



Maintaining cowpea genetic purity



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Introduction

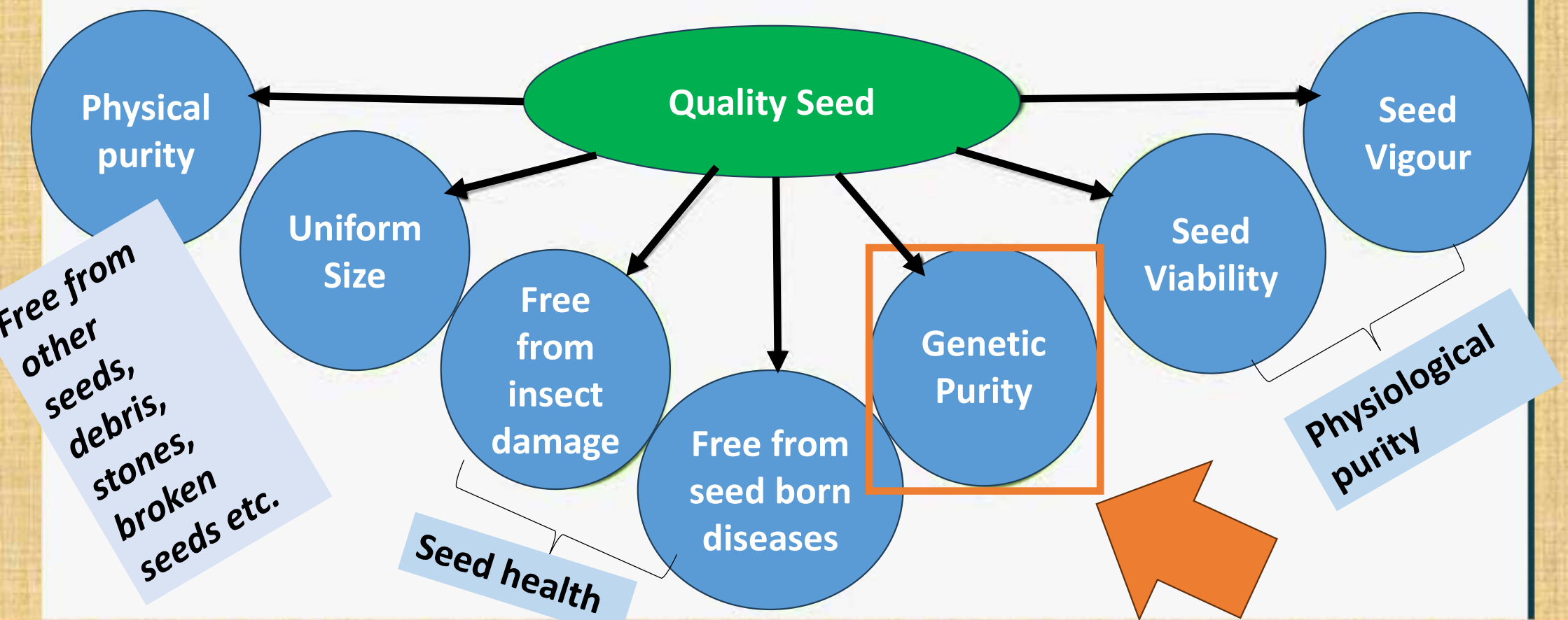
- ❑ Production, distribution and usage of high-quality seeds is fundamental in modern Agricultural system
- ❑ Farmers grow crops each season from seeds, the quality of seeds can have a major impact on the potential of crop yield
- ❑ Seeds carry genetic traits incorporated by years of breeding and selection, it is therefore a key input in crop productivity .



the effectiveness of other inputs depends largely on the quality of the seeds planted

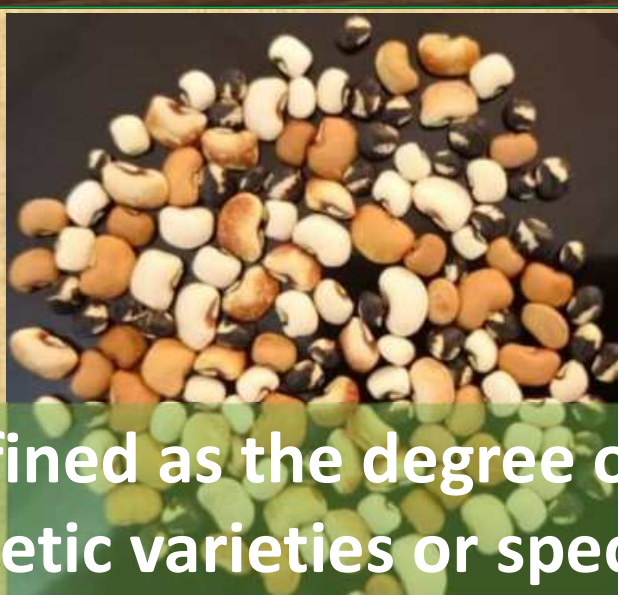
What makes up a quality Seed?

