

Non - Invasive Methods for Diagnosing Seed Quality: A Review

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Introduction

Seeds are the basis for all plant life on earth. So, seed should be grown and processed precisely to enhance the crop productivity. Quality seed can boost the agriculture production by 15-20%. Quality seed is of utmost importance for the successful field establishment. Various methods are to diagnose the seed quality viz; conventional and advance methods. Conventional methods are time consuming, laborious and are invasive one. So, with the advancement in the field of seed quality testing, we require the new methods which should be non- invasive, accurate, rapid and simple. Several non-invasive methods are developed for diagnosing seed quality. These methods are mirco-optrode technique, modified breath analyser, image-spectroscopy technology viz; multispectral imaging, near infra-red spectroscopy, infrared thermograph and cold plasma technology etc. These methods can be used for assessing the composition of seed, varietal identification, diseases and insect infestation and also for germination and vigour.

1. Multispectral Imaging

Multispectral imaging is a new technology that is being used to assess seed quality parameters i.e. insect and fungal infestation, seed shape, size, morphology and chemical composition. It integrates the conventional vision and spectroscopy technique to attain both spatial and spectral information from target objects. MSI setup consists of video-meter lab instrument and a high-power LED. The seed samples are placed at the bottom of the integrating sphere and within five to ten seconds a high-resolution multispectral image is captured. A data analysis is done by video meter lab software (Fig 1).

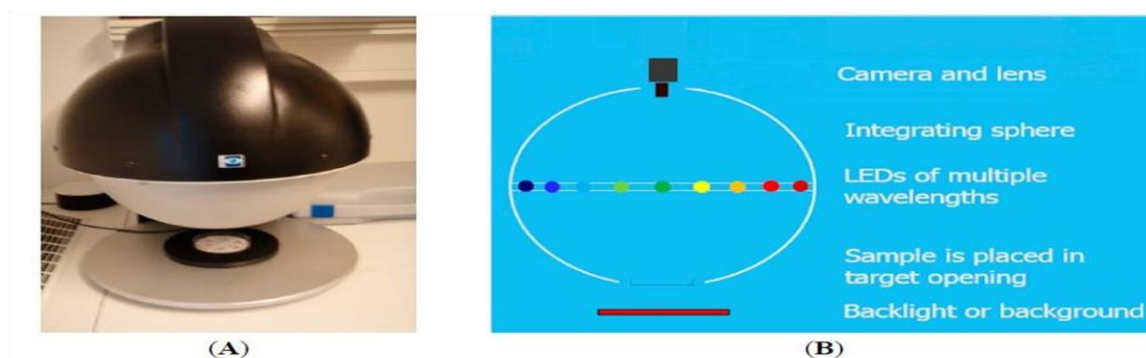
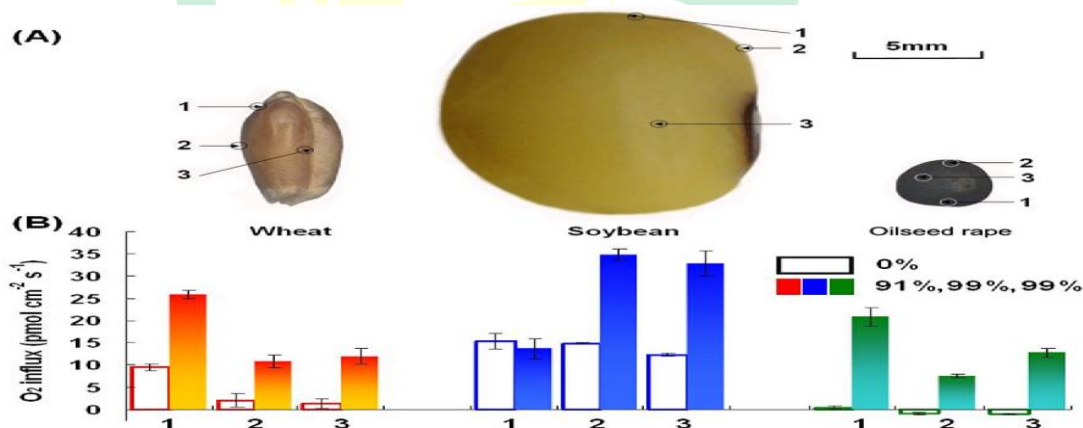


Figure 1. (A) Picture of the VideometerLab instrument and (B) is the outlines setup of the VideometerLab instrument.

2. Micro – Optrode Techniques

