Bangladesh

Groundnut

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Economic importance of groundnut

Groundnut is the third most important oilseed crop in Bangladesh grown in an area of 90,000 ha in 2010 with a production of 129,000 tons (Source: DAE 2012). However, the FAOSTAT data shows only an area of 33,500 ha and a much lower production. It is mainly consumed as roasted nut (*badam*) or as confectionery item. Limited amount of it is also used for extraction of edible oil used for cooking purpose and oil-cake is used as cattle feed. During 2000/01 to 2009/10, groundnut production increased at the rate of 5% per annum. High growth in groundnut production occurred as a result of steady increase in groundnut yield at the rate of 3.9% and increase in groundnut area at the rate of 1.1% per annum. The average yield in 2010 was 1591 kg ha^{-1}, an increase of 43% compared to the yield in 2001 (Source: FAOSTAT 2011). Groundnut is mainly cultivated in Char areas (riverbed or areas adjacent to river with sandy-loam soil type) that generally remain inundated with water during rainy season (June to September). Consequently, more than 90% of groundnut cultivation is in postrainy season.

The major groundnut growing districts in the country are Dhaka, Mymensingh (Dhaka Division), Comilla, Chittagong, Rangamati (Chittagong division), Sylhet (Sylhet Division), Jessore, Rajshahi (Khulna division) and Rangpur (Rangpur division). During 2007/08 to 2009/10, top five groundnut growing districts (Noakhali, Faridpur, Dinajpur, Dhaka and Chittagong) accounted for 58% of groundnut production and 60% of groundnut area in Bangladesh. The annual groundnut seed requirement is about 8958 tons; however, only 87 tons of seed is supplied by public sector agencies (BARI, BADC and DAE). Private sector is not engaged in groundnut seed production. Groundnut production has to be increased to meet the domestic demand and there is scope for area expansion by increasing cultivation in Char area.

Seed production target

Area: 33,591 in 2010 (Source: FAOSTAT 2012)

National production: 34,600 tons in 2000 and 53,461 tons in 2010 (FAOSTAT 2012)

Average yield: 1591 kg ha^{-1} in 2010

Proportion of production sold commercially: 90%

National demand: 225,000 tons (2015–17) as per the projection of IMPACT model

Expected growth in demand: 1.08% annually as per the IMPACT model projection

Target yield by 2015: 1.9 t ha^{-1}

Agroecology

The major groundnut growing districts fall in four agroecological zones:

Zone 3: Tista Meander Floodplain

Zone 7: Active Brahmaputra-Jamuna Floodplain

Zone 12: Low Ganges Floodplain

Zone 18: Young Meghna Estuarine Floodplain

These are characterized by Char areas, where soil is sand to sandy-loam. The Char areas have poor water-holding capacity and also very poor nutritional status. Most of the areas consist of riverbed and riverine region. Groundnut is the principal crop of Char land where other crops cannot survive due to moisture stress and it also prevents soil erosion as the Char lands are highly prone to soil erosion. Moreover, the Char areas are increasing as the river water is declining during winter and consequently new islands erupt in the riverbeds. In every 3–5 years, the Char area increases by 36,000 ha in the country and needs to be brought under crop production.

Dominant varieties

Dhaka 1 is the oldest (released in 1976) and dominant variety grown all over the country although several improved groundnut varieties were released in the country for cultivation in different regions. Other groundnut varieties released in Bangladesh are Dhaka 2 (1976), DG 2 (1979), DM 1 (Tridana) (1987), Jingbadam (1988), ICGS (E) 55 (1995), BARI Chinabadam 5 (1998), BARI Chinabadam 6 (1998), BARI Chinabadam 1 (2000), BARI Chinabadam 2 (2000), BARI Chinabadam 3 (2000) and BARI Chinabadam 8 (2006) (Source: Ministry of Agriculture, Bangladesh).

