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Physical Purity Test in Paddy

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Short Communication

Abstract

Rapid industrialization is a global trend and a cause of concern for those who care about its unwanted consequences. Industries rely heavily on chemical processes requiring heavy metal compounds which eventually lead to their efflux or emission into the surrounding environment. Heavy metals are toxic in nature to varying degrees and cause a host of diseases in man. Lead (Pd) is a greater health hazard owing to its extensive use in the products that come in our contact on a daily basis. Lead pipes are a source of lead exposure through water whereas the antiknock compounds cause its exposure through air. This review takes a closer look at the various physiological effects of lead toxicity in the light of latest studies that have added significant pieces of experimental evidence to our knowledge of mechanisms underlying toxic effects of Lead which often prove lethal and may even go undetected. The review discusses the possible sources and routes of lead exposure and elaborates on its toxic effects with special reference to nervous system, cardiovascular system, haemopoietic system, excretory system and reproductive system. It is hoped that a thorough understanding of the mechanisms of lead toxicity will lead to development of better strategies of prevention and treatment of lead toxicity.

Introduction

Seed is the vital and basic input of agricultural production on which the performance and efficacy of other inputs depend. A good quality rice seed should be pure, full and uniform in size, free from weeds, insect, disease and other inert matters and more over it should be viable (>80 % germination). Every country has its own regulatory system to control the quality of seed. In India, the Seed act 1966, provided the impetus for the establishment of official seed certification agencies by the states. These certification agencies entrusted with responsibility of testing the seed quality. The quality of seed is regulated both at field level and after harvest of the seed by these certification agencies.

Objective of The Physical Purity Test

a) To determine the composition by weight of the sample being tested and the results are expressed as weight percentage.

b) To determine the identity of the various species of seeds and inert matter constituting the sample.

Need of The Physical Purity Test

a) Seed Certification or Seed Law Enforcement Agencies to judge that the seed lot confirms to the prescribed standards.

b) It is pre-requisite for germination test because 'pure seed' component is used for germination testing.

Sample Size

The sample sent to the seed testing station either by a company, private person or sampling agency, is called submitted sample. The minimum size of the submitted sample for paddy seed is 400 g. The minimum size of the working sample (drawn from submitted sample) for paddy seed is 40 g.

In case of pelleted seed, submitted sample is not less than 7500 pellets. The working sample of not less than 2500 pellets is depleted by shaking in fine mesh sieves immersed in water. A sieve of 1.00 mm mesh above a sieve of 0.5 mm mesh is recommended. The pelleting material is dispersed in the water and the remaining seed material is dried overnight on filter paper and then in an air oven at a temperature of 130^0C for two hours. After drying, the material is subjected to a purity analysis as in case of non-pelleted seeds.

Materials Required for The Test

The seed samples received in the laboratory (submitted sample) are required to be reduced to obtain working samples for carrying out the test.

A Seed divider: Mostly mechanical seed divider such as Boerner/Soil type/Gamet type divider based on principle of centrifugal force are used to homogenize the submitted sample and getting the desired size of working sample.

It consists of a hopper, a cone and series of baffles directing the seeds into two spouts. The baffles are of equal size, arranged in circle and are directed inward. They are equally spaced and every alternate one leading to one spout. A valve at the base of the hopper retains the seeds in the hopper. When the valve is opened, the seeds fall by gravity over the cone where it is equally distributed in two spouts (Figure 1) [1].

In this divider, the channels are arranged in a straight row. It consists of a hopper with attached channels, a frame work to hold the hopper, two receiving pans and a pouring pan (Figure 2).

In this divider, the seeds fall on a shallow rubber spinner which on rotation by an electric motor, throw out the seeds by centrifugal force. The circle or the area where the seeds fall is equally divided into two parts by a stationary baffle so that approximately equal quantities of seed will fall in each spout (Figure 3).

While mixing and dividing the seed, the following guidelines need to be followed:

i. Check the cleanliness of the divider and the container.

ii. Pour the entire contents of the submitted sample into the hopper of the divider.

iii. Recombine the contents of both sample receiving pans and again pass it through the divider.

iv. Repeat this process twice in order to homogenize the submitted sample.

v. Set aside the contents of one container to reduce the sample size.

vi. Divide the contents of the other container subsequently till the weight of working sample is obtained.

Optical aids: A magnifying glass of 3-5 times magnification is useful.

