SEED QUALITY

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Concept

The quality of seeds is considered as an important factor for increasing yield. The use of quality seeds helps greatly in higher production per unit area to attain food security of the country. Quality seeds have the ability for efficient utilization of the inputs such as fertilizers and irrigation. Well thought policy, planning, congenial regulatory system, facilities for capacity and structural improvement both in public and private sectors are required for production, processing, preservation, and distribution of sufficient quantity of quality seeds in time to the farmers.

Seed

Seed may be defined as "Structurally a true seed is a fertilized matured ovule, consisting of an embryonic plant, a store of food and a protective seed coat, a store of food consists of cotyledons and endosperm"

However, from the seed technological point of view seed may be sexually produced matured ovule consisting of an intact embryo, endosperm and or cotyledon with protective covering (seed coat). It also refers to propagating materials of healthy seedlings, tuber, bulbs, rhizome, roots, cuttings, setts, slips, all types of grafts and vegetative propagating materials used for production purpose.

Thus seed is the most vital and crucial input for crop production, one of the ways to increase the productivity without adding appreciably to the extent of land now under cultivation by planting quality seed.

Difference between seed and grain

Seed	Grain
It should be a viable	Need not be a viable
It should have maximum genetic & physical purity	Not so
Should satisfy minimum seed certification standards	No such requirements
Treated with pesticide /fungicide to protect seed against storage pests and fungi	Not treated with any chemicals, since used for consumption
Respiration rate and other physiological and biological processes should be kept at low level during storage	No such specifications
Production is technically organized	Not so
It should satisfy all the seed quality attributes	No need

Quality Seed

Quality seed is defined as varietally pure with a high germination percentage, free from disease and disease organisms, and with a proper moisture content and weight.

Quality seed insures good germination, rapid emergence, and vigorous growth. These aspects translate to a good stand (whether greenhouse or field). Poor quality seed results in "skips," excessive thinning, or yield reductions due to overcrowding, all of which diminish profitability.

Importance of quality seed

1. Seed is a vital input in crop production;
    - It is the cheapest input in crop production and key to agriculture progress.
    - Crop status largely depends on the seed materials used for sowing
    - Response of other inputs in crop production depends on seed material used
2. The seed required for raising crop is quite small and its cost is so less compared to other inputs
3. This emphasis the need for increasing the areas under quality seed production
4. It is estimated that good quality seeds to improved varieties can contribute about 20-25% increase in yield.

The advent of modern plant breeding methods and biotechnological advances in seed industry plays a significant role in developing of high yielding varieties and hybrids.

Benefits of using quality seeds

1. They are genetically pure (true to type).
2. The good quality seed has high return per unit area as the genetic potentiality of the crop can be fully exploited.
3. Less infestation of land with weed seed/other crop seeds.
4. Less disease and insect problem.
5. Minimization of seed/seedling rate i.e., fast and uniform emergence of seedling.
6. They are vigorous, free from pests and disease.
7. They can be adopted themselves for extreme climatic condition and cropping system of the location.
8. The quality seed respond well to the applied fertilizers and nutrients.
9. Uniform in plant population and maturity.
10. Crop raised with quality seed are aesthetically pleasing.
11. Good seed prolongs life of a variety.
12. Yield prediction is very easy.
13. Handling in post-harvest operation will be easy.
14. Preparations of finished products are also better.
15. High produce value and their marketability.

Factors affecting seed quality

Seed quality is determined by a number of genetic and physiological characteristics. The genetic component involves differences between two or more genetic lines, while differences between seed lots of a single genetic line comprise the physiological component.

The genetic factors that can influence quality include:

- Genetic make-up
- Seed size
- Bulk density

The physical or environmental characteristics include:

- Injury during planting and establishment
- Growing conditions during seed development
- Nutrition of the mother plant
- Physical damage during production or storage by machine or pest
- Moisture and temperature during storage
- Age or maturity of seed.

Deterioration in seed quality may begin at any point in the plant's development stage from fertilization onward. Seed quality depends upon the physical conditions that the mother plant is exposed to during growth stages, as well as harvesting, processing, storage and planting. Temperature, nutrients and other environmental factors also affect seed development and influence seed quality.

High quality seeds are the result of good production practices, which include:

- Proper maintenance of genetic purity
- Good growing conditions
- Proper timing and methods of harvesting
- Appropriate processing during threshing, cleaning and drying
- Appropriate seed storage and seed distribution systems.

Structural concept of seed quality

Knowledge about the various quality aspects of seeds greatly contributed to agricultural development in the past and will continue to play a major role in future enhancement of crop production. Seed quality is a multiple concept comprising several components (Thomson, 1979). The components are divided in four major groups:

i. Genetic quality
ii. Physical quality
iii. Physiological quality
iv. Pathological quality

