RAMA UNIVERSITY

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FACULTY OF AGRICULTURAL SCIENCES

AND ALLIED INDUSTRIES

SEED CERTIFICATION

Seed certification

It is a legally sanctioned system for quality control and seed multiplication and production. It involves field inspection, pre and post control tests and seed quality tests.

Purpose of seed certification

To maintain and make available to the farmers, through certification, high quality seeds and propagating materials of notified kind and varieties. The seeds are so grown as to ensure genetic identity and genetic purity.

Eligibility for certification of crop varieties

Seed of only those varieties which are notified under section 5 of the seeds Act, 1966 shall be eligible for certification.

Breeder seed is exempted from certification. Foundation and certified class seeds come under certification. Breeder seed is produced by the plant breeder and seed technologist which is inspected by a monitoring team consisting of the breeder, representative of seed certification agency (Deputy Director of Agriculture), representative of National Seed Corporation (NSC, Deputy Manger) and nominee of crop co-ordinator (S-11). The crops shall be inspected at appropriate stage.

SEED CERTIFICATION PROCEDURES OR PHASES OF SEED CERTIFICATION

1. Receipt and scrutiny of application
2. Verification of seed source
3. Field inspection
4. Post harvest supervision of seed crops
5. Seed sampling and testing
6. Labelling, tagging, sealing and grant of certificate.

I. RECEIPT AND SCRUTINY OF APPLICATION

a. Application for registration

Any person, who wants to produce certified seed shall register his name with the concerned Assistant Director of seed certification by remitting Rs.25/- per crop, per season. There are 3 seasons under certification viz., kharif (June - September), rabi (October - January) and summer (February - May).

The applicant shall submit two copies of the application to the ADSC 10 days before the commencement of the season or at least at the time of registration of sowing report. On receipt of the application, the Assistant Director of Seed Certification will verify the time limit variety eligibility and its source, the class mentioned, remittance of fee etc., The application, if accepted will be given an application no. The original application is retained and the duplicate is returned to the applicant.

b. Sowing report (Application for the registration of seed farm)

The seed producer who wants to produce certified seeds shall apply to the Assistant Director of Seed Certification in the prescribed sowing report form in quadruplicate with prescribed certification fees along with other documents such as tags to establish the seed source.

Class of seed	Source of seed
1. Foundation class	Breeder seed
2. Certified class	Foundation seed
3. Foundation Class stage II	Foundation class stage - I
4. Certified Class stage II	Certified Class stage - I.

Separate sowing reports are required for different crop varieties, different classes, different stages and if the seed farm fields are separated by more than 50 meters. Separate sowing reports are also required if sowing or planting dates differ by more than 7 days and if the seed farm area exceeds 25 acres.The sowing report shall reach concerned Assistant Director of Agriculture Seed Certification within 35 days from the date of sowing or 15 days before flowering whichever is earlier. In the case of transplanted crops the sowing report shall be sent 15 days before flowering.The producer shall clearly indicate on the reverse of sowing report, the exact location of the seed farm in a rough sketch with direction, distances marked from a permanent mark like mile stone, building bridge, road, name of the farm if any, crops grown on all four sides of the seed farm etc., to facilitate easy identification of the seed farm by the seed certification officer.

The Assistant Director, Seed Certification on receipt of the sowing report, scrutinises and register the seed farm by giving a Seed Certification number for each sowing report. Then he will send one copy of the sowing report to the Seed Certification officer, on to the Deputy Director of Seed Certification and the third to the producer after retaining the fourth copy.

2. VERFICATION OF SEED SOURCE

During his first inspection of seed farm the Seed Certification officer will verify whether the seed used to raise the seed crop is from an approved source.

3. FIELD INSPECTION

OBJECTIVE

The objective in conducting field inspection is to verify the factors which can cause irreversible damage to the genetic purity or seed health.

INSPECTION AUTHROITY

The seed certification officer authorized by the registering authority shall attend to field inspections.

CROP STAGES FOR INSPECTION

The number of field inspections and the stages of crop growth at which the field inspections should be conducted vary from crop to crop. It depends upon duration and nature of pollination of the seed crop.

If the crop is grown for hybrid seed production, the number of field inspections during the flowering stage should be more than one in the case of self-pollinated / cross / often cross pollinated varieties.

In hybrid seed production and variety seed production of cross pollinated crops the inspection during flowering should be made without any prior notice of the seed grower to judge the quality of operation undertaken by him to maintain the genetic purity of the crop. But in the case of self-pollinated crop the seed grower may be informed about the date of inspection.

In the former case if prior notice is given to the seed grower, it may not be possible to detect the damage by the contaminants whereas in the latter case prior notice will lead to improvement of the quality of the seed production work and thus the quality of seed.

