton/ha (BBS, 2012, 2011). Its production can be increased up to 30-40 ton/ha using high yielding varieties and improved production technology (Chowdhury and Hasan, 2013). Moreover, in recent years, potato has become an important crop for food security, especially during extreme flooding during the monsoon. Potato is the only crop for which seed stocks are kept in cold stores ready for immediate planting after floods. Increased productivity of potato, even on a small scale, is possible with efficient management of available resources and good quality seed (Ilangantileke et al., 2000).

However, at present nearly 460thousand hectares (ha) of cultivable land is under potato cultivation and the country produced 8,326 thousand tons potato in the year 2010-2011 (BBS, 2012). The average yield of potato per ha is 13.32 tha^{-1} which is very low in comparison to other potato producing countries like 43.2 tha^{-1} in France, 44.7 tha^{-1} in Netherlands and 44.6 tha^{-1} in the USA in 2007 (Anonymous, 2008). Hossain *et al.* (2008) reported that the national average yield of potato is very low (19.07 tha^{-1}) compare to its potential yield 30-40 tha^{-1}, due to lack of quality seed, cultivation of indigenous potato (yield 5-7 tha^{-1}) and high price of quality seed. Bangladesh is the third largest potato producer in Asia and standing sixth in the world (FAO, 2010). Bangladesh experienced much progress in its potato production in the past decades; it has increased by 5 percent per annum.

In the scenario of Bangladesh, after the rice (Boro-irrigated rice, Aman-rainfed rice, Aus-short duration rice), potato is the second most important crop in terms of consumption in some parts of the country such as Munshigonj district. Recently, it has become important and popular food crop because of quick economic return and its multiple uses as vegetable and delicious processed items. Various processed produced like flakes, starch, chips and crips, frozen French fries, rings of potato are being produced at industrial level while chips, french fries, sun-dried products are produced at home-scale level (Hortex Foundation, 2011). Inspite of having great potential and scope, there are many challenges for successful production of potato in Bangladesh. In this regard, lack of good quality seed at affordable prices by small and marginal farmers is, however, a major constraint to increase productivity. Certified seed from the formal system meets only 5–10% of the total seed needs and its production through field multiplication takes a long time. Only elite farmers can afford this expensive certified seed. The balance of the seed requirement is supplied by the informal system that is managed

Corresponding author email: biosinfonet@gmail.com (Siddique, M. N. A.)

by seed producers, ware potato producers, and traders. Many farmers still use ware potato production technology for producing seed. Seed available through the informal system is of poor quality and of unknown origin and seed potato generation number. Most potato growers are unaware of an optimal management practices for seed production.

Considering the scope and limitation of potato for food security and poverty alleviation of rural people, this review focuses on area coverage, production, varieties grown and yields of potato in Bangladesh with special preference to seed potato sources, formal and informal seed production, certification and actors involve in Bangladesh.

II. Methodology

This non-independent review is compiled and prepared based on an earlier version of article which was presented at the Center for Development Innovation (CDI), Wageningen University, the Netherlands during May-June, 2014. Most of the information that is provided collected through internet, secondary source, personal communication and publications (annual reports, biennial reports, books, reading materials, newsletter etc.). The author made personal communication for information with Bangladesh Agriculture Development Cooperation (BADC), Tuber Crop Research Center (TCRC), Bangladesh Agriculture Research Institute (BARI) and Department of Agriculture Extension (DAE) of the Ministry of Agriculture, Bangladesh. All the sources are included in the reference section. The authors does not guarantee any specific sets standard and accuracy of information in terms of literature, time, statistics or any other content within or beyond this article.

III. Result and Discussion

Area coverage, potato production and yields in Bangladesh

Bangladesh has made remarkable progress in terms of area coverage, production and average yield of potato during the past decades.

Table 01. Area coverage, production and yield of potato in Bangladesh

Fiscal Year	Area ('000 ha)	Production Quantity('000 MT)	Yield/ha (MT)
2010-11	460	8326	18.10
2009-10	360	7124	19.79
2008-09	396	5268	13.31
2007-08	402	6648	16.53
2006-07	345	5167	14.98
2005-06	301	4161	13.81

Source: Statistical Year Book of Bangladesh, 2009 and Department of Agriculture Extension (DAE), 2011

It is evident from the Table 01 that potato production was 8.4 million MT from 0.46 million ha of area with an average yield 18.10 MT/ha in 2010-11 while the average yield was 13.81 MT/ha in 2005-06. Figure 01 is also showed that the gradual increase in yields, area harvest and production on a long term basis from 1961 to 2007. However, potato overall area coverage, production quantity have ups and downs trend during 2005-2011, and economic return also depends on total amount of annual production, price varies greatly in the market. However, the increase of yield in the recent years is mainly use of disease free seeds of

Corresponding author email: biosinfonet@gmail.com (Siddique, M. N. A.)

improved varieties, appropriate production technologies and different promotional campaign. Meanwhile, there is a large gap between average national yield of potato of Bangladesh compared to other potato growing countries of the world like the Netherlands, UK, France, USA and Germany. For instance, potato yield in UK is about 48 MT/ha (Hortex Newsletter, 2011), which is more than two and half times higher than that of Bangladesh. While on the other hand, compared to some developing countries the productivity of potato in Bangladesh is somewhat similar as shown in Figure 02. Figure 03 shows distribution and yield estimate of potato throughout Bangladesh in the country map.