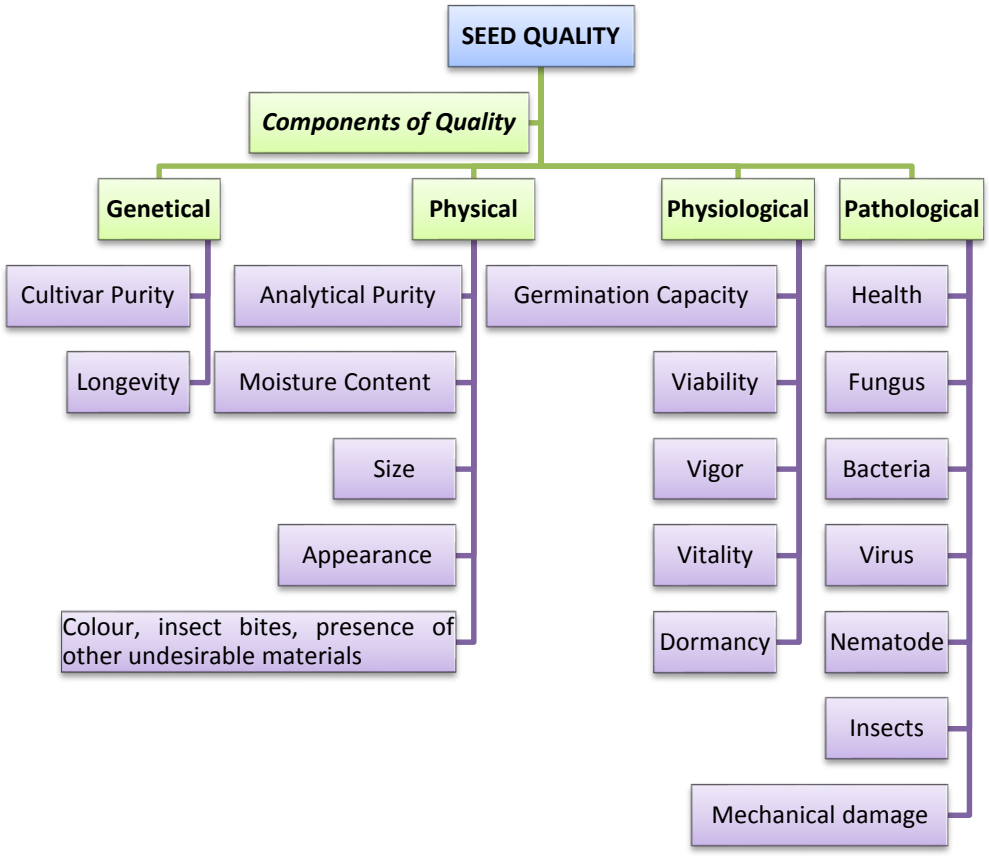

Fig. A structural concept of seed quality (Huda, 2001)

Genetic attributes of seed quality

Seed of the same variety: Within crops (species) such as maize, rice or groundnuts there are thousands of distinct kinds of these crops. These distinct kinds of the particular crop are referred to as varieties or cultivars. Plants produced by seeds of a variety present the same characteristics and that these characteristics are reproducible from a generation to another. The definition of a cultivar is an assemblage of cultivated plants which is clearly distinguished by any characteristics (morphological, physiological, cytological, chemical or others) and which, when reproduced (sexually or asexually) retains its distinguishing characters.

There are modern varieties that are the result of plant breeding and varietal development programmes, multi-location trials, national variety release systems and formal seed production systems. Another kind of crop varieties are traditional varieties (landraces) that are produced and conserved by farmers which can be local population of plants selected by farmers or sometimes are modern varieties that were released many years ago.

Seed of different varieties of the same crop are often difficult or impossible to distinguish once it is harvested. Mixing of different varieties of the same crop or species can occurs when the grain/seed is sold and it enters into the formal and informal marketing system.

A mixture of varieties can be a problem because:

- Mixed varieties may mature at different times which lead to problems in harvesting, postharvest handling, and results in lower yields.
- Additionally, each seed of an undesired variety in a mixture will produce seed when it is planted and those seeds will produce more seed so that each year the proportion of the undesired variety becomes greater.
- Field inspection followed by roguing (removal of undesirable plants) during the growing period of the seed crop is one of the steps taken to insure varietally pure seed in certified seed.

However, it must be pointed out that traditional varieties or landraces particularly of cross pollinated varieties used by subsistent farmers are often populations of plants that are not very uniform. This heterogeneous character can be an advantage in some circumstances of low rainfall, low fertility and pest and disease pressure. In other situations such as seed for bean in Burundi, farmers prefer to plant a mixture of several different kinds of beans.

Adapted to the local conditions: The length (days) of the growth cycle is a critical characteristic in particular for rainfed crops so that they mature while there is sufficient moisture for grain filling. Adaptation to soil, soil fertility, diseases, pests, day length, and moisture regimes are all important characteristics of a crop variety. Plants will grow well and produce an abundance of seed only in the proper environment. It is difficult to anticipate how a variety will respond to a different agro-ecological zone until it is actually grown there. Therefore variety trials are important as they establish the recommended zones of adaptability for varieties. Though earlier maturing varieties may be of interest to farmers in drought condition it is not always the best option. For example bird attacks on the maturing grain of varieties that mature earlier than the conventional longer duration variety can be quite severe and discourage farmers from planting early maturing varieties.

However, when early maturing varieties must be grown, there are some varieties of some crops tolerant to bird damage to minimize the effect of this pest e.g. in rice, sorghum etc.

For early maturing varieties it is also possible to delay the planting so that the maturity of the crops corresponds with later maturing varieties in order to spread birds' damage over the entire crops of the area. It is also important to note that crop adaptation has a limit and it is wrong to believe that a variety can do well under all growing conditions. This should be kept in mind as we proposed new varieties to farmers during emergency operations.

Proper characteristics for use: A crop must have the right organoleptic characteristics and this refers to processing, cooking, colour, and taste characteristics that are compatible with local preferences. Farmers have rejected many new varieties because of poor taste or cooking and processing factors. In addition aspects other than the edible grain may be important since the plant may be used for other purposes after harvest, such as the stalks being used for building material or fodder. Also the choice of variety should take into consideration, the crop architecture suited to local agronomic, particularly harvesting practices e.g. an otherwise good dwarf varieties have been rejected because of the back-breaking nature of its harvesting, especially when the farmer's holding is large and there is no machine power.