The key points to be observed at each stage of inspection

Stage of crop	Key points to be observed at inspection
I. Pre flowering stage (Vegetative Stage)	a. Verification of seed source b. Confirmation of acreage given in the report. c. Land requirement to keep check on genetic as well as physical contamination and spread of disease inoculum. d. Planting ratio e. Border rows f. Isolation distance
II. Flowering Stages (May be II and III inspections when 50% of plants begin to flower).	g. Guide the grower in identification of offtypes, pollen shedder, diseased plants, shedding tassels etc., a. Confirm the observation of plants inspection were correct. b. Confirm whether grower had continued thorough rouging, after the previous inspection. c. Verify the removal and occurrence of offtypes, pollen shedders, shedding tassels, objectionable weed

III. Inspection during post flowering and pre-harvesting stage.	plants and diseased plants. a. Confirm the correctness of observations, made in earlier inspections. b. Guide the grower on rouging, based on pods, earhead, seed and chaff characters such as colour, shape and size. c. Explain to the grower when and how to harvest the crop and process.
IV. Inspection during harvest (This is the last inspection conducted on a seed crop).	a. Verify that male parent rows have been harvested separately. b. Ensure complete removal of offtypes, other crops, weeds and diseased plants etc., c. Seal properly by the certification agency of the threshed produce after initial cleaning and drying. d. Instruct the seed growers for sage storage and transportation.

Field standards maintenance

Minimum number of field inspections required for different crops for certification

CROP	MINIMUM NUMBR OF INSPECTIONS	STAGES OF CROP
Paddy and Wheat	2	Flowering to harvest
Sorghum		
Hybrid	4	Ist before flowering IInd and IIIrd during flowering IVth prior to harvest.
Varieties	3	Ist before flowering IInd during flowering IIIrd prior to harvest
Maize		
Inbred lines Single crosses Other hybrids	4	Ist before flowering Rest during flowering
Varieties	2	Ist before flowering IInd during flowering
Bajra		

Hybrids	4	Ist before flowering IInd and IIIrd during flowering IVth prior to or during harvest.
Varieties	3	Ist before flowering

		IInd during 50% flowering IIIrd prior to harvest.
Green gram Black gram Red gram Cowpea	2	Ist before flowering IInd flowering and fruiting stage
Groundnut	2	Flowering to harvest
Sesame	3	Ist before flowering IInd during flowering IIIrd from fruit maturity to harvest
Sunflower	2	Flowering to harvest
Rape and mustard	3	Ist before flowering IInd during flowering to fruiting IIIrd from maturity to harvest
Soybean	2	Flowering to harvest
Castor	2	Flowering to harvest
Cotton (Varieties) (Hybrids)	2 4	Flowering to harvest Ist before flowering IInd and IIIrd during flowering IVth during harvest
Brinjal Tomat o Chilli Bhendi	3	Ist before flowering IInd during flowering to fruiting IIIrd during maturity.
Carrot	3	Ist early (20-30 days after sowing) IInd when lifted and replanted IIIrd during flowering
Cabbage	3	Ist before marketable stage IInd when the heads have formed IIIrd during flowering
Cauliflower	4	Ist before marketable stage IInd during curd formation IIIrd when most plants have formed curds IVth during flowering
Onion (seed to seed)	3	Ist during early vegetative stage IInd during bulb formation IIIrd during flowering

Field counts

The purpose of field inspection is to find out field standards of various factors in the seed farm. It is impossible to examine all the plants in the seed farm. Hence, to assess the field standards of various random counting is followed.

Points to be observed before counting

1. All plants falling in each count must be examined for each factor

2. In hybrid seed field the prescribed number of the field counts should be taken in each parent separately.

Sources of contamination or factors to be observed

The contaminants are

1. Physical contaminants
2. Genetical contaminants

Physical contaminants are inseparable other crop plants, objectionable weed plants and diseased plants. Genetical contaminants consists off-types, pollen shedders and shedding tassels.

a. Off type

Plant that differs in morphological characters from the rest of the population of a crop variety.

Off type may belong to same species or different species of a given variety. Plants of a different variety are also included under off types.

Volunteer plants and mutants are also off types.

b. Volunteer plant

Volunteer plants are the plants of the same kind growing naturally from seed that remains in the fields from a previous crop.

c. Pollen shedders

In hybrid seed production involving male sterility, the plants of 'B' line present in 'A' line are called pollen shedders.

Some times 'A' line tends to exhibit symptoms of fertile anthers in the ear heads of either on the main tiller or side tiller and these are called partials. These partials are also counted as pollen shedders.

The number of counts taken and the method employed in taking counts vary from crop to crop. It is necessary to take minimum of 5 counts upto 5 acres and an additional count for every 5 acres or part of as given below.

Area of the field (in acres)	Number of counts to be taken
up to 5	5
6-10	6
11-15	7
16-20	8
21-25	9

Double count

In any inspection. if the first set of counts shows that the seed crop does not confirm to the prescribed standard for any factor, a second set of counts should be taken for the factor. However, when the first set of counts shows a factor more than twice the maximum permitted, it is not necessary to take a second count.

On completion of double count assess the average for the two counts. It should not exceed the minimum permissible limit.