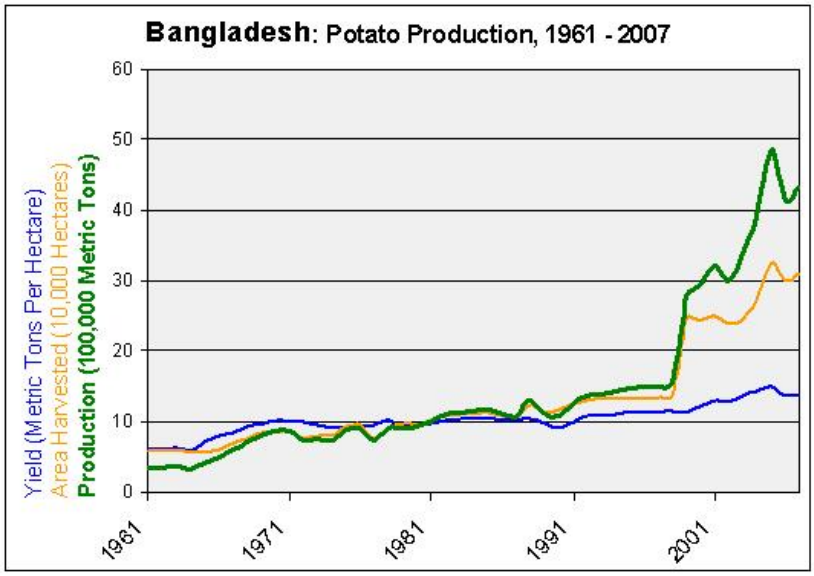


Figure 01. Long term potato yield, area harvested and production in Bangladesh (Source: World Potato Atlas, 2009)

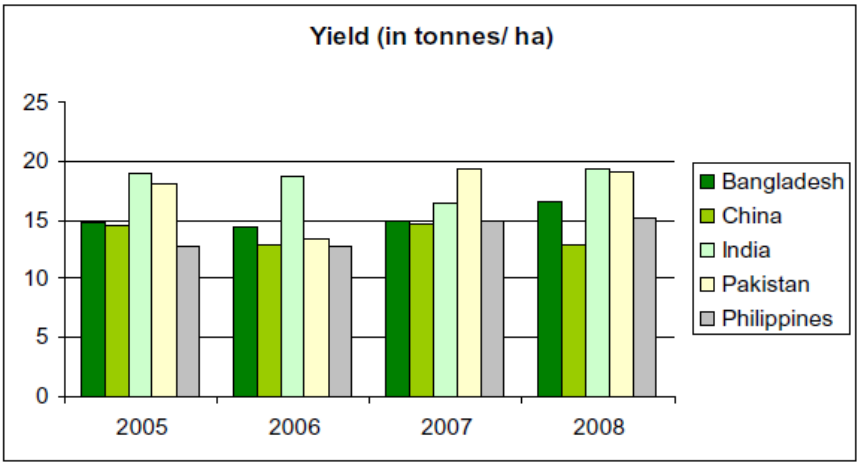


Figure 02. Potato yield of selected developing countries (Source: FAO Statistics, 2009)

Corresponding author email: biosinfonet@gmail.com (Siddique, M. N. A.)

