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Validation of Validity Period of Certified Seed of Chickpea

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The vital amino acids cysteine, methionine, tryptophan, and other nutrients found in pulses, which are a significant source of vegetable protein, are necessary for the correct growth and development of the human body. On an average Pulses contain 20-25% protein in dry seed. These are cheaper than animal protein for vegetarian people and hence may be poor man`s meat for developing countries like India. Besides, a rich source of protein in the daily diet menu, the pulses have also been proved worthy and important for sustainable agriculture as they enhance physical, chemical, and biological properties of soil and function as natural mini nitrogen factory.

The chickpea (*Cicer arietinum L.*), which ranks third among all grain legumes in the world, is a significant pulse crop. Among the pulses grown in country, gram occupies a predominant position and is considered as a king of pulses. India contributes about 68% share in global chickpea production and is a leading chickpea producing country. An Indian sub-continent accounts for 70 and 80 percent area and production of chickpea crop, respectively in the world**.** In India, gram is cultivated in about 32 per cent of total area of pulse crops and it contributes 45 per cent to total production of pulses. Statistically, it occupies about 65 to 70 lakh hectares with a production of 50 to 55 lakh tones every year. The average yield is approximately 823 kg ha-1. Chickpea seed contains around 17.7, 0.49, 0.11, and 0.04 percent protein, lysine, methionine, and tryptophan.

Seeds have been critical to the growth of agriculture since crop plants were modified for commercial cultivation. For seed to play a catalytic role, it should reach to farmers in a good quality state, *i.e*. high genetic and physical purity, high germination percentage and free from designated diseases. If the seed is tested again and meets the requirements for physical purity, germination rate, and insect pest damage, the validity period may be extended by another six months.

"Seed vigour is the sum total of those properties of the seed which determines the potential level of activity and performance of the seed or seed lot during germination and seedling emergence."

Low vigorous seeds are those that perform poorly after sowing. The germination rate is high for healthy, viable seed. Reduced vigour and germination may have an impact on the yield percentage or quantity. Seed vitality has been recognized as one of the key aspects of seed quality.

Factors affecting seed vigour

The standard germination test is most widely used to evd commonly known factors which influence vigour level such as:

1. Genetic constitution: The measurement of seed viability is often employed as an indicator of the storage capability of seed batches. Genetic traits, such as hardiness, disease resistance, and chemical composition, have a favorable effect on seed vigour.

2. Germination: The vigour test is more sensitive than the standard germination test and it is a good choice for the determination of seed lot quality under field conditions**.** Despite having the same germination rate, seed lots can vary in terms of seed ageing and behavior in the field. Low vigour seeds resulted in soybean yields with number of pods and number of seeds per pod inversely correlated with yield, i.e. seed vigour had a direct effect on plant population and an indirect effect on seed yield.

3. Maturity at harvesting stage: Timely harvesting avoids prolonged exposure to moisture, and is the best means of avoiding weathering. Harvesting when the crop is past its prime prolongs field exposure and accelerates seed degradation. After physiological maturity if the seeds are retained on mother plant seeds will deteriorate, physiological changes in seed may lead to formation of rigid seeds or off color seeds in pulse crops.

4. Post harvest deterioration: Lower temperature and humidity result in delayed seed deteriorative process and thereby leads to prolonged viability period. When damaged seeds are planted, seedling emergence may be poor and disease transmission to the new crop may take place. When seeds are stored, damage will inevitably occur. These environmental conditions are very difficult to maintain during storage. The seed storage environment highly influences the period of seed survival.

5. Environmental and nutritional condition of the mother plants: Very cold temperatures may also damage seed quality especially in the early phases of seed maturation though oil crops can withstand hot periods during flowering, very high temperatures result in premature flowering, and production of poor quality seeds. Cool temperatures are necessary for fruit, legume, and vegetable crops to bloom and pollinate normally. Many crops, such as vegetables, legumes, and fruit trees, fail to set strong seeds successfully if hot, dry climatic conditions persist during flowering.