Pest and disease tolerance: Tolerance to pests and diseases (biotic factors) means that a plant can live with these organisms without significant loss of yield and quality.

Obviously tolerance to important diseases and pest is extremely important and a major objective of plant breeders. Disease and pest resistance is considered absolute resistance to damage by the organisms. Tolerance and resistance can breakdown with time due to mutations in the parasites or hosts. New sources of resistance and tolerance are always being sought by plant breeders. Having precise information on disease and pest tolerance of a variety is important when considering the introduction of new crops and varieties.

High yielding ability: High yielding ability is linked to a range of plant characteristics including plant architecture, nutrient use efficiency and factors mentioned above i.e. adaptation to local conditions, pest and disease tolerance etc. Higher yields mean more food and income for farmers. With resource poor farmers it is important that the high yield can be achieved under low input conditions (minimal or no fertilizer and pesticides) or with the use of organic or mineral soil amendments.

However, emergency operations should not be used for providing untested new crop varieties to farmers. Observing good farming practices in terms of land preparation, sowing time, weeding, soil fertility management and water management, and avoiding postharvest loss, are important for high yield.

Physical attributes of seed quality

Physical seed quality refers to the percentage of pure seed of the right crop in a seed lot; sometimes seed size is also accounted for. It is measures by some components viz. Analytical purity, moisture content, size, appearance, colour, insect bites, and presence of other undesirable materials.

1. Analytical purity

Analytical purity also called physical purity, indicates how much of the sample consist of seed of the species being tested and how much contamination of in the form of other seed and inert matter is present (Wingell, 1983).

It is essential to have specific information on purity about the seed lot such as:

a) species purity
b) presence of obnoxious weed seed
c) inert matter

Pure Seed: The pure seed shall refer to the species stated by the sender, or found to predominant in the test, and shall include all botanical varieties and cultivars of that species.

Other Seed: Other seeds shall include seeds and seed like structures of any plant species other than of pure seed.

Species purity: When it is desirable to avoid contamination of one crop species by another similar type, a larger sample is examined and the number of seeds of the species is counted. The result is then expressed as the number of seeds in the weight of seed examined, e.g. two per kg. (Thomson, 1979).

Obnoxious weed: There are some species of weeds which are not universally present on all farm and which one established are difficult to eradicate. Weeds of this kind are described as obnoxious weed. Certified seed should be free from them. It is expressed by number in the weight of seed examined. (Thomson, 1979 and ISTA, 1985).

Inert Matter: Pieces of broken or damaged seed one half of the original size or less, straw, chaffs, stone, dust, nematode, gall, dead or living units, ergots etc. i.e. materials which have no life and which are not considered as seed of any plants are separated as inert matter (Thomson, 1979 and ISTA, 1985). And percent by weight is calculated.

2. Moisture Content

A seed can be regarded as a structure composed of complex substances such as cellulose, starch, fat and protein, with some water (Thomson, 1979). The moisture content of a sample is, either, the loss in weight when dried, or the quantity of water collected when it is distilled. It is expressed as a percentage of the weight of the original sample. It is the chief reason that causes loss of viability. It is generally assumed that the high respiration at high temperature is related in some way to rapid loss in germination (Harrington, 1972.).

3. Size

Seed size is usually expressed as the weight of thousand seeds. Alternatively, though less precisely, it may be expressed as weight of seeds that can be contained in a certain volume, such as a hectoliter (Thomson, 1979). Seed size can also be indicated by grading through different mesh sizes of sieves. Uniformity of size is of importance for several reasons. It can influence the effectiveness of seed cleaning operations. More important, uniform size makes uniform size makes uniform growth of the seedlings, so that the growth of a plant is not retarded by shading effect of a larger neighbour. It enables a mechanical drill to distribute the seed more evenly in space and depth (Thomson, 1979).

Physical quality parameters such as seed uniformity, extent of inert material content, and discoloured seed can be detected by visually examining seed samples.

Closely examining handfuls of seed is the first step to better understanding the quality of seed that are being provided to farmers and it gives the first but not the only opportunity to decide seed cleaning needs.

Physiological Quality

Physiological quality refers to the ability of a seed to germinate and includes components like germination capacity, viability, vigour and characteristics related to dormancy.

1. Germination capacity: Germination in a laboratory test is the emergence and development from the seed embryo of those essential structures which for kind of seed being tested, indicate the ability to

develop into a normal plant, under favourable condition in soil (ISTA, 1985). The germination capacity of a lot is the percentage by number of pure seeds, which produce seedlings in a laboratory test (Thomson, 1979).

The first thing in crop cultivation is that seed must germinate. A seed without viability is no seed and in no way can be used for crop production. Germination of seed should be as such which can ensure establishment of optimum plant stand for desirable production.

2. Viability: Viability means that a seed is capable of germinating and producing a "normal" seedling. Therefore, it is used synonymously with germinating capacity. In this sense, a given seed is either viable or non-viable, depending on its ability to germinate and produce a normal seedling; thus, only seed lots representing populations of seeds may exhibit levels of viability.
In another sense viability denotes the degree to which a seed is alive, metabolically active, and possesses enzymes capable of catalyzing metabolic reactions needed for germination and seedling growth.

However, a quality seed must have viability.