Number of plants for a count

S.No	Crop	Number of plants / heads per count	Remarks
1	Soybean Jute, Lucerne, Mesta, , Berseem	1000 plants	Closely planted crops
2	Beans, cluster beans, cowpea, green gram, black gram, peas, mustard, sesame, bengal gram, safflower, niger	500 plants	Mediu spaced m crops
3	Bhendi, brinjal, chilli, castor, cole crops, cotton, cucurbits, ground nut, miaze, potato, red gram, tomato and sunflower	100 plants	Wide spaced crops
4	Bajra, barely, oats, paddy, wheat, ragi, sorghum	1000 heads	Tillering crops.

d. Shedding tassels

These plants which shed or shedding pollen in female parent rows. When 5 cm or more of the entire spike, which shed or shedding are counted.

e. Inseparable crop plants

These are plants or different crops which have seed similar to seed crop

Crop	Inseparable crop plants
Wheat	Barely, oats, gram and triticale
Barely	Oats, gram, wheat and triticale
Oats	Barely, gram, wheat and triticale
Tritical e	wheat, barely, oats, gram and rye

f. Objectionable weed plants

These are weeds

1. Whose seeds are difficult to be separated once mixed
2. Which are poisonous
3. Which have smothering effect on the main crop
4. Which are difficult to eradicate once established
5. Difficult to separate the seeds. These seeds cause mechanical admixtures

S.No	Crop	Common name of the weed	Botanical name
1	Paddy	Wild rice	*Oryza sativa var fatua Convolvulus arvensis Helianthus spp Abelmaschus spp Argemone*
2	Wheat	Wild morning	
3	Sunflowe	glory Wild	
4	r Bhendi	sunflower Wild	
5	Rape and mustard	okra	
6	Lucerne	Mexican prickly	

		poppy Dodder	*mexicana Cuscuta spp*

g. Designated diseases

The diseases which may reduce the yield and quality of seeds are termed as designated diseases.

S.No.	Crop	Name of the disease	Casual organism
1	Wheat	Loose	*Ustilago tritici*
2	Sorghu	smut	*Sphacelotheca sorghi*
	m	Grain	*Sphacelotheca reiliana*
3		smut	*Claviceps microcephala*
	Pearl millet	Head	*Tolyposporium*
		smut	*pencillariae*
4		Ergot	*Scelerospora*
5	Cowpea	Grain	*graminicola*
6	Greengra	smut	*Colletotrichum*
7	m	Downy	*lindemuthianum*
8	Gingelly	mildew	*Psedomonoas phasiolicola*
9	Sunflower	Anthracnose	*Cercospora sesami*
	Brinjal	Halo blight	*Plasmopara halsterdii*
10	Chilli	Leaf spot	*Phomopsis vexans*
		Downy	*Alternaria solani*
	Tomato	mildew	*Colletotrichum*
		Phomopsis	*capsici Alternaria*
		blight Leaf	*solani Stemphylium*
		blight	*solani* (TMV)
		Anthracnose	
		Early blight	
		Leaf spot	
		Tobacco mosai c virus	

Land requirement

The field offered for certified seed production should not been grown in the previous season with the same crop. If it was grown, the variety should be the same. In that case, the field should be irrigated at least 3 weeks before sowing and ploughed just prior to sowing, in order to destroy germinating seeds.

Isolation

Separation of seed fields from fields of other varieties of the same crop, same variety fields not confirming to varietal purity requirements, and other related species fields and fields affected by diseases to prevent genetic and diseases contamination. The minimum distance to be maintained between the seed crop and the contaminant is called isolation distance.

Isoalation distance

Crop	Foundation Seed (M)	Certified Seed (M)

Self pollinated crops Cereals and millets	3	3
Paddy : variety	200	100
hybrid	3	3
Wheat		
Pulses	10	5
Green	10	5
gram Black	3	3
gram Soy	10	5
bean	10	5
Bengal	10	5
gram Cow		
pea Lab		
Lab		
Oil seeds		

Ground nut	3	3
Vegetables		
Tomato	50	25
Cluster	10	5
beans	10	5
French bean	10	5
Peas	50	25
Lettuc	5	5
e		
Potato		
Often Cross pollinated	200	100
crops Millet	300	200
Sorghu		
m	200	100
Variety		
Hybrid	100	50
Pulses	50	30
Red gram		
Oil seeds	200	100
Sesame	400	200
Cotton	400	200
variety		
Vegetables		
Brinjal		
Chillie		
s	400	200
Bhendi	400	
Cross pollinated	400	
crops Millets		200
Maize	1000	200
(varieties)	400	200
Inbred line	200	100
Single cross	300	150
hybrid Double	400	200
cross hybrid Bajra	600	400
(hybrid) Bajra		
(variety)		
Sun	1600	1000
hemp		
Castor	1000	500
Sunflower	1000	800
(variety)	400	200
Sunflower	1000	500
(hybrid) Cabbage		
Beetroot		
Radish		
Cauliflower		
Onion		
Carrot		
Amaranthu		
s Gourds		

Inspection report

The seed certification officer after taking field counts and comparing them with the minimum field standards, the observations made on the seed farm field should be reported in the prescribed proforma to

1. Deputy Director of Agriculture (Seed Certification)
2. To the Seed Producer
3. Assistant Director of Agriculture (Seed Certification) and
4. Fourth copy retained with see certificate officer

Assessment of seed crop yield

It is necessary to avoid malpractice's at the final stage during harvest operation.

The seed certification officer is expected to fix the approximate seed yield.

Liable For Rejection Report (L.F.R)

If the seed crop fails to meet with any one factor as per the standards, Liable for Rejection report is prepared and the signature of the producer is obtained and sent to Deputy Director of Agriculture Seed Certification within 24 hours.

