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Center for Smart Agriculture

Organic Farming



Module 6: Plant propagation

Session 2: Criteria for seed evaluation and multiplication.



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- Seed -an embryonic plant enclosed in a protective outer covering.
- Good quality seed is the sum of its genetic, physiological, physical and health traits.
- Concerning genetic quality, the material should be of known origin, already tested in the region, and produced in an isolated environment.



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The best plants on the farm should be chosen by considering vigorous growth, high yielding plants, good quality fruits (shape, colour and flavour (when applicable)), best fruit covering, good health, etc. The selected plants should be looked after with the utmost care.



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Introduction of Seed production

Introduction contains the topics

1. Definition and scope of seed and seed technology.
2. Concept of Seed Quality.
3. Categories and classes of seeds.
4. Brief history of its development in India.
5. Relevant organizations in India and abroad.





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It should include the smallest possible amount of inert material (remains of flowers, fruits, etc.). It should have good weight and size, without mechanical damage (e.g. wild radish seeds are very sensitive, their seed cuticle being very brittle during the seed cleaning process).



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Health quality should be achieved by working-up a healthy, organic soil, rich in organic matter, nutrients and microorganisms, so that plants grow healthy and without nutrient or physiological imbalances that make them susceptible to pests and diseases.



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Seed testing

- To gain information about the field planting value of the seed lot.
- To obtain result that can be used to compare the value of different seed lots.
- To identify the seed quality problems and their probable cause (causes of seed deterioration).
- To determine the need for drying, processing and specific procedure that should be used.
- To determine whether seed meets IMSCS or labeling specification.
- Determination of selling price of seeds.
- Predicting storability of seeds



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Seed testing: Components

- Moisture test
- Germination test
- Physical purity test
- Dormancy test
- Seed Vigour & viability Tests
- Seed health test
- Genetic purity test



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SEEDLINGS EVALUATION

- a) Normal seedlings: Seedlings which show the capacity for continued development into normal plants, when grown in good quality soil and under favorable conditions of water supply, temperature and light. These are the seedlings which possess all the essential structures with a well developed root.
 - i. Intact seedling
 - ii. Seedling with slight defects
 - iii. Seedling with secondary infection
- b) Abnormal seedlings: which do not show the capacity for continued development into normal plants, when grown in good quality soil and under favorable conditions of water supply, temperature and light
 - i. Damaged seedlings
 - ii. Deformed seedlings
 - iii. Decayed seedlings



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c) Dead seeds

d) Hard Seeds

e) Fresh seed

The percentage germination is calculated to the nearest whole number. If the result is nil for any type of category, it is reported as zero instead of leaving the appropriate column blank. The sum of the percentage of the normal, abnormal seedling, hard and dead seeds must be 100.

(i) Germination (%) = Normal seedling/ No. of seeds per rep. x 100

(ii) Germination (%) = Normal seedling + Hard seeds/ No. of seeds per rep. x 100



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Seed classes

- **Nucleus Seed:** It is handful of seed maintained by concerned breeder for further multiplication. The nucleus seed will have all the characters that he breeder has placed in it and it is of highest genetic purity. The quantity of nucleus seed is in kilograms.
- **Breeder Seed :** It is produced by the concerned breeder or sponsoring institute or and which is used for producing foundation seed. It is of 100% genetic purity. The label/tag issued for B/s is golden yellow in color. The quality of breeder seed is assured by the monitoring team constituted by the govt.
- **Foundation Seed:** It is produced from breeder seed and maintained with specific genetic identity and purity. It is produced on govt. farms or by private seed producers. The quality of foundation seed is certified by certification agency. It has genetic purity of above 98%. The certification tag or label issued for F/s is white in color



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Seed Quality – Classes

1. Nucleus seed: This is cent per cent genetic pure seed with physical purity produced under the direct supervision of the concerned plant breeder.
2. Breeder's seed: This is the progeny of the nucleus seed multiplied in large area under the supervision of plant breeder and monitored by a committee. It provides cent per cent physical and genetic pure seed for production of foundation class. Golden yellow coloured certificate is issued for this category by the producing agency.



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- **Foundation seed:** Progeny of breeder's seed is handled by recognized seed producing agencies in public and private sector under the supervision of Seed Certification Agency in such a way that its quality is maintained according to the prescribed standard. Seed Certification agency issues a white colour certification for foundation class seed. Foundation seed is purchased by Seed Corporation from seed growers.
- **Certified seed:** Progeny of foundation seed produced by registered seed growers under the supervision of Seed Certification Agency by maintaining the seed quality as per minimum seed certification standards. Seed Certification Agency issues a bleu colour (Shade ISI No. 104, azure blue) certificate.
- **Nucleus seed:** is the handful of original seed obtained from selected individual plants of a particular variety for maintenance and purification by the originating breeder. It is further multiplied and maintained under the supervision of qualified plant breeder to provide breeder seed. This forms the basis for all further seed production. It has the highest genetic purity and physical purity.