Balances: Balances intended for weighing samples, sub-samples, fractions and components must meet certain requirements regarding precision. The whole range of weights between 0.5 and 1000g can be determined with two balances: an analytical balance enabling 0.1 mg to be read accurately (capacity 160-200 g), and a precision balance with about 1 kg capacity, allowing 10mg to read accurately.

Weighing Table: All balances should be placed on a weighing table. Such a table should Consist of a strong slab (8cm thick) with anti-vibration cushioning and supported by concrete or brick pillars.

Purity Work Board: It is used for separation of different components of seed samples efficiently (Figure 4)

Various other equipment's:

- Spoons, spatula. forceps, scalpel needles, shallow trays, funnels, watch glass, etc. are always needed for a normal purity analysis.
- Small metal containers to receive the working sample and its components.

Storage unit: A cupboard for storing the main seed collection is needed. Storage units containing small plastic drawers are recommended. The seeds are put into labelled glass test tubes/jars and stored in the drawers.

Working Procedure of the Purity Test

Working sample and weighing the working sample

The purity analysis may be made on one working sample of the prescribed weight drawn from the submitted sample or on two sub-samples of atleast half of this weight, each independently drawn. The number of decimal places to which the working sample and the components of the working sample should be weighed is given below.

Purity analysis shall be made on a working sample taken from the submitted sample. The size of the

Figure 1. Boerner divider.

Figure 2. Soil divider.

Figure 3. Gamet divider.

Figure 4. Purity Work Board.

working sample shall not be less than 40 g in case of paddy. As per the (Table 1) since the weight of the working sample is within the range of 10-99.99 g so the working sample and its components should be weighed up to two decimal places [2].

Separation

- The subsample (purity working sample) is spread on the working table or a purity board.
- Each particle is judged individually based on external appearance (shape, size, colour, gloss, surface texture) under transmitted light.
- All other seeds and inert matter particles present are removed leaving the pure seed and separated into the three components (pure seed, other seed and inert matter) as mentioned below.
- Each component part shall be weighed in grams to the minimum number of two decimal places and the percentage is calculated (by weight) and recorded on the purity form.
- Components may be retained for future reference.

Definitions of Three Components

In India, the purity test components are arranged into four groups (pure seed, other crop seed, weed seed and inert matter). However international certificate mentions only three components instead of four: the components 'other crop seed' and 'weed seed' have been combined into one fraction, called 'other seeds'. The descriptions of these three components as given in the ISTA (International Seed Testing Association) Rules are given below [3].

Pure seed

- The pure seed shall refer to the species stated by the sender or found to predominate in the test and shall include all botanical varieties and cultivars of that species. Here it is *Oryza sativa*.
- Spikelet with glumes, lemma and palea enclosing a caryopsis excluding the awn when length of awn is longer than the length of the floret.
- Floret, with or without lemma, with lemma and palea enclosing a caryopsis excluding the awn when length of awn is longer than the length of the floret.
- Caryopsis.
- Piece of caryopsis larger than one-half the original size.

The above structures (even if immature, undersized, shrivelled, diseased or germinated, provided they can definitely be identified as of that species) shall be regarded as pure seed in case of paddy.

In case of pelleted seed, pure pellets shall include:

a) Entire pellets regardless of whether or not they contain seed.

b) Broken and damaged pellets in which more than half the surface of the seed is covered by pelleting material.

Other crop Seed: Other seeds shall include seeds and seed-like structures of any plant species other than that of pure seed.

Weed seed: It includes seeds of those species normally recognized as weeds or specified under Seed Act as a noxious weed.

Inert Matter: Inert matter shall include seeds, seed-like structures and other matter as follows:

- Pieces of broken or damaged caryopsis, one half the original size or less.
- Paddy seeds with awns longer than length of floret.
- Soil, sand, stones, stems, leaves, pieces of bark, flower, nematode galls fungus bodies (such us bunt or smut balls) and all other matter that are not seeds.

The seed standards for different class of seed prescribed by Indian Minimum Seed Certification

Standard is described in (Table 2).

*Objectionable weed shall be: wild rice (*Oryza sativa* L. var. *fatua* Prain) (Syn. *O. sativa* L. f. *spontanea* Rosch.)

Table 1. Weight of the working sample and the decimal places for working sample and its components.

Weight of the working sample(g)	The number of decimal places	Example
<1	4	0.7534
1-9.999	3	7.534
10-99.99	2	75.34
100-999.9	1	753.4
1000 or more	0	7534

Table 2. Indian minimum seed certification standards for foundation and certified seed.

