

## 8. Seed Processing and Testing



### Can you recall?

1. What is the difference between seed and grain?
2. How will you recognize good seed?
3. Do you know different types of seed?
4. Why seed is cleaned and dried before storage?
5. Is any processing required before sowing seed?

### 8.1 SEED PROCESSING PLANT

#### 8.1.1 Meaning and Importance of seed processing :

- Seed processing means improving the quality of harvested seed through a series of operations, viz. cleaning, drying, grading, testing, shelling, treating, bagging and labelling.
- Seed processing may be defined as the process of removal of dockage in a seed lot and preparation of seed for marketing.

Seed processing may be understood to comprise all the operations after harvest that aim at maximizing seed viability, vigour and health.



### Remember this

- Seed processing is a vital part of the total technology involved in making available high quality seed.
- It assures the end users, seed of high quality with minimum adulteration.
- In agriculture, the term seed processing includes cleaning, drying, seed treatment, packaging and storage.

#### Importance :

1. It helps in taking such preventive measures that maintain seed viability. These measures include drying of seed.
2. It helps in improving the seed quality by removing adulterants and unfit seed.

3. It provides information about seed quality standards to the buyers. These quality standards are determined by purity test, moisture test, germination test, etc.
4. Processing makes seed handling easier. Use of appropriate bags prevent seed damage during handling and storage.
5. It helps in keeping healthy seed. The seed treatment not only reduce the seed borne infection but also protect seed in storage. It also protects seed and seedlings from attack of pest and diseases.
6. Use of designated tags facilitates seed identification and handling.
7. It helps in getting higher yield as the proportion of pure seed is higher in processed seed, that will give rise to vigorous and healthy plant stand.
8. Processed seed is uniform in size due to removal of seed appendages. Hence machine sowing becomes easier.
9. It helps in preventing spread of weed seed.
10. It helps in improving storage life of seed.



### Keep in Mind

Seed processing is based on differences in physical properties between the desirable seed and the contaminants. The physical properties are size, shape, length, weight, colour, surface texture, affinity for liquid and electrical conductivity

#### 8.1.2 General processing Sequence for complete cleaning of seed of different crops :

##### A. General processing sequence :

The normal processing sequence involves the activities such as receiving, drying, pre conditioning, precleaning, cleaning, separation and upgrading, treating, weighing, bagging, storage or shipping.