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Seed Quality: Thompson (1979) defined seed quality as a multiple concept comprising several components and their relative importance in different circumstances and laid much emphasis on

- 1. Analytical purity / physical purity
- 2. Species purity / Genetic purity
- 3. Freedom from weeds
- 4. Germination percentage
- 5. Seed vigour and health
- 6. Seed Moisture content
- 7. Seed size, weight and specific gravity



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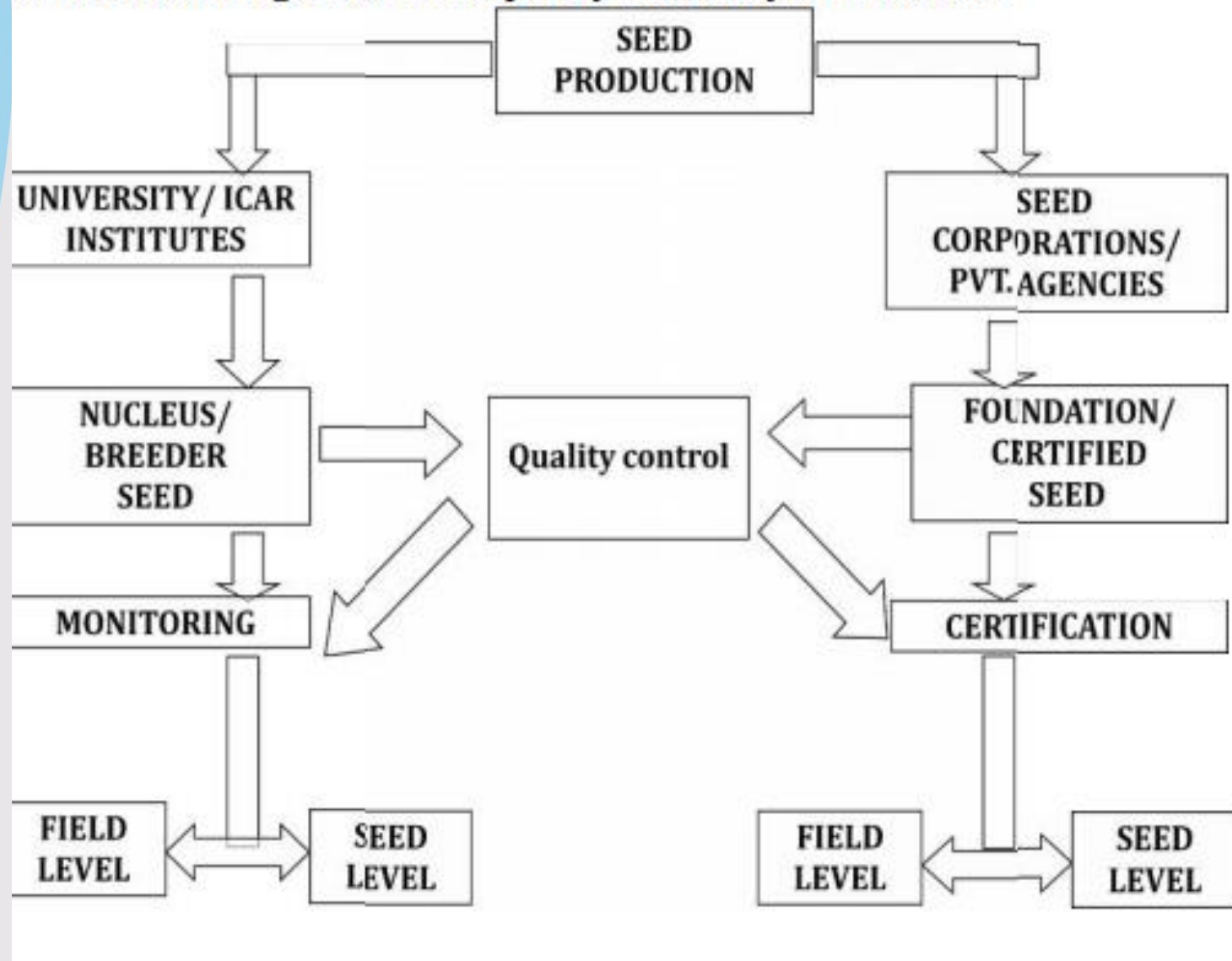
- **Seed quality characters:** A good seed should have the following quality characters.
- **Improved variety:** It should be superior to the existing variety i.e. the yield should be higher by 20-25% than the existing variety or it should have some desirable attributes like disease resistance, drought resistance, salt tolerance etc., with good yield potential.
- **Genetic Purity:** The seed should be true to type. The seed should possess all the genetic qualities / characters, which the breeder has placed in the variety, genetic purity has direct effect on the yields. If there is any deterioration, there would be proportionate decrease in the yield or performance.
- **Physical Purity:** Physical purity of a seed lot refers to the physical composition of the seed lots. A seed lot is composed of pure seed, inert matter, broken seeds, undersized seeds, soil and dust particles weed seeds, OCS etc. Higher the content of pure seed better would be the seed quality. Pure seed together with germination gives the planting value of the seed lot.