Re-inspection

For the factors which can be removed without hampering the seed quality, the producer can apply for re-inspection to the concerned Deputy Director of Agriculture Seed Certification within 7 days from the date of first inspection order. For reinspection half of the inspection charge is collected.

Post harvest supervision of seed crop

The post harvest inspection of a seed crop covers the operations carried out at the threshing floor, transport of the raw seed produce to the processing plant, precleaning, drying, cleaning, grading, seed treatment, bagging and post processing storage of the seed lot.

Pre-requisites for processing

1. Processing report should accompany the seed lot
2. ODV test for paddy should be done at the time of sealing and issue of processing report or before processing. If the result exceeds 1% of the produce may be rejected.
3. It should be correlated with the estimated yield
4. Seed should be processed only in approved processing unit.
5. Field run seed should be brought to the processing unit within the 3 months from the date of final inspection. Processing and sampling should be done within 2 months in oil seed crops and 4 months for other crops from the date of receipt in the processing unit. In cotton the kapas from the passed lot should be moved to the ginning factory within 5 days from the date of issue of processing report. The ginning should be done within 3 months from the date of final harvest inspection report. Ginned seeds should be moved to seed processing unit within in 5 days of ginning. Inspection and sampling should be done within 3 months after ginning.

Intake of raw produce and lot identification

The seed certification officer in-charge of the seed processing plant may, after verification of the above stated documents and total amount of seed accept the produce for processing. After verification he should be issue a receipt to the seed grower. Each seed lot has tobe allocated a separate lot number for identification.

Processing of seed lot

1. It is done to remove chaff, stones, stempieces, leaf parts, soil particles etc from the raw seed lot.
2. Grading to bring out uniformity in the seed lot.
3. Seed treatment to protect it from storage pests and diseases.

Processing inspection

1. The processing should be done in the presence of concerned seed certification officer.
2. The recommended sieve size should be used for grading
3. While processing of paddy, the work of perfect processing have to be evaluated then and there.

This is done by conducting a float test. Take 400 seeds from the processed seed and put in to a tumbler of water. Count the floating paddy seeds. Maximum float admissible is 5%. If the float seeds exceed the limit, adjust the air flow or feeding to perfect the processing.

4. In maize before shelling the cobs should be examined for off type and off coloured kernels. Individual cobs should be examined with reference to its vareital characters. The cobs of off types and off coloured kernels should be rejected.
5. Seed sorting in cotton.

The ginned seeds will be evaluated for its quality. A maximum of 3 % for the following factors can be taken into accounts.

1. Immature seeds
2. Ill filled seeds
3. Broken seeds
4. Stained seeds and
5. Over fuzzy seeds

Ground nut Pod verification

In groundnut 4 % of ill - filled pods can be allowed.

After processing the seeds may be treated, packed, weighed and sealed before the Seed Certification Officer.

The unit of packing may be equal to the seed rate of 1/2 or one acre or ha.

5. Seed sampling and testing

During packaging Seed Certification officer will draw samples according to ISTA Procedure and send the sample to Assistant Director of Agriculture (See Certification) concerned within a day of sampling. The ADASC will in turn send the sample to the Seed Testing Laboratory within 3 days of receipt of the sample to testing seed standards viz., physical purity, germination, moisture content and seed health as prescribed. The Seed Testing Officer will communicate the result to the ADASC concerned within 20 days.

On receipt of the analytical report the ADASC will communicate the result to the producer and Seed Certification officer.

6. Labelling, tagging, sealing and grant of certificate

After receiving the seed analytical report the Seed Certification officer will get the tag from the ADASC and affixes labels (producer's label) and tags (blue for Certified Seed and White for Foundation Seeds) to the containers and seals them to prevent tampering and grants certificate fixing a validity period for 9 months. Tagging should be done within 60 days of testing.

7. Resampling and reprocessing

When a seed lot does not meet the prescribed seed standards in initial test, on request of the producer Seed Certification Officer may take resample.

If the difference in germination analysed and required is within 10, then straight away resampling can be done. If it is >10, reprocessing and resampling may be done.

The producer should request the Seed Certification Officer concerned in writing within 10 days from the receipt of the result. No charge is collected for resampling.

When a seed lot, fails even after free sampling reprocessing can be taken upon special permission from Deputy Director Seed Certification. For such reprocessing a fee of Rs.20/- Q and lab charges Rs.10/- Q is collected.

ii) Osmotic priming

It is a very expensive but it is a required process, particularly for large seeded legumes like peas, beans etc., They have high protein content and large embryo and are susceptible to soaking injury. High protein seeds are hygroscrpic and hydro philic.

Osmotic priming is nothing but making the seeds to imbibe water very slowly. Osmotic solutions used are (PEG) (poly ethylene glyster). Maintol is high toxic. PEG is inert and will increase very slowly. By preconditioning through osmotic priming, the seeds are invigourated which results in higher field emergence and higher seedling vigour.

iii) Fluid drilling

This is a technology evolved for mechanical sowing of seeds particularly the germinated seeds. The seeds are coated with a jelly material called guar gel. It is to have a buffer action to avoid damage of the germinated seeds.

iv) Separation of viable seeds.

It is a new concept particularly for groundnut. This is a good method to get desired seed germination and plant population. Increase of groundnut the actual population requirement is 30 plants / m2. Actual multiplication rate in groundnut is 1:8 . There are about 30-40% of dead seeds and of such dead seeds are eliminated, then we will be able to maintain the plant population. This is the base for evolving this technology.