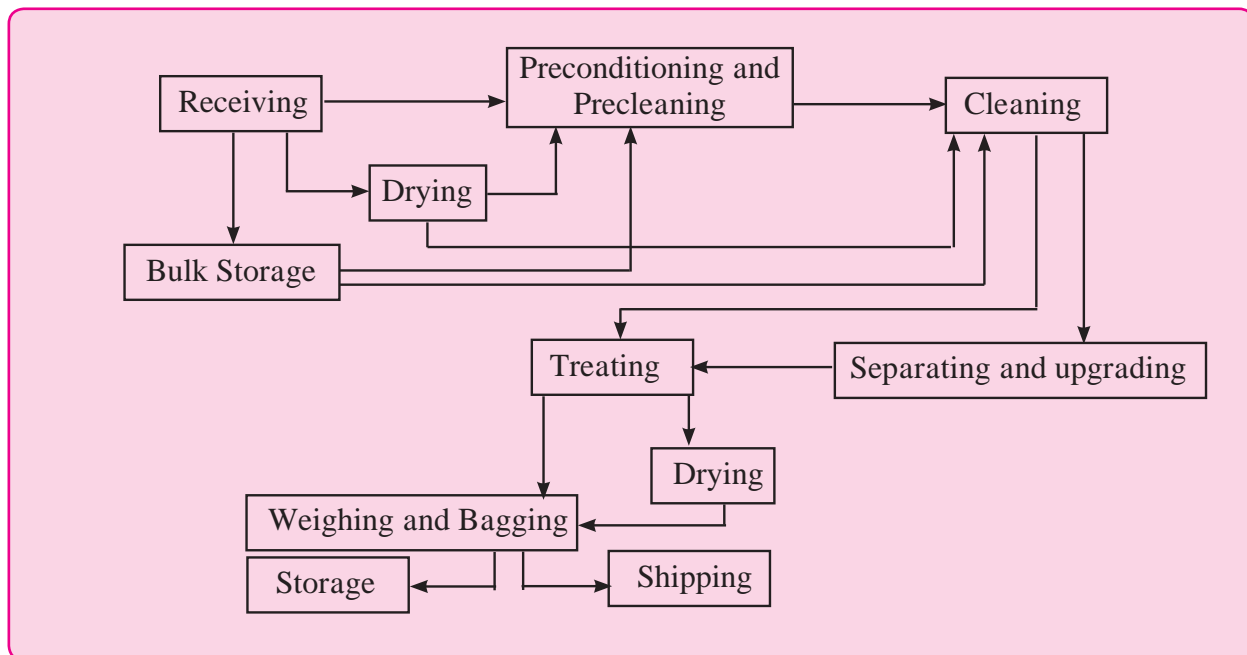


Fig. 8.1 Basic flow diagram showing essential steps in seed processing



### Observe and Discuss

#### Material removed from harvested seed

- Threshed
- Shelled
- Dried

#### Inert material

- Noxious weed seed
- Deteriorated seed
- Damaged Seed

- Common weed seed
- other crop seed,
- other variety seed
- off size seed

#### Marketable seed

- Cleaned
- Graded
- Treated
- Packaged
- Tested

**1. Drying :** Drying of seed means lowering the seed moisture content to safe moisture limits. At harvesting, the seed normally contain high per cent of moisture. In order to avoid any negative effects of high moisture, the seed has to be dried to 8 to 12% moisture. If the seed is stored at high moisture content, it affects germination quickly and seed is affected with pest and diseases. The two common methods of seed drying are sun drying and forced air drying.

#### 2. Preconditioning and precleaning :

Pre-conditioning means operations such as shelling, debearding, etc. that prepare seed lot for basic seed cleaning and also removal of trash stones, clods, etc. larger in size than crop seed. Precleaning remove particles that are lighter in weight and smaller in size than the crop seed.

**3. Cleaning :** Seed impurities like weeds, immature seed, inert matters, infected seed, other crops seed, damaged seed etc are removed from seed lot on the basis of differences in physical properties.

**4. Upgrading :** The various processing operations conducted after basic cleaning for further improvement of seed quality are called as upgrading. After cleaning the seed requires grading. The grading is of two types viz length grading and gravity separating. The clean seed



### Think about it

- What will happen when harvested seed is directly used for sowing?
- Harvested seed is stored without drying.
- Harvested seed is not cleaned and treated.

is further graded in this process on the basis of length of seed. The immature or infected seeds that may not have been removed in the cleaning process are removed in this process.

Gravity separating is followed after length grading and is helpful in removing light and immature seeds.

**5. Seed blending :** Blending is an attempt to produce more uniform seed lot. Seed blending refers to combining two or more varieties of the same species. Seed mixing denotes combining two or more species.

**6. Treating :** This process is followed after grading. In this process a suitable fungicide/pesticide is used to protect the seed from pest and various diseases.

**7. Weighing and Bagging :** Processed seed may be handled either in bags or in the bulk. When seed is being bagged a small platform is commonly used to weigh the filled bags which are then sewed by hand or machines.

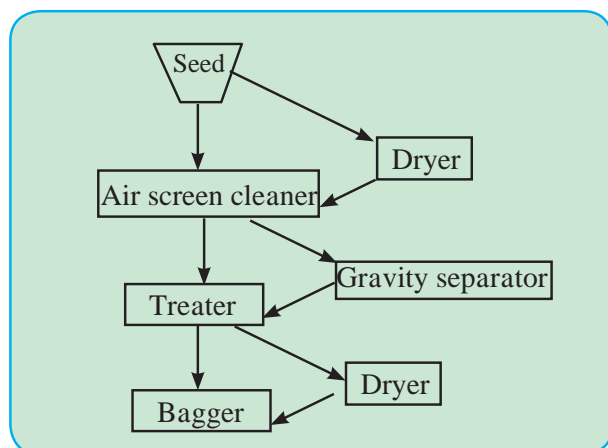
**8. Storage :** The seed is stored to maintain it in good physical and physiological condition from the time they are harvested until they are planted.