Key constraints

Lack of quality seed production and supply of cultivars of appropriate duration (mainly short-duration) and consequently cultivation of obsolete variety Dhaka 1 in large areas is one of the important constraints. Others include abiotic constraints like mid- and end-of-season drought, salinity, floods, excess moisture and humidity, extreme temperature, soil factors like erosion and poor fertility status coupled with low input use. Biotic constraints are foliar diseases (late leaf spot and rust), root rot, viral diseases, nematodes and insect pests. Socioeconomic constraints are lack of awareness on production technology among the farmer and trained manpower, lack of support price and marketing, and lack of storage facilities.

Strategic partners

The strategic partners and their role in the seed system are given in Table 1.

Capacity building needs (staff, infrastructure)

Training in groundnut breeding methodologies, seed production and molecular breeding (MAS and bioinformatics) is needed for national partners and women scientists need to be included in such training programs. Basic infrastructure facilitates to support seed production activities, phenotyping facilities for foliar diseases screening, and glasshouse facility for crossing programs are needed at Oilseeds Research Center, BARI, Gazipur.

Table 1. Strategic partners and their role.

Strategic partner	Role
ICRISAT	Project implementation, monitoring, coordination and reporting, NARES capacity enhancement [scientists, technicians, Department of Agriculture (DoA) and NGO staff and farmers]; generation and supply of genetic and breeding resources to NARES, preparation and distribution of farmer-friendly generic literature on farmer-preferred varieties (FPVs), integrated crop management (ICM) and basic seed production
Bangladesh Agricultural Research Institute (BARI)	Evaluation of FPVs in national testing system; facilitation of release of FPVs at national level; organization of breeder seed production for formal seed sector
Bangladesh Agricultural Development Corporation (BADC), BARI, Department of Agriculture Extension (DAE) and various NGOs involved in seed production and allied activities	Production and marketing of certified/truthfully labeled seed of FPVs
Farmers	Conduct of farmer participatory varietal selection (FPVS) trials and evaluation of varieties as per their preference, participation in formal and informal seed production and marketing

Special cultural/gender considerations

- Women are engaged in preparation and sale of groundnut-based food items for cash income to meet family needs. This activity helps to improve livelihoods of poor rural women in poverty-stricken Char areas. Large numbers of poor people employ themselves for selling roasted nut at places of mass gathering.
- Promotion of groundnut cultivation will enhance employment opportunities particularly for rural women by engaging them in local markets like selling roasted/slated groundnut and other local preparations.
- Increase in production would also increase the drudgery of women and hence there is need for varieties suitable for mechanical harvesting. Similar interventions are required at various stages of production, like weeding and harvesting that reduce drudgery for women, offering more time to pursue productive activities.
- In terms of seed storage options, women are in the forefront of adaptive research and they often make the hard decision of what to use for seed, and what to use as food to feed their children. This may be important especially for decentralized seed enterprises. Seed production and delivery approaches and tools that capture priorities from both male and female participants as well as giving them equal opportunities for participation, will be emphasized. A gender considerate skills and knowledge enhancement in areas of seed systems will facilitate an equitable participation of men and women.
- Participation and employment opportunities to women will be increased through their involvement in hand-sorting to remove *Aspergillus flavus* infected kernels.
- It is also proposed that the participatory monitoring and evaluation system will be guided by a performance measurement framework that integrates local and gender specific indicators for monitoring project outcomes.

Processing and storage requirements and market opportunities

Majority of the groundnut produced is used for food purposes in domestic markets. Demand for groundnut for food uses is expected to rise with increase in income and population. The groundnut export markets are yet to be opened-up in the country.

- Bangladesh imports groundnut oil and shelled groundnut on a regular basis. In 2008, Bangladesh imported 27 tons of groundnut oil spending US$ 100,000 (Source: FAOSTAT 2011). Bangladesh Bureau of Statistics (BBS) reported sudden jump in groundnut oil import in 2008–09 – that was the time when all edible oil prices experienced rapid increase all over the world. This implies one important fact that groundnut oil is well accepted by the Bangladeshi consumers, if available at a competitive price.
- Due to lack of knowledge and shortage of storage facility, farmers sell groundnut in the local markets at a cheap rate just after harvesting. Consequently groundnut farmers are deprived from actual price but the middlemen are benefited. Hence good storage facilities are needed.