This can be done in 2 ways

1. Manual separation based on germination symptoms (groundnut)
2. Based on physical property (pine seeds - Sweden) IDS (Incubation - Drying and Separation method).

SEED SAMPLING

Seed sampling is to draw a portion of seed lot that represent the entire seed lot.

Introduction

Seed lot - It is an uniformly blended quantity of seed either in bag or in bulk.

Seed Size	Maximum quantity per lot
Larger than wheat and paddy Smaller than wheat and paddy Maize	20,000 kg 10,000 kg 40,000 kg

Sampling intensity

a. For seed lots in bags (or container of similar capacity that are uniform in size)

I. up to 5 containers — Sample each container but never, < 5 Primary sample

6-30 " — Sample atleast one in every 3 containers but never > than 5 P.S.

31-400 " — Sample atleast one in every 5 containers but never < 10 P.S.

401 or more — Sample atleast one in every 7 containers but never < 80.

II. When the seed is in small containers such as tins, cartons or packets a 100 kg weight is taken as the basic unit and small containers are combined to form sampling units not exceeding this weight e.g. 20 containers of 5 kg each. For sampling purpose each unit is regarded as one container.

b. For seeds in bulk

Up to - 500 kg	-	Atleast 5 Primary sample
501 - 3000 Kg	-	1 Primary sample for each 300 kg but not less than 5 Primary sample
3001-20,000 Kg	-	1 Primary sample for each 500 kg but not less than 10 Primary sample
20,001 and above	-	1 Primary sample for each 700 kg but not less than 40 Primary sample

PRINCIPLES OF SAMPLING

Sample is obtained from seed lot by taking small portion at random from different places and combining them. From this sample smaller samples are obtained by one or more stages. In each and every stage thorough mixing and dividing is necessary.

Methods of sampling

a. Hand sampling

This is followed for sampling the non free flowing seeds or chaffy and fuzzy seeds such as cotton, tomato, grass seeds etc., In this method it is very difficult to take samples from the deeper layers or bag. To over come this, bags are emptied completely or partly and then seed samples are taken. While removing the samples from the containers, care should be taken to close the fingers tightly so that no seeds escape.

b. Sampling with triers

By using appropriate triers, samples can be taken from bags or from bulk.

I. Bin samplers

Used for drawing samples from the lots stored in the bins.

2. Nobbe trier

The name was given after Fredrick Nobbe- father of seed testing. This trier is made in different dimensions to suit various kinds of seeds. It has a pointed tube long enough to reach the centre of the bag with an oval slot near the pointed end. The length is very small. This is suitable for sampling seeds in bag not in bulk.

3. Sleeve type triers or stick triers

It is the most commonly used trier for sampling : There are two types viz.,

1. With compartments 2. Without compartments.

It consists of a hollow brass tube inside with a closely fitting outer sleeve or jacket which has a solid pointed end. Both the inner tube as well as the outer tube have been provided with openings or slots on their walls. When the inner tube is turned, the slots in the tube and the sleeve are in line. The inner tube may or may not have partitions.

This trier may be used horizontally or vertically. This is diagonally inserted at an angle of 30 ^{o}C in the closed position till it reaches the centre of the bag. Then the slots are opened by giving a half turn in clockwise direction and gently agitated with inward push and jerk, so that the seeds will fill each compartment through the openings from different layers of the bag, then it is again closed and with drawn and emptied in a plastic bucket. This trier is used for drawing seed samples from the seed lots packed in bags or in containers.

TYPES OF SAMPLES

1. Primary sample

Each probe or handful of sample taken either in bag or in bulk is called primary sample.

2.Composite sample

All the primary samples drawn are combined together in suitable container to form a composite sample

3. Submitted sample

When the composite sample is properly reduced to the required size that to be submitted to the seed testing lab, it is called submitted sample. Submitted sample of requisite weight or more is obtained by repeated halving or by abstracting and subsequently combining small random portions.

4. Working sample

It is the reduced sample required weight obtained from the submitted sample on which the quantity tests are conducted in seed testing lab.

Weight of submitted sample

The minimum weight for submitted samples for various tests are as follows

1. **Moisture test**

   100 gm for those species that have to be ground and 50 gm for all other species.

2. **For verification of species and cultivar**

Crop	Lab only (g)	Field plot & Lab (g)
Peas, beans, maize, soybean and crop seeds of similar size	1000	2000
Barley, oats, wheat and crop seeds of similar size Beet root and seeds of similar size	500	1000
All other genera	200	500
	100	250

3. **For other tests like purity and count of other species**

Crop	Size of seed lot (kg)	Size of submitted sample (g)	Size of working purity (g)	Sample count of other species (g)