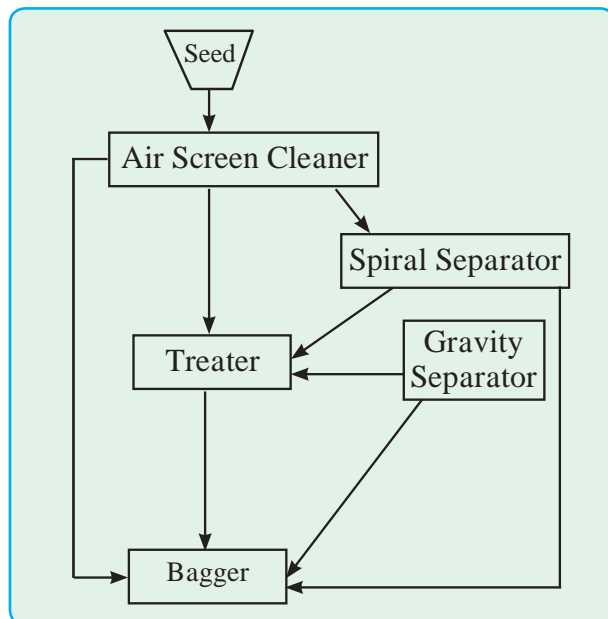
### Try this

Visit near by seed processing plant and observe layout and instruments used in it.

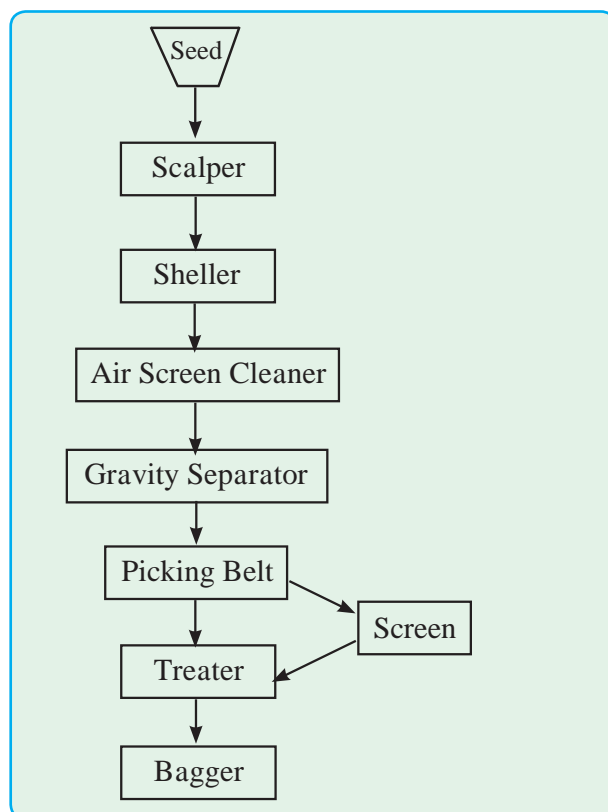
## B. Processing sequence for complete cleaning of Jowar, soybean, groundnuts and cotton seed