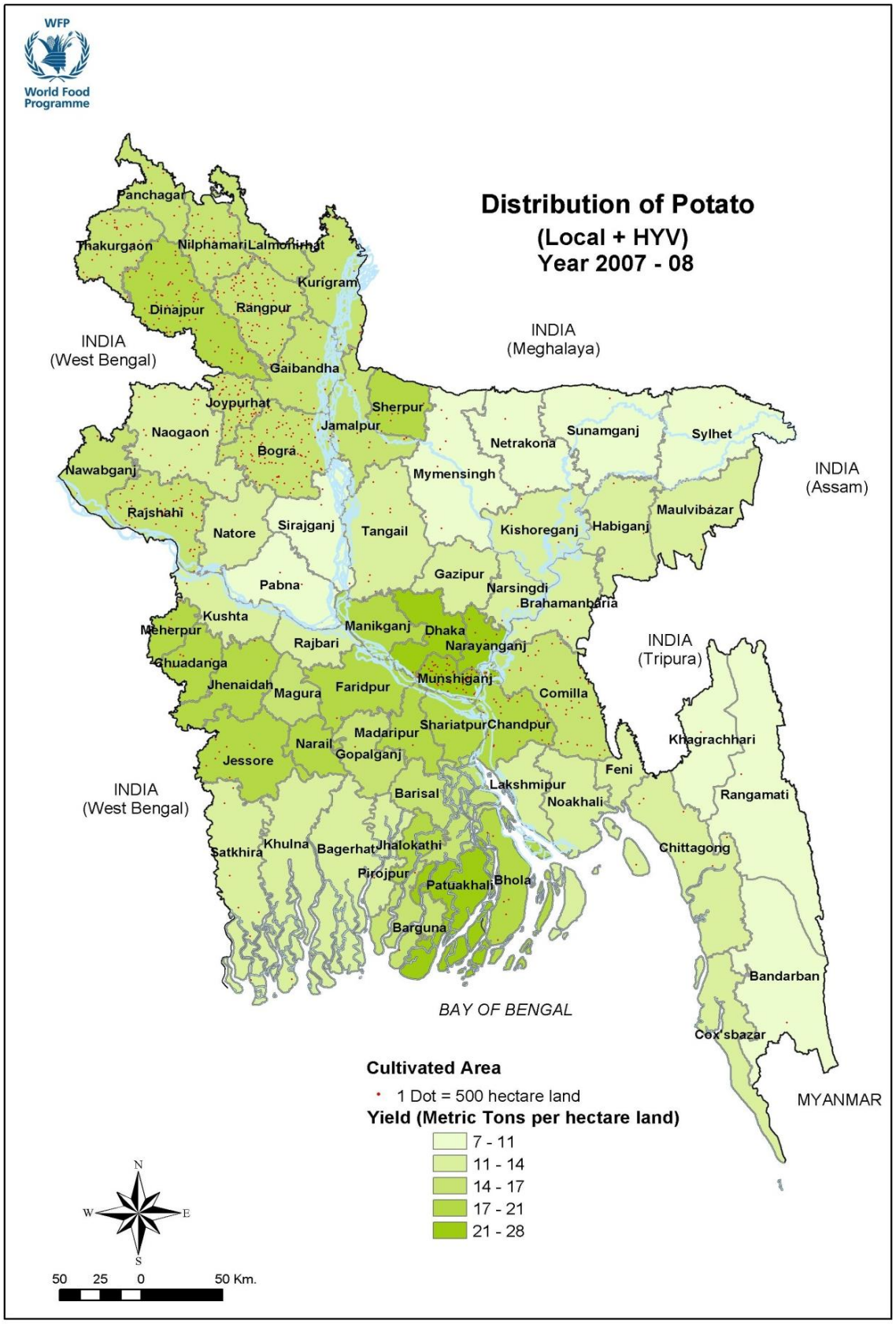
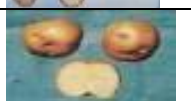


Figure 03. Distribution and yield of potato (Source: World Food Security Atlas, 2008)

Corresponding author email: biosinfonet@gmail.com (Siddique, M. N. A.)

Potato varieties grown in Bangladesh

Tuber Crop research Centre (TCRC) of BARI has so far developed 44 varieties which were selected from exotic varieties, foreign germplasm and germplasm developed in Bangladesh through crossing-breeding programme. The most popular and suitable variety is selected as per producers and end users requirement. Key features of 27 released varieties along with their important characteristics are given below:

Name of Variety (Year of Release)	Key Features	Tuber Yield	Introduced from	Crop
BARI Alu-5 Patrones (1993)	White skin Early maturing	25-30 t/ha	Netherlands	
BARI Alu-5 Multa (1993)	White skin Popular variety	25-30 t/ha	Netherlands	
BARI Alu-7 Diamond (1993)	Red skin Most popular variety	25-35 t/ha	Netherlands	
BARI Alu-8 (Cardinal) (1993)	Red skin Most popular variety	25-35 t/ha	Netherlands	
BARIAlu-10 (Kufri Sindhuri) (1993)	Red skin	25-30 t/ha	India	
BARIAlu-13 (Granola) (1994)	White, smooth skin, suitable for export.	20-30 t/ha	Netherlands	
BARIAlu-15 (Binella) (1994)	White smooth skin	25-35 t/ha.	Netherlands	
BARI Alu-16 (Arinda) (2000)	White smooth skin	25-35 t/ha	Netherlands	
BARI Alu-17 (Raja) (2000)	Attractive redskin, Substitute for local variety. Moderately resistant to late blight.	25 -30 t/ha.	Netherlands	
BARI Alu-19 (Bintje) (2003)	Pale yellow skin, Suitable for food processing.	20-25 t/ha.	Netherlands	
BARI Alu-21 (Provento) (2004)	Smooth skin, pale yellow flesh. Long dormancy period in natural storage.	25-35 t/ha	Netherlands	
BARI Alu-22 (Saikat) (2004)	Red pale yellow and flesh. Suitable for saline areas.	25-30 t/ha	CIP, Lima, Peru	
BARI Alu-25 (Asterix) (2005)	Smooth skin and pale yellow flesh. Suitable for food processing.	25-35 t/ha	Netherlands	

Corresponding author email: biosinfonet@gmail.com (Siddique, M. N. A.)