Policies needed

The following policies are needed in the seed system:

Introduction of new varieties through farmer-participatory varietal selection (FPVS) and its recognition in formal release of a variety at state level, recognition of truthfully labeled seed produced through informal seed systems, market-price determination based on aflatoxin content, easy access to credit for small-scale farmers, enhanced subsidy on agricultural machinery required for groundnut cultivation including sprinklers for irrigation, and quality seed supply.

Key issues for competitiveness (ie, reducing production costs, increase market value)

- Quality seed production and supply of new improved varieties
- Cultivation of short-duration, drought tolerant and disease resistant high-yielding genotypes
- Cultivation of varieties with special confectionery traits will increase the market value of the produce
- Adoption of ICM practices that include use of inputs like fertilizers to increase net returns
- Suitable machinery for various small-scale field operations in groundnut to reduce the cost including portable sprinkler irrigation sets

Mechanization as it relates to timely planting/harvesting and processing

Farmers still use indigenous equipment for sowing and other operations up to harvest. But in some areas where road communication is developed, small-scale machinery like power tillers are used. Specially designed seeder-cum-fertilizer applicator may enhance timely planting. Portable sprinkler irrigation will help to increase the yield of groundnut in Bangladesh. Other farm machinery include groundnut digger suitable for dryland conditions, seed drill, thresher and decorticators at affordable or subsidized price. Technologies/equipment for tasks that women do to reduce drudgery are also needed.

Environmental/sustainability issues

No negative environmental/sustainability issues are associated with groundnut cultivation. Being an energy rich crop (high oil content), it harvests more carbondioxide (CO_2) from the environment for the same level of economic yield than non-oil crops. Groundnut ensures systems sustainability by supporting livestock. Groundnut haulms provide nutritious fodder thus improving livestock productivity. It ensures sustainability of rainfed cropping system by fixing biological nitrogen. Diseases and insect pest tolerant varieties require minimum pesticide use.

Monitoring and evaluation

It includes annual in-country review and planning meeting, visits to partner locations during the cropping season, farmer–scientist interaction meeting to assess impact, gender disaggregated focus group discussion with all value chain stakeholders to gauge preliminary impacts/constraints of the project, and conducting workshop with partners to share findings of reports, field-level interactions, etc.

Seed production plan

Groundnut seed roadmap for Bangladesh is presented in Table 2.

Table 2. Groundnut seed roadmap for Bangladesh[1].

Ecology[2]	Demand (ha)	Variety characteristics: Productivity traits	Variety characteristics: Market traits	Promising varieties	Seed available in 2012 (breeder and foundation seed) (t)	Seed production (t): Breeder seed	Seed production (t): Foundation and Certified seed	Seed to reach 20% adoption (t)	Seed production goal (t) for Year 3	Key partners
Zone 3, 7, 12 and 18 characterized by Char areas with sand and sandy loams	90,000	Drought tolerant, short duration, foliar fungal disease tolerant	Medium bold seed	BARI Chinabadam 4 BARI Chinabadam 8	11 6	42	340	2700	2700	Production: Breeder seed by BARI; foundation and certified seeds by BADC, BARI, DAE, NGOs Distribution: BADC, DAE, NGOs

1. Seeding rate: 150 kg pods per ha.
2. Zone 3 = Tista Meander Floodplain; Zone 7 = Active Brahmaputra-Jamuna Floodplain; Zone 12 = Low Ganges Floodplain; and Zone 18 = Young Meghna Estuarine Floodplain.

Chickpea

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Introduction

Chickpea is one of the important food legumes of Bangladesh. The area and production of chickpea has declined because of high emphasis on enhancing area and production of staple cereals like rice, wheat, maize and other short-duration oilseed crops. There is increasing concern about the sustainability of high input, cereal-dominated cropping systems in Bangladesh. Crop diversification with legumes can help in improving soil fertility and system productivity. Chickpea is one of the most important pulse crops in Bangladesh considering consumers' choice and consumption. It has been traditionally cultivated in Bangladesh under rainfed condition.