Seed quality is defined by its genetic purity, physical purity, physiological purity and seed health [weed seeds, diseases]



What is Genetic Purity?

- ❑ Genetic purity is defined **as True-to-Type plants** or seeds that conform to the characteristics of the variety as described by the breeders
- ❑ Genetic purity or genuineness of a variety is determined based on characteristics of the seeds, seedlings, or plants that are heritable (Morphological, physiological or chemical compounds)



Genetic purity is also defined as the degree of contamination of seeds caused by undesired genetic varieties or species

Why the need for genetic purity?

- ❑ Provide growers with more consistent crop across variable conditions
- ❑ Farmers benefit from full genetic potential of a variety—Stable yield
- ❑ Ensures uniform emergence, growth and maturity [**easy management**]
- ❑ Pure seeds responds well to added fertilizer and other input
- ❑ Seedlings are vigorous, fast growing and can tolerate some degree of pests and diseases

Pure seeds



Uniform emergence



Uniform growth



Uniform maturity



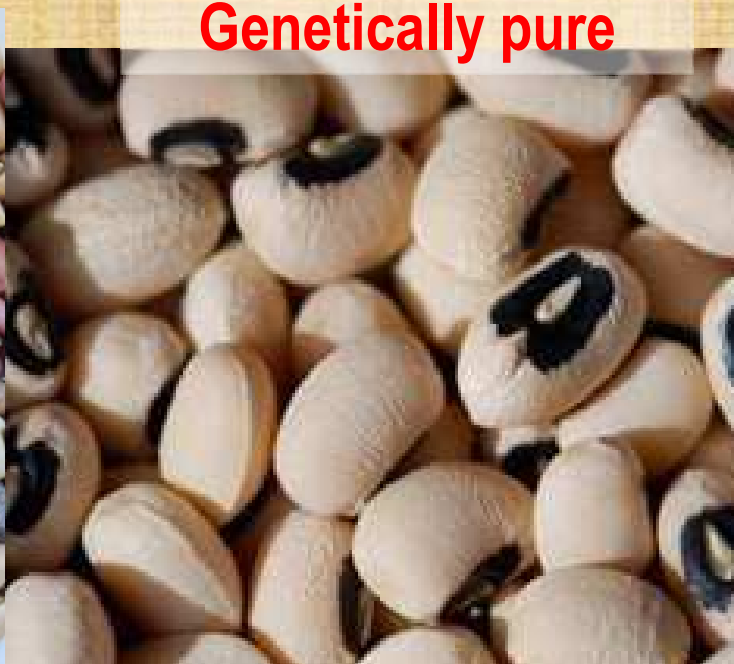
Why the need for genetic purity?

- ❑ Eliminates complaints from seed buyers regarding purity issues
- ❑ Used in plant variety protection, registration, certification and patents
- ❑ Displays novelty of a variety [distinct, uniform and stable]
- ❑ Helps in documentation of genetic resources

Genetically impure

Genetically pure

Pure seeds in genebank



Standards for genetic purity of seed classes

- ❑ In practice, genetic purity standards have been established by seed laws and seed certification agencies to ensure that buyer receives seeds that is within certain purity tolerances
- ❑ Tolerance levels are established based on crop biology [Self vs Cross pollinated species]
- ❑ Earlier generation of seeds have stricter standards to be able to meet certified seed purity criteria

Classes

	Purity
1. Breeder's seeds	100%
2. Foundation seeds	99%
3. Certified seeds	98%

How genetic purity is lost

The genetic purity of a variety deteriorates due to several factors:

- 1. Developmental Variations:** When seeds are grown in harsh environments for several consecutive generations, growth responses may start to vary. To avoid such developmental variations, it is good to grow a variety in the environment where it is well adapted to.