Methods of testing seed vigour of check pea

Vigour is not a single measurable trait like germination or viability but in general, with different relation of compensation of the germination seeds or subsequent seedling. When compared to a germination test, a vigour test should yield a reproductive outcome that is more closely correlated with seed performance in the field in specific situations.

There are number of tests which are employed to know the performance of the seed lot of different varieties of chick pea are based on seedling length, seedling dry matter production, speed of germination etc.

1. Growth Tests: Growth tests are based on the idea that even in ideal conditions, seeds with greater vigour will grow more quickly than those with less vigour. The test is done along with the regular germination test. The number of normal seedlings, germinated on the first count day, as specified in the germination test for each species, is counted. The seedlings are grown either in laboratory, green house or field. In laboratory, in between rolled towel paper method should be followed. Ten seeds are planted in the centre of the moist towel papers in such a way that the micropyles are oriented towards bottom to avoid root twisting. The germinator is kept at the crop-recommended temperature and contains the wrapped towel papers. After a specified period of time (5-10 days) towel papers are removed and five seedlings arc selected, their length is measured and means seedling length is calculated.

2. Conductivity Test: An accurate evaluation of membrane permeability can be obtained by measuring the electrical conductivity (EC) of the leachate with a reliable and sensitive conductivity meter. The EC has been positively correlated with the emergence percentage of

peas and broad beans. The value of this test appears to be restricted to the large seed species of the leguminosae.

First the conductance of distilled water is measured in a beaker. The electrode is then cleaned with a tissue paper and conductance of the leachate is read. The electrode is thoroughly washed using a wash bottle and wiped with a clean tissue paper before reusing. To get the EC of leachate the reading of distilled water is substracted from the sample reading. The reading is expressed as *mhos/cm/g* of seed. Lower the value of EC greater is the seed vigour.

3. Hiltner Test (Brick gravel test): The test was developed by Hiltner in Germany in 1917. He observed that the seeds of cereal crops affected by Fusarium disease were able to germinate in regular test but were not able to emerge from brick gravels of 2-3 mm size. Compared to this, healthy seeds were able to emerge from the brick gravel.

4. Paper Piercing Test: The brick gravel test and the paper piercing test both operate on the same principles. High vigour seed lots are expected to produce strong seedlings which can pierce a particular type of paper while seedlings of poor vigour lots may not be able to pierce the paper. As a result, seedlings that break through the paper to emerge are stronger than those that are unable to do so.

5. Cold Test: The cold test has been developed in USA. The test aims to differentiate between weak and vigorous seed lots by subjecting them to low temperature prior to germination at optimum temperature. This has been criticized for using field soil which greatly varies from place to place.

6. Accelerated Ageing Test: Before ordinary germination, the seeds are exposed to high temperatures and relative humidity in a chamber to speed up the ageing process. The seed lots that show high germination in accelerated ageing test are expected to maintain high viability during ambient storage as well. Thus Ageing test gives an indication of the performance of the seed lot during ambient storage. Tests conducted at Pantnagar with Bragg soybean seeds have shown positive relationship between 3 days accelerated ageing test (42- 45°C temperature, 95- *100%* RH.) and viability after 6 months *of* ambient storage. The test also suffers from fungal growth on seeds at high temperature and humidity.

Future Role of Seed Vigour Testing

Seed vigour is an important component of seed quality, and an acceptable level is required in addition to the usual quality criteria of moisture, purity, germination, and seed health to achieve optimal plant stand and crop yield.

As agricultural and horticultural techniques become progressively more sophisticated, the need for high vigour seeds will increase and testing standards, similar to those recognized for germination will be required. There is currently no single, widely used method for assessing seed vigour because the technology has not yet reached its pinnacle. Research is needed to further refine the current seed vigour test methods and to develop new methods which are more related to field/storage conditions.

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