BARI Alu-26 (Felsina) (2006)	Smooth skin and pale yellow, flesh	25-35 t/ha	Netherlands	
BARI Alu-27 (Esprit) (2008)	White smooth skin and pale yellow flesh Suitable for food processing	25-35 t/ha	Germany	
BARI Alu-28 (Lady Rosetta) (2008)	Attractive yellow flesh and medium deep eye. Suitable for processing	25-30 t/ha	Netherlands	
BARI Alu-29 (Courage) (2008)	Attractive yellow flesh. Suitable for processing	20-26 t/ha	Netherlands	
BARI Alu-30 (Meridian) (2009)	White skin light yellow flesh	25-35 t/ha	Germany	
BARI Alu-31 (Sagitta) (2010)	White skin, oval shaped large size,	30-40 t/ha	Netherlands	
BARI Alu-32 (Quincy) (2010)	Red skin	30-40 t/ha	Netherlands	
BARI Alu-33 (Almera) (2011)	Pale yellow flesh	25-35 t/ha	Netherlands	
BARI Alu-34 (Laura) (2011)	Red skin, deep yellow flesh	25-35 t/ha.	Germany	
BARI Alu-35 (2012)	Developed in Bangladesh by crossing programme Tubers: yellow skin, oval shaped medium deep eye and light cream flesh	38-45 t/ha	Bangladesh	
BARI Alu-36 (2012)	Developed in Bangladesh by crossing programme Red skin, long oval shaped, medium to large size, shallow eye and light yellow flesh	34-42 t/ha	Bangladesh	
BARI Alu-37 (2012)	Developed in Bangladesh by Crossing programme. Yellow skin, oval to long oval shaped, medium size, shallow eye and light yellow flesh	38-44 t/ha	Bangladesh	
BARI Alu-38 (2012)	Brownish skin, oval to long oval shaped, medium size, shallow eye and cream colour, flesh	32-40 t/ha	Germany	
BARI Alu-39 (2012)	Brownish skin, oval to long oval shaped, medium to large size, shallow eye and cream colour flesh	30-40 t/ha	Netherlands	

Source: Chowdhury & Hasan, 2013.

Seed potato sources and actors involvement: formal and informal sector

At the rate of 1.5 tha^{-1}, seed potato requirement per year is approximately 0.7 million tons. Quality seed is the prime input for successful crop production. There are a number of actors involved in the supply of seed potatoes both from public and private sectors. The public sector

Corresponding author email: biosinfonet@gmail.com (Siddique, M. N. A.)

is trying to improve the seed quality through formal seed system and private sector is coming with added quantities with certified seeds and truthfully labeled seeds (TLS). Farmers are using 90% of the total requirement of which 66% are of no definite quality. Bangladesh Agriculture Development Corporation (BADC) has been supplying only 12,000 metric tons of quality seed-potato among the farmers as a whole against the annual demand of approximately 0.7 million tons at present. The sector wise present supply of seed potatoes in Bangladesh is presented in the Figure 04.

