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Standardization of Tetrazolium Test for Rapid Viability Assessment in Cowpea Seeds *Manshi Singh and Dr. Uzma Khatoon Kamla Nehru Institute of Physical and Social Sciences (KNIPSS), Sultanpur, Uttar Pradesh, India *Corresponding Author's email: singhmanshi75207@gmail.com

From the most important cultivated legumes, Cowpea (*Vigna unguiculata L. Walp*) has shown several agronomic, environmental and economic advantages, contributing to further improve the diets and incomes of peasant farming across tropical savannah zones Africa, Asia and South America. It is a member of the Fabaceae family, subtribe Phaeseolinae, Vigna genus, and Catjang section. The *V. unguiculata* subspecies *unguiculata* is responsible for all cultivated lobia. It is also known as black-eyed pea or southern pea etc.

It is a centuries-old human crop, having originated in Africa and spread throughout Latin America and Southeast Asia. It is now cultivated in more than 100 countries between 40°N and 30°S latitudes. In Indian context, it is mainly cultivated in arid and semi arid tracts of grown in pockets of Punjab, Haryana, Delhi, and West UP along with considerable area in Rajasthan, Karnataka, Kerala, Tamil Nadu, Maharashtra and Gujarat. As of the 2021–2022 agricultural year, India produced approximately 2.5 million tonnes of cowpea (lobia), cultivated over an area of about 1.5 million hectares. This results in an average yield of around 1,667 kg per hectare. These figures are based on data from the Directorate of Pulses Development and Indiastat. Its cultivation makes a major contribution to food security for people living in the most marginal areas. It demonstrates remarkable adaptability to diverse agro-climatic conditions, thriving in warm temperatures between 20°C and 35°C and requiring moderate annual rainfall of 60–100 cm. The crop favors well-drained sandy loam soils with a pH range of 5.5 to 7.5 and exhibits notable drought tolerance, making it suitable for semi-arid regions. Lobia is known as drought hardy nature, its wide and droopy leaves keeps soils and soil moisture conserved due to shading effect.

In India, cowpea is primarily grown during the Kharif season (June–July), although it is also cultivated during the summer and rabi seasons in certain southern states. In non-tropical climates, this heat-loving crop should be sown after all danger of frost has passed and the soil is warm. Seeds sown too early will rot before germination. Black-eyed peas are extremely drought tolerant, so excessive watering should be avoided. The crop is relatively free of pests and disease. Root-knot nematodes can be a problem, especially if crops are not rotated. As a nitrogen-fixing legume, fertilization can exclude nitrogen three weeks after germination. Owing to its symbiotic nitrogen-fixing capability, cowpea necessitates minimal nitrogen supplementation, though it benefits from phosphorus fertilization. Average yields range from 10 to 15 quintals per hectare for dry seeds and 40 to 50 quintals per hectare for green pods.

Importance of cowpea in our day to day life

It has multiple uses like food, feed, forage, fodder, green manuring and vegetable. Lobia seed is a nutritious component in the human diet, and cheap livestock feed as well. Both the green and dried seeds are suitable for canning and boiling. Lobia Beans is a rich source of plant-based protein(approximately 23–25%), and essential nutrients, making it a valuable addition

to your garden. Its seeds are rich in lysine and tryptophan, which are a valuable source of plant protein. One 100 g serving of cooked lobia contains 484 kilojoules (116 kilocalories) of food energy and is an excellent source of folate and a good source of thiamine, iron, magnesium, manganese, phosphorus, and zinc. The legume is also a good source of dietary fiber (6.5 g per 100 g serving) and contains a moderate amount of numerous other vitamins and minerals. With its vibrant green vines, it produces an abundant supply of beans packed with fiber, vitamins, and minerals.

Agriculturally, lobia plays a vital role in sustainable farming systems due to its ability to fix atmospheric nitrogen, thus enhancing soil fertility and reducing the need for synthetic fertilizers. It is often used in crop rotations and intercropping systems to improve soil health and break pest cycles. In addition, lobia residues after harvest are used as organic matter to enrich soil structure. In some regions, lobia seeds are also processed into flour for use in bakery and snack industries. The blossom produces nectar plentifully, and large areas can be a source of honey. Because the bloom attracts a variety of pollinators, care must be taken in the application of insecticides to avoid label violations. Overall, lobia significantly contributes to food security, livestock nutrition, and sustainable agriculture, especially in resource-limited environments.

Tetrazolium test: Rapid and reliable method

The TZ test, one of the most significant discoveries in seed testing in the 20th century. It determines the percentage of viable seeds within a sample, even if seeds are dormant. This is particularly useful for freshly harvested seeds that possess high levels of dormancy such as some grasses and native species. The results of the TZ teat indicate the amount of viable seeds in a sample that are capable of producing normal plants under suitable germination conditions. While germination test takes 3-4 weeks to be completed in most grass species, a TZ test can be finished within 24-48 hours. It is no surprise that this test is increasingly gaining a wide recognition as a fast method to determine seed viability of field crops, grasses, vegetables, flowers, shrubs, treus & native seed throughout the world. TZ test involves the use of 2,3,5-triphenyl tetrazolium chloride (TTC), which is colourless in its oxidized form but turns red when reduced by dehydrogenase enzymes in living tissues. This reaction helps differentiate viable (red-stained) from non-viable (unstained) tissues. This study aims to apply the tetrazolium test to lobia seeds and assess its accuracy by comparing it with standard germination tests.

Advantages of Tetrazolium Test

- 1. Speed: Results available within 2-4 hours after preparation.
- 2. Quick and fairly accurate.
- 3. Can also determine the viability of a dormant seed lot in Short time.
- 4. Structural Insight: Visualizes internal damage from pests or environmental stress.
- 5. Cost-effective: Reduces incubation time and labor.

Limitations

- 1. Requires expertise in interpreting staining patterns.
- 2. Correct evaluation is possible only after prolonged experience.
- 3. Invasive: Seeds are dissected and can't be rewed.
- 4. Not suitable for small or hard-to-section seeds without special equipment.
- 5. Micro-organisms harmful for seedling emergence remain undetected.