



Lecture 05: SEED QUALITY

Seed is a basic input in agriculture. Strictly speaking seed is an embryo, a living organism embedded in the supporting or the food storage tissue. In seed, the importance is given to the biological existence whereas; in grain the importance is given to the supporting tissue the economic produce.

Seed is defined as

- A ripened ovule or a fertilized matured ovule containing embryo which has developed after fertilisation.
- The dry dispersal unit or matured ovule developed after fertilization
- Any part (or) organ of plant which has the capability to regenerate into a new plant
- A propagule responsible for maintaining the intrinsic (or) genetic qualities of the variety / hybrid.
- An 'embryo', a living organism embeded in the supporting (or) the food storage tissue and a protective coat.
- Any propagative material.
- Miniature plant.
- Dormant plant
- Link between two generations
- Carrier of service material.
- Generative part of a plant that develop into a new plant.

However, the widely accepted definition for a seed is matured ovule that consisting of an embryonic plant together with a store of food, all surrounded by a protective coat.

As per Seed Act (1966) seed includes

- Seed of food crops including edible oil seeds and seeds of fruits & vegetables.
- Cotton seeds
- Seeds of cattle fodder
- Jute seeds
- Seedlings, tubers, bulbs, rhizomes, roots, cuttings, all types of grafts and other vegetative propagated material for food crops (or) cattle fodder.



Differences between seed and grain

SEED	GRAIN
It should be a viable one	Need not be a viable one
It should have maximum genetic & physical purity	Not so
Should satisfy minimum seed certification standards	No such requirements
It should be completely treated with pesticide /fungicide to protect seed against storage pests and fungi	It should never be 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
Should be compulsorily certified / truthful labelled	No such condition in grain production
Should never be converted into grain unless warranted	Can be converted as seed provided the situation warrants
It should satisfy all the quality norms	Not considered

Importance of seedSeed is the vital input in crop production because through seed only the investment made on other inputs like pesticide, fertilizer, irrigation and crop maintenance can be realized. The seed required for raising the crop is quite small and its cost is also less compare to other inputs, but the greater income farmer gets depends upon the quality of the small quantity of seed he uses. In addition to above seed is the basic for the following event of agriculture.

A carrier of new technologies

- In India for instance, the cultivation of high yielding varieties have helped to increase food production from 52 million tonnes to more than 200 million tones over a period of 50 years.

A basic tool for secured food supply

- The successful implementation of the High Yielding Varieties Programme (HYVP) in India has led to a remarkable increase in production and to a new assessment of future development potential. As a result, food imports from other countries have been substantially brought down inspite of the rapid population increase.



The principal means to secure crop yields in less favorable production areas

- The supply of good quality seeds of improved varieties suitable to these areas is one of the few important immediate contribution to secure higher crop yields.

A medium for rapid rehabilitation of agriculture in cases of natural disaster

- Widespread floods and droughts in various parts of the country and elsewhere have focused attention on these recurrent crises and the accompanying threats of famine and starvation. The establishment of National Seed Reserve Stocks should receive high priority for meeting such natural calamities.
- This would provide improved seeds in emergency periods to production areas for rapid production of food grains.
- This would supply seeds to disaster regions for resowing, as no seed would normally be available in such regions.

SEED QUALITY

Seed quality is the possession of seed with required genetic and physical purity that is accompanied with physiological soundness and health status.

The major seed quality characters are summarized as below.

1. Physical Quality:

It is the cleanliness of seed from other seeds, debris, inert matter, diseased seed and insect damaged seed. The seed with physical quality should have uniform size, weight, and colour and should be free from stones, debris, and dust, leaves, twigs, stems, flowers, fruit well without other crop seeds and inert material. It also should be devoid of shriveled, diseased mottled, molded, discolored, damaged and empty seeds. The seed should be easily identifiable as a species of specific category of specific species. Lack of this quality character will indirectly influence the field establishment and planting value of seed.

This quality character could be obtained with seed lots by proper cleaning and grading of seed (processing) after collection and before sowing / storage.

2. Genetic purity:

It is the true to type nature of the seed. i.e., the seedling / plant / tree from the seed should resemble its mother in all aspects. This quality character is important for achieving the desired goal of raising the crop either yield or for resistance or for desired quality factors.

3. Physiological Quality:

It is the actual expression of seed in further generation / multiplication. Physiological quality characters of seed comprises of seed germination and seed vigour.