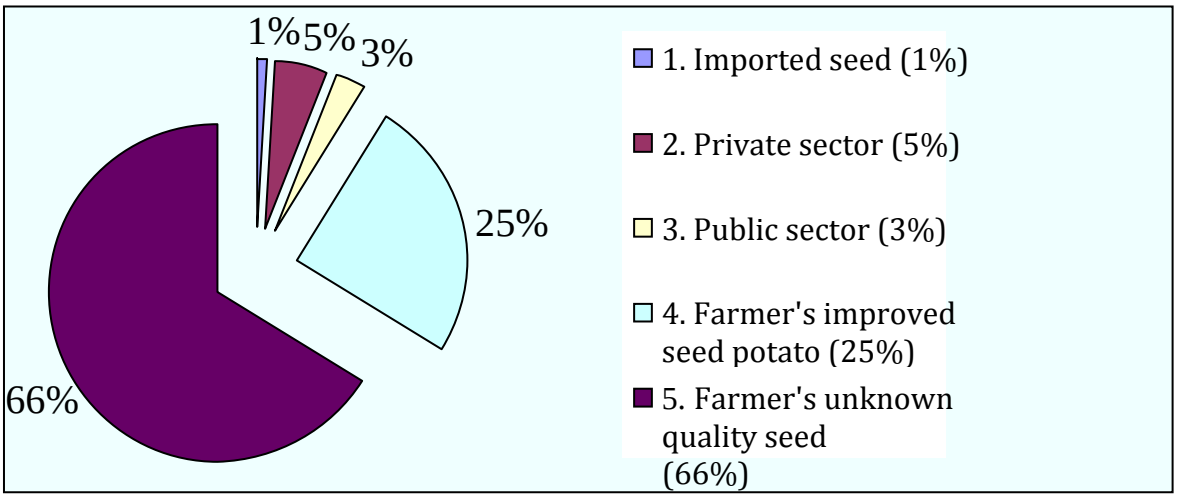


Figure 04. Estimation of seed potato supply in Bangladesh (adapted from Karim, 2009)

Both private and public sector together supply only 5% quality seed of the total requirement (Karim, 2009). Remaining 95% is the low quality seed potato which is produced by the farmers themselves. At first, seeds of modern high yielding varieties were imported from the Netherlands around 1960 and continued there after (Kadian *et al.* 2000).

Bangladesh has both formal and informal potato seed systems. In the formal seed system, high quality seed is produced in an organized program by multiplying disease-free planting material over several generations. The Tuber Crop Research Center (TCRC) maintains germplasm *in vitro* and produces breeder (pre-foundation) seed for Bangladesh Agriculture Development Cooperation (BADC), Ministry of Agriculture.

To avoid importing of seed potatoes from abroad, Tuber Crops Research Centre of Bangladesh Agriculture Research Institute (BARI) established a breeder's seed production farm at Debigonj, Panchagarh district and BADC established foundation seed production farm at Domar, Rangpur district.

Breeder seed has been mainly produced by the TCRC, while private sector breeder seed production is scare in Bangladesh. However, then breeder seed is distributed to BADC, NGOs and the private sector for further multiplication. The remaining breeder seed sold to the farmers. Breeder seed is planted at BADC seed farms for one or two multiplications before being supplied for certified seed production to contract growers. Certified seed produced and supplied by BADC is approximately 12,000 ton annually and meets about 5% of the total seed requirement. The existing sources of quality planting material produced by contract farmers and sold by the BADC are beyond the reach of poor farmers. The sale price of different categories of seed varies from US $0.16 to US$ 0.38.

Corresponding author email: biosinfonet@gmail.com (Siddique, M. N. A.)

BADC has been supplying only 12,000 metric tons of quality seed-potato among the farmers as a whole against the annual demand of 600000 metric tons at present (BADC Annual Report, 2011-12) which is only 5-6% of the total requirement of seed potato in Bangladesh. In general, the BADC price of certified seed is about 20–25% higher than for ware potatoes. Farmers who cannot afford or do not have access to BADC seed have no option left, but to turn to informal systems for their required see potato, which are mostly of poor quality. A majority of seed comes from this informal farmer seed system.

Apart from formal Govt. sector, there are success stories by contact growers supported by private sector in seed potato production such as KONIKA Seed Company, PADAKHP, BRAC, SYNGENTA Foundation, PRAN Agro Ltd. etc. For instance, a contact grower named 'Shawkat' began to produce seed potato. He enrolled with the Konika Seed Company as a contract farmer, and for the first time, received formal training in farming and agricultural practices. Working with Konika, he learned potato production techniques, including fertilizer application, irrigation scheduling, and harvesting time and techniques. He also learned about the benefits of crop rotation and how he could incorporate a three-month potato crop into his growing cycle and keep his land productive year-round (Chemonics.com, 2014).