3. Vigor: Vigor has been defined as that condition of active good health and natural robustness in seed which upon planting, permits germination to proceed rapidly under a wide range of growing conditions (Woodstock, 1969). It has also been defined as the potential for rapid uniform germination and fast seedling growth under general field conditions (Ching, 1973). The following conceptual parameters have emerged which clarify the meaning of vigor in terms of seed, seedling and plant performance (Copeland, 1976):

a) Speed of germination;
b) Uniformity of germination and plant development under non-uniform condition;
c) Ability to emerge through crusted soil;
d) Germination and seedling emergence from cold, wet, and pathogen-infected soil;
e) Normal morphological development of seedlings; and
f) Storability under optimum or adverse conditions.

The germination capacity of a seed lot indicates its ability to establish seedlings in good field conditions; vigor indicates its ability to do so in stressed conditions. The germination figure may, therefore, include seeds of insufficient vigor which may not be suitable for good establishment on the farm (Thomson, 1979).

4. Dormancy: The inability of a viable seed to germinate even under suitable conditions is called seed dormancy.

The ability of seeds to delay their germination until the time and place are right is an important survival mechanism in plants. Seed dormancy may be a complex and puzzling challenge to the seed analyst and the seed researcher, but it is the method through which plants are to survive and adapt to their environment.

Pathological Quality

Pathological seed quality refers to the presence or absence of plant disease in or on the seed i.e. seed health.

Seed Health

Health of a seed refers to the presence or absence of disease causing organisms, such as fungi, bacteria and viruses, and animal pests such as eelworms and insects, on or in the seeds but physiological conditions such as trace element deficiency may be also involved (ISTA, 1985).

Associate Organisms:

Five groups of organisms commonly associated with seed cause diseases and damages to seed, seedlings and crops. They are:

a. Fungi
b. Bacteria
c. Viruses
d. Nematodes and
e. Insects.

Some other diseases of seed result from efficiencies of plant nutrients and from undetermined causes. Mechanical damages also impair seed quality (Alice and Charles, 1961; and ISTA, 1985).

a. Fungi: The fungi may play a vital role in influencing the keeping quality of grains and seed. Nearly 150 species of fungi have been found associated with cereal seed of various kinds.

Association of fungi in grains is likely to be greater in region where wet season prevails at the time of harvest or atmospheric humidity remains high during the maturity of seed because of the proximity of the region to the sea shore (Dharamvir, 1974). Improper store management and crop husbandry increase prevalence of fungi (Henderson and Christensen, 1961).

Fungi affect yield, germination, color and odor.

b. Bacteria: Many of the bacteria that cause diseases in cereals are seed-borne such as bacterial wilt of corn (*Bacterium stewartii*), halo blight of oats (*Pseudomonas coronafaciens*) and bacterial blight of oats (*Xanthomonas translucens*). The bacterial diseases occur most frequently in areas where high humidity or wet weather prevails during the time heads are formed (Kreitlow *et al.*, 1961).

c. Virus: Barley stripe mosaic or false stripe is one of the few virus diseases of cereals known to be seed-borne. Infection has resulted on reduction in yield of 75 percent in wheat and 64 percent in barley (Kreitlow *et al.*, 1961).

d. Nematode: Most grain nematode diseases are associated with soil infection, but several are seed borne. They include the white tip disease of rice and nematode disease of wheat and rice (Kreitlow *et al.*, 1961). Ufra disease of broadcast Aman rice as well as transplanted Aman and Boro is caused by nematode and yield is affected sometimes drastically (BRRI, 1980).

e. Insect: Every minute of the day and night billions of insects are chewing, sucking, biting and boring away our crops, livestock, timbers, garden, mills, and warehouse (Haeussler, 1952).

Seed suffer in qualitative and quantitative loss during storage due to several biological factors, insect sharing major claim (Yadav, 1983).

The insects found most commonly in stored are rice weevil, granary weevil, lesser grain borer, angoumois grain moth, cadelle, saw toothed grain beetle, flat grain beetle, flour beetle, bruchid beetle, dermestids, bruchids, several bean and cowpea weevils, Indian meal moth and almond moth (Henderson and Cristensen, 1961).

f. Mechanical damage: If the seed is subjected to an impact during harvesting, threshing, cleaning and packaging there may be fracturing of parts of the embryo or cracking, chipping, or flaking of the seed or seed coat. These injuries are damaging because they provide entry for pathogenic and saprophytic microorganisms. The latter may decay the seed after planting, or deprive the seedling of nutrients from cotyledons. Under humid condition invasion by microorganisms becomes serious and moldy-seed commonly results. Seed which is infected but not decayed at the time of planting may decay in the soil (Baker, 1972).

Germinability of machine threshed seeds decreased faster and resulted in fewer living seeds at 80%, 85% and 90% relative humidity than hand threshed seeds. This decrease was not marked at 75% RH for machine threshed seed (Kulik, 1973).

Quality seed system in Bangladesh

Seed More than 160 different crops are grown in Bangladesh, the yield of almost all crops are low as compared to the yield of the other countries. Lack of supply of quality seeds is one of the important limiting factors, only 18% of the total requirement of the quality seeds are supplied by the public and private organizations, 82% of the seeds are produced traditionally by the farmers are of very poor quality.

Seed quality is assessed by purity, germination and moisture content of the seed lot. Seed health is not considered. Facilities for seed quality testing are available in a very few private companies, none of them have seed health testing facility. Most of the private seed companies test their seeds from SCA, SPC or BADC. Truthfully labeled seeds (TLS) are in the top of the list of seed supply by the companies, the quality of which is supposed to be equivalent to certified seeds. But the farmers are not happy of the quality of the TLS available in the market as its performance is not satisfactory.