The liveliness of a seed is known as viability. The extent of liveliness for production of good seedling or the ability of seed for production of seedling with normal root and shoot under favorable condition is known as germinability. Seed vigour is the energy or stamina of the seed in producing elite seedling. It is the sum total of all seed attributes that enables its regeneration of under any given conditions. Seed vigour determines the level of performance of seed or seed lot during germination and seedling emergence.

Seed which perform well at sowing are termed as quality seed and based on the degree of performance in production of elite seedling it is classified as high, medium and low vigour seed. The difference in seed vigour is the differential manifestation of the deteriorative process occurring in the seed before the ultimate loss of ability to germinate. Difference in seed vigour will be expressed in rate of emergence, uniformity of emergence and loss of seed germination.

Hence it is understood that all viable seeds need not be germinable but all germinable seed will be viable. Similarly all vigourous seeds will be germinable but all germinable seed need not be vigourous. Physiological quality of seed could be achieved through proper selection of seed (matured seed) used for sowing and by caring for quality characters during extraction, drying and storage.

Seed with good vigour is preferable for raising a good plantation as the fruits, the economic come out are to be realized after several years. Hence selection of seed based on seed vigour is important for raising perfect finalize plantation.

4. Seed Health

Health status of seed is nothing but the absence of insect infestation and fungal infection, in or on the seed. Seed should not be infected with fungi or infested with insect pests as these will reduce the physiological quality of the seed and also the physical quality of the seed in long term storage. The health status of seed also includes the deterioration status of seed which also expressed through low vigour status of seed. The health status of seed influences the seed quality characters directly and warrants their soundness in seed for the production of elite seedlings at nursery / field.

Hence the quality seed should have

- High genetic purity
- High pure seed percentage (physical purity)
- High germinability
- High vigour
- Higher field establishment
- Free from pest and disease



- Good shape, size, colour etc., according to the specification of variety
- High longevity / shelf life.
- Optimum moisture content for storage
- High market value

Characteristics of good quality seed

- **Higher genetically purity:**

Breeder /Nucleus - 100%

Foundation seed - 99.5%

Certified seed - 99.0%

- **Higher physical purity for certification**

Maize , Bhendi	99%
All crops (most)	98%
Carrot	95%
Sesame, soybean &jute	97 %
Ground nut	96 %

- Possession of good shape, size, colour, etc., according to specifications of variety
- Higher physical soundness and weight
- Higher germination (90 to 35 % depending on the crop)
- Higher physiological vigour and stamina
- Higher storage capacity
- **Free from other crop seeds (Expressed in number /kg)**

Crop	Designated inseparable other crop seeds
Barley	Wheat ,oats & gram
Oats	Wheat ,gram & barley
Wheat	Oats, gram & barley

Other crop seeds are the plants of cultivated crops found in the seed field and whose seed are so similar to crop seed that is difficult to separate them economically by mechanical means. Cause physical admixture with the crop seed only when these crop mature approximately at the same time when seed crop matures.

- **It should be free from objectionable weed seeds**



These are plants of weed species which are harmful in one or more of the following ways.

- The size and shape of their seeds are so similar to that of the crop seed that is difficult to remove their seed economically by mechanical means.
- Their growth habit is detrimental to the growing seed crop due to competing effect.
- Their plant parts are poisonous or injurious to human and animal beings
- They serve as alternate hosts for crop pests and diseases.

Objectionable Weeds of Seed Crop Plants

Crop	Objectionable weeds
Berseem	Chicory(<i>Chicorium intybus</i>)
Cucurbits	Wild Cucurbita sp.
Kasuri methi	Melilous sp.
Lettuce	Wild lettuce(<i>Lactuca sativa</i>)
Bhendi	Wild Abelmoschus sp
Rape & Mustard	<i>Argemone mexicana</i>
Wheat	<i>Convolvulus arvensis</i> (Hiran kuri)
Paddy	Wild paddy (<i>Oryza sativa</i> var. Fatua)

- **It should be free from designated diseases**

It refers to the diseases specified for the certification of seeds and for which certification standards are to be met with. These diseases would cause contamination, when they are present in the seed field or with in the specified isolation distance (eg. loose smut of wheat). For this the the certification distance has been prescribed as 180 meters.

