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Quality Assurance Techniques

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QUALITY ASSURANCE TECHNIQUES

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Emphasis: Mechanical Damage

THE CHLOROX SOAK TEST

This test is used in the field to determine the percentage of soybean (Glycine max) seed damage due to combining or threshing. It is also adaptable to use in the laboratory. The test can be used for beans (Phaseolus vulgaris) and possibly other large dicotyledonous seeds which may be injured in combining, threshing or seed cleaning.

Materials Needed:

1. Two or more small tray(s), plastic is preferable, large enough to hold 100 or more seeds are needed.

2. Chlorox (household bleach, 5.25% sodium hypochlorite) and ordinary tap water are used.

Procedures:

1. Mix approximately three fluid ounces (3/16 of a pint) of chlorox in one gallon of water. In the laboratory where only small quantities may be needed a three to five percent solution of chlorox in water may be used.

2. Count one or more replicates (depending on the accuracy desired) of 100 seeds each excluding "splits" or obviously broken seeds. Place each of the 100 seed replicates in a tray.

3. Pour a sufficient amount of the chlorox-water solution over the seed so its covers all the seeds.

4. After 10-15 minutes pour off the chlorox-water from each 100 seed replicate then spread the seeds on toweling so they may be checked.

5. Count the number of swollen seeds in each 100 seed replicate. If more than one replicate is included, average the number of swollen seeds in all of the replicates.

Conclusion:

In the field it is generally considered that if there is over 10 percent swollen seed, seed damage is excessive. This degree of damage indicates that an adjustment should be made in the combine. In a

cleaning plant the percentage of swollen seeds should be determined on a lot both before and after cleaning to determine the damage caused in cleaning.

For total damage due to a particular operation, the "obviously broken" and "split" seed should be added to the % swollen seed to obtain a total seed damage %.

Notes:

1. Avoid handling the chlorox-water solution over varnished or painted surfaces.

2. If seeds are left in chlorox solution more than 15 minutes, non-damaged seeds will begin to absorb the solution.

3. The chlorox-water solution poured off the seeds may be re-used but probably should not be saved more than a day.

4. Chlorox may be obtained from any supermarket.

FAST GREEN TEST

The fast green test is used to reveal the extent of pericarp damage in seed corn (Zea mays). Pericarp damage to corn seed can be detected by use of a stereoscopic microscope; however, the use of fast green is simple and rapid and does not necessitate the use of expensive laboratory equipment. Fast green may also be used to detect seed coat damage in legume seeds such as alfalfa (Medicago sativa), crimson clover (Trifolium incarnatum) and other legume seeds of similar size. Fast green in the low concentrations used is non-toxic to embryos and small seedlings. Therefore, stained seeds can be germinated and the normal and abnormal seedlings examined to observe the nature of the damage.

Materials Needed

1. Fast green FCF can generally be purchased in 10 or 25 gram amounts from a chemical supply house.

2. The fast green is soluble in ordinary tap water.

3. 250 ml beakers or similar containers (1/2pint jar) are about the right size to hold 100 seeds of corn, the fast green solution and still permit room for stirring.

4. A 1000 ml. flask, or similar size container (quart jar) should be available for mixing the fast green in water.

Procedures

1. Prepare a 0.1% percent solution of fast green by adding one gram of fast green to 1000 ml. of water (one quart). If only a small smount of solution is needed, mix 0.1 gram of fast green in 100 ml. of water (approx. 1/4 pint).

2. Count out one or more 100 seed replicates of corn (or other kind of seed) at random. Place each replicate in a 250 ml. beaker or 1/2 pint jar.

3. Pour sufficient fast green solution into each container to cover the seed. Stir the seed in the solution intermittently during the first 30 seconds. Allow the seed to stand in the solution approximately two minutes more.

4. Pour off the fast green solution and rinse thoroughly under running tap water.

5. Spread each 100 seed replicate on an absorbent towel or paper to dry.

6. Count the seeds in each 100 seed replicate that show stained pericarp breaks. Average the number for all the replicates.

Conclusions

Seed corn pericarp damage in the 30-50% range should be of concern to a seedsman. When the damage is over 50% the seedsman should take action to reduce damage in shelling and handling corn seed. Severe pericarp damage will cause loss of yield even though the seed is treated.

In the case of legume seeds, generally each stained seed is dead or will develop into an abnormal seedling when placed on a moist substrate to germinate.

