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Session 117: Factors influencing seed production; maintenance of varietal purity, generation systems of seed multiplication



Factors influencing seed production

The factors that greatly influencing the seed production are conveniently divided into **four main headings**, namely:

- 1. Crop management practices,**
- 2. Climatic factors,**
- 3. Stage of seed development and**
- 4. Postharvest processing**

Factors influencing seed production

1. Crop management practices

To produce good quality seeds, it is essential that the crop is grown under optimal field conditions

Thus, the selection of suitable areas and fields in terms of soil texture, pH and fertility status are important considerations for regeneration of a particular crop

In general, soils should be uniform, well drained and deep with good water-holding capacity.

Fields with a history of disease problems or that possess other negative characteristics such high salinity, water logging etc. should be avoided.

Low-lying areas which are cool and moist with water drainage problems should be avoided as they favour disease incidence and possibly poor crop development.

Soils low in fertility or those suffering from mineral deficiencies would produce less vigorous plants and should be avoided

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Factors influencing seed production

Stress during reproductive growth can limit the ability of seed to develop properly (Dornbos 1995). Dense plant canopies also reduce air movement and promote many foliar and stem diseases, ultimately affecting seed development

Perennial weeds serve as alternate hosts and reservoirs for many plant pathogens, particularly plant viruses. Hence, removing the alternate hosts can help reduce not only the amount of the pathogen present each year, but also the resident insect population that is capable of transmitting the disease

Among the various factors that can influence genetic integrity (e.g. sample size, pollination, diseases, etc.), the management of pollination is probably the most critical one that has direct impact on seed quality (Engels 3 and Rao 1998)

The time from harvest to storage is another critical period where insects can infect seeds and reduce quality

Seed predation by granivores – especially rodents and birds that feed on the seeds of plants as a main or exclusive food source, in many cases leaving the seeds damaged and not viable

Factors influencing seed production

2. Climatic conditions

Climatic conditions during seed formation significantly affect the initial quality of seeds

Low precipitation and low relative humidity during seed maturation favour the production of high quality seeds as pest and disease incidence will be low under these conditions (Delouche 1980)

Frequent rainfall and high relative humidity, temperature extremes such as hot weather and frost occurring during maturation can adversely affect the seed quality

Strong winds may also affect seed production. Hence, It is necessary to install temporary or permanent windbreaks to prevent lodging of plant and seed bearing organs

Locations close to the seas or oceans can reduce the risks of diseases and viruses and may thus support disease-free seed production as long as the strong winds, sea spray and high humidity do not become the limiting factors

For instance, a very low pressure of aphids was observed in the coastal region compared to a higher pressure in the inland sites (Böhm and Fittje 2002) that's why the coastal areas are used for potato (*Solanum tuberosum* L.) seed production in Germany and the Netherlands

Factors influencing seed production

3. Stage of seed development

Immature seeds are known to deteriorate rapidly during storage, and delayed harvesting beyond optimum maturity leads to weathering and loss in quality

Harrington (1972) suggested that seeds under development attain maximum viability and vigour at physiological maturity and they begin to age with viability and vigour declining thereafter

Time of the day can be important and crops prone to shattering can be best harvested with dew in the morning to minimize seed losses

Factors influencing seed production

4. Post-harvest processing

A variety of factors, including the method of harvest, drying and seed handling affect seed quality and subsequent longevity

Usually, orthodox seeds attain the ability to withstand desiccation during development close to mass maturity or the end of grain filling-period (Ellis et al. 1987)

Critical damage was reported to be the least when harvested at 16-18% moisture in many crops including, corn, soybean, and groundnut (*Arachis hypogaea* L.)

Rapid drying to very low moisture contents can cause problems like case hardening or seed coat splitting (cleavage damage) in crops like soybean, groundnut and chickpea (*Cicer arietinum* L.) (Chromarty et al. 1982; Rao et al. 1990) or reduce germination in green panic (*Panicum maximum* Jacq.) seeds (Okada, 1986).

Hence, two stage drying can followed to avoid such problems:

First stage drying- the seeds can be dried slowly at 40-45% RH, followed by the
Second stage drying- drying at the very low relative humidities

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Factors influencing seed production

Mechanical injuries during harvesting and threshing predispose the seeds to microbial attack, which can accelerate their deterioration when stored under poor conditions

Seeds that are spherical are better protected against mechanical injuries than seeds that are elongated or irregularly shaped (Moore 1972)

Large-seeded legumes, because of greater surface area are particularly susceptible to injuries that reduce viability

Covering structures like glumes and shells protect the seeds from mechanical injuries and offer protection to moulds and storage fungi.

Kalashnik and Naumenko (1979) reported that unhulled sorghum seeds store better than hulled seeds, which implies the protective role of hull

The process of removing the covering structures before storage can sometimes damage the testa, lowering quality and predisposing the seeds to pest and disease attacks. Therefore, seeds are better conserved with covering structures as long as they do not require much additional storage space (e.g. forage grasses)

Maintenance of varietal purity

Horne (1953) suggested various steps, to maintain varietal purity, are as follows:

1. Use of approved seed only in seed multiplication
2. Inspection and approval of seed fields prior to planting
3. Field inspection and approval of crop at critical stage for verification of genetic purity, detection of mixtures, weeds, and for freedom from noxious weeds and seed borne diseases etc
4. Sampling and sealing of cleaned lots
5. Growing of samples with authentic stocks or grow out test

Generation systems of seed multiplication

Generation system of seed multiplication is nothing but the production of a particular class of seed from specific class of seed up to certified seed stage

Generation system model depends on:

1. The rate of genetic deterioration
2. Seed multiplication ratio
3. The total seed demand

Based on these basic factors, the chain of seed multiplication models could be.,

- a. **Three-Generation model:** Breeder seed - Foundation seed - Certified seed
- b. **Four-Generation model:** Breeder seed - Foundation seed (I) Foundation seed (II) - Certified seed
- c. **Five-Generation model:** Breeder seed - Foundation seed (I)- Foundation seed (II) -Certified seed (I) - Certified seed (II)

For most of the often cross pollinated and cross pollinated crops 3 & 4 generation models is usually suggested for seed multiplication.

Ex: Redgram, Greengram, Rape, Mustard, Sesame, Sunflower and most of the vegetable crops



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*Thank
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