In the early 1980s, area of chickpea was about 113,000 ha and production 87,000 tons. Major chickpea producing districts are: Faridpur, Madaripur, Chapainawabgonj, Jessore, Jhenaidah, Magura, Narail, Patuakhali, Rajshahi and Natore. These districts cover 69% of chickpea area and 70% of chickpea production in the country. Most of these areas belong to the Agroecological Zones 11 and 12. The soils of these areas are moderately drained heavy structured clay-loam. The top five chickpea producing districts (Rajshahi, Faridpur, Barisal, Jessore and Jhenaidah) account for about 50% of area and production of chickpea in the country. Average yield of chickpea in Bangladesh is about 1200 kg ha^{-1}. The domestic demand of chickpea exceeds the local supply and the deficit is met through import. Bangladesh imported on an average 80,000 to 100,000 tons (valued at US$ 40 million to 55 million) chickpea per year during 2007 to 2012. Bangladesh imports chickpea mainly from Canada and Australia. However, there are good opportunities to expand area and production substantially with adoption of improved varieties and crop management practices. Chickpea area and production in Bangladesh are given below.

Average area: 7,000 ha (DAE 2012)

Average production: 9,000 tons (DAE 2012)

Average yield: 1200 kg ha^{-1} (DAE 2012)

Proportion of production sold commercially: 10–75%

Dominant varieties

Bangladesh Agricultural Research Institute (BARI), Joydebpur and Bangladesh Institute of Nuclear Agriculture (BINA), Mymensingh have released 16 chickpea varieties for cultivation in different regions of the country. BARI Cholla 5 (released in 1996), BARI Cholla 3 (released in 1993), BARI Cholla 9 (released in 2011) and local varieties are popular among farmers. BARI Cholla 8 is the only kabuli variety (released during 1998) which was popular at the initial time, but due to susceptibility to *Helicoverpa* pod borer and botrytis gray mold (BGM) it lost its importance. ICRISAT has been working in close collaboration with BARI and the breeding material supplied by it has led to release of six cultivars.

Potential for chickpea cultivation in Bangladesh

Cropping system in Bangladesh is mainly rice based where chickpea is grown in the postrainy season, mainly in two cropping systems: rice/jute (April–August)–fallow (August–October)–chickpea (November–April); and rice (July–December)–chickpea (December–April)–fallow (April–June). The

period from November to April is considered optimal for chickpea; thus about 60–65% of chickpea is grown during this period. In the second cropping pattern, chickpea sowing is delayed until rice harvest. However, mid-November is considered to be the optimum time for sowing chickpea in Bangladesh, except in the Barind tract. Some chickpea genotypes have capacity to tolerate drought and in that case sowing time can be delayed. However, late sowing caused drastic reduction in yield and net profit compared with timely sowing. BINA Cholla-4 can be sown up to early December under rainfed condition for better yield but the seed size is small. BARI Cholla-9 has also the late sowing potentiality.

Chickpea has proven to be very suitable to grow after rice in the Barind region of Bangladesh. About 800,000 ha land of the high Barind tract in Northwestern Bangladesh can be brought under chickpea cultivation. Relatively less humid climate in the Barind area is not favorable for *Helicoverpa* pod borer infestation and BGM infection which are major problems of chickpea cultivation in Bangladesh. On-farm trials have shown that yield of chickpea can be increased through the use of seed priming technique. The seed priming process involves soaking the seeds overnight (for about 8 h), surface drying them and then sowing the following day. Seed priming was evaluated in many locations (farmer-managed trials) in the high Barind tract over four years (1998–2002). Seed priming raised yields by 22 to 48% (from 1.1 to 1.6 t ha^{-1}) and reduced the risk of crop failure by half. The major constraint to adoption in the Barind area of Bangladesh is non-availability of quality seed and lack of knowledge of improved crop production technology. Pod borer infestation and BGM infection is relatively low in the Barind area due to less humid climate, so there is a scope to bring 0.8 million ha land of the high Barind tract in Northwestern Bangladesh under chickpea cultivation.