Crop	Designated disease	Causal organism
Wheat	Loose smut	<i>Ustilago tritici</i>
Sorghum	Grain smut Kernel smut	<i>Sphacelotheca sorghii</i>
Mustard	Alternaria blight	<i>Alternaria sp</i>
Pearl millet	Grain smut Green ear Ergot	<i>Tolyposporium penicillariae</i> <i>Sclerospora graminicola</i> <i>Claviceps microcephala</i>
Sesame	Leaf spot	<i>Alternaria sp</i>
Brinjal	Little leaf	Datura virus 2
Chilies	Anthraxnose leaf blight Leaf blight	<i>Gloesporium piperatum</i> <i>Alternaria solani</i>



Cucurbits	Mosaic	<i>Cucumis virus</i>
Cowpea	Anthrachnose	<i>Colletotricum sp</i>
Bhendi	Yellow vein mosaic	Hibiscus virus 1
Potato	Brown rot	<i>Pseudomonas solanacearum</i>
	Root knot nematode	<i>Meloidogyne incognita</i>
Tomato	Early blight	<i>Alternaria solani</i>
	Leaf spot	<i>Xanthomonas vesicatoria</i>

- **It should have optimum moisture content for storage**

Long term storage - 6 - 8 %

Short term storage - 10-13%

- **It should have high market value**

Role of good quality seed

Therefore at most care must be given upon the use of quality seed and thus certification guarantees quality and ensures high and assured yield under environmental stress conditions. This emphasizes the need for increasing the area under quality seed production. So one has to take efforts to produce quality seed and boost the yield by seed to seed seedling concept.

Significance of quality seed

- Ensures genetic and physical purity of the crops
- Gives desired plant population
- Capacity to withstand the adverse conditions
- Seedlings produced will be more vigourous, fast growing and can resist pest and disease incidence to certain extent
- Ensures uniform growth and maturity
- Development of root system will be more efficient that aids absorption of nutrients efficiently and result in higher yield.
- It will respond well to added fertilizer and other inputs.
- Good quality seeds of improved varieties ensures higher yield atleast 10 - 12 %

SEED AND ITS MULTIPLICATION

Seed multiplication ratio

It is the ratio of seed yield per seed generation i.e. many seeds are produced from a single seed.

Seed renewal period

Seeds undergo genetic deterioration on continuous usage for reproduction, due to the



developmental variation, mechanical mixture mutation, natural crossing, minor genetic variation, selective influence of pest and disease and techniques of plant breeder. Hence some seed should be used for multiplication continuously. Hence selectively multiplied seed should be used after certain generation, i.e. seed should be renewed after certain generations adopting generation systems.

Seed replacement rate

Seed replacement rate is the quantity of quality seed that have replaced the actual seed requirement of the location that are normally produced by the farmer using their own seed.

$$\text{SRR} = \frac{x}{y} \times 100$$

Where x = Quantity of actual quality seed sown / used in an area / location

Y = Quantity of quality seed (certified) required for the entire production area / location


This replacement rate can give an idea on how much certified (quality) seed is being used. The seed replacement rate in India is around 15 - 20% which may vary with crop varieties. However it will be 100% for hybrid seeds. This SRR give an idea on how much certified seed is being used as a base seed for production of crops by farmers which will indirectly stresses or expose the requirement of quality seed for further production.

Generation system

In seed production as per Seed Act and Rules seeds are multiplied in definite system which is known as generation system of seed production. It involves three stages of multiplication known as Breeder seed, Foundation seed and certified seed. This generation system can be altered depending on pollination behaviour and demand if warranted.

Multiplication ratios and seed multiplication stages

S.No	Seed crop	Multiplication ratio	Seed renewal period (times)	Seed multiplication stages		
				BS	FS	CS
1.	Paddy	152	4	1	1	2
2.	Wheat	49	4	1	1	2
3.	Barley	26	4	1	1	2
4.	Maize hybrid	248	1	1	1	1
5.	Maize variety	115	3	1	1	1
6.	Jowar hybrid	179	1	1	1	1
7.	Jowar variety	94	3	1	1	1
8.	Bajra hybrid	380	1	1	1	1



9.	Bajra variety	175	3	1	1	1
10.	Ragi	420	4	1	1	2
11.	Gram & Peas	24	3	1	1	2
12.	Pigeon peas	150	3	1	1	1
13.	Other pulses	125	3	1	1	1
14.	Groundnut	18	5	1	2	2
15.	Brassicas	200	3	1	1	1
16.	Sesamum	200	3	1	1	1
17.	Linseed	42	4	1	1	2
18.	Other oil crops	(73-100)	3	1	1	1
19.	Cotton	46	3	1	1	1
20.	Jute	120	3	1	1	1
21.	Fodder	75	3	1	1	1