Seed Purity

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Concept

In common terms purity is an expression of how 'clean' the seed lot is.

Purity of a seed lot indicates in percentage how large a fraction is made up of pure seeds of the species in question, and how much is made up of inert matter and other seeds. Impurities may be any non-seed material (leaf, flower, fruit fractions, soil etc.), small fractions of seeds of the actual species, as well as seeds of other species.

Purity is expressed as the weight percentage of pure seed fraction over the total weight of the working sample:

$$\text{Purity} = \frac{\text{Weight of pure seed}}{\text{Total weight of working sample}} \times 100$$

Components of seed purity and their characteristics

There are 3 major components of a seeds lot carried out for purity analysis. These are:

1. Pure seed
2. Other crop seed
3. Inert matters

1. Pure seed

The pure seed shall refer to the species stated by the sender, or found to Predominate the test, and shall include all botanical varieties and cultivars of that species (even if immature, undersized shriveled disease or germinated providing. They can be definitely identified as of that species) unless transformed into visible fungal-sclerostia, smut balls or nematode galls. Pure seed shall include a) intact seed units (commonly found as dispersal units i.e. achenes and similar fruits, schizocarp, florets etc) as defined for each genus or species; b)pieces of seed units larger than, one half their original size.

Seed units of families Fabaceae (Leguminaceae), Brassicaceae (Cruciferae), Cupressaceae, Pinaceae and Taxodiaceae with the seed coat entirely removed shall be regarded as inert matter. Separated cotyledons of Fabaceae are regarded as inert matter, irrespective of whether or not the radicle plumule axis and/or more than half of the tests may be attached.

Definition of Pure Seed for specific crops

Poaceae

Oryza spp. (Paddy)

- Spikelet, with glumes, lemma and palea enclosing a caryopsis including the awn irrespective of its size.
- Floret, with or without lemmas, with lemma and palea enclosing a caryopsis including the awn irrespective of its size.
- Caryopsis.
- Piece of caryopsis larger than one-half the original size.

Triticum, *Zea*, *Secale* (Wheat, Maize, Triticale)

- Caryopsis
- Piece of caryopsis larger than one-half the original size.

Hordeum spp. (Barley)

- Floret, with lemma and palea enclosing a caryopsis with or without awn or with or without rachis segment irrespective of their length.
- Piece of floret containing a caryopsis larger than one-half the original size.
- Caryopsis
  Piece of caryopsis larger than one-half the original size.

Avena (Oat)

- Spikelet with lemma and palea enclosing a caryopsis, with or without awn plus attached sterile floret.
- Floret with lemma and palea enclosing a caryopsis, with or without awn.
- Caryopsis
- Piece of caryopsis larger than one-half the original size.

Sorghum

- Spikelet, with glumes, lemma and palea enclosing a caryopsis with or without hyaline palea or lemmas, rachis segments padicle(s),awn(s),attached sterile or fertile floret(s).
- Floret, with lemma and palea ,with or without awn.
- Caryopsis.
- Piece of caryopsis larger than one-half the original size.

Fabaceae (Gram, Pea, Mungbean, Soybean, Sunhemp)

- Piece of seed larger than one-half the original size with testa.
- Seeds and pieces of seed without testa is regarded as inert matter. Separated cotyledons are regarded as inert matter irrespective of whether or not the radicle-plumule axis or more than half of the testa may be attached.

Brassicaceae (Radish, Mustard, Cabbage and Cauliflower)

- Piece of seed larger than one-half the original size with testa.
- Seeds and pieces of seed without testa is regarded as inert matter. Separated cotyledons are regarded as inert matter irrespective of whether or not the radicle-plumule axis or more than half of the testa may be attached.

Solanaceae (Chillies, Brinjal, Tomato, Tobacco)

- Seed with or without testa.
- Piece of seed larger than one-half the original size with or without testa.

Liliaceae (Onion, Garlic)

- Seed with or without testa.
- Piece of seed larger than one-half the original size with or without testa.

Amaranthaceae (*Arnaranthus*)

- Seed with or without testa.
- Piece of seed larger than one-half the original size with or without testa.

Cucurbitaceae (Watermelon, Muskmelon, Cucumber, Pumpkin, Squash, Bottle guard)

- Seed with or without testa.
- Piece of seed larger than one-half the original size with or without testa.