Preferred traits and qualities of chickpea

In Bangladesh chickpeas are consumed in various forms and are subjected to primary processing, ie, dehulling, splitting, grinding, parching and roasting. Consumers of chickpea are sensitive to quality characteristics depending on the use. Kabuli chickpeas are mostly consumed as dried whole seed cooked separately or combined with other ingredients. Kabuli chickpeas are differentiated on the basis of seed color (beige or cream) and larger seed size. Large seed is preferred and fetches higher price. The other preferred qualities are cream color, uniform size and thin seed coat. Desi chickpeas are consumed in different forms – fresh green seed, dried whole seed, roasted and puffed, roasted and split (*phutdna dhal*), splits (*dhal*) and flour (*besan*). Splits and flour are the most common forms of consumption (70–75%) followed by whole seed (15–20%). Green immature chickpea is used as vegetable. Large seed, light brown or golden yellow color, thin seed coat and good water absorption capacity are the preferred qualities. Desi type chickpea is more preferred by the Bangladeshi consumers than kabuli type due to its red-brown seed coat.

Target yield and beneficiaries

Target yield by 2016: 1600 kg ha^{-1} in project locations Rajshahi, Chapainawabgonj (33% increase)

Target beneficiaries by 2016: >100,000 (This will be achieved by coordinated approach among research stations, DAE, BADC and NGO partners)

Key constraints to production

- Abiotic: Drought, temperature extremes, poor soil fertility and boron deficiency
- Biotic: Fusarium wilt, BGM, collar rot, dry root rot, pod borer and pulse beetles

- Socioeconomic: Low profit and high risk, limited inputs, lack of cash and credit, lack of storage system and knowledge of advanced storage technique, and lack of support price and marketing

Strategic partners

Bangladesh Agricultural Research Council (BARC), BARI and BINA are the major organizations for agricultural research and management, while Bangladesh Agricultural Development Corporation (BADC), Department of Agricultural Extension (DAE) and NGOs are involved in transfer of technology and developmental activities. Further details on role of partners are given in Table 1.

Table 1. Role of strategic partners in research and development of chickpea in Bangladesh.

Partner	Role
ICRISAT	Project implementation, monitoring, coordination and reporting; NARS capacity enhancement [scientists, technicians, Department of Agriculture Extension (DAE) and NGO staff and farmers]; generation and supply of genetic and breeding resources to NARS; preparation and distribution of farmer-friendly generic literature on farmer-preferred varieties (FPVs); integrated crop management (ICM) and basic seed production
Bangladesh Agricultural Research Institute (BARI)	Evaluation of FPVs in national testing system; facilitation of release of FPVs at national level; organization of breeder seed production for formal seed sector
BADC, BARI, DAE and NGOs	Production and marketing of certified/truthfully labeled seed of FPVs, dissemination of technologies and allied activities
Farmers	Conduct farmer participatory variety selection (FPVS) trials, evaluation of varieties of their preference and participation in formal and informal seed production and marketing

Major initiatives

The Government earlier launched a Crop Diversification Program (CDP) with the assistance of CIDA. BARI established a Pulses Research Centre (PRC) located at Ishurdi that focuses on pulses research.

NARS capacity building needs

The chickpea improvement program is very weak in Bangladesh. It needs to be strengthened with trained staff and by development of basic infrastructure facilities.

Special cultural/gender considerations

Women farmers play an important role in Bangladesh agriculture, including production and processing of food legumes. Participation of women farmers in various activities needs to be ensured. Women remain conservative due to the prevalent social system and are not engaged in field work. However, after harvesting, most of the work is carried out by household women.

Possible interventions to increase production and productivity

- Increased productivity through adoption of improved varieties and crop production practices.
- Increasing area through utilization of fallow lands and introduction of chickpea in new cropping systems.
- Inclusion of early chickpea variety in between transplanted aman–boro cropping pattern.

Institutional and technical innovations

Some innovations required are:

Strengthening research for chickpea improvement and development of improved crop production practices; strengthening seed production and delivery systems; and strengthening of extension services to enhance awareness of farmers for improved cultivars and production technologies.