Tissue culture/*In vitro* seed potato supply

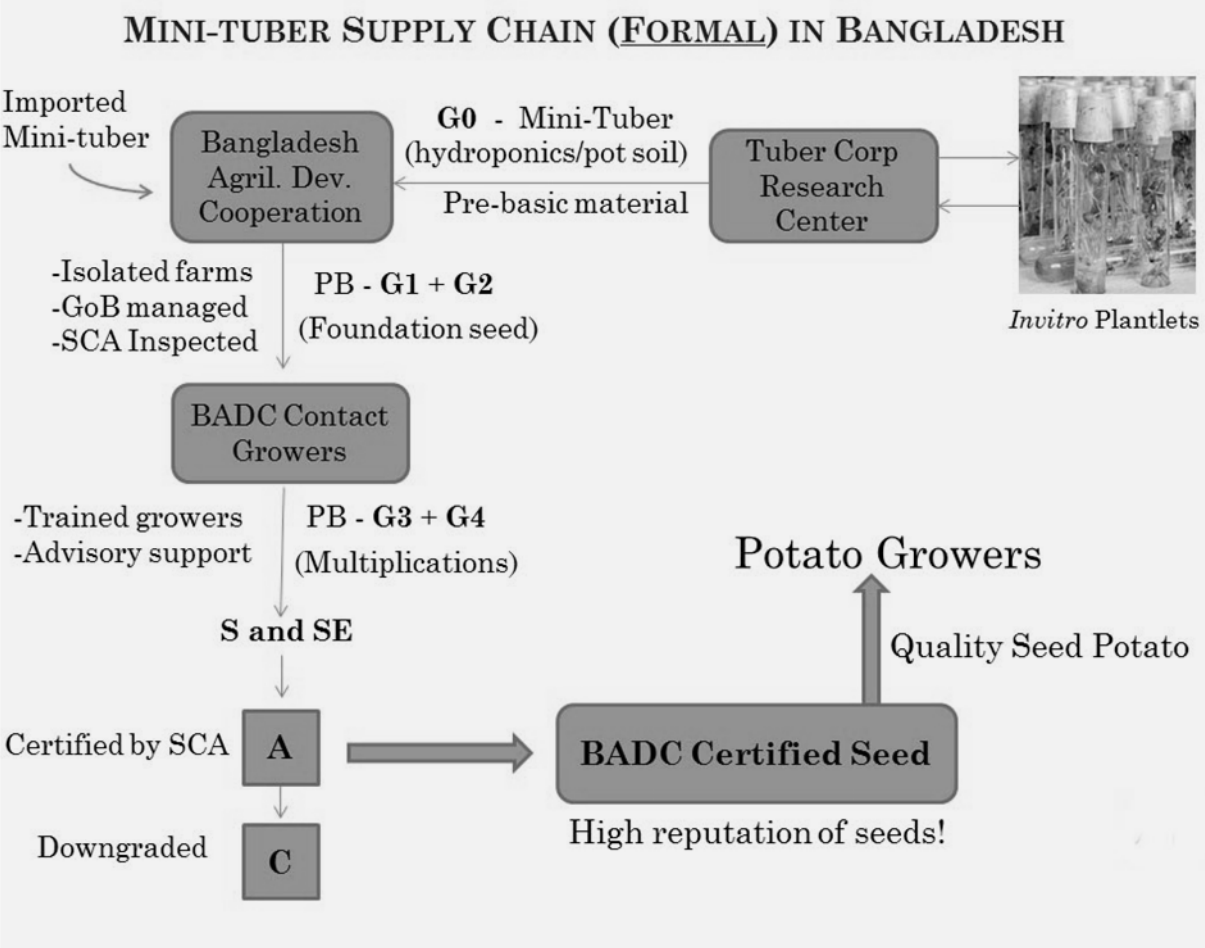
Horticulture Improvement Center under Bangladesh Agriculture Development Corporation (BADC) has taken step against the existing crisis of breeder potato-seed. They are expecting that it could be solved easily through successful expansion of tissue culture technology at the grassroots. BADC thinks there has been a bright prospect of enhancing the production of breeder seed through best uses of the innovated technology and the farmers have a vital role to make the prospect into realistic. Accordingly, BADC has undertaken a programme for producing 25,000 metric tons of seed-potato through applying tissue culture technology by 2012 in the country. To make the effort a complete success, two more tissue culture laboratories would be set up soon as mentioned by BADC officials.

While private sector such as The Bengal Seeds Company Limited has undertaken a program for producing 948 metric tons of different category seed potato through applying tissue culture technology during the current season and the plants are growing well. Apart from NGO like Bengal Seed Company, BRAC is also producing tissue culture plating materials of potato in Bangladesh.

Mini-tuber seed potato supply

There is a great potential of mini-tuber seed supply and multiplication in Bangladesh, whether from tissue culture or hydroponically produced pre-basic materials and or imported mini-tuber multiplication by contact growers or at farmer level through guided seed plot technique supported by Dept. of Agriculture Extension, Bangladesh. This approach could be also visible by private companies who have already established production of pre-basic seed potato and contact grower channel. Tuber Crop Research Center, Bangladesh Agriculture Development Corporation and Seed Certification Agency (SCA) of Bangladesh could play pioneer role to establish mini-tuber seed supply chain. Certified seeds of 'A' class and downgraded seed of 'C' class might be cheaply available during growing season if mini-tuber multiplication system become establish in Bangladesh at farmer level supported by DAE. Thus, a simplified schematic diagram is shown below for mini-tuber supply chain of formal sector:

Corresponding author email: biosinfonet@gmail.com (Siddique, M. N. A.)



'G0, G1, G2, G3……' means potato generations during seed multiplication stages, 'PB' means pre-basic seed potato, 'S, SE, A & C' means seed potato classes and 'SCA' means Seed Certification Agency.