Malvaceae (Cotton)

- Seed with or without testa (testa with or without fuzz).
- Piece of seed larger than one-half the original size with or without testa.

Compositeae (Sunflower, lettuce, chicory)

- Achene, with or without beak, or with or without pappus, unless it is obvious that no seed is present.
- Piece of achene larger than one-half the original size, unless it is obvious that no seed is present.
- Seed with the pericarp/testa partially or entirely removed.
- Piece of seed larger than one-half the original size, with the pericarp/testa partially or entirely removed.

2. Other Seed

a. Other crop seed: Other crop seed shall include seed units of any plant species other than of pure seed grown as crops.

b. Weed Seed: Seeds, florets, bulblets, tubers, or sporocarps of plants recognized as weeds by laws, regulation or by general usage shall be considered weed seeds. Further classification of species is determined with the use of the reference, "Uniform Classification of Weed and Crop Seed" which is published by the Association of Official Seed Analysts.

3. Inert Matter

Soil particles, stones, chaff, stems, leaves, flowers, cone scales, pieces of bark, pieces or resin, etc.. Pieces of broken and damaged seed units of crops which are half the original size or less. Damaged weed seed with over half the embryo missing.

Inert matter includes seed units and all other matter and structures that are not defined as pure seed, other crop seed or seed as follows:

Seed units in which it is readily apparent that no true seed is apparent.

- Pieces of broken or damaged seed units half or less than half the original size.
- Those appendages not classed as being part of pure seed in the pure seed definitions must be removed and included in the inert matter.
- Seed of Fabaceae, Brassicaceae, Cupressaceae, Pinaceae and Taxodiaceae with the seed coat entirely removed.
- Unattached sterile florets, empty glumes, lemmas, paleas, chaff, stems, leaves, cone scales, wings, bark, flowers, nematode galls, fungus bodies such as ergot, sclerotia and smut balls, soil, sand, stones and all other non seed matter.

Each of the four component parts is weighed and a percentage is calculated from the sum of the four component parts. This purity information is used to tag the seed for sale and is reported on the analyst's Report of Analysis.

Factors affecting seed purity

- Genetic purity of the mother seeds
- Growing conditions during seed development
- Nutrition of the mother plant
- Weather condition of the field
- Age or maturity of seed
- Methods of seed processing
- Injury during planting and establishment
- Damage during production or storage by machine or pest

- Presence of seed-borne pathogens
- Moisture and temperature during storage

Means and ways of improving seed purity

- Use quality seeds for seed production
- Maintaining genetic purity
- Proper cultivation of seed crops
- Make the field weeds free
- Make the threshing floor clean
- Seed treatment against seed borne pathogen
- Proper storage condition

Maintaining genetic purity during seed production

The various steps suggested by Hartmann and Kester (1968) for maintaining genetic purity. The steps are

a. Providing adequate isolation to prevent contamination by natural crossing or mechanical mixtures.
b. Roguing of seed fields, prior to the stage at which they could contaminate the seed crop
c. Periodic testing of varieties for genetic purity
d. Certification of seed crops to maintain genetic purity and quality seed.
e. Adopting generation system. (the seeds produced is restricted to four generation only i.e. starting from breeders seeds.) and the seeds can be multiplied up to three more generations i.e. foundations, registered and certified.

Suggested Readings:

Copeland, L.O. and McDonald, M.B (1999) Principles of Seed Science and Technology. 3rd Edn. Springer, New York

Agrawal, R.L. (1995) Seed Technology. 2nd Edn. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

Huda, M.N (2001) Why Quality Seed? — Reality & Vision. Bangladesh-German Seed Development Project, Dhaka

MOA (2006) manual for Seed Quality Control. Seed Wing, Ministry of Agriculture, Government of the People's Republic of Bangladesh.

Adkins, S.W., Ashmore, S.E. and Navie, S.C. (2007) Seeds: Biology, Development and Ecology. CAB International, Oxfordshire

Bewley, J.D., Bradford, K.J., Hilhorst, H.W.M. and Nonogaki, H. (2013) Seeds: Physiology of Development, Germination and Dormancy. 3rd Edn. Springer, New York.