Seed replacement rate

The quality seeds of popular high yielding or hybrid varieties are the good seeds preferable to the farmers for cultivation. The productivity in agriculture will increase many-fold if replacement bad seeds are replaced by the good seeds. The farmers will be very encouraged and benefited by replacement of the bad seeds by the good seeds. It may be mentioned here that, the seed replacement rate has increased greatly with the introduction of hybrid seeds particularly maize, vegetables and rice. The seed replacement rate is also considerably increased in jute and wheat mainly because of availability of quality seeds of improved varieties. Since the quality of farmer's saved seed is poor, the availability of quality seed will not only improve seed replacement rate but also help saving of seeds by using lower dose of seed per unit area. The seed replacement rate of oilseeds like mustard, groundnut and soybean are considered to be much higher mainly because of making availability of quality seeds of these crops by public sector seed enterprise the BADC. The seed replacement rate of potato is also high due to supply of sufficient quantity of quality seed potato by both public and private sectors. The role of cold storage is most important and essential for maintaining seed potato quality. The BADC as well as many private seed companies have their own cold storage facilities, some private seed companies and few financially solvent farmers can avail the facility to store their seed potatoes in cold storage. But resource poor farmers' don't have such facility and can't avail the cold storage facility to store their seed potato.

Once the farmers get the seeds of a high yielding variety from the seed organizations, they cultivate it, produce seed and store for reuse in the next season. Most of them rarely come for replacement of the seed stock until the yield potential of that cultivar declined remarkably. The advanced big farmers sometimes contact the seed organization for replacement of their seed stock by the good seeds or the seeds of a new variety.

Seed replacement rate is around 25-35 % in rice which is higher (55%) in wheat. In case of maize the seed replacement rate is maximum which is more than 99% as the farmers used to buy the hybrid seeds this crop from the seed companies. The seed replacement rate was only 1.155 in 2005-2006 which increased to 13.14% in 2007-2008.

Similarly, the seed replacement of oil seed crops tend to increase from 2.95% in 2005-2006 to 10.22% in 2007-2008. (Table 13)The seed replacement rate is steady in vegetables; 29-36% of the total requirement of seeds is replaced by the quality seeds supplied by the seed organization. Around 4-6% is the seed replacement of potato. Seed replacement rate is highly unsatisfactory in spices.

Seed Requirement and Supply

The public sector like BADC, DAE, BARI, BRRI and BJRI produce the seeds in their own land or in the field of contract growers following the seed certification procedure and are known as formal seeds. Similarly the seed supplied by the seed companies and NGOs are also formal seeds. A portion of the formal seeds like the hybrid seeds of rice, maize, and vegetables, and HYV seeds of spices, potato and jute are imported by both public and private sectors. The seed production and distribution system in the public and private seed companies are mostly organized and formal system.

Another source of seed supply is the informal seeds produced by the farmers and preserved traditionally in their own land. These seeds are never being subjected to any quality test and seed production procedure is not applied. The informal seeds are of bad quality.

Four hybrid varieties (three from India and one from China were first introduced in Bangladesh in 1998. As of 2008 a total of sixty hybrid rice have been released in Bangladesh, out of which 57 hybrids in private sector, one in public sector (BADC) and two hybrids developed by BRRI. The hybrid seeds of maize and sunflower have been introduced in Bangladesh in 1980.

At present about 18% of the total requirement of seed of different crops is met up by the formal seed system and the remaining 82% comes from the informal system which includes farmers' saved seeds. Approximately 99% of the requirement of pulses seed is fulfilled by the farmer seeds; less than 1% of the total requirements are supplied by BADC. The supply of potato seeds by public sector is only 2%, the remaining 98% of the total requirement are met through private sectors and farmers own seeds. Around 50% of the total seeds of different vegetables are supplied by different seed companies.

The requirement of rice seeds varies 303875-306840 tons of which 117985-122985 tons are supplied by the formal sectors in the three rice growing seasons. Out of requirement of 37000-37500 tons in aus season only 4690- 4885 tons seed are supplied by the formal sector; in amon season supply is 36600-40700 against the requirement of 167875-168000 tons; and in boro season supply is 72400-77400 tons while the requirement is 99500-102400 tons.

Requirement of wheat seeds is 69600-70800 tons and the corresponding supply is 39200-41050 tons. But in case of wheat seed, its requirement and supply has been decreasing remarkably may be due to diversion of wheat area to other high value crops.

Supply of maize seeds is nearly equal to the requirement of about 4970- 6800 tons annually. The supply of maize seed is quite high mainly because of hybrid seeds which are imported by private sector seed companies. Some minor cereals like barley, sorghum, foxtail millet etc. are cultivated on the marginal lands and are quite important. But there is no organized supply of seed for these crops. Farmers keep seed and use it for cultivation.

Only 2808-3280 tons seed of pulses are supplied by the formal system against the requirement of 20965- 21370 tons per year. Although a very small quantity of pulse seed is supplied by BADC but sometimes the seeds is remained unsold. The maximum quantity (above 90%) of pulse seed is used by farmers' own saved poor quality seed.

Requirement of oil seeds is 14450- 15000 tons and the supply is only 1477 - 1982 tons.

About 930-1438 tons of vegetable seeds are supplied by the formal system, the requirement is 2600-2620 tons. The supply of potato seed is 22500-39686 tons against the requirement of 600000 tons. Minimum quantity, 384-496 tons seed of spices are supplied by the formal sector whereas its requirement is 137000-153462 tons per year.