Figure 05. Simplified schematic diagram of tentative mini-tuber supply chain for formal sector seed potato supplier in Bangladesh

Seed Certification system

The health status of the standing crops of BADC contract growers is monitored regularly. The quality standards have been established by Seed Certified Agency (SCA) of BADC for certified seeds procured from contract seed growers and sold to farmers.

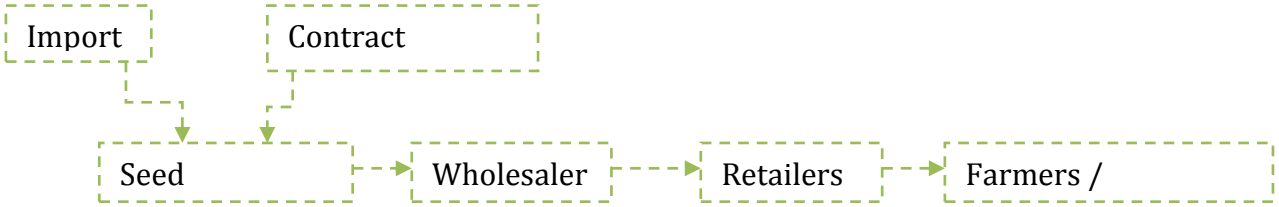
Seed Supply and Marketing Systems

There are three types of marketing systems in the seed sector in Bangladesh. Despite commercialization of agriculture still major amount of seeds are farm and or farmer saved seed. Firstly, farmers are the main source of seed production and its later availability. After fulfilling their own demand, farmers are generally producing and preserving more seeds which they sale in the local market during the growing season. Potato growers are buying seeds directly from seed producing farmers unless able to obtain better seed potato, thus there exist a farmer to farmer scenario.

Secondly, local seed traders are buying locally produced seed from the farmers and are selling the seed locally with some benefits.

Corresponding author email: biosinfonet@gmail.com (Siddique, M. N. A.)

The third system, structural or organized system can be divided into two sub-systems. One depends on import and other depends on local production. In the import based system of marketing distributors/importers are importing seeds directly from foreign countries such as Netherlands and making available to the farmers or seed users through whole-sellers and retailers. In the local production based system of marketing distributors/marketing organizations are producing seeds through contract farmers or procuring seeds from the reliable seed producers of selected areas, and after cleaning, grading and processing preserving in seed stores. These seed are made available to the farmers through whole sellers and retailers.



However, farmers usually collect seeds from various sources (such as formal and informal sector) and when required depending on socio-economic condition, quality, price and market availability. The intention is to try to get as better of quality of seed as possible for higher yield.

Actors in seed chain and their responsibility in Bangladesh

It is crucial to develop strong relationships between the public sector, private sector and leading NGOs for the production and diffusion of healthy seed of improved potato varieties.

Responsible actor manpower should provide intensive training on improved agro-techniques at seed production sites for seed/ware potato production to farmers, extension personnel, NGOs, and the private sector. Farmer field schools for integrated pest management presently operated by DAE, Developmental Organizations and NGOs in Bangladesh would be useful for disseminating proper seed flow management in the informal seed system.

Reduction of seed multiplication generations from six to two at government seed farms, followed by two multiplications in farmer's fields would be efficient. After two multiplications at the farm level, farmers can sell the produce as certified seed to other farmers to attain productivity.

Agriculture extension personnel and research organizations and or relevant authorities should conduct farmer participatory research to evaluate and diffuse improved technology for good quality seed production at the farm level in major potato growing areas of the country.

Major problems of potato sector in Bangladesh

Inspite of success in potato production during last few decades in Bangladesh, there still remains manifold problems in this sector. Lack of good quality certified seed at farmer level is a crucial reason for lower yield and potato diseased. BARI developed many potato varieties

Corresponding author email: biosinfonet@gmail.com (Siddique, M. N. A.)

but lack of high yielding varieties for processed products and export market is still missing. Lack of indigenous improved varieties has also become scare in the country. During harvesting season, due to lack of knowledge, high post-harvest spoilage is evidenced throughout the country; especially in the years when production is higher. For the potato growers high incidence of disease (late and early blight of potato, fusarium and brown rot, leaf roll virus, common scab, black heart, root knot etc.) and insect/pests (cut worm, aphids, tuber moth, cricket, leaf hopper etc.) still remain a drawback to attain maximum yield of potato. Other problems in potato sector are fluctuating price of potato in domestic and export market, and limited storage facility at public level and farmer level.