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Schematic Diagram of seed quality control system in India



Source:

<https://krishi.ica.gov.in/jspui/bitstream/123456789/11980/1/Mannual%20Volume%20I.pdf>



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- **Seed germination and vigour:** Seed germination refers to the ability of a seed when planted under normal sowing conditions to give rise to a normal seedling. Seed vigour refers to the sum total of all seed attributes that give effective plant stand in the field. Higher germination percentage and vigour gives adequate plant population and uniform growth, which have profound effect on, yield and determine the planting value of the seed.
- **Freedom from weeds and other crop seeds:** This is an extension of physical purity described earlier. There are certain weed species, which are very harmful to the crop and once established they are difficult to eradicate. An absolute freedom from seed of such species is highly desirable and is one of the important criteria for determining the planning quality of seeds.
- **Seed health:** Seed health refers to the presence or absence of disease organisms or insect pests on the seed. The quality of a seed lot depends on its health, hence the seed should be free from seed borne disease and insect pests.
- **Seed moisture:** The seed moisture is the most important factor in determining the seed germination and viability during storage. At high seed moisture content there is high incidence of pest attack and at moisture content above 16% seed get heated and the viability is lost. Hence the seed should be stored at safe moisture levels of 11-13%



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- Seed size, weight and specific gravity: Seed size, weight and specific gravity has been found to have positive correlation with seed germination and vigour in many crops. Therefore the seed should be bold with high specific gravity.
- Seed Colour: The colour of the seed often reflects the condition during seed maturation. The farmers from ancient times have regarded good normal shine as invariable quality guides.
- The colour and shine deteriorates only when the weather conditions are adverse during maturation or when insects infest the crop or when it is handled badly. The seed lots having high genetic purity, high germination and with a minimum amount of inert matter, weed seeds and other crop seeds and are free from diseases is said to be of high quality and if it is lacking of these it is said to be of low quality.



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Depending on the longevity of seeds are classified into

1. **Orthodox Seeds:** Orthodox seeds are long-lived seeds. They can be successfully dried to moisture contents as low as 5% without injury and are able to tolerate freezing temperatures. At physiological maturity they contain moisture content of 30 – 50%. Most of the field crops like cereal, pulses, oilseeds etc. are the example of orthodox seeds.
2. **Recalcitrant Seeds:** They are short-lived seeds, which cannot be dried to moisture contents below 30% without injury and are unable to tolerate freezing. They are difficult to store successfully because of their high moisture content encourages microbial contamination and results in more rapid seed deterioration. Storage of these seeds at subzero temperatures causes the formation of ice crystals, which disrupts cell membranes and causes freezing injury. These seeds are from perennial trees in the moist tropics such as coconut, coffee, cacao, citrus etc.



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Seed characterization

- To analyze the quality, morphometric characteristics and viability of seeds
- 1. Automate for germination monitoring by image analysis
- 2. Near infrared analyzer
- 3. Morphometric analyzer by image analysis





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Seed Multiplication Process

- After manufacturing of the seed, the next important step is to ensure multiplication and distribution of high-quality seeds, as the quality and quantity of agricultural output of an entire country depend on it. This process is carried out by the various government as well as private seed manufacturers engaged in hybrid seed production in India.



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- A seed is one of the cheapest yet most essential agricultural input which is quintessential for sustained agriculture. When a variety of seed is released only a small quantity of the seed is made available with the breeder, which is known as the nucleus seed. The breeder undertakes the process of seed multiplication to produce commercially viable quantities of seed.



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- A new or improved variety of seed is not released unless and until enough true seeds have been produced to make it viable commercially. Multiplication of a seed involves the following steps: -
 - 1. Nucleus Seed
 - 2. Breeder Seed
 - 3. Foundation Seed
 - 4. Registered Seed
 - 5. Certified Seed



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