Notes

1. Generally the use of a fast green solution for soybeans is not satisfactory. The solution is readily absorbed even by some of the non-damaged seeds.

2. The amount of seed coat damage revealed by the fast green test in new crop alfalfa seed has been used to predict seed germination.

3. The fast green solution may be poured off and re-used. However, if much residue is retained in the solution it should be discarded.

4. Fast green also stains clothes and fingers.

Source of Fast Green

Fast green (FCF) may be obtained from most chemical supply houses. One source is listed here for your information.

Fisher Scientific Company
Chemical Manufacturing Division
Fair Lawn, NJ 07410

FERRIC CHLORIDE TEST

Mechanical injured areas of legume seeds turn black when placed in a solution of ferric chloride. This is a practical method of providing a quick estimation of the percent abnormalities to expect in a seed crop. This on-the-spot check, with appropriate adjustments to equipment, can reduce damage to the remainder of the crop.

Materials Needed:

1. Ferric Chloride ($FeCl_3$) is generally obtained in reagent lump grade. The lumps should be gound to a powder before use. Grinding may be done by rubbing the lumps in a mortar with a pestle.

2. A mortar and pestle or some other means of grinding is needed.

3. Petri dishes or similar containers should be available.

Procedures:

1. Prepare a 20 percent solution of ferric chloride ($FeCl_3$) by adding 4 parts water to 1 part $FeCl_3$ by weight. A one-third cup of ferric chloride powder in 1/2 pint water provides sufficient quantity to do numerous tests. Add a half teaspoon of liquid detergent to the solution.

2. Count out at least two 100-seed samples and place them in petri dishes or saucers. If time permits, two or more 100 seed samples should be counted out to increase test accuracy.

3. Pour enough solution into each dish to completely cover the seeds. Be sure all seeds are totally submerged; however, a few light seeds may float.

4. Start to separate black staining seeds within 5 minutes after addition of the solution. Regardless of how small the black stain is, these seeds should be separated. However, be sure that the stain is black and not a natural dark brown.

5. Continue to separate black seeds until 15 minutes after addition of the solution to the seeds. DO NOT SEPARATE SEEDS AFTER 15 MINUTES.

6. Count the number of black stained seeds in each hundred seed replicate. Average the number for all the replicates.

Conclusion:

Generally all stained seeds are dead or develop into an abnormal seedling when germinated.

Note:

The solution may be poured off at the end of the test and re-used.

INDOXYL ACETATE TEST

Indoxyl acetate is used to accentuate mechanical damage to soybean seed so that it is easily visible. A purple color develops around cracks and fractures in the seed coat.

Materials Needed

1. Indoxyl acetate - this chemical can be obtained from a chemical or biological supply house (see below).

2. Ethyl alcohol - obtain from a drug store. Ask specifically for ethyl alcohol.

3. "Household" ammonia - obtain from drug store.

4. Cotton "balls" - obtain from drug store.

5. 1000 ml flasks (or quart jars), and 100 ml flasks (or a "cup").

Procedures

1. Prepare a 0.1% solution of indoxyl accetate by dissolving 1 gram of the chemical in about 100 ml (1/2 cup) of ethyl alcohol. Stir to dissolve. Place the solution in a 1000 ml. flask (or quart jar) and bring volume to 1000 ml (or quart) by adding water.

2. Place 100 soybean seed selected at random in a small plastic dish (cup size) and cover with the indoxyl acetate solution for 2 minutes. Drain off solution, rinse seeds briefly, and place in a small plastic screen basket. Suspend basket in a larger container - such as a small plastic pail or jar - and drop a couple of cotton balls saturated with household ammonia in the bottom of the plastic pail. Position a lamp with 100 to 150 w. incandescent bulb so that it can warm and dry the seed. The stain will develop in 5 to 10 minutes as the seed dry.

4. Examine the number of seed with purple stains indicating cracks in the seed covering. Determine percentage of damaged seed.

Conclusion

The purple stain developed accentuates the damage to soybean seed and facilitates mechanical damage analysis.

Note

The purple stain can develop along so-call growth splits in the seed coat. This must be distinguished from "real" mechanical damage by visual examination.

Source of Chemical

Indoxyl acetate can be obtained from many chemical and biological supply houses. One source is:

Fisher Scientific Co.
Chemical Manufacturing Division
Fair Lawn, NJ 07410