Strategies for intervention in potato sector of Bangladesh

Though there are lots of problem prevailing for the potato sector, strengthening capacity and capability of formal and private sector seed potato production to ensure certified and disease free seed would be a potential solution. Apart from this, strengthening potato research and development is also needed. Strengthening local quality potato seed production whether by formal and informal sector is very crucial to meet the demand of seed potato in Bangladesh. Other developments strategies are encouraging potato based processing enterprises**,** ensuring better extension services for adoption of modern technology by farmers and seed potato grower. Establishment of community based low cost cold storage facility at farmer's level**,** exploring new export market by the commercial counselor in Bangladesh Foreign mission, and campaign for more potato consumption should also be ensured by both govt. and private sectors.

IV. References

[1] Anonymous, (2008). International year of the world potato production. [www.potato2008.org/en/world/. Accessed 26 October 2011].
[2] BADC Annual Report, (2012). Bangladesh Agriculture Development Cooperation, Annual Report 2011-12. Dhaka, Bangladesh.
[3] BBS, (2012). Bangladesh Bureau of Statistics. Statistical Year Book of Bangladesh, Bangladesh Statistics Division, Ministry of Planning, Govt. of the People's Republic of Bangladesh.
[4] BBS, 2011. Bangladesh Bureau of Statistics. Vegetables Production Statistics, 2011. Dhaka, Bangladesh.
[5] Chemonics.com, (2014). Chemonics – an international development company. Potatoes "Seed" success story for Bangladeshi farmers. Accessed 28 May 2014. [http://www.chemonics.com/OurImpact/SharingImpact/ImpactStories/Pages/Potatoes-%E2%80%9CSeed%E2%80%9D-Success-for-Bangladesh-Farmers.aspx].
[6] Chowdhury, M. A. H. & Hasan, M S. (2013). Handbook of Agricultural Technology, Bangladesh Agricultural Research Council, Farmgate, Dhaka, 230p.
[7] DAE, (2011). Department of Agriculture Extension. Agricultural Statistics, Ministry of Agriculture, Kharmarbari, Farmgate, Dhaka.
[8] FAO, (2010). FAOSTAT. [http://faostat.fao.org/, Accessed July, 2010].
[9] Hortex Foundation, (2011). Horticulture Export Development Foundation, Newsletter, July-September, 2011. Dhaka, Bangladesh. [www.hortex.org]
[10] Hortex Newsletter, (2011). A quarterly publication of the horticulture export development foundation, Dhaka, Volume 11, Number 3, July-Sep. 2011. p.8
[11] Hossain, M., Dey, T. K., Akther, S., Bhuiyn, M. K. R., Hoque, M. A., Kundu, B. C., Hossain, M. A. & Begum, S. N. (2008). Activities and achievements of Tuber Crops Research

Corresponding author email: biosinfonet@gmail.com (Siddique, M. N. A.)

Centre at a Glance. Bulletin published by the Tuber Crops Research Centre, BARI, Gazipur, 23p.

[12] Hossain, M., Lal, B. M. & Chowdhury. A. (2001). Changes in agriculture and economy in the flood-prone environment in Bangladesh, 1998-2000, Workshop on Flood-prone Rice Systems held from 9-11 January 2001, at BRAC Center for Development Management, Rajendrapur, Gazipur, Bangladesh.

[13] Ilangantilekel, S. G., M. S. Kadian, M. Hossain, A. E. Hossain, U. Jayasinghe & Mahmood, A. A. (2000). Toward alleviating poverty of rural potato farmers by strengthening the potato seed system in Bangladesh: A rapid rural appraisal. CIP Program Report, 1999-2000. [http://www.cipotato.org/potato/tps/docs/32seedBan gldsh.pdf]

[14] Kadian, M. S., Ilangantileke, S. G., Jayasinghe, U., Hossain, A. E., Hossain, M & Babu, A. G. C. 2000. Potato seed system in Bangladesh and Srilanka. Proc. Of the Global Conference of Potato, held at New Delhi 6-11 December, 1999, Vol. 1. pp.690-697

[15] Karim, M. R. (2009). Seed potato production through tissue culture technology. In: Seminar program arranged by Bangladesh Agricultural Development Corporation, Dhaka.

[16] Siddique, M. N. A., Islam, M. M., Halim, M. A., Kamaruzzaman, M., Sultana, J. & D Karim, 2014. Mapping of site-specific soil spatial variability by geo-statistical technique for textural fractions in a Terrace soil of Bangladesh. Journal of Bioscience and Agriculture Research 01(01): 08-16.

[17] Statistical Year Book of Bangladesh (2009). Bangladesh Bureau of Statistics, Dhaka.

[18] World Potato Atlas, 2009. International Potato Center: World Potato Atlas. Accessed 28 May 2014.
[https://research.cip.cgiar.org/confluence/display/wpa/Bangladesh]

[19] World Food Security Atlas, (2008). World Food Programme, Roma RM, Italy.

Corresponding author email: biosinfonet@gmail.com (Siddique, M. N. A.)