Processing and storage requirements and market opportunities

Seed processing and storage facilities need to be strengthened at the research stations. Knowledge empowerment of women farmers is needed in safe storage of seeds and grains. Due to lack of knowledge and shortage of storage facility, farmers sell chickpea in the local markets at a lower price just after harvesting. Consequently, chickpea farmers lose their valuable seeds and are deprived of good price. Hence, knowledge about seed storage needs to be provided to the farmers.

Key policies (recently implemented/needed) to promote legumes in the country

Policy support from Government is needed for encouraging crop diversification, increasing cropping intensity and seed production and marketing of pulses.

Key issues for competitiveness (ie, reducing production costs, increase market value)

Some key issues are the development of improved cultural practices and promotion of high-yielding and moisture stress tolerant cultivars preferred by the market and which can be afforded by the farmers. Chickpea must fit in the rice–rice and rice–fallow cropping system so that farmers can get an additional crop. The present level of profitability of alternative postrainy season (*rabi*) crops is high and thus farmers may not grow chickpea replacing other postrainy season crops. Bangladesh needs early-maturing, large-seeded desi chickpea varieties having erect plant type, BGM and pod borer tolerance. There is a need for appropriate value addition activities and quality seed production and supply of improved high-yielding varieties.

Some new areas for research intensification

- Disease and pest monitoring and management research in addition to identification of resistant sources.
- On-farm research to identify new cropping pattern involving pulses.
- Identification of potential areas and limiting factors for pulses and find their solution.
- Identification of innovative and beneficial farmers' practices on pulses and validate them.
- Identification of breeder seed production so that BADC and private seed companies/NGOs can multiply the seed of new varieties to meet the demand.

Special cultural/gender considerations

Women farmers play an important role in Bangladesh agriculture, mostly in postharvest processing of food legumes. The active participation of women farmers in various activities has to be ensured. In terms of seed storage options, women are in the forefront of adaptive research and they often make the hard decision of what to use for seed, and what to use as food to feed their family. Seed production and delivery approaches and tools that capture priorities from both male and female participants as well as giving them equal opportunities for participation will be emphasized. A gender considerate skills and knowledge enhancement in areas of seed systems will facilitate equitable participation of men and women.

Environmental/sustainability issues

Being a high protein rich crop, chickpea harvests more carbondioxide (CO_2) from the environment for the same level of economic yield than non-legume crops. Chickpea cultivation ensures sustainability of rainfed cropping system by fixing biological nitrogen. Disease and insect pest tolerant varieties require minimum pesticide use. No negative environmental/sustainability issues are associated with chickpea cultivation.

Monitoring and evaluation

- Annual in-country review and planning meeting
- Monitoring visits during the cropping season
- Farmer–scientist interaction meeting to assess impact
- Workshop with partners to share findings

Seed production plan

Chickpea seed production plan for Bangladesh is given in Table 2.

Table 2. Seed roadmap for chickpea in Bangladesh[1].

Ecology	Demand (ha)	Variety characteristics: Productivity (t ha^{-1})	Variety characteristics: Type	Promising varieties	Seed currently available (Breeder + Foundation) (t)	Production: Breeder seed (t)	Production: Foundation + Certified seed (t)	Seed to reach 30% adoption (t)	Seed production goal (t): 2012	Seed production goal (t): 2013	Seed production goal (t): 2014	Key partners (seed production and distribution)
Rainfed	4,480	2	Desi	BARI Cholla 5	15.00	0.94	93.14	94.08	18.82	28.22	47.04	BARI, BINA, BU, BADC, DAE and NGOs
Rainfed	350	2	Desi	BARI Cholla 9	1.30	0.07	7.28	7.35	1.47	2.21	3.68	
Rainfed	70	2	Desi	BARI Cholla 3	0.06	0.02	1.45	1.47	0.29	0.44	0.74	
Rainfed	1,400	2	Desi	BINA Cholla 4	3.30	0.29	29.11	29.40	5.88	8.82	14.70	
Rainfed	700	2	Desi	BU Cholla 1	1.85	0.15	14.55	14.70	2.94	4.41	7.35	

1. Seeding rate 70 to 120 kg ha^{-1} (depending on seed size).