How genetic purity is lost

2. Mechanical mixtures: occurs at the time of sowing, Volunteer plants, mixed planting of varieties, during harvest, threshing, contaminated bags,



Contaminated
in field by
volunteer
plants



Same seed
drill is used to
plant seeds of
multiple
varieties



Growing
different
varieties close
to each other
in the field



Mixing
happening
during
threshing



Contamination
during harvest
[both
mechanical or
by hand]



Contaminated
bags or seed
containers



Contaminated
during seed
processing

It is advisable to rouge (remove) off types at different stages of production

How genetic purity is lost

3. Mutation (Rare): A change in the gene of a plant, producing a new character that can be transmitted to subsequent generations.

It's advisable to always remove any visible mutations



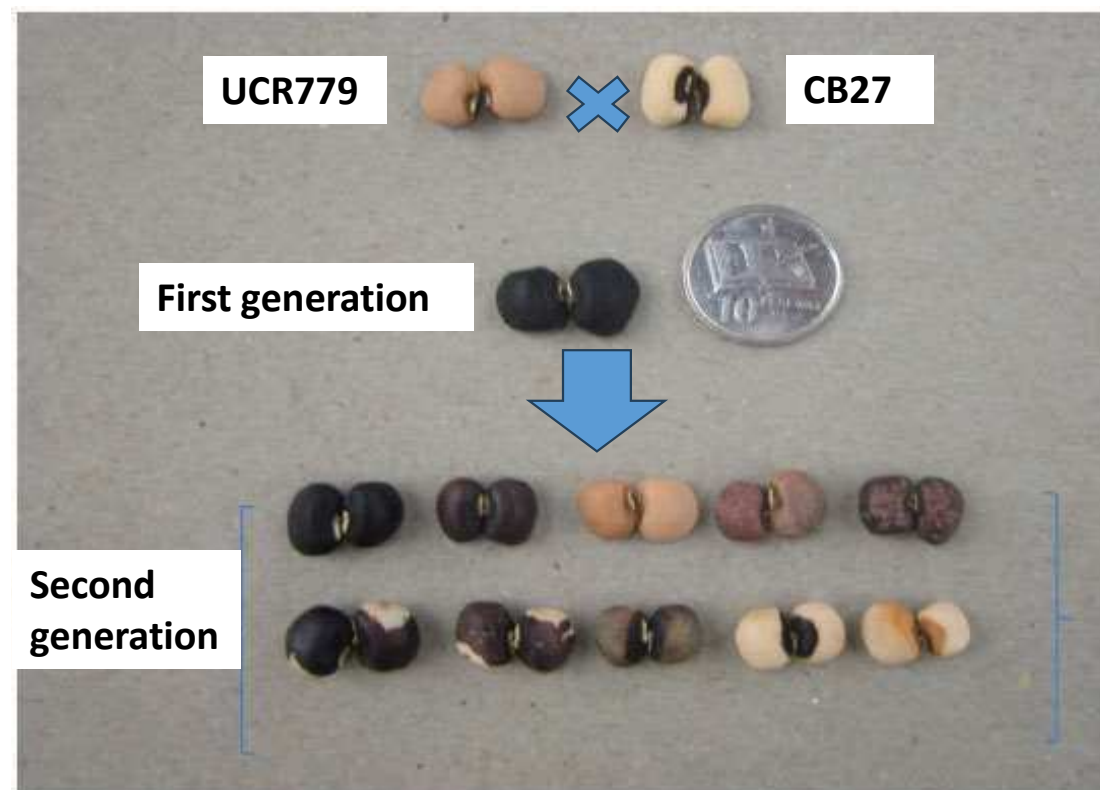
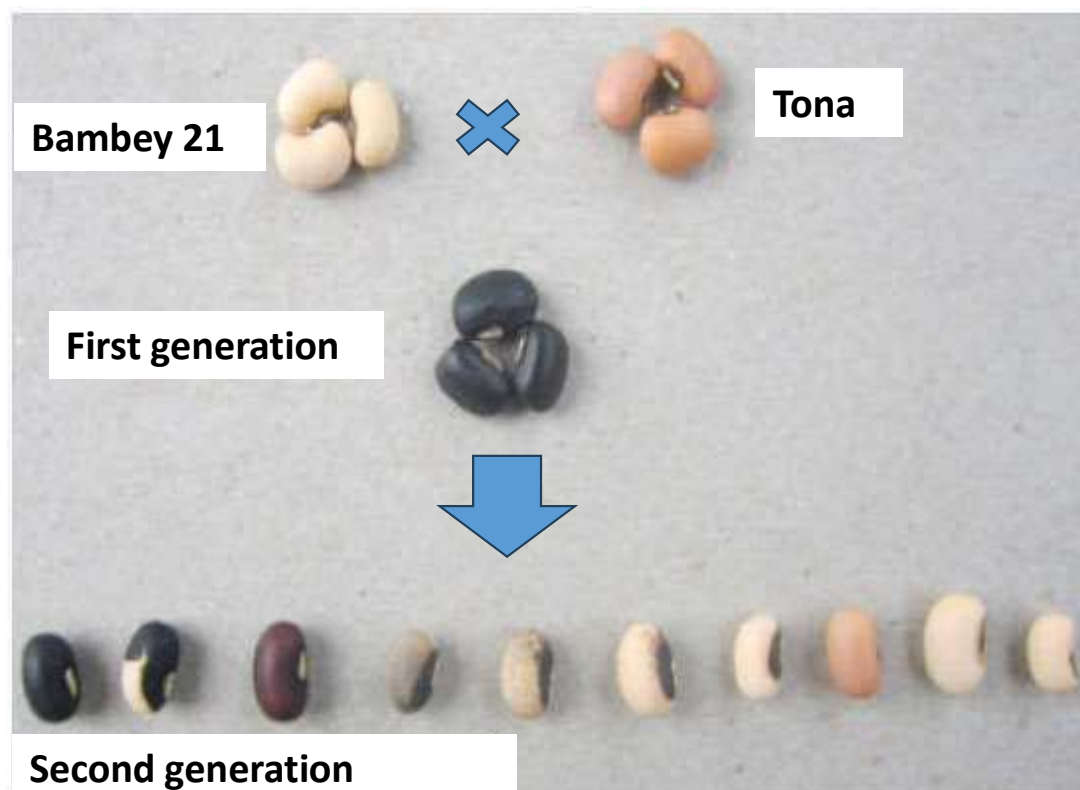
How genetic purity is lost