**Fig. 8.2 Processing sequence for complete cleaning of Jowar seed**



**Fig. 8.3 Processing sequence of Soybean seed**

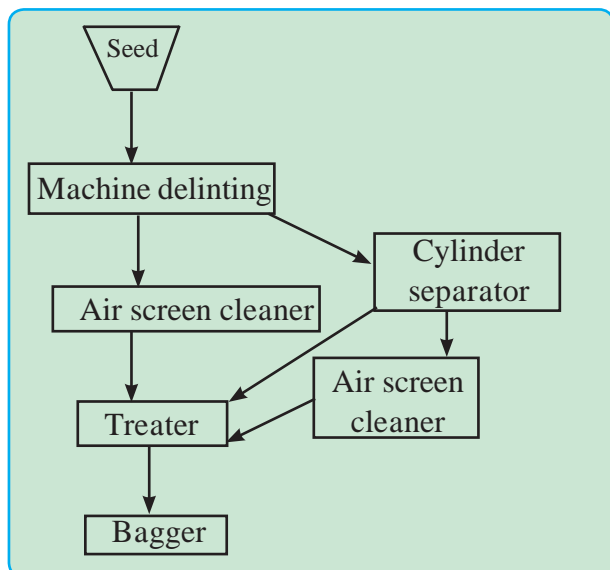


**Fig. 8.4 Processing sequence for complete cleaning of Groundnut seed**

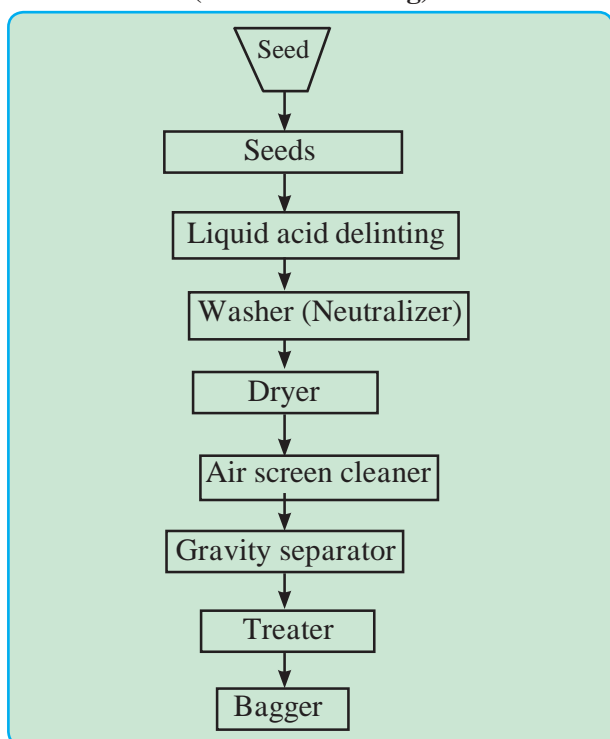


### Internet my friend

**Search for uses of following equipments**  
Air screen cleaner, sheller, scalper, gravity separator, dryer, treater, bagger, spiral separator, washer, etc.



**Fig. 8.5 Processing sequence for cotton seed (machine delinting)**



**Fig. 8.6 Processing sequence for complete cleaning of cotton seed (acid delinting)**

### 8.1.3 Layout and planning of seed processing plant :

#### A. Factors to be considered while planning and designing seed processing plants

The following points should be considered in laying out a seed processing plant.

1. Size of operation, sequence of operations.
2. Kinds of crop seed to be handled, Kinds of contaminating crop.

3. Kind of weed seed usually present in seed lots.
4. Selection of equipment and expenditure needed.
5. Location of the plant, area required.
6. Type of drying facilities required.
7. Facilities required for seed cleaning and storage.
8. Facilities for transport of seed to and from processing plants.
9. Source of power for electricity machinery.
10. Availability of labour and their wages and training.
11. Competition from the other processing plants.
12. Appointment of manager for plant - Priority should be given to education, experience, curiosity and locality.
13. Facilities for seed sell - Market should be near to the proposed project area.

The layout planner must have detail knowledge of the seed to be processed, its physical characteristics and contaminants in it. He should know about selection of machines used to bring the seed to marketing standard.

**B. Planning :** After the selection of proper machines, elevator capacities, cleaning sequences and layout design have been selected, detailed lay out planning can begin. Careful layout planning is useful to identify and prevent trouble spots before the plant is built. As the layout or design develops, it should be drawn on paper. First, draw lines of flow and then convert these flow lines into machine lines. After revisions, detailed drawings can be made to show exact locations of equipment and distances. Scale drawings are the most widely used method of layout planning. Scale models and scale templates are also vey effective, but are more expensive.

### C. Analysis of operation :

- I. Processing sequence :** After the selection of machines. The next step is determination of proper processing sequence. The seed separators, elevators, conveyors and storage bins should be so arranged that seeds flow continuously from receiving to end, and yet be flexible enough to bypass a machine or return to a part for recleaning.
- II. Machine capacity :** Equipment capacity must be carefully planned to prevent bottlenecks. When the overall operating capacity needs have been determined, machines should be able to handle the capacity with some reserve capacity. Surge bins can handle variations in individual machine capacities. In case of great differences either larger models or more than one machine be installed in parallel flow.
- III. Conveying :** The type of conveying system is a very important factor. The conveying system must be able to handle the capacity needed in a particular spot.