Paddy	25,000	400	40	400
Wheat	25,000	1000	120	1000
Maize	40,000	1000	900	1000
Sorghu	10,000	900	90	900
m Bajra	10,000	150	15	150
Red	20,000	1000	300	1000
gram	20,000	1000	120	1000
Green gram	20,000	1000	150	1000
Black gram	20,000	1000	1000	1000
Bengal gram	20,000	1000	400	1000
Cowpea	20,000	1000	500	1000
Soybean	20,000	1000	1000	1000
Groundnut (pods)	20,000	1000	600	1000
Groundnut	10,000	70	7	70
(kernels) Gingelly	20,000	1000	250	1000
Sunflower (variety)	20,000	1000	125	250
Sunflower (hybrid)	20,000	1000	350	1000
Cotton linted (variety)	20,000	350	35	350
Cotton de-	20,000	350	35	350
linted (variety)	20,000	250	25	250
Cotton linted (hybrid)	10,000	150	15	150
Cotton de-	10,000	150	15	150
linted (hybrid)	20,000	1000	140	1000
Brinjal	10,000	70	7	70
Chillie	10,000	7	7	7
s	10,000	100	10	100
Bhendi				
Tomato (variety)				

Tomato (hybrid) Cabbage Cauliflower Knolkhol	10,000 10,000	100 100	10 10	100 100

The samples taken may packed in bags, sealed and marked for identification. For moisture testing the samples should be packed separately in moisture proof polythene bag and kept in the container along with the submitted samples.

Information to accompany the sample

Date Kind Variety
Class of seed Lot No.
Quantity of seed in lot (kg)
Test(s) required (1) Purity (2) Germination (3) Moisture Senders Name and Address

Types of sample used in Seed Testing Laboratory

Service sample - Sample received from the farmers

Certified sample - Sample received from certification agencies or officers

Official sample - Sample received from the seed inspectors.

Mixing and dividing of seeds

The main objective of mixing and dividing of seeds is to obtain the representative homogenous seed sample for analysis by reducing the submitted sample to the desired size of working sample.

Method of mixing and dividing

1. Mechanical dividing
2. Random cups method
3. Modified halving method
4. Spoon method
5. Hand halving method

1. Mechanical method

The reduction of sample size is carried out by the mechanical dividers suitable for all seeds except for chaffy and fuzzy seeds.

Object ive of mechanical dividing

- To mix the seed sample and make homogenous as far as possible
- To reduce the seed sample to the required size without any bias
- The submitted sample can be thoroughly mixed by passing it through the divider to get 2 parts and passing the whole sample second time and 3rd time

if necessary to make the seeds mixed and blended so as to get homogenous seed sample when the same seeds passed through it into approximately equal parts.

- The sample is reduced to desired size by passing the seeds through the dividers repeatedly with one half remain at each occasion.

TYPES OF MECHANICAL DIVIDERS

1. Boerner divider

It consists of a hopper, a cone and series of baffles directing the seeds into 2 spouts. The baffles are of equal size and equally spaced and every alternate one leading to one spout. They are arranged in circle and are directed inward. A valve at the base of the hopper retains the seeds in the hopper. When the valve is opened the seeds fall by gravity over the cone where it is equally distributed and approximately equal quantity of seeds will be collected in each spout. A disadvantage of this divider is that it is difficult to check for cleanliness.

2. Soil divider

It is a sample divider built on the same principles as the Boerner divider. Here the channels are arranged in a straight row. It consists of a hopper with attached channels, a frame work to hold the hopper, two receiving pans and a pouring pan. It is suitable for large seeds and chaffy seeds.

3. Centrifugal or Gamet Divider

The principle involved is the centrifugal force which is used for mixing and dividing the seeds. The seeds fall on a shallow rubber spinner which on rotation by an electric motor, throw out the seeds by centrifugal force. The circle or the area where the seeds fall is equally divided into two parts by a stationary baffle so that approximately equal quantities of seed will fall in each spout.

II. RANDOM CUP METHOD

This is the method is suitable for seeds requiring working sample upto 10 grams provided that they are not extremely chaffy and do not bounce or roll (e.g.) Brassica spp.

Six to eight small cups are placed at random on a tray. After a preliminary mixing the seed is poured uniformly over the tray. The seeds that fall into the cup is taken as the working sample.

III. MODIFIED HALVING METHOD

The apparatus consists of a tray into which is fitted a grid of equal sized cubical cups open at the top and every alternate are having no bottom. After preliminary mixing the seed is pouted evenly over the grid. When the grid is lifted approximately half the sample remains on the tray. The submitted sample is successively halved in this method until a working sample size is obtained.

IV. SPOON METHOD

This is suitable for samples of single small seeded species. A tray, spatula and a spoon with a straight edge are required. After preliminary mixing the seed is poured evenly over the tray. The tray should not be shacked there after. With the spoon in one hand, the spatula in the other and using both small portions of seed from not less than 5 random places on the tray should be removed. sufficient portions of seed are taken to estimate a working sample of approximately but not less than the required size.

SEED GERMINATION TEST

It is defined as the emergence and development from the seed embryo, of those essential structures, for the kind of seed in question, indicates its ability to produce a normal plant under favourable conditions.

Principles

Germination tests shall be conducted with a pure seed fraction. A minimum of 400 seeds are required in four replicates of 100 seeds each or 8 replicates of 50 seeds each or 16 replicates of 25 seeds each depending on the size of seed and size of containers of substrate.

The test is conducted under favourable conditions of moisture, temperature, suitable substratum and light if necessary. No pretreatment to the seed is given except for those recommended by ISTA.

Materails required

A. Substratum

The substratum serves as moisture reservoir and provides a surface or medium for which the seeds can germinate and the seedlings grow.The commonly used substrata are sand, paper and soil.