4. Natural crossing: The purity of a variety may be contaminated by pollen coming from another variety. Cowpea is self-pollinated but has ~2% outcrossing. Don't plant very close to other varieties



How genetic purity is lost

5. Techniques of a breeder: Premature release of variety when it is not yet stable. Report to breeder so that the variety can be purified

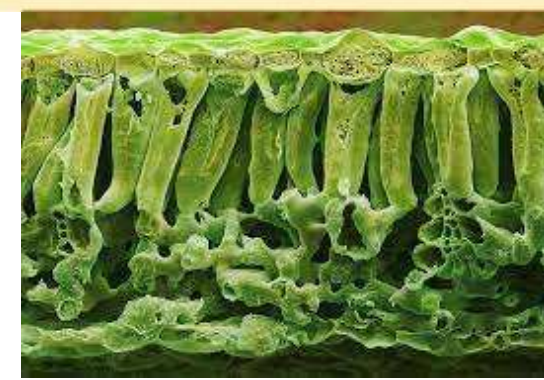


How can you detect genetic impurity?

Use of morphological tests: Morphological characters are examined either traditionally (Grow Out Test) or in the lab using magnifying hand lens/scanning electron

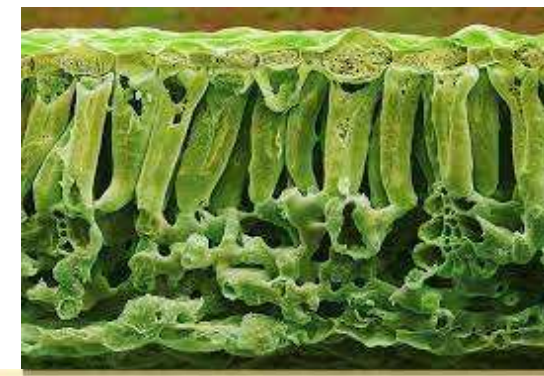


The test seed sample is grown together with reference seed, morphology characters are observed and compared with the authentic variety