Sl.no.	Components	Standards for each class	
		Foundation	Certified
1	Pure seed (minimum)	98.0%	98.0%
2	Inert matter (maximum)	2.0%	2.0%
3	Huskless seeds (maximum)	2.0%	2.0%
4	Other crop seeds (maximum)	10/kg	20/kg
5	Other distinguishable varieties (maximum)	10/kg	20/kg
6	Total weed seeds (maximum)	10/kg	20/kg
7	*Objectionable weed seeds (maximum)	2/kg	5/kg
8	Seeds infected by paddy bunt (*Neovossia horrida* (Tak.)Padwick&Azmatulla Khan) (maximum)	0.10% (by number)	0.50%(by number)
9	Germination (minimum)	80.00 %	80.00%
10	Moisture (maximum)	13.00 %	13.00 %
11	For vapour-proof containers (maximum)	8.00 %	8.00 %

Calculation and Expression of Results

One whole working sample

- Add together the weights of all the component fractions from the working sample. This sum must be compared with the original weight as check against gain or loss. If there is a discrepancy of more than 5% of the initial weight, a retest must be made. The result of the retest is then reported.
- The percentage by weight of each of the component parts shall be reported to two decimal place. Percentages must be based on the sum of the weights of the components, not on the original weight of the working sample.
- Add together the percentages of all fractions. Fractions that are to be reported as a "trace"(components less than 0.05 %) are excluded from this calculation; the other fractions shall then together total 100.0 %.
- If the sum does not equal 100.0 % (either 99.9 or 100.1) then add or subtract 0.1% from the largest value that is normally the pure seed fraction). (Note: If a-correction of more than 0.1% is necessary, check for a calculation error.)

Two half working samples

- For each half working sample, calculate the percentage by weight of each component to at least two decimal places. Add the appropriate percentages together from each half working sample and calculate the average percentage by weight for each component.
- The difference for each component of the two half working samples shall not be in excess of the tolerance as prescribed by ISTA. If all the components are within the tolerance, then average of each component is calculated and round the averages off to one decimal place.
- If any of the components are out of tolerance, then analyse further pairs (but not more than four pairs in all) until a pair is obtained which has its members within tolerance.

Two or more whole working samples

There are occasions when it is necessary to test a second whole working sample.

- When two complete tests have been carried out, proceed as with duplicate analysis on half working samples as described in ‘b’and find out the appropriate tolerance.
- If the difference between the results exceeds the tolerance, analyse one more working sample. If the highest and lowest result do not differ by more than twice the tolerance, report the weighted average of the three.
- For each of the samples to be included in the final result add the weights of each fraction together and perform the calculation and round according to procedures described in section (a) above. Average the results and round it to two decimal places again.

Reporting Results

- The result of a purity analysis shall be given to one decimal place and the percentage of all components must total 100.
- Components of less than 0.05 % shall be reported as "Trace".
- The percentages of pure seeds other seed and inert matter must be reported in the spaces provided on the Analysis Certificate. If the result for a component is nil, this must be shown as '-0.0-' in the appropriate space.
- The Latin name of the species of pure seed must be reported on the Analysis Certificate. The kind of inert matter and the Latin name of each species of other seed must be reported.
- When a particular kind of inert matter, species of other seed is found to the extent of 1 % or more and when at the request of the sender, a particular species has been determined and found present to the extent of 0.1% or more, the percentage of such material must be shown on the Analysis Certificate.

Special tests related to purity analysis:

The purity analyst is required to do certain test in addition to physical purity, required for meeting seed certification standards prescribed by Indian Minimum Seed Certification Standard (IMSCS: (Table 2).

Determination of other distinguishable varieties: It is done in a working sample of 400g (whole submitted sample) based on the morphological characteristics of the seeds under magnification. The availability of authentic samples for comparison is a must for this determination. The result is reported as number/kg.

Determination of number of objectionable weed seed(OWS): The minimum weight of working sample for this test is 400 g (whole submitted sample). The sample is placed on a purity work board and objectionable weed seeds and inseparable other crop seeds, if present, are separated and reported as number / kg.

Determination of husk less seed: It is determined in a working sample consists of 400 seeds drawn randomly from the pure seed component and completely husk less seed are separated (partly husk less seeds should be excluded) and their number counted. The result is expressed as percentage of husk less seeds (by number).

Conclusion

The above special tests including physical purity helps in improving the plant stand by increasing the pure seed component, raising a pure crop by eliminating other crop seed, weed seeds, raising a disease free-crop by eliminating inert matter thus help in maintaining seed quality and providing quality seed.

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