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Seed Quality Assessment of Maize (*Zea mays*) with Respect to Low Temperatures Conditions

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After rice and wheat, maize (*Zea mays* L.) is the third most important cereal crop. It is a member of the Maydeae and the Poaceae grass family, with chromosome number 2n=20. The nutrient-rich cereal is grown on 193.7 million hectares of land worldwide, with production and productivity of 1147.7 million tonnes and 5.92 t/ha, respectively (FAOSTAT, 2020). Maize is grown in 170 countries around the world. Maize is grown on 9.2 million ha in India, with an average production and productivity of 27.8 million tonnes and 2.9 t/ha, respectively (2018-19). Sweet corns exhibit poor seed germination and vigour, which is linked to a lack of nutrient availability during seed germination due to low starch content and greater imbibition rates, resulting in significant solute leakage and vulnerability to physical damage and biotic stressors (Styer *et al*., 1983). There are inadequate seedling energy stores due to diminished starch, and the pericarp cracks during seed ripening, resulting in solute leakage during germination. Sweet corn (*Zea mays* var. *saccharata*) is typically planted in cold soil at suboptimal temperatures in early spring and summer. To ensure optimum plant stand, it is crucial to comprehend the relationship between the temperature, germination, and vigour of sweet corn. Low temperatures (10°C) have a negative impact on seed germination; field emergence, seedling growth, and crop stand during the winter season (December-February) (Parera *et al*., 1996) and are a major bottleneck in sweet corn cultivation in farmers' fields. The current study focuses on evaluating sweet corn performance under low temperature conditions using different parameters available.

To evaluate seed germination and vigour of maize at low temperature, various vigour assessment measures were applied. Bruggink *et al*., (1991) discovered that a low temperature (8.8°C versus 13.3°C) throughout a cold period during a cold test in soil reduced the number of emerged seedlings, normal seedlings, mostly in artificially aged seeds. When the cold period was extended from three to fourteen days, the emergence rate was lowered. Low temperature impairment during the soak time was critical in cold tests; consequently, care might be made to guarantee that the substrate was rapidly cooled to 10°C. Among the 24 maize lots tested for standard germination, cool germination, and cold test, the cool germination test count at 144 hours had a strong association with field emergence. However, the final count of cold tests suggested greater field performance (Noli *et al*., 2010). Seed vigour in maize seed lots increased following a cold test at 4.5°C than after a cold test at 10°C and this might be due to decreased pathogen virulence in the field soil used during the cold test. This impact of pathogen virulence may be minimised if sterile sand is employed as a substratum instead of field soil.

Low temperature has a negative influence on physiological quality and enzyme expression of alcohol dehydrogenase, catalase, a-amylase, and malondialdehyde. Tekrony *et al*., (1989) evaluated the field performance of four maize hybrids and discovered that low vigour lots had slower emergence, smaller seedling growth, and delayed ultimate emergence. The cold test is found to be superior for assessing early seedling development vigour in maize. The primary root protrusion test in super sweet corn at 15°C and a primary root protrusion of 2 mm long is sufficient to differentiate vigourous seed lots, with results equivalent to classic vigour tests. Matthews and Hosseini (2006) evaluated the emergence of eleven distinct maize hybrid seed lots in growth chambers at 13°C and discovered a strong relationship between emergence and mean germination time. Mean Just Germination Time (MJGT) derived from time to first radicle appearance and Mean Germination Time (MGT) estimated from 2mm radicle emergence stage associated favourably with Mean Emergence Time (MET), seeding length, and seedling size at 13°C. Slower germination lots showed higher variability and lower mean root length at both 13°C and 20°C, while MJGT at 20°C was substantially associated to both MJGT and MGT at 13°C. In addition to the ISTA (2019) validated radicle emergence (RE) test, Sivritepe *et al*., (2016) proposed Germination Index (GI) and Electrical Conductivity (EC) as potential maize vigour tests. Kader (2005) discovered the Germination Index (GI) to be the most complete measuring metric, including both germination % and speed of germination. The environment has a direct influence on vigour manifestation, and that tests based on seedling development, such as speed of germination and seedling emergence speed, are insufficient to detect small differences in physiological potential when environmental conditions are favourable for germination (Marcos Filho, 1999).

Rezvani *et al*., (2017) used MGT followed by saturated salt accelerated ageing to predict field performance of maize seed lots and discovered the most suitable and categorising seed vigour technique for seed lots generated in warm climates. The accelerated ageing test, recognised by ISTA for soybean seed quality assessment, was a widely used seed vigour evaluation method (ISTA, 2019). Delouche and Baskin (1973) developed the Accelerated Ageing Test (AAT) to evaluate seed lot storage capability, but it was also used to evaluate maize seed vigour. Lovato *et al*., (2005) germinated thirty maize seed lots at 25°C after cold treatment (10, 7.5, and 5°C for 7 days) and after AA (72 h/45°C) and discovered that the AA test was as effective as the cold test at 10°C for evaluating maize seed vigour, whereas standard germination showed poor correlation with field emergence when compared to other vigour tests. Noli *et al*., (2008) evaluated three vigour tests with maize field performance, finding that the cold test had the strongest association with field performance and the soak test had the lowest, and that vigour indicated by the AA test was impacted by seed lot age more than other vigour tests.

According to the findings, the cool germination test at 18°C was strongly connected with field emergence and cold test, however normal germination failed to show linkage with field emerging in seed lots under examination. These findings showed that a cool germination test at 18°C may be used instead of a cold test to examine vigour differences between maize seed batches.

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