Limitations of morphological test

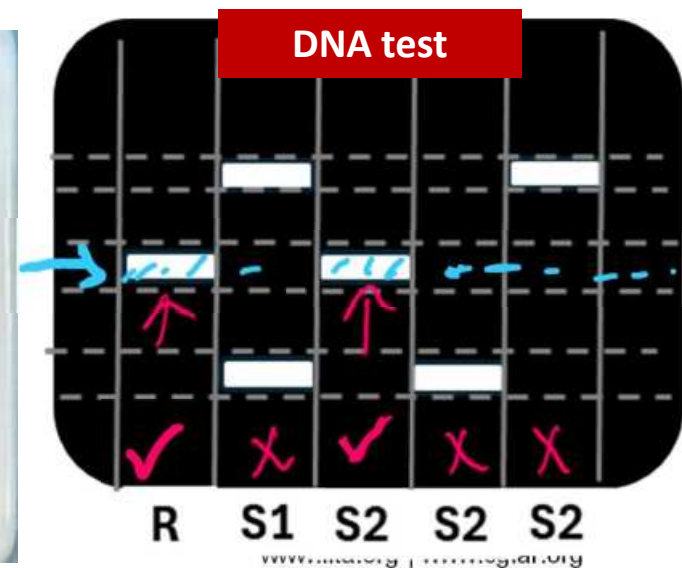
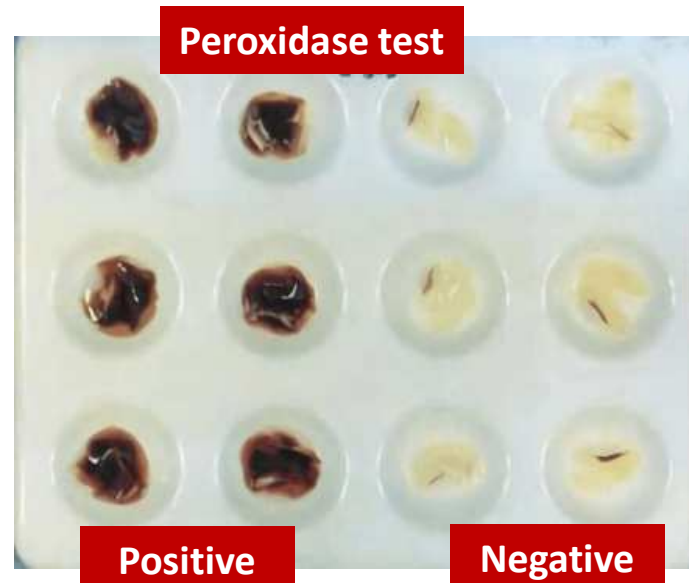
Affected by environmental conditions, takes more land, laborious, time consuming



Other more effective methods are available

Other advanced methods of detecting genetic purity

- ❑ **Chemical tests:** Different chemicals are used to test the purity of a variety. It rely on the presence of specific enzyme or compound within the seed of different varieties
- ❑ **DNA markers:** Samples are taken from test plants, DNA extracted, and special molecular markers used to detect any unusual variations in the sample. Test samples can be compared with reference sample.



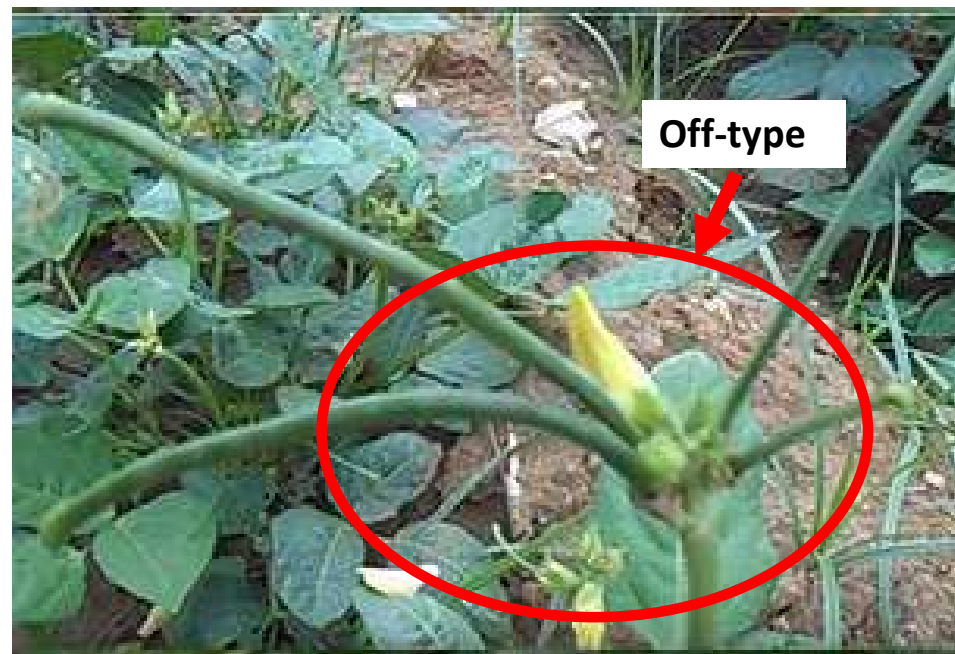
How can we maintain genetic purity of a variety?