Many farmers buy jute seed, as it is difficult to preserve jute seed with their own initiative. The area of jute cultivation is decreasing, as its cultivation is not profitable in the context of emergence and increased popularity of synthetic fibre. As a result the requirement of jute seed might also be decreasing in the future. Cotton seeds are supplied only by the Cotton Development Board (public organization). Around 125-184 tons certified seeds, 49-69 tons Foundation seeds and 5-6 tons Breeder seeds are produced and supplied by the Cotton Development Board (Table 15). Tobacco seeds are supplied by the private tobacco companies. There is also no organized seed supply system for sweet potato and aroids.

Public seed agencies and infrastructure

Ministry of Agriculture (MoA)

The Ministry of Agriculture looks after all the activities related to seeds through its Seed wing. Preparing, adopting and administrating policies, acts, rules and regulations related to seed activities are the jobs undertaken by the ministry. Different statutory organizations and bodies such as National Seed Board, Seed Certification Agency are the implementing organizations of the seed legislations.

Seed Wing (SW)

Seed Wing established in the year 1992 under the Ministry of Agriculture to assist the government in handling the seed activities of the country. Director General is the head of the Seed Wing assisted by one Chief Seed Technologist and two Assistant Seed Technologists. The responsibilities of the Seed Wing are

a) help update policies and plan strategies for the development of the seed industry with special attention given to promoting private sector seed enterprises and to ensure implementation of such policies and strategies;
b) monitor development and commercialization of the seed sector;
c) oversee and co-ordinate the production of breeder and foundation seed by public and private seed enterprises to meet farmer's demands;
d) promote human resource development in the seed sector through training, seminars and workshops;
e) develop a permanent cadre of trained and experienced seed technologists in public sector institutes to ensure sustained growth of the seed industry;
f) plan and promote seed technology research in the NARS, BAD and the private sector;
g) plan and implement a seed security system including maintenance of buffer stocks of seeds.

The Seed Wing should provide technical assistance and other support/services to promote the development of a private sector seed industry.
National Seed Board (NSB)

The aim of the National Seed Board is to advise the Government on matters arising out of the administration of this Ordinance and to carry out the other functions assigned to it by or under the Seed Ordinance. The NSB is the statutory body comprising of concerned officials and representatives from the private sector. Originally there were 15 members of the NSB. The number has been extended to 19 including 3 (three) members coming from the private sector. The present provision of memberships is at the maximum 25 in number. Secretary, Ministry of Agriculture is the Chairman and Director General of the Seed Wing is the Member Secretary of the Board. The Government has the authority to select the Member Secretary. NSB advises the Government on different seed management activities such as the application of seed ordinance, rules, policy, variety releases & registration, quality control, fixation of seed standards etc.

National Seed Board generally meets twice a year. If required, a special meeting of the NSB can be convened. Decisions of the NSB are circulated to the members in the form of proceeding of the meeting. Decision regarding release of a variety is published in the official gazette of the government. Sometimes an official order or a circular is issued to notify the decision of the NSB on specific matters.

National Seed Board has two committees: (1) Technical Committee and (2) Seed Promotion Committee. The Technical Committee prepares, through the meeting, recommendations on certain matters for consideration of the NSB. Most specifically the committee is solely responsible to recommend the release of a variety. The Seed Promotion Committee is mostly responsible for promoting use of quality seed. The committee generally decides the quantity of seed to be supplied and the variety to be promoted. NSB advises the Government on all matters regarding the promotion and development of Seed Industry; the suitability and functions of the Government Seed laboratory; to notify any kind or variety of seeds, withdraw or denotify outdated varieties; the procedure or standards for certification, test or analysis of seeds; the role and responsibilities of the certification agency; seed security system; for the registration of varieties of crops grown in Bangladesh, whether developed locally or imported; make arrangement for the registration of Seed Dealers in Bangladesh; meet any time in a year, not less than twice, to dispose of matters brought before the Board for decision; change any form attached to these rules for better functioning of the seed activities; recommend the rate of fees to be levied for analysis of samples by seed laboratory and for certification by the certification agency; discharge any other work or function, subject to the prior approval of the Government, for carrying out the purposes of the Ordinance.

Seed Certification Agency (SCA)

Seed Certification Agency (SCA) established in 1974 is the regulatory authority under the Ministry of Agriculture. It is well equipped for seed testing and variety evaluation (VCU and DUS). It has its head office at Gazipur. A twelve hectare control farm is attached to SCA headquarter for VCU, DUS, pre and post control and grow-out tests. SCA is headed by the Director. It has five Regional Field Officers and 32 Field Officers throughout the country. The central laboratory of SCA is at Gazipur and another laboratory at Ishurdi. The Seed Certification Agency shall certify seeds of any notified or other registered varieties and authorized for seed certification and variety release through field inspection, market monitoring and seed quality testing. It also coordinates the technical committee meetings and the field evaluation and variety release system.

The Seed Certification Agency shall certify the seeds of any notified kinds or varieties or other registered varieties; outline the procedures for growing, processing, storage and labeling of seeds intended for certification and to ensure that the seed lots finally approved for certification are true to the variety and conform to the standard regarding the germination percentage, purity percentage, moisture contents and such other components of seed quality for certification.

The Seed Certification Agency shall inspect fields to ensure the minimum standards for isolation, rouging, and other factors specific to the kind or variety are maintained at all times, as well as ensure that seed borne disease are not present in the field to a greater extent than those provided in the standards for certification; inspect seed processing plants to see that the admixtures of other kinds and varieties are not introduced; ensure that field inspection, seed processing plant. inspection, analysis of samples and issue of certificate, including marking, labeling and sealing, are taken expeditiously.

The Seed Certification Agency shall conduct DUS (Distinctness, uniformity and stability) tests, and co-ordinate and organize multi-location trials for performance testing of varieties (VCU-value for cultivation and use).