#### 8.1.4 Types of layouts

There are three main types of processing plant layouts viz. multistorey, single level and combined design.

- 1. Multistorey :** In this type, seed is carried by elevators to the top floor and emptied into large bins. Cleaning machines are then arranged in a vertical series on the lower floors. Seed flows from one machine down into the next by gravity.
- 2. Single level :** In the single storey plant, seed is moved from one machine to the next by elevators placed between the machines. The advantage of this system is that one man can supervise the processing without running up and down stairs.
- 3. Combined designs :** A compromise between the single and multistory system could also be adopted.



#### Do you know ?

The following five types of seed processing units are approved by the director of seed certification to carry out the certification works.

1. Seed processing and tagging unit.
2. Ginning unit
3. Ginning, processing and tagging unit
4. Delinting unit
5. Cleaning and tagging unit.



**Fig. 8.7 Single storey layout of seed processing plant**

#### 8.1.5 Records and forms in seed processing plant

Following records and forms are maintained in seed processing plant.

- 1. Inward (raw seed) register :** It is a register for entering information of seed lots received for processing. In order to identify the seed lots, they should be given a number as soon as seed are brought in the the processing plant .While registering entry following information is recorded.
  - a. Name of farmer (seed grower) with address.
  - b. Name of crop and variety,
  - c. Stage/class of seed.
  - d. Number of gunny bags and weight of seed lot.
- 2. Receipt book :** Processing plant manager issue the receipt of concerned seed lot to seed grower. It consists of name and address



of seed grower ,stage of seed produced, no.of gunny bags and weight of the seed lot.

3. **Seed processing Register** : It contains all kinds of entries regarding the types of processing done to get right type of quality to the seed. It consists of following information. Name of seed producer with address, number of gunny bags and weight of seed lot, date of processing and weight of good seed, Number of packed bags and weight, seed lot passed or failed, number of tags used for tagging

4. **Analysis record and File** : Before tagging seed by appropriate tags, sample has to be drawn from the processed seed lot and sent to seed testing laboratory for different tests such as germination, purity, etc. The entry should contain following information

- Name of the testing laboratory
- Test number
- Name of the crop, variety and stage of seed.
- Name of the person or organisation giving the sample.
- Date of testing.
- Pure seed percentage.
- Percentage of other crop seed
- Inert matter percentage.
- Percentage of weed seed.
- Seed germination percentage.
- Percentage of hard seed, dead seed and fresh un-germinated seed

5. **Seed control register** : It consists of information regarding results from seed testing lab., weight of seed passed or failed and low grade seed.

6. **Bill book** : This is used for making seed processing bill which contains

- Charges for all kinds of seed tests
- Tag and label charges
- Shift charges
- Seed certification fee
- Other charges

7. **Bill register** : This register consists of all information regarding bill of processed

seed grower wise and season wise. Details of payment received is also recorded.

8. **Outward or Shipping (Packed and low grade seed) record** : Information is recorded as follows.

- Date of handing over seed to seed grower or seed company.
- No. of total packed bags and weight of packed seed.
- Quantity of fail seed.
- Quantity of low grade seed handed over to seed grower.
- Release order of concerned seed lot.

9. **Seed processing report file** : Processing plant manager prepare a seed processing report and handed over to seed grower. It contains information regarding number of gunny bags of raw seed and total weight of raw seed, no. of bags and total weight of good seed, quantity of low grade seed, quantity of fail seed if any, no. of tags used, etc.



### Can you recall?

- How planting value of seed is determined?
- Give names of some laboratory instruments
- What are the objectives of seed testing?
- Can you observe seed borne pathogens?

## 8.2 SEED TESTING LABORATORY

### 8.2.1 Meaning and objectives of seed testing :

Seed testing is the science of evaluation of planting value of seed. Seed testing is essential to achieve following objectives.

#### A. Objectives of seed testing:

- To determine seed quality i.e. their suitability for planting.
- To identify seed quality problems and their probable causes.
- To determine the need for drying, processing and specific procedures that should be used.
- To determine if seed meets established quality standards or labelling specifications.

