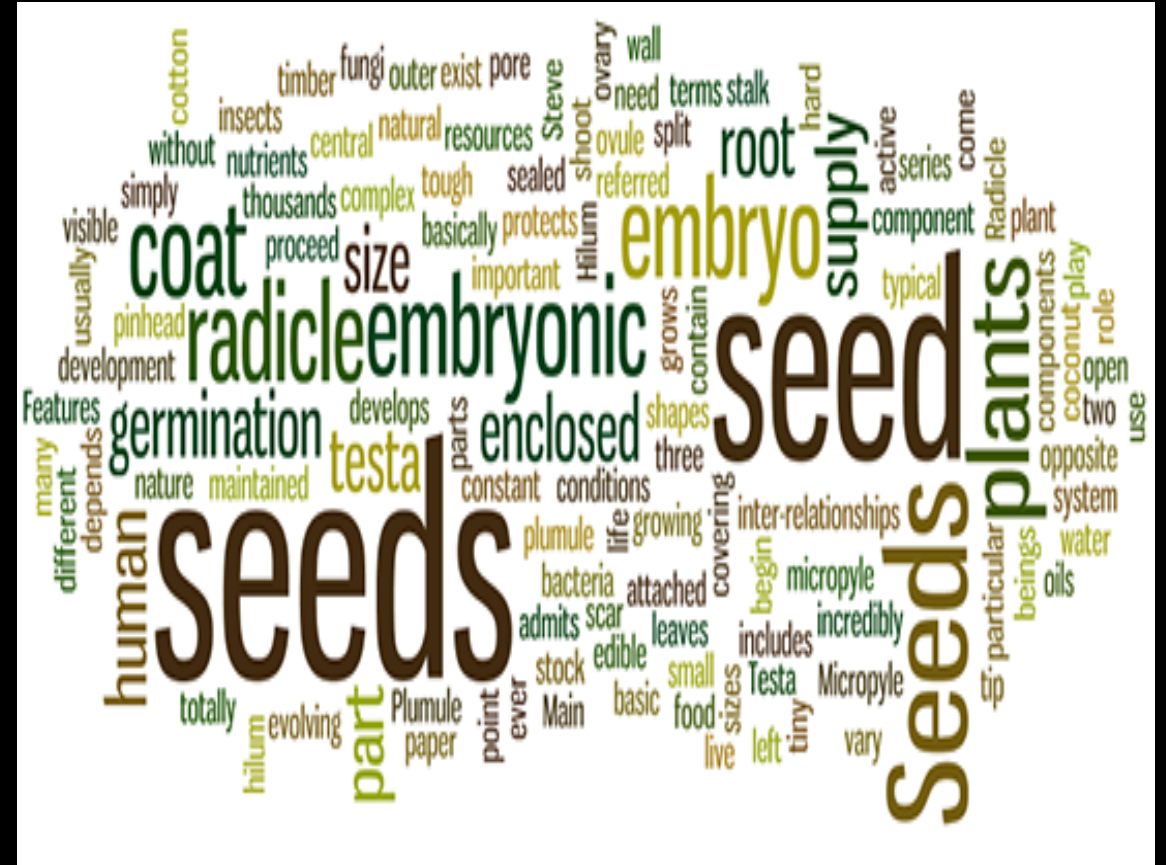


Workshop 1: Improving Yields Using High-Quality Seed

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Topics

- Introduction
- Seed Identification
- Seed Quality
 - Physical Purity
 - Uniformity
 - Germination
 - Vigor
 - Genetic
- Other factors affecting crop yield
- Summary

Seed First

- Seeds are one of the most important factors influencing yield potential.
- **Crop seeds contain all the genetic information to potentially determine:**
 - Yield
 - Adaptation to environmental conditions
 - Resistance to insect pests and, disease.

Seed First

- **One of the farmers' most critical management decisions is the selection of seed source and variety.**
- **The cost of seed (for planting) usually is 20-25% of the total cost of production.**
- **Poor seed quality will affect every component of yield.**

Seed Frist

No management practice (fertilizer, tillage, weed and pest management can increase crop yields beyond the limit set by the seed quality.

Seed is therefore the baseline for success or failure of any crop production.

Crop Yield

Yield components:

- **Plants/acres**
- **Heads/plant**
- **Kernel weight**

New world record In 2015, David Hula of Charles City, VA recorded corn yield of 532 bu/acres

High Yield

- To achieve high yields, one must plant high quality seed.
- Hybrid/OPV buy certified seed.
- Certified seed is at least:
 - 98% pure and
 - Has at least 90% germination percentage.


Certified Seed/Seed Certification

- The purpose of seed certification is to preserve genetic purity and identity.
- Requirements for producing certified seed:
 - **Planting eligible stock**
 - **Field inspection of the growing crop**
 - **Conditioning seed in an approved plant**
 - **Sampling**
 - **Laboratory analysis and proper labeling of the seed.**