- ❑ Avoid planting different varieties close to each other to prevent contamination by natural crossing or mechanical mixtures
- ❑ Rouging of seed fields prior to the stage at which they could contaminate the seed crop.
- ❑ Periodic testing of varieties for genetic purity

Variety A



Variety B



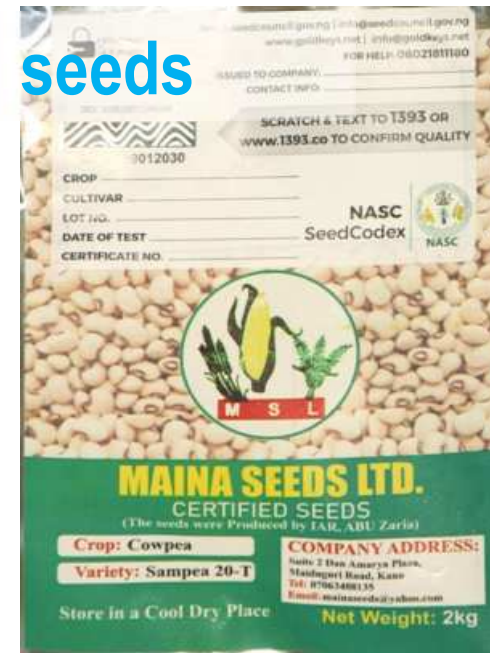
How can we maintain genetic purity of a variety?

- ❑ Avoiding genetic shifts by growing crops in areas of their adaptation only.
- ❑ Plant seeds that are certified to maintain genetic purity and quality of seed.
- ❑ Use clean seed handling equipment (planter, harvester, processors, bags etc)
- ❑ Avoid growing your variety in a field that was previously planted with a different variety of the same crop. This can cause contamination from volunteer plants

Clean planter

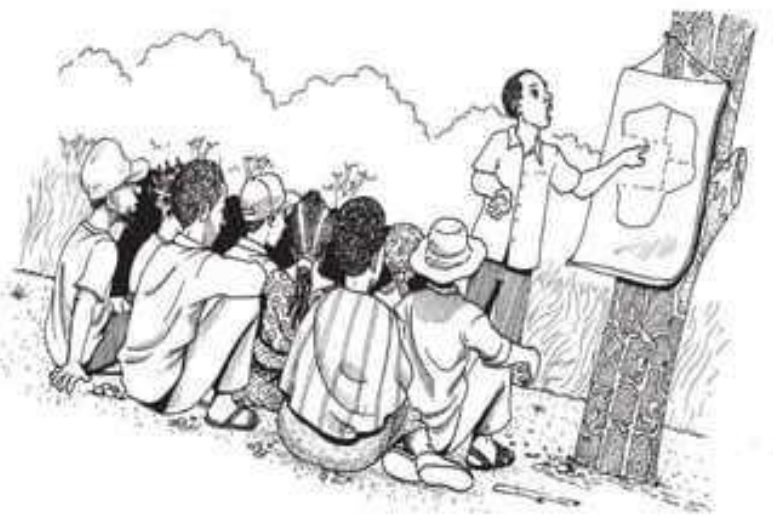


Certified seeds



What is your role in genetic purity?

- ☐ Create awareness about the importance of using genetically pure and quality seeds
- ☐ Guide farmers on where to access genetically pure seeds
- ☐ Teach farmers on how to keep seeds pure for the next planting
- ☐ Identify and report to breeders, the varieties that are not stable
- ☐ Conduct genetic purity tests [grow out test or use of DNA markers]



Quality seeds from seed companies



Conclusion

- ☐ If the seed possesses all the genetic qualities that breeder has placed in the variety, it is said to be genetically pure
- ☐ Genetic purity of a seed stock is important to ensure that growers, processors and consumers receive the crop variety that they expect
- ☐ Farmers need genetically pure seeds to be able to get higher returns
- ☐ Extension agents play a key role in advising farmers on obtaining genetically pure seeds

Conclusion

Genetic purity has direct effect on ultimate yields. If there is any deterioration in the genetic makes up of the variety during seed multiplication and distribution cycle, there would definitely be proportionate decrease in its performance e.g. yield, disease resistance etc.

Readings

- ❑ Darya Khan Akbarzai. Methods and procedures for testing genetic purity
- ❑ Kent Bradford. Methods to maintain genetic purity of seed stocks. [8189.pdf \(ucanr.edu\)](#)

Thank you!