5. To establish quality and provide a basis for price and consumer discrimination among lots in the market.



### Try this

Visit a near by seed testing laboratory to study its planning and functioning.

**B. ISTA : The International Seed Testing Association (ISTA)** was founded in 1924. It is an association of laboratories which are authorized to check on the marketability of seed as defined in the laws of different countries. It has more than 100 members worldwide. The permanent secretariat of ISTA is in Norway.

The primary object of ISTA is to develop, adopt and publish standard procedures for sampling and testing seed. It promotes uniform application of rules and methods of testing for the evaluation of seeds. It also promotes research in all aspects of seed science and Technology including sampling, testing, storing, processing and distribution. It encourages cultivar certification, participates in conferences and training courses. The technical and scientific work of the association is carried out by fifteen special committees. It publishes scientific and technical papers in the associations journal, (seed science and Technology).

One of the foremost achievements of ISTA is the adoption of the International Rules for seed testing. These rules prescribe testing techniques based upon scientific evidence. International seed analysis certificate, widely used in seed trade, is another achievement.

In developing the rules for seed testing following objectives serve as guidelines.

1. To provide methods by which the quality of seed samples can be determined accurately.
2. To explain methods so that seed analysts working in different laboratories in different countries throughout the world can obtain uniform results.
3. To relate the laboratory results regarding planting value.
4. To perform the tests in the most economical manner.
5. To complete the tests within the shortest period of time

**C. Seed Testing Laboratory:** Seed testing services are required to gain information regarding planting value of seed lots. The seed testing laboratory is the premises where seed quality testing work is effectively made. To carry out responsibilities effectively, this is necessary that seed testing laboratories are established, managed and equipped in a manner

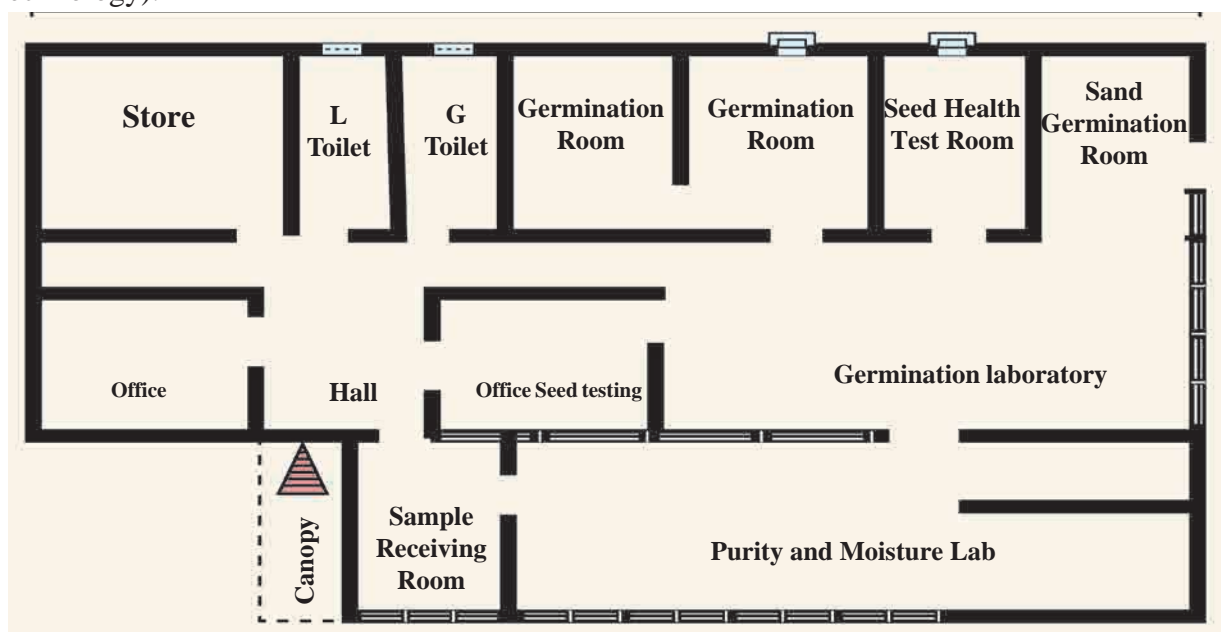


Fig. 8.9 Layout of seed testing laboratory

such that whatever samples are received should be analyzed in the least time.