The agency monitors by post control sampling procedures the seeds quality as declared on the labels of seed containers offered for sale by seed Dealers and feedback results to the Seed Dealers to create awareness about quality; carry out varietal description activities as a part of review and recommend from time to time minimum standards of seeds quality of different crops.
SCA employs 30 field officers who work under five regional field offices. Most of the field offices are located in the seed producing and processing areas of BADC and other private/NGO seed enterprises. With the support from SID/DANIDA, SCA has established 25 regional seed testing laboratories throughout the country. The laboratories are equipped with the most basic instruments for purity, germination and moisture tests. For that reason, SCA field inspectors and other technical staff have been trained at SCA in Gazipur in laboratory procedures.

Bangladesh Agricultural Development Corporation (BADC)

This is virtually the sole public agency for production, preservation and distribution quality seeds of high yielding varieties of different crops seeds such as rice, wheat, jute, potato, vegetables, oil seed and pulses.

The Bangladesh Agricultural Development Corporation (BADC) is a public sector organization under the Ministry of Agriculture responsible for multiplication, processing and marketing of seeds of different crops. It is the largest seed producer and supplier in Bangladesh. Its Headquarters is in Dhaka. BADC has established a system of seed multiplication of different crops by engagement of approximately 50,000 smallholders as contract growers, 23 seed production farms, 16 contract grower zones, seed sale offices in all districts and connections with more than 1,000 registered private seed dealers. BADC offers facility to the seed growers, traders and farmers for processing and preservation of seeds at minimum price to enhance the supply of quality seeds of different crops in the country.

Department of Agricultural Extension (DAE)

Department of Agricultural Extension: Department of Agricultural Extension (DAE) is the biggest organization under Ministry of Agriculture having its staff down to village level. About 22,000 workers are engaged in disseminating agricultural technology and materials along with seed technology directly to the farmers. Agricultural technologies developed by NARS are taken to the farmers through the extension system of DAE.

Besides, there are technical committees at national, regional and district levels for determining requirement of some technology(s) and feedback to the NARS. Plant Protection Wing under DAE is responsible for implementation of the Plant Quarantine services. It also issues import and export permits and phytosanitary certificates for importing and exporting plants and plant products as per Plant Quarantine Act. DAE is also producing quality seed through farmers seed production programme. This is the biggest organization of the agriculture sector disseminating technologies for production and preservation of quality seeds by the farmers.

DAE will be responsible for promoting newly involved superior crop varieties. For this purpose DAE will: Monitor the farmer's response/demand for varieties and transmit farmer preferences to the NSB so that adjustments to production of Breeder and Foundation seed can be made; Promote new varieties among farmers through demonstration plots; Advise NSB on developments in the seed sector; Create a suitable career structure for seed technologists in all seed sector agencies so that staff continuity and retention of experience can be achieved; and Improve facilities at entry points for laboratory testing and post entry quarantine testing.

Agricultural Information Services (AIS) facilitates dissemination and sharing of information from private and public sector seed agencies and enterprises with the farming public, particularly with respect to promotion of new varieties.

Cotton Development Board

Cotton Development Board (CDB) is a public sector organization and takes care of all activities like variety development, seed production and supply, cotton production and its marketing. It has two cotton research and seed multiplication farms and five regional officers for cotton production and procurement in different parts of the country. Its headquarters is in Dhaka headed by Executive Director.

Bangladesh Agricultural Research Council (BARC)

Bangladesh Agricultural Research Council (BARC) under Ministry of Agriculture is the apex body of the National Agricultural Research Sysytem in Bangladesh. The main responsibility of BARC is to strengthen the national agricultural research capability through planning and integration of resources according to the national priorities. BARC has the responsibility to coordinate research and promote inter-institute collaboration, monitor and review the research program of NARS institutes, assist institutes in strengthening research capacities and to establish system-wide operational policies and standard management procedures and to assure that each institute is optimally governed. Total staff of BARC is 216 of which 42 are technical staff.

National Agricultural Research System (NARS)

The different research organizations forming the national agricultural research system (NARS) consists of Bangladesh Agricultural Research Institute (BARI), Bangladesh Rice Research Institute (BRRI), Bangladesh Jute Research Institute (BJRI), Bangladesh Sugarcane Research Institute (BSRI), Bangladesh Institute of Nuclear Agriculture (BINA), Bangladesh Tea Research Institute (BTRI), Bangladesh Livestock Research Institute (BLRI), Fisheries Research Institute (FRI), Bangladesh Forest Research Institute (BFRI) and Soil Resources Development Institute (SRDI). BARI, BRRI, FRI and BJRI have their regional research centres at different agro-ecological and agro-climatic locations of the country. The research activities of all the organizations are coordinated by Bangladesh Agricultural Research Council (BARC). BARC is headed by the Executive Chairman and it has a Board of Governors. All the Research Institutes are headed by a Director General and managed by a Board of Governors. BARI and BRRI has Seed Technology Division and BJRI has a Seed Technology Unit to undertake research on seed technological aspects.

According to 'The national Seed Policy 1993' varietal development by NARS should anticipate the increase in irrigated high-input, high-output cropping systems and adapt their crop species and variety selection criteria accordingly. With an increasing demand of food by a fast expanding population, it is imperative that NARS respond by releasing seeds of high-input responsive crop varieties into the agricultural sector. In particular, the use of hybrids must be expanded. To achieve this, the NARS will: reoriented its plant breeding programmes to develop varieties that respond to sustainable high-input, high output technology especially emphasizing diversified crops, such as oilseeds, pulses, cereals (other than rice), vegetables, fruits, etc. that fit into rice-based cropping systems and the NARS will need to respond to farmer's current demands for varieties and crops; design breeding programmes keeping in mind the opportunity of importing improved seed which may be an economic way to obtain improved varieties; develop adequate maintenance breeding units at their regional/central research stations; and co-ordinate variety development programmes between scientists and institutes in both public and private sectors by developing common objectives and testing procedures.