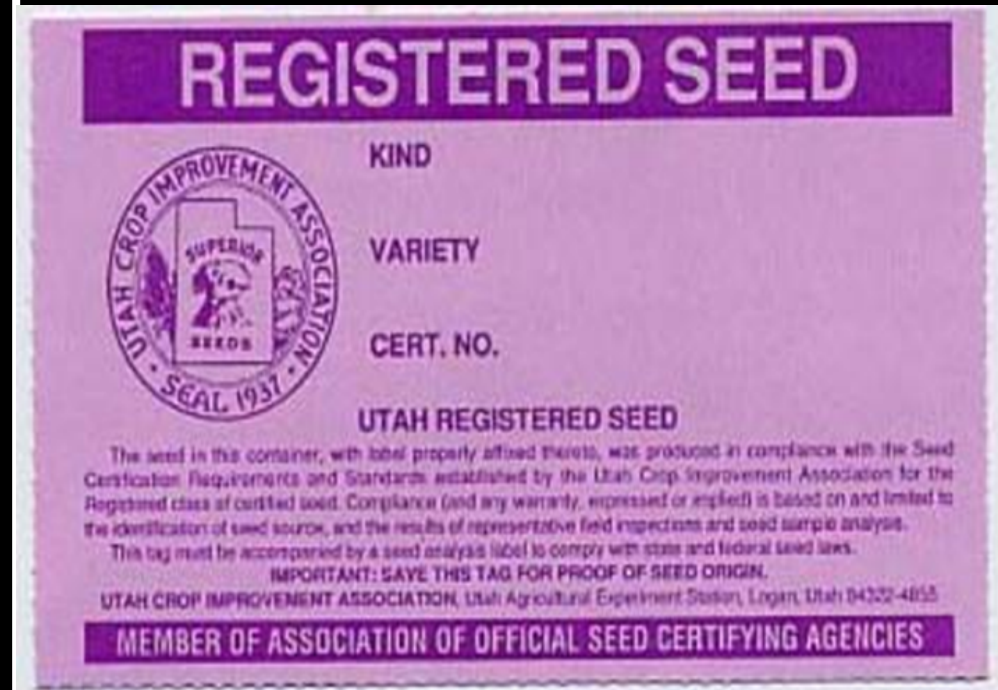
Seed Certification

- Four classes of certified seed of released varieties
1. **Breeder (white tag) – not available commercially- provide source**
 2. **Foundation (white tag). Is multiplied from breeder seed and is grown under the supervision of a Foundation Seed Program of public/private institution controlling the variety.**

Tag No. WA 05		FOUNDATION SEED
Kind	Karnataka State Seed Certification Agency BANGALORE	Class of Seed
Variety.....		Certificate No
Lot No.....		Date of issue of Certificate
		Date of Test
Use of seed after expiry of the validity period is entirely at user's risk and the holder of the certificate shall not be responsible for any damage to the user. No one should purchase the seed if seal or the certification tag has been tampered with.		Certificate Valid upto (provided seed is stored under cool and dry environment)
Name and Address of the Seed Producer.....		Seed Certification Officer (Name & Place)
		Validity of certificate further extended upto
		Seed Certification Officer (Name & Place)

Seed Certification

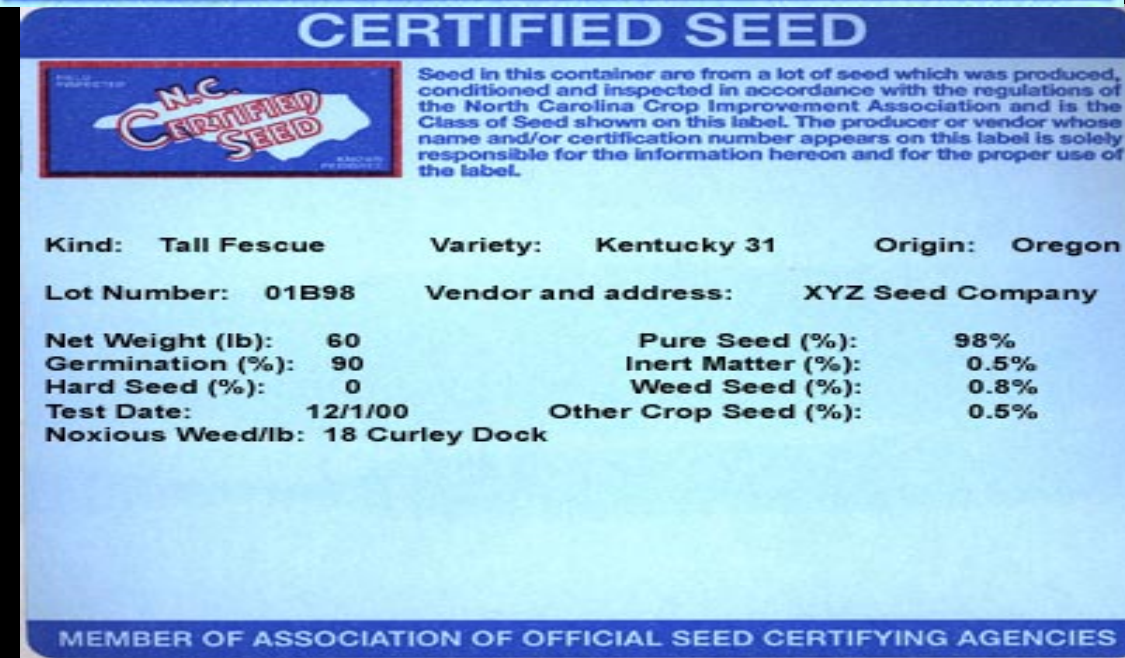
3. Registered (purple tag), progeny of breeder or foundation seed. Available in regular market – normally required to produce certified seed



Seed Certification

4. Certified (blue tag)

- Progeny of foundation or registered seed
- Most common and is the large-volume class sold to growers for producing a commercial crop of the variety.



Factors to consider when selecting cultivars

- **Hybrid vs Open pollinated variety (OPV)**
- **Yield reliability**
- **Drought tolerance**
- **Disease tolerance**
- **Stand-ability**
- **Insect tolerance**
- **Length of season**
- **Maturity time**

Hybrid vs OPV

What is a hybrid?