Seed testing laboratories are essential in seed certification and quality control of seed. These results may cause rejection of poor seed or low grade seed in account of law.

### 8.2.2 Layout and design of Seed Testing Laboratory(STL) :

The layout and design of a seed testing laboratory would chiefly depend on two factors viz. capacity and type of tests required to be conducted. Therefore, at the time of design of building apart from considering the capacity and type of tests, other requirements should also be considered to maximize the use of all available space, to minimize the cost of construction, to provide good working atmosphere, safely and to minimize the cost of maintenance.

#### Points to be considered while preparing layout and design.

##### A. General Principles :

1. The layout should be such that movement of samples from one section to another is rapid and easy.
2. The room of the officer-in-charge is located in such a way that supervision becomes easy and effective.
3. There should adequate working space and arrangement for light.
4. The space can be divided into separate rooms for office, sample reception, dry room, health testing room etc.
5. The germination room and storage room should not face direct sunlight.
6. The design should permit extension in future.
7. Arrangement of water and drainage should require minimum plumbing work.
8. The decent furnishing, light arrangements and other necessities should be provided.

##### B. Building :

A testing laboratory can be housed as a separate building or it could be a part of large building. A minimum of 1500 sq. ft. working space has been suggested for laboratories handling 10,000 samples annually.

##### C. Land and other structure :

For cultivar purity test the provision for green house is required. In addition small plot (1 acre) for grow out test is also essential.

##### D. Staff :

The number of workers in seed testing laboratory should be related to number of samples, crop species to be handled and kind of tests performed. For laboratory handling 10,000 samples per year required staff is given in the below table.

**Table 8.10 Staff requirement for STL**

Sr. no.	Post of person	No. of person/staff
1.	Officer incharge	01
2.	Senior seed analysts	04
3.	Junior seed analysts	06
4.	Laboratory assistants	10
5.	Laboratory attendants	04
6.	Account officer	01
7.	Account clerk	02
8.	Store keeper	01
9.	Foreman	01
10.	Peons	02

##### E. Equipments :

The rules for testing seed includes the type of equipments and its specifications. The equipments should be selected accordingly.

### 8.2.3 Records and forms in STL :

**Records and forms in seed testing laboratory** : The record in seed testing laboratory will show important facts, the dates of various tests and reports about seed samples. It will give information about seed condition regarding planting value. It shows ways of improving quality aspects. The following records and forms are maintained in seed testing laboratory.





### Remember this

Seed testing started more than a hundred years ago to avoid unscrupulous practices prevalent in the seed trade. The first lab for seed testing was established in Germany in 1869. In India, the first seed testing laboratory was established in 1961.

1. **Letter file** : In this file all those letters received from agricultural universities, seed companies and seed growers, etc. are maintained.
2. **Sample entry register** : As soon as the seed sample is received from seed grower or seed processing plant at the seed testing laboratory, its first entry is made in the register as follows.
  - a. Name of the seed grower or seed processing plant with address.
  - b. Name of crop and variety.
  - c. Stage/class of seed
  - d. Weight of seed sample.
  - e. Date of sample received.
  - f. Seed tests required.
3. **Sample slip file** : The samples received from Seed grower or seed processing plant are accompanied with sample slip. These sample slips are kept in this file.
4. **Sample coding register** : After the entry is made in the sample entry register, specific code is given to the sample and same are recorded in this register.
5. **Receipt book** : In seed testing laboratory receiving clerk prepare payment receipt according to service sample or certified sample and hand over one copy to concerned seed grower or seed processing plant.
6. **Allotment register** : Before sending sample to different sections for carrying different quality tests (analysis), lot wise allotment groups are made up to 25 samples. Entry of these allotment lots is made in allotment register. After that sample lot is handed over to purity section.
7. **Purity register** : After the completion of purity test following information is recorded in this register.
  - a. Code number of seed sample
  - b. Weight of working sample
  - c. Weight of remaining seed sample (handed over to storage section)
  - d. Pure seed percentage.
  - e. Percentage of other crop seed.
  - f. Percentage of weed seed.
  - g. Inert matter percentage
8. **Purity work card** : Purity work section prepare purity work report on card and submit to reporting section. Pure seed is handed over to mounting or germination section.
9. **Mounting or germination test register** : In this register following information is recorded.
  - a. Code number of seed sample
  - b. Number of seed used in each replication used.
  - c. Date of putting seed sample for germination and method of germination used.
  - d. Date of first count.
  - e. Date of final count.
  - f. Normal seedling percentage.
  - g. Abnormal seedling percentage.
  - h. percentage of hard seed.
  - i. Percentage of dead seed.
  - j. Percentage of fresh ungerminated seed
10. **Germination work card** : Mounting section prepare germination card according to sample and submit to reporting section.
11. **Report register** : Result regarding all the tests from purity and Mounting / Germination section are recorded in this register. Then seed testing report is prepared by reporting section and sent to the concerned seed grower or seed processing plant through post.
12. **Sample storage register** : This register is maintained by seed storage section according to code number of seed sample. (Generally seed sample is stored for three years )