I. Sand

a. Size of sand particle

Sand particles should not be too large or too small. The sand particles should pass thorugh 0.80 mm sieve and retained by 0.05 mm sieve.

b. Toxicity

Sand should not have any toxic material or any pathogen. If there is presence of any pathogen, found, then the sand should be sterilized in an autoclave.

c. Germination Tray

When we use the sand, germination trays are used to carry out the test. The normal size of the tray is 22.5 x 22.5 x 4 cm. They tray may either zinc or stainless steel.

B. Method of seed placement

1. Seeds in sand(s)

Seeds are planted in a uniform layer of moist sand and then covered to a depth of 1 cm to 2 cm with sand.

2. Top of sand (TS)

Seeds are pressed into the surface of the sand

C. Spacing

We must give equal spacing on all sides of facilitate normal growth of seedling and to avoid entangling of seed and spread of disease. Spacing should be 1-5 times the width or diameter of the seed.

D. Water

The amount of water to be added to the sand will depend on size of the seed. For cereals, except maize, the sand can be moistened to 50% of its water holding capacity. For large seeded legumes and maize sand is moistened to 60% water holding capacity.

II. Paper

Most widely used paper substrates are filter paper, blotter or towel (kraft paper). It should be have capillary movement of water., at vertical direction (30 mm rise / min.).It should be free from toxic substances and free from fungi or bacteria.It should hold sufficient moisture during the period of test.The texture should be such that the roots of germinating seedlings will grow on and not into the paper.

A. Methods

a. Top of Paper (TP)

Seeds are placed on one or more layers of moist filter paper or blotter paper in petridishes. These petridishes are covered with lid and placed inside the germination cabinet. This is suitable of those seeds which require light.

b. Between Paper (PP)

The seeds are germinated between two layers of paper

c. Roll Towel Method

The seeds are placed between two layers of paper and rolled in towels. The rolled towels are placed in the germinator in an upright position.

d. Inclined Plate Method

Germination on glass plate with germination paper and kept at an angle of

45^{o}

III. SOIL

Should be non-caking, free from any large particles. It must be free from weed seeds, bacteria, fungi, nematode or toxic substances. Soil is not recommended for reuse.

B. TEMPERATURE

Required temperature is maintained (most seeds germinate between 20-30 ^{o} C).

C. LIGHT

Light should be provided for seeds requiring light for germination (e.g.) lettuce and tobacco.

GERMINATION REQUIREMENTS FOR DIFFERENT CROPS

Crop	Substratum	Temp (^{o}C)	First count days	Final Count days	Pre-treatment
Paddy	BP,TP,S	20-30	5	14	Preheat (50^{o}C)soak in H_2O or HNO_3 24 hrs.
Maize	BP,S	20-30	4	7	-
	TP,B	20-30	3	7	0.2 % KNO_3 (2-3 hrs) Prechill
Bajra	P	20-30	4	10	-
Sorghum	TP,BP				
Pules		20-30	4	6	-
Red gram	BP,S	30	4	7	-
Black gram	BP,S	20-30	5	8	
Green gram	BP,S	20-30	5	8	-
Bengal gram	BP,S	20-30	5	8	-
Cowpea	BP,S	20	5	8	-
Peas	BP,S	20	7	14	
Castor	TP	20-30	5	10	-
Groundnut	BP,S	20-30	4	10	-
Sunflower	TP,B	20-30	3	6	
Sesame	P	20-30	4	12	Remove shells
Cotton	TP,B	20-30	7	14	Ethrel (25 ppm) 48 hrs.
Brinjal	P	15-20	5	14	
Tomato	TP,B	20-30	7	14	(Hot water 85^{o} C 1 min) KNO_3
Chillies	P	20-30	6	21	KNO_3
Bhendi	BP,S	20-30	4	10	Prechill
Onion	TP,B	20-30	5	10	prechill
Carrot	P	30-35	5	14	Prechill, KNO_3 light
Radish	TP,B	20-30	4	14	-
Cabbage	P	20-30	4	14	-
Cauliflower	TP,B				
Ash gourd	P				

Biter gourd Bottle gourd	T P S BP,S BP,S				

GERMINATION APPRATUS

1. Germination Cabinet / Germination

This is called chamber where in temperature and relative humidity are controlled.

We can maintain the required temperature.

2. Room Germinator

It works with same principle as that of germinator. This is a modified chamber of larger one and the worker can enter into it and evaluate the seedlings. Provisions are made to maintain the temperature and relative humidity. This is used widely in practice.

3. Counting Board

This is used for accurate counting and spacing of seeds. This consists of 2 plates. The basal one is stationary and top one is movable. Both top and basal plates are having uniform number of holes viz., 50/100, when the plates are in different position. After taking the sample, the top plate is pulled in such a way that the holes are in one line so that the fixed number of seeds fall on the substratum.

4. Vacuum Counter

Consists of a head, pipe and wall. There are plates of 50 or 100 holes which can be fitted to the head. When vacuum is created the plate absorbs seeds and once the vacuum is released the seeds fall on the substrate.

5. Impression Board

Made of plastic / wood with 50 or 100 holes/pins. Here the knobs are arranged in equal length and space. By giving impression on the sand it makes uniform depth and spacing for seed.

