Technical Update 35

Electrical conductivity test for vining pea seed

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One of the most useful tests for identifying vining pea seed lots which may fail to emerge in the field under adverse soil conditions is based on the determination of the amounts of inorganic salts released by seed when soaked in water. The test measures the electrical conductivity of a solution after soaking seeds in de-ionised water.

Although the basic principles of the test are simple to carry out in the laboratory, unless great care is taken it is very easy to obtain inconsistent results either on a day-to-day basis or between laboratories. These problems prompted PGRO to lead an investigation and a review of the test procedure. As a result of discussions with the British Seed Trade, the Official Seed Testing Station for England and Wales and Dr S. Matthews of the University of Aberdeen, a standardisation procedure has been evolved which should help eradicate the major causes of discrepancies which can occur during the seed test.

METHOD & MATERIALS

METER

Several types of electrical conductivity meters are available from a range of manufacturers. The meter must be capable of accurate measurements between 100 - 1000 µS g^{-1} and an immersion cell or probe with a cell constant of 1.0 is recommended.

CONTAINERS

The base diameter of the container should ideally be 80 mm ± 5 mm. It can be of any material, although if a non-disposable form is used, it must be washed in hot water and a non-ionic detergent between tests and allowed to drain. Rinsing with deionised water should be carried out at some time after washing. The washing operation should be checked periodically to prevent the build-up of salts from the tap water. The containers should have a flat top to allow covering during the test.

WATER QUALITY

Distilled water is likely to contain electrolytic material and so deionised water is essential. The quality should be such that the maximum level of electrical conductivity does not exceed 20 micro-Siemens.

WATER TEMPERATURE

The water used should be stored at 20°C for at least 24 hours prior to use. This ensures temperature stabilisation and will also ensure even imbibition during the 24-hour period of the test.

SEED SAMPLES

Fungicidal seed treatment: There is one available seed treatment in the UK (Prepper (fludioxonil)), in some countries other seed treatments are available. In most cases, the active ingredients, the carrier materials and the dyestuffs do not contain electrolytes therefore the seeds should not be washed beforehand. If the seed treatment is unknown, check that ingredients do not need to be removed before the test is carried out.

Weighing: Two samples of 50 dry seeds should be weighed in grams to one decimal place.

TEST PROCEDURE

250 cm^3 of deionised water, as measured using an accurately calibrated measuring cylinder or dispensing device, is added to the two replicates of 50 weighed seeds in the containers. The containers are then covered to prevent evaporation loss and entry of foreign matter. A separate container of 250 cm^3 of deionised water without peas should be prepared at the beginning of each test (blank). All containers should be kept at 20°C for 24 hours.

MEASURING ELECTRICAL CONDUCTIVITY

Using the dip-cell, a reading in microsiemens (µS) of the blank container of water is made and the reading recorded.

1. Each pot of peas and water should be thoroughly stirred, carefully wiping the glass or plastic rod with some clean paper towel in between each pot.
2. Using a **coarse** sieve pour the contents of one container through the sieve into a clean container, before returning the water alone to the original container.
3. Dip the cell into the solution, giving a quick careful stir, record the reading and then subtract the conductivity value of the blank water.
4. Between replicates, the clean beaker and sieve should be shaken to remove adhering droplets. The beaker and cell should not be rinsed between tests as the dilution may alter the overall result.
5. Cleanliness is essential, as the test is very sensitive to the presence of electrolytes (e.g. from contact with the skin).

EXPRESSION OF RESULTS

For each of the replicated seed samples, the weight of the dry seed is divided by the electrical conductivity result, and the mean of the two replicates is converted to the vigour grade.

If it is found that large differences occur between the conductivities of the two replicates of each seed sample, i.e. more than $4\mu Sg^{-1}$ then a retest should be carried out.

CHECKING THE METER

Dry potassium chloride (Analytical grade) at 150°C for 1 hour and cool in a desiccator. Dissolve 0.5323 g of the dried salt in deionised water and dilute to 1 litre.

Transfer some of the solution into a clean container and hold in a water bath until the temperature is 20°C. Using the dip-cell the specific conductivity at 20°C should be 1000 µS. Remember to subtract the conductivity of the deionised water.

Alternatively, calibration solutions can be obtained from several laboratory supply companies.

CLEANING THE TEST CELL

It is advisable that, at the end of a day's testing, the dip-cell is rinsed with deionised water.

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