### Q. 1 Answer the following question.

#### A. Select the appropriate alternative and complete the following statement.

- Lowering of moisture in seed to safe limit means .....  
a. Drying                      b. Mixing  
c. Conditioning              d. Treatment
- The international seed testing Association was founded in .....  
a. 1924                              b. 1926  
c. 1824                              d. 1826
- The processing operations conducted after basic cleaning for further improvement of seed quality are called as.....  
a. drying                      b. upgrading  
c. cleaning                      d. treating
- A minimum of 1500 sq. ft. working space has been suggested for laboratories handling ..... samples annually.  
a. 100                              b. 1000  
c. 10,000                              d. 1,00,000
- In .....type of processing plant layout one man can supervise processing work.  
a. single level                      b. multistorey  
c. combined design              d. none of these

#### B. Make the pairs.

##### Group 'A'

- Preconditioning
- Pre-cleaning
- Drying

##### Group 'B'

- Removal of particles smaller than crops seed
- Ploughing
- Shelling
- Lowering of seed moisture contents
- Harrowing

### C. Find the odd one out.

- Seed handling, drying, cleaning, seed coat.
- Scalper, sheller, air screen cleaner, plough.
- Multistorey, single level, tower, combined design.
- Receipt book, seed control register, bill book, seed processing register, sample slip file.
- Later file, sample entry register, purity register, note book.

### D. State true or false.

- Seed processing comprises drying of seed.
- Seed processing makes seed handling easier.
- Sheller is important in groundnut seed processing.
- Seed testing identify seed quality problems and their probable causes.
- The design of seed testing laboratory should not permit extension in future.

### Q. 2 Answer in brief.

- Draw flow chart of processing sequence for complete cleaning of soybean seed.
- Write short note on preconditioning and pre-cleaning.
- Write definition of seed processing
- With the help of suitable flow diagram give processing sequence for complete cleaning of jowar seed.
- Write the names of layout of seed processing plant.

**Q.3 Answer the following questions.**

1. Describe types of seed processing plant.
2. List out records and forms in seed testing laboratory.
3. Write in brief about seed processing register.
4. Explain planning of seed processing plant
5. Write short note on ISTA

**Q.4 Answer the following questions.**

1. Write in brief about analysis of operation in seed processing plant.
2. Draw basic flow diagram showing essential steps in seed processing.
3. Enlish records in seed processing plant.
4. Draw a flow diagram of processing sequence for complete cleaning of groundnut seed.
5. Make a report on your visit to seed testing laboratory or seed processing plant.

**Q.5 Answer the following questions in detail.**

1. Explain the importance of seed processing.
2. Write objectives of seed testing.

**Q.6 Answer the following questions in detail.**

1. Which factors should be considered while plaing and desinging a seed processing plant?
2. What are the general principles considered at the time of preparing layout and design of seed testing laboratory.



**Activity**

1. Collect information about cotton seed processing.
2. Visit a seed processing plant near your place and submit visit report.
3. Suggest necessary changes to process seed.



**Students activity - visit to a seed processing plant and seed testing laboratory**