D.Seedling Evaluation

ISTA classified the seedlings into different categories based on the development of essential structures.

CATEGORIES OF SEEDLINGS

1. Normal seedlings
2. Abnormal seedlings
3. Hard seeds
4. Fresh ungerminated seeds
5. Dead seeds

1. Normal Seedligns

Seedlings which show the capacity for continued development into normal plant when grown in favourable conditions of soil, water, temperature and light.

Characters of Normal Seedlings

1. A well developed root system with primary root except in certain species of graminae which normally producing seminal root or secondary root.

2. A well developed shoot axis consists of elongated hypocotyl in seedlings of epigeal germination.

3. A well developed epicotyl in seedlings of hypogeal germination
4. One cotyledon in monocotyledons and two in dicotyledons
5. A well developed coleoptile in graminae containing a green leaf.
6. A well developed plumule in dicotyledons.
7. Seedlings with following slight defects are also taken as normal seedlings. Primary root with limited damage but well developed secondary roots in leguminosae (Phaseolus, Pisum), graminae (maize), cucurbitaceae (cucumis) and malvaceae (cotton).
8. Seedlings with limited damage or decay to essential structures but no damage to conducting tissue.
9. Seedlings which are decayed by pathogen but it is clearly evident that the parent seed is not the source of infection.

II. Abnormal seedlings

Seedlings which do not show the capacity for continued development into normal plant when grown in favourable conditions of soil, water, temperature and light.

Type of abnormal seedlings

A. Damaged seedlings

Seedlings with any one of the essential structures missing or badly damaged so that the balanced growth is not expected. Seedlings with no cotyledons, with splits, cracks and lesions or essential structures and without primary root.

B. Deformed Seedlings

Weak or unbalanced development of essential structures such as spirally twisted or stunted plumule or hypocotyl or epicotyl, swollen shoot, stunted roots etc.,

C. Decayed seedlings

Seedlings with any one of the essential structures showing diseased or decayed symptoms as a result of primary infection from the seed which prevents the development of the seedlings.

III. Hard seeds

Seed which do not absorb moisture till the end of the test period and remain hard (e.g) seeds of leguminosae & malvaceae.

IV. Fresh ungerminated seeds

Seeds which are neither hard nor have germinated but remain firm and apparently viable at the end of the test period.

V. Dead seeds

Seeds at the end of the test period are neither hard nor fresh or have produced any part of a seedling. Often dead seeds collapse and milky paste comes out when pressed at the end of the test.

Retesting

If the results of a test are considered unsatisfactory it shall not be reported and a second test shall be made by the same method or by alternative method under the following circumstances.

1. Replicates performance is out of tolerance

2. Results being inaccurate due to wrong evaluating of seedlings or counting or errors in test conditions.
3. Dormancy persistence or phytotoxicity or spread of fungi or bacteria. The average of the two tests shall be reported.

Use of tolerances

The result of a germination test can be relied upon only if the difference between the highest and the lowest replicates is within accepted tolerances.

To decide if two test results of the same sample are compatible again the tolerance table is used.

Reporting resutls

The results of the germination test is calculated as the average of 4 x 100 seed replicates.It is expressed as percentage by number of normal seedlings.The percentage is calculated to the nearest whole number.The percentage of abnormal seedlings, hard, fresh and dead seeds is calculated in the same way. These should be entered on the analysis of certificate under appropriate space.If the result is nil for any of these categories it shall be reported as 'O'.

Types of germination

Two types of seed germination occur and neither appears to be related to seed structure. These two types can be illustrated by observing the germination of bean and pea seeds. Although these seeds are similar in structure , their germination patterns are quite different. Epigeal germination in beans and hypogeal in peas.

EPIGEAL GERMINATION

During germination the cotyledons are raised above the ground. During root establishment the hypocotyl begins to elongate in an arch which breaks thro' the soil, pulling the cotyledon and enclosed (epicotyl) thro' the ground and projecting them into the air. (e.g) bean, castor, cucurbits and other dicots and onion.

Hypogeal germiantion

During germination, cotyledons remain beneath the soil while the plumule pushes upward and emerges above the ground. Here the epicotyl (plumule) elongates (e.g) Peas, grams, mango, grasses and many other spp.

Seed standards for germination

S.No.	Crop	*Class*	
		Foundation Seed	**Certified seed**
1	Paddy	80	80
2	Maize (inbreds)	80	-
	Single cross	80	80
	Double cross	-	90
	Variety	90	90
3	Sorghum (variety)	75	75

	Hybrid	75	75
4	s	75	75
5	Cumbu	75	75
6	Ragi	75	75
7	Black gram	85	85
8	Bengal gram	75	75
9	Green gram	80	80
10	Horse gram	75	75
11	Peas	75	75
12	Pigeon pea	70	70
13	Castor variety	70	70
14	Ground nut	80	80
15	Sesame	70	70
16	Soybean	70	70
17	Sunflower	65	65
18	Cotton	80	80
19	Jute	60	60
20	Gourds	70	70
21	Brinjal	60	60
22	Chillies	65	65
23	Bhendi	70	70
24	Tomato	70	70
25	Cabbage	65	65
26	Cauliflowe	60	60
27	r Carrot	70	70
28	Radish	60	60
	Beet root		