- **A hybrid is the product (1st generation progeny) of a cross between two unrelated (genetic dissimilar) parents**
- **Self pollination is the process of taking the pollen from a single plant and applying this to the silks of the same plant.**

Hybrid vs Open-Pollinated Variety

- Hybrids have an advantage over OPV for resource-poor producers?
Reasons:
 - Unreliable seed availability
 - Low input use and
 - Crop failure is common.
- Big question – which variety type hybrid or OPV is the most sustainable.

Hybrid vs OPV

Advantages of growing hybrid maize are:

- 1. Higher yielding than OPV varieties**
- 2. Uniform in color, maturity and other plant characteristics**
- 3. The uniformity of the grain high market value**
- 4. Hybrid yield on average 18% more than OPV.**

Critical Stages

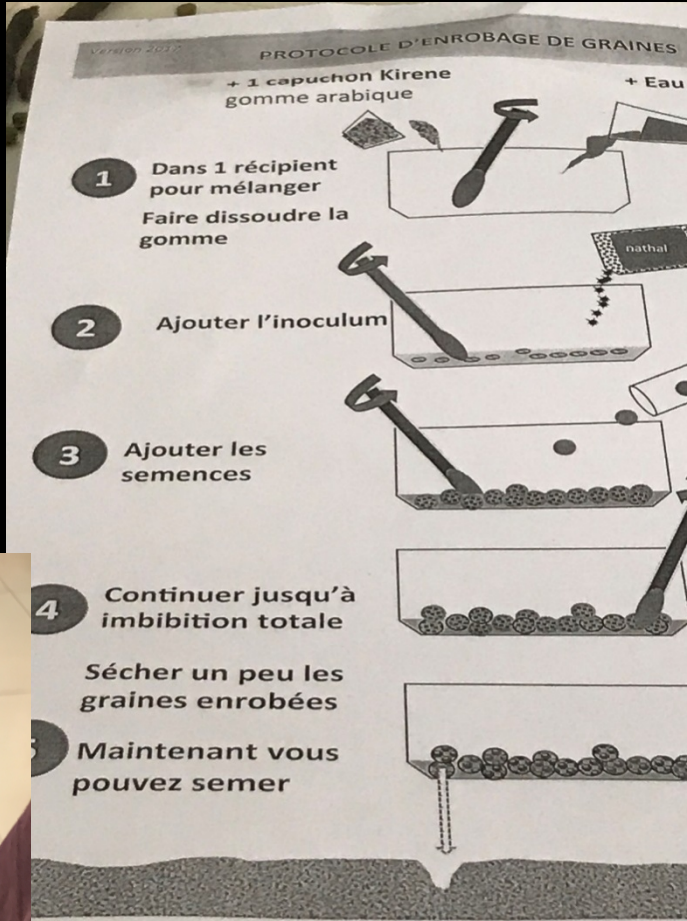
Growth Stage	Yield loss from 4 days visible wilting (%)
Early Vegetative	5-10
Tassel Emergence	10-25
Silking	40-50
Blister	30-40
Dough	20-30

Classen and Shaw, 1970

Hybrid vs OPV Varieties

- If plant saved grain from hybrid maize
 - Reduce yield by up to 50%, compared to maize grown from purchased seed.
 - Planting grain saved from OPV varieties does not result in yield losses.

Mungbean (*Vigna radiata* L.) *Bradyrhizobium Inoculum*



Hybrid Seed - Senegal



Hybrid vs OPV

What is OPV?

- An OPV variety seed is produced by random cross pollination
- The pollination of the plants in the field is not controlled
 - Crop will not be uniform
 - The crop will vary in plant height
 - Color of silks vary
 - Various cob size and shape, and
 - Will mature at different times.

Hybrid vs OPV

Advantages of growing OPV:

1. Low or no seed cost.
2. Seed can be saved.
3. OPV have a broader genetic base and are more variable in flowering dates.
 - This results in a longer flowering period,
 - Enable an OPV to pollinate during short periods of high stress.
 - This variation can at times, offer more stable yields than more uniformly flowering hybrids.
4. It is important to buy certified seed every three years to maintain genetic purity.

Hybrid vs OPV

Disadvantages of OPV:

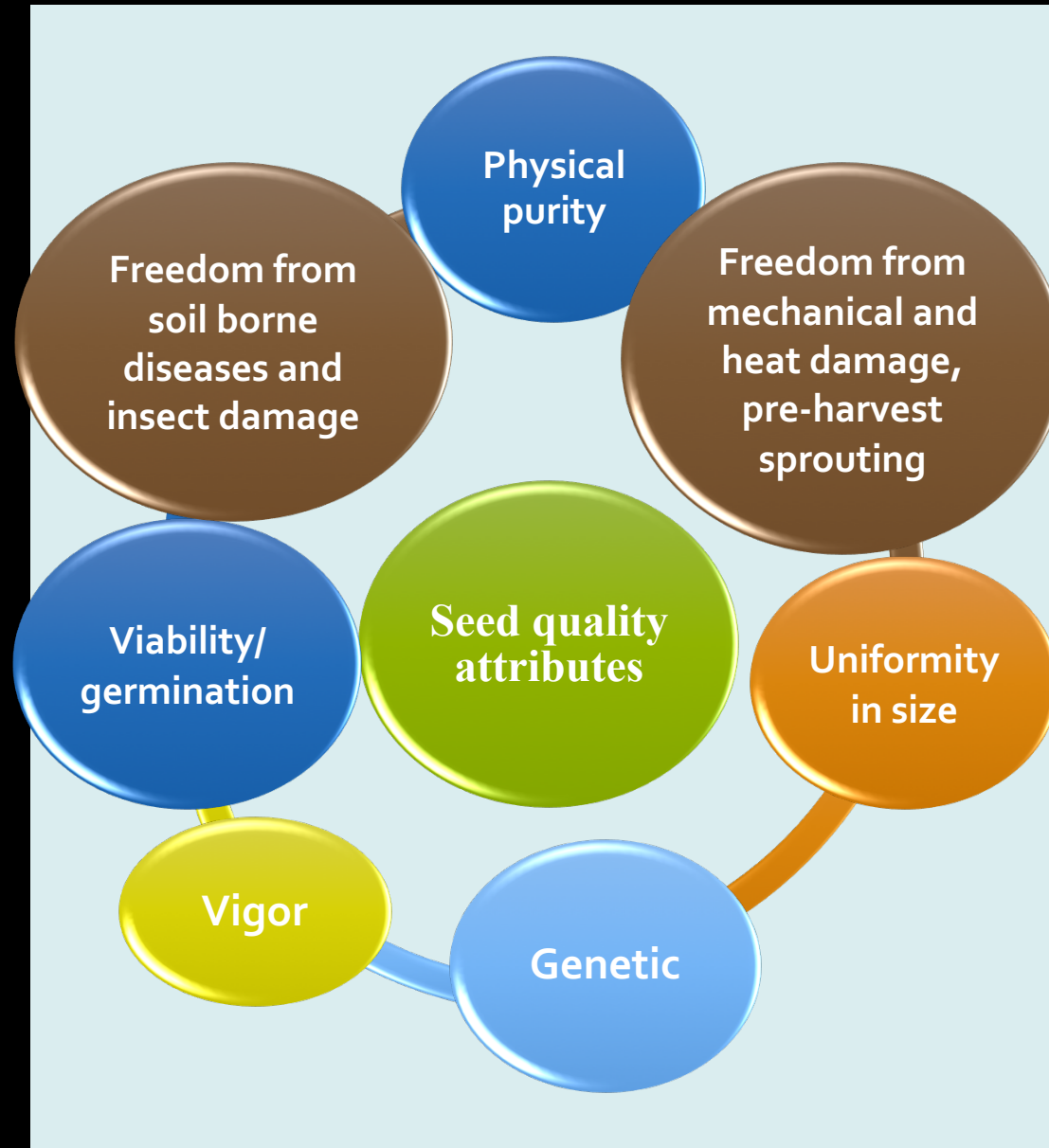
- 1. The yield potential is typically 10 - 25% less.**
- 2. Not be uniform in color, maturity and other plant characteristics.**
- 3. Could impact on the price of the grain, i.e quality.**
- 4. To keep an OPV pure, it should be planted at least 300 m from other varieties.**
- 5. Poor seed quality -**

Hybrid vs OPV

The ranking of the grain yield at any given management level will be:

- 1. Hybrid**
- 2. OPV**
- 3. Saved OPV and**
- 4. Saved hybrid**

Seed Quality Attributes

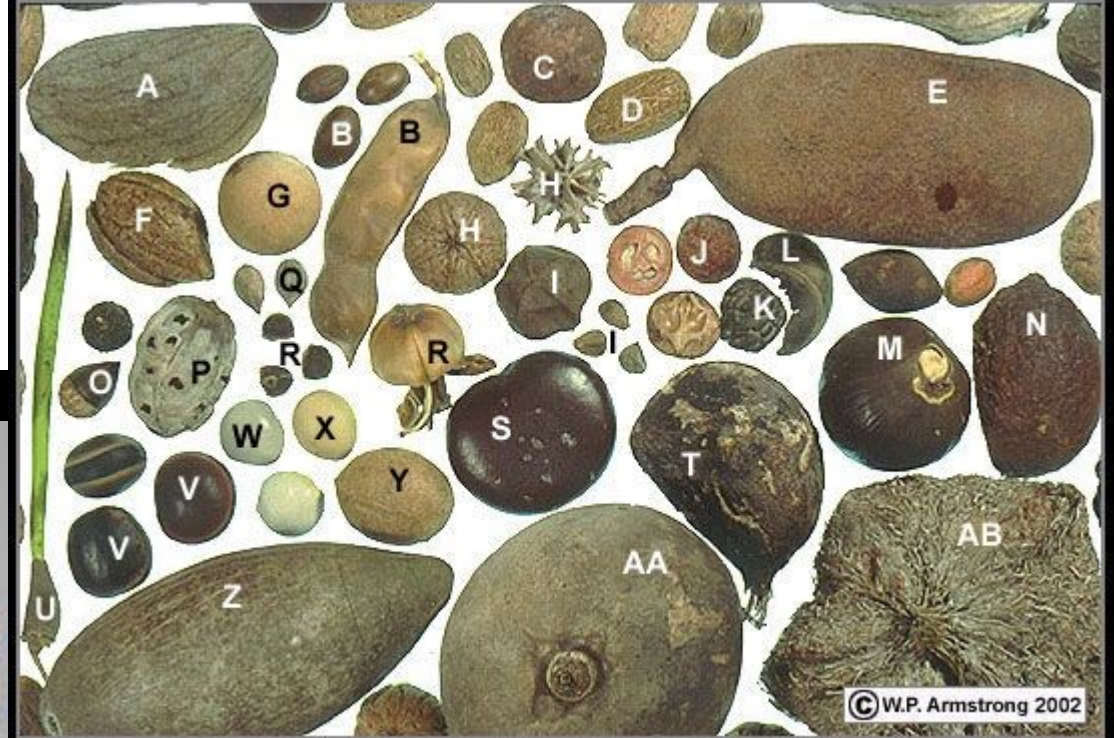
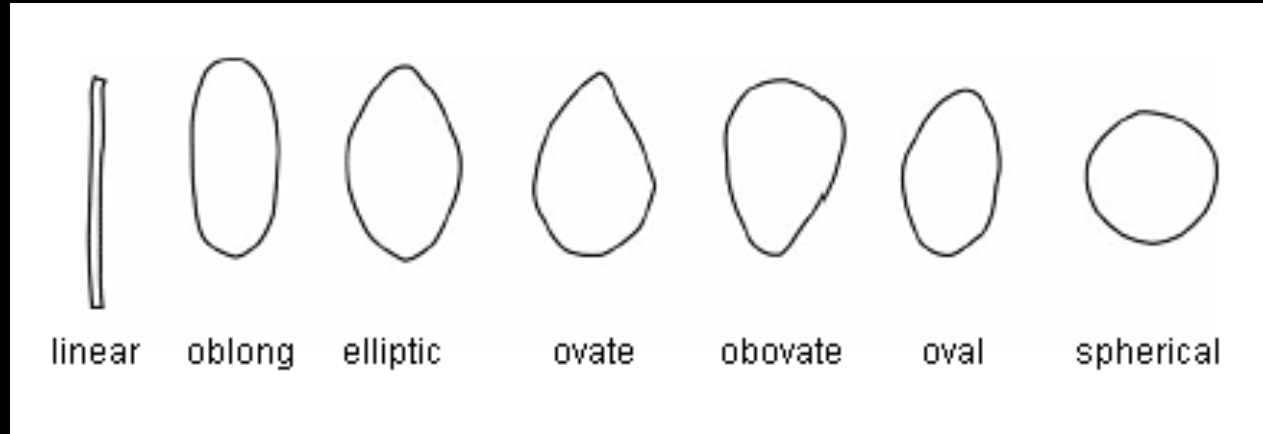


Seed Quality Attributes

Varietal purity tests include looking for percentage of:

- 1) Germination**
- 2) Mixed in varieties (Seed ID)**
- 3) Weed seeds and other crop seeds (Seed ID)**
- 4) Inert material (stones, soil, etc.)**
- 5) Red rice seeds, and**
- 6) Moisture content**

Seed Identification



Seed Identification

*Alfafa Medicaco
sativa*



- Kidney shaped
- Mustard colored
- 2mm +

Seed Identification



Triticum aestivum ssp



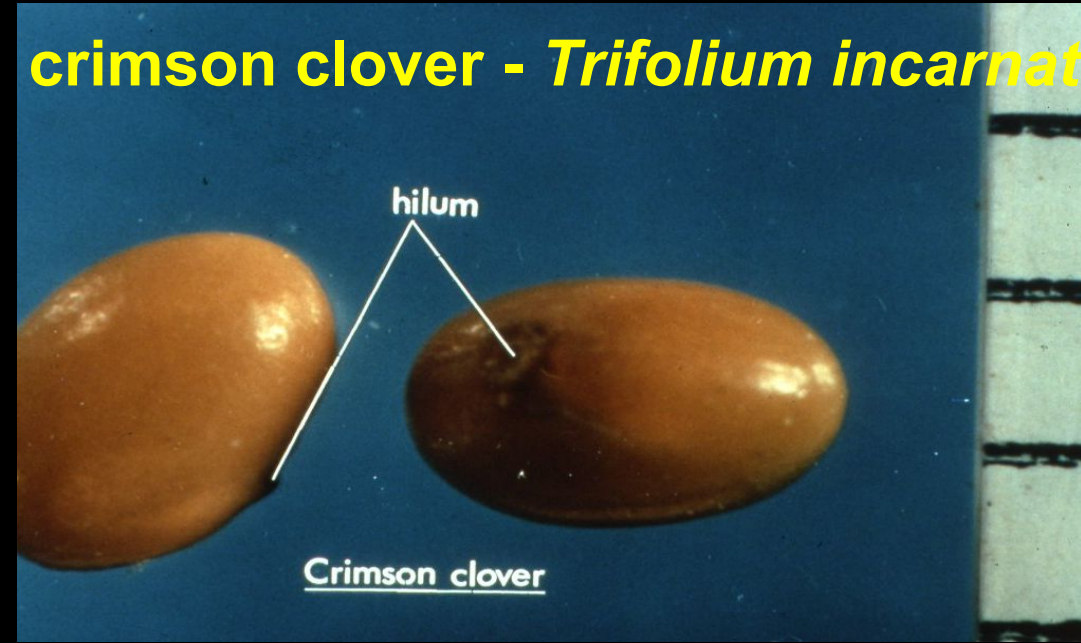
Wheat (durum)

Seed Identification

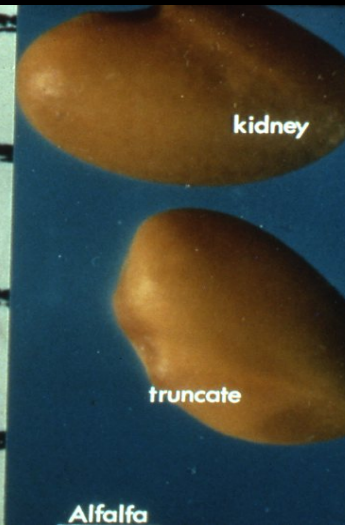
red clover - *Trifolium pratense*



crimson clover - *Trifolium incarnatum*



sweetclover –
Melilotus spp.



alfalfa - *Medicago sativa*

Seed Identification

crownvetch - Coronilla varia



common vetch - Vicia sativa

Seed Quality Attributes

How to measure varietal purity:

- **Grain size**
- **Shape**
- **1000-grain weight, and**
- **If rice, number of red grains in the sample**

Seed Quality Attributes

How to measure varietal purity:

- Grain size and shape
- Length-width ratio is a very stable varietal property
- Comparing the length-width ratio of the sample with a published ratio for the variety
- A significant deviation means either a different variety or a mixture of varieties.

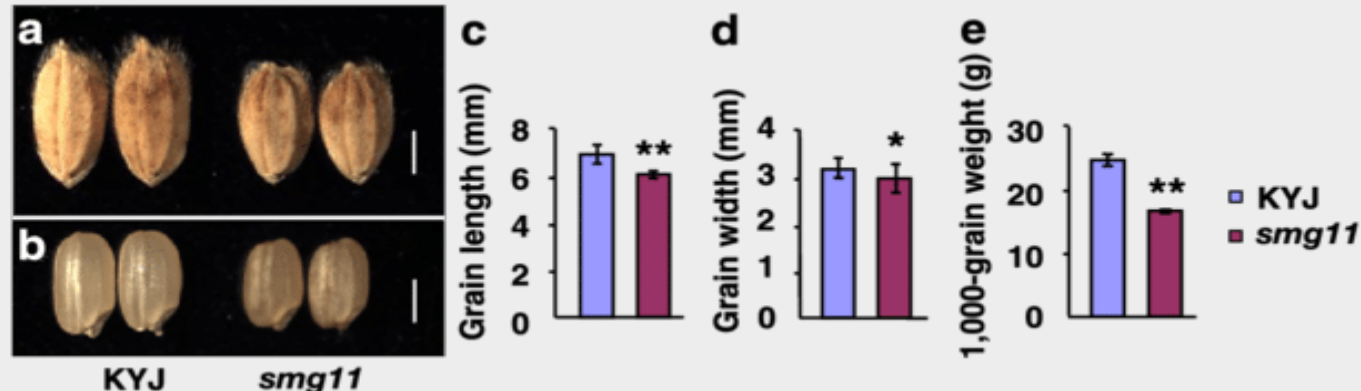
Scale (length, mm)		
Extra long (more than 7.5)		
Long (6.6 to 7.5)		
Medium (5.51 to 6.6)		
Short (5.5 or less)		

Scale	Shape	Length-width ratio
1	Slender	3.0
3	Medium	2.1 – 3.0
5	Bold	1.1 – 2.0
9	Round	Less than 1.1

Seed Quality Attributes

1000-grain weight

- Each variety has weight for 1000 grains.
- Select a random sample from the seed batch
- Count 1,000 whole grains from the sample.
- Weigh the 1,000 grains.



Seed Quality Attributes

Vigor

Seedlings have four significant morphological sites for evaluating vigor:

A. Root system

B. Hypocotyl (the embryonic axis between cotyledons and root).

C. Cotyledons (storage tissue of reserve food for seedling development).

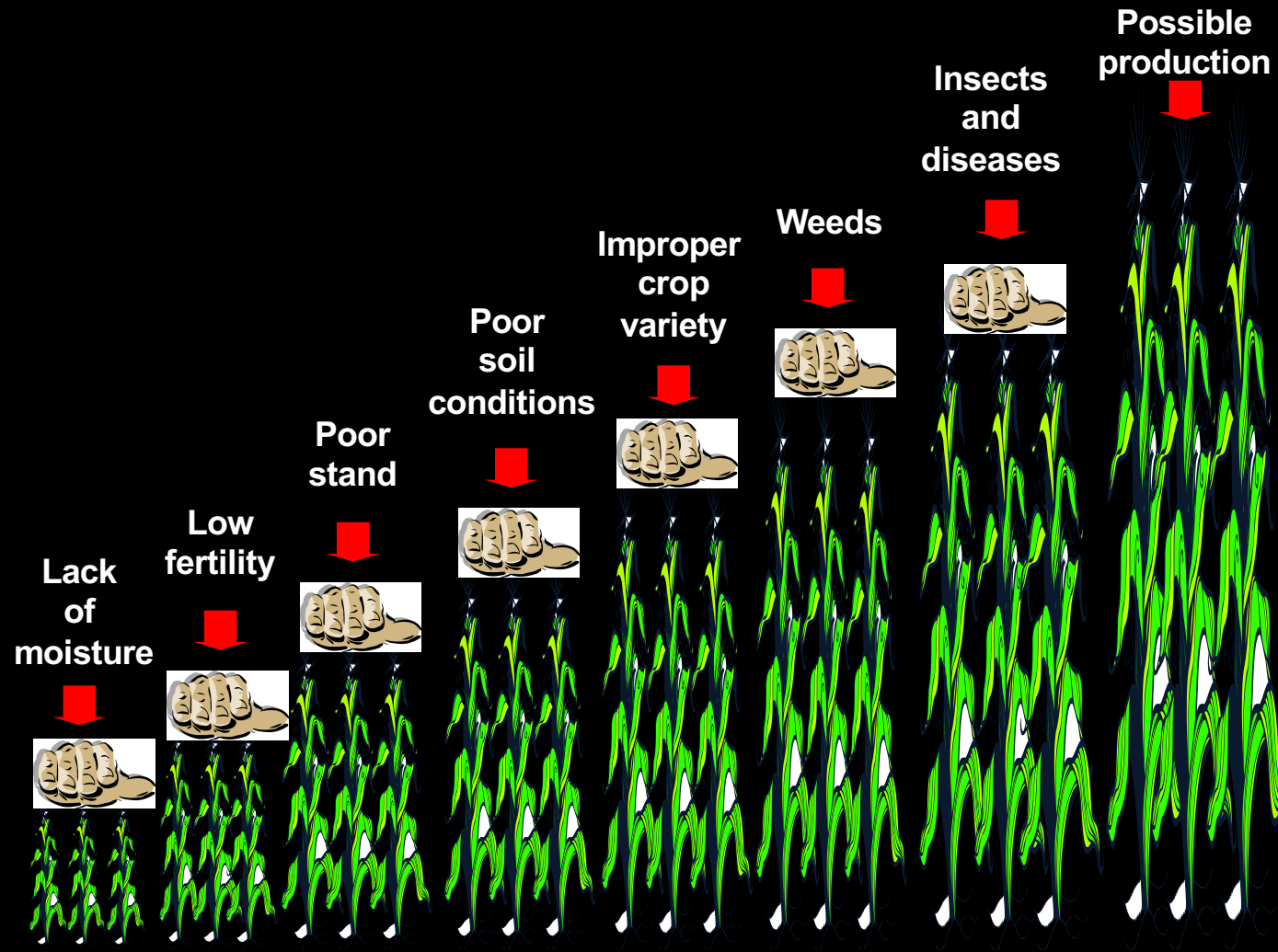
D. Epicotyl (the embryonic axis above the cotyledons).



Factors Determining Good Quality Seed

- Seed quality is a crucial determining factor of yield and quality of crop production.
- **Good quality seed is superior in genetic and physiological purity**
- The quality of the seeds is determined by the interaction of a number of genetic and environmental factors

Factors Limiting Crop Production



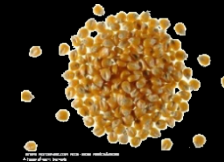
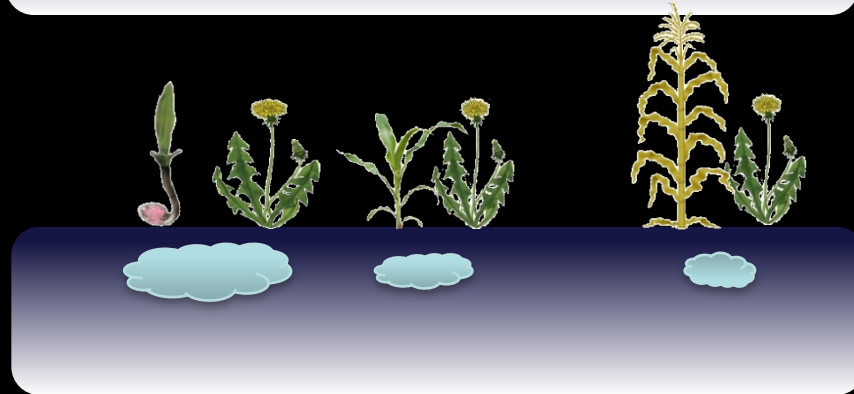
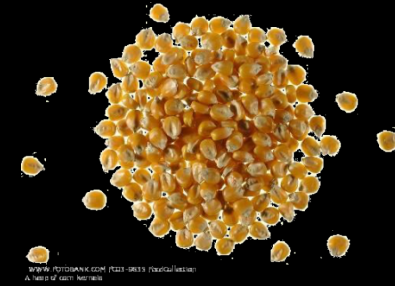
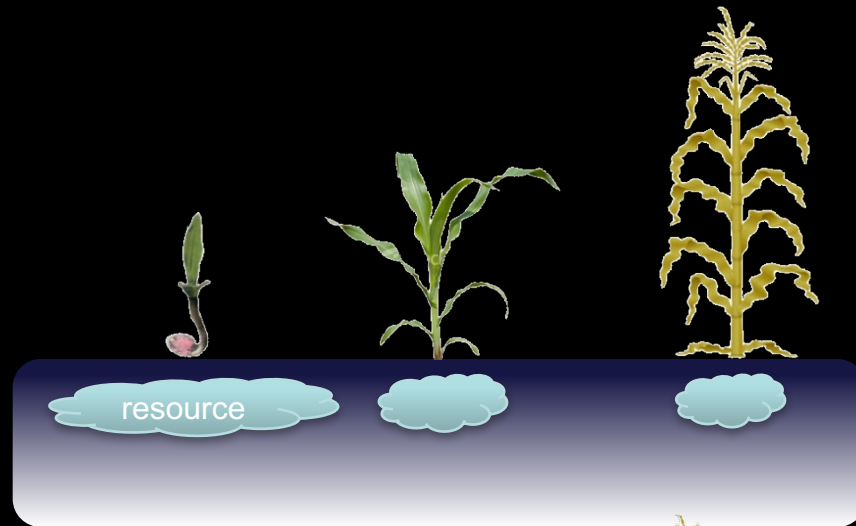
Ideal Soil

- Deep and well drained
- Hold water and nutrients
- Medium soil texture
- High organic matter
- Loose and porous
- Biological activity
- Not all soils equal
 - Soil productivity group
 - Chemical analysis

Organism	Biomass
	lb/A
Pasture roots	2500
Bacteria	2052
Actinomycetes	2052
Fungi	6244
Algae	219
Protozoa	80
Nematodes	60
Mites	65
Collembola	65
Earthworms	624
Other fauna	40
Total Biota	14001

Adapted in part from Brady and Weil 2002

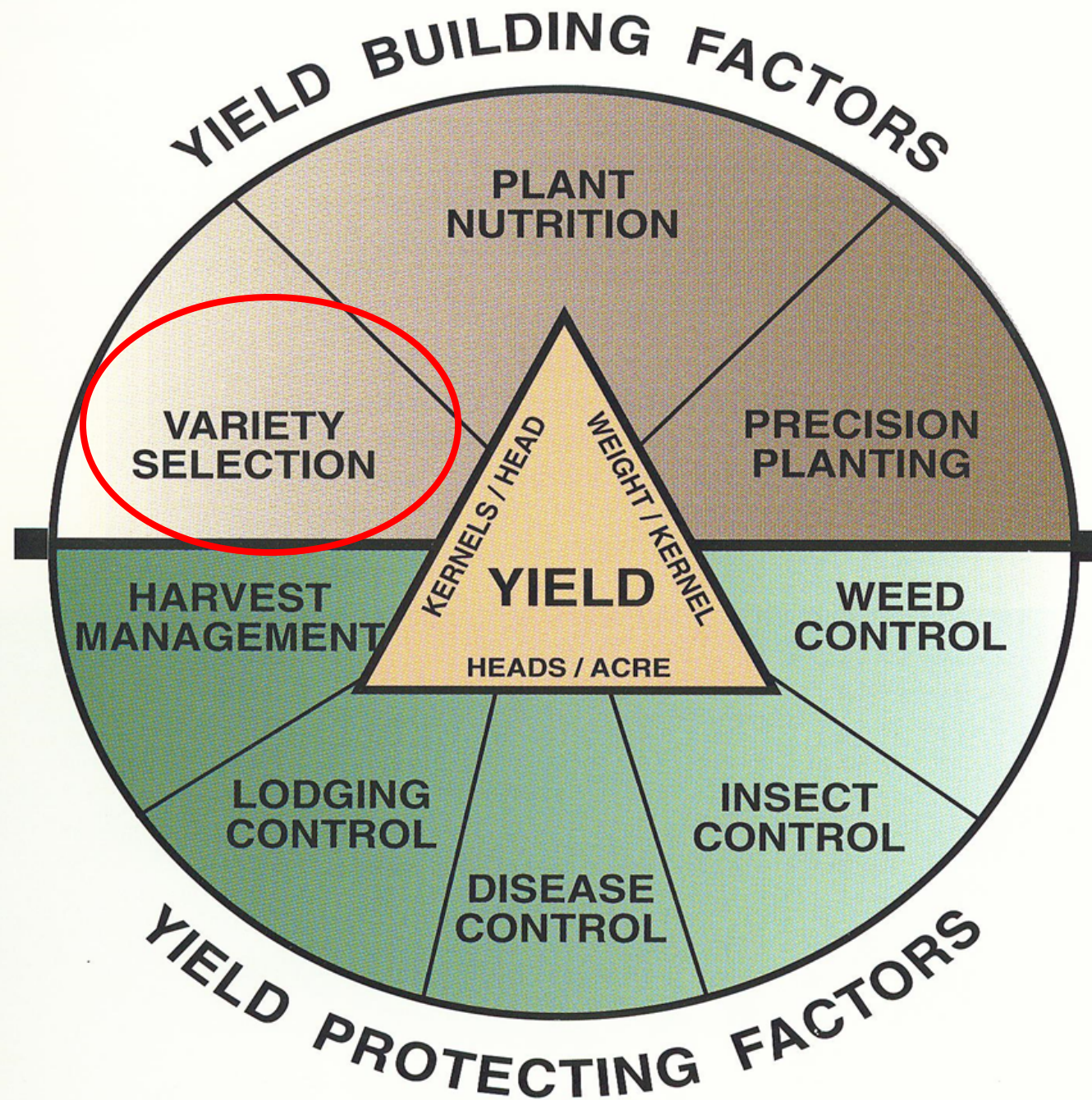
Competition



Legume Fertilization

- **Nitrogen**
 - N fertilizer not normally applied
 - Fix N from the atmosphere
- **Lime, P & K according to soil test**
 - High calcium, P and K
- **Boron**
 - usually applied to Alfalfa
- **Molybdenum**
 - apply if pH is less than 5.7
 - Lime!!!

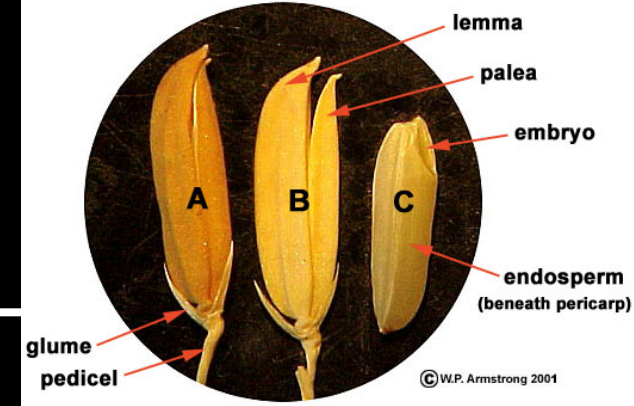




Summary

- **High quality seeds are free of:**
 - **Weed seeds**
 - **Seed-borne diseases**
 - **Insects**
 - **Pathogens**
 - **Mechanical injury**
- **Buy certified seed that is pure and labeled**
 - **Hybrid**
 - **Open Pollinated Variety**
- **Do simple germination test**

Maize - *Zea mays*



Black turtle fieldbeana – *Phaseolus vulgaris*



Soybean- *Glycine max*



Sorghum – *Sorghum bicolor*



foxtail millet - *Setaria italica*



Sesame – *Sesamum indicum*



Mingren sunflower – *Helianthus annuus*



Rice



Amaranth spp.