Seed Pathology Centre (SPC)

Seed Pathology Centre (SPC) located at the campus of the Bangladesh Agricultural University (BAU) will establish/strengthen a course in seed technology, which would cover all aspects of the seed industry from seed breeding to its multiplication and distribution, seed policy and seed industry development; develop its seed laboratory as a National Seed Health Laboratory which will, besides supporting the university's teaching functions, regularly review the seed quarantine requirements and develop seed technology necessary for the production of healthy seed; and promote the technology and production of inoculum for legume seeds in both public and private sectors.

Seed activities and various seed operations

BADC as the public seed organization has 30 seed multiplication farms, 20 seed processing centres, 10 cold stores, 22 Regional seed distribution centres (for seed dealers) and 78 Thana seed sale centres all over the country. Five Directors (planning, seed, irrigation, supply, finance). Seed activities are managed by the Member Director (Seed) through different divisions: farms, contract growers, procession, marketing. Each Manager and Project Director as head of the division are responsible for managing their activities, which are mostly crop-specific. Only Manager Marketing is to undertake marketing responsibilities of all seeds produced by BADC through different divisions.

Crop covered and size of operations, seed sale

The public seed organizations deals with almost all crops including rice, wheat, maize tuber crops, pulses & oilseed, jute and vegetables. Bulk quantity of rice seeds of the varieties suitable for cultivation in aus, amon and boro seasons are marketed by BADC. There is an increased trend in rice seed market occupied by the organization.

Quantity of aman rice seed has increased from 5669 tons in 2005-2006 to 12260 in 2006-2007 and 13500 toms in 2007-2008; boro rice seeds sale was almost double 23831-30650 tons; while the sale was very in case of aus rice seeds which was only 470-940 tons. The sale of wheat seeds ranged 12851-21000 tons and that of maize seeds 233-470 in each growing season during the years 2005-2008. About 21000 tons of potato seed tubers of BADC was available in the market in 2007-2008 cropping season which was 14000 tons in 2006-07 and 9231tons in 2005. The sale of jute seed was 393, 1275 & 1327 tons in 2005-2006, 2006-2007 and 2007-2008, respectively; the seed quantity of pulses in the market was 275, 585 & 699 tons while that of oilseed was 435, 663 & 750 tons; the BADC market of vegetable seeds remained steady with 75- 86 tons seed sale. BARI distributed 761 kg of vegetable seeds in 2006-2007 which was more than double, 1619 kg in 2007-2008.

Private seed agencies and infrastructure

Although private seed companies have been established since the post independence era, accelerated growth of the private sector began after mid nineties. The emergence of the private industry has been a phenomenon of the last 15 years in Bangladesh. Hybrid rice production is being continuing by private sector since 1998. Currently there are large numbers of private seed companies, together with a few multinational companies.

In Bangladesh about 18 seed companies have the seed production facility either in their own farm, leased land or in the contract growers field through the close supervision by the technical skilled manpower designated as “Seed Production Manager” or Farm Manager”. These companies also have seed processing and packaging facility and manpower. About 12 seed companies have seed processing and

packaging and storage facility and manpower. All the seed companies have produced seed marketing network with a significant number of Market Manager through seed dealers selected by the company.

Non Governmental Organizations (NGOs)

There are many non-government organizations working in the country, very few of them have organized activities in seed. During late nineties some NGOs had started to take up seed activities in an organized way. During the period more than a dozen of NGOs have started activities on research, multiplication, processing and marketing of seed. NGOs play an important role in seed supply in Bangladesh as in all other sectors of the Bangladesh civil community. Many of the NGOs have taken up seed production, seed marketing and distribution both as relief programmes and on commercial conditions.

More than 20 NGOs are involved in seed production and marketing. These include Bangladesh Rural Advancement Committee (BRAC), Grameen Krishi Foundation, Proshika, RDRS, Gono Kollan Trust and Agricultural Advisory Society. The NGOs have recently launched an organization named NGO Seed Forum.

Seed activities and various seed operations

Seed Merchants' Association

This is a registered organization formed by the seed merchants who are mostly engaged in procuring seed from home and aboard and marketing. It is managed through an executive committee having a President and a General Secretary. This is the most active organization in the private sector dealing with seed. It has about 200 registered members. It has an office and good communication network through telephone, fax, email, etc. It has a representative in the National Seed Board.

Seedmen's Society of Bangladesh

This organization was formed in March 1993 to manage activities in the private sector taking representatives from different seed organizations. As yet members are very few in number. It has a governing council consisting of 16 members with a President and a General Secretary. It has a representative in the National Seed Board.

Seed Growers Association

The Seed Growers Association is not a registered organization. It has an executive committee headed by a President and activities are performed by General Secretary. It has a representative in the National Seed Board.

Bangladesh Seed Dealers Welfare Association

During 1996 and Seed Wing MoA started registering private organizations or individuals who had been performing any sort of seed activities. These registered Seed Dealers formed an organization in the name of Bangladesh Seed Dealers Welfare Organization.

Seed related professional societies

- Seed Science Society of Bangladesh. http://sssb-bau.org/
- Bangladesh Society of Seed Technology. http://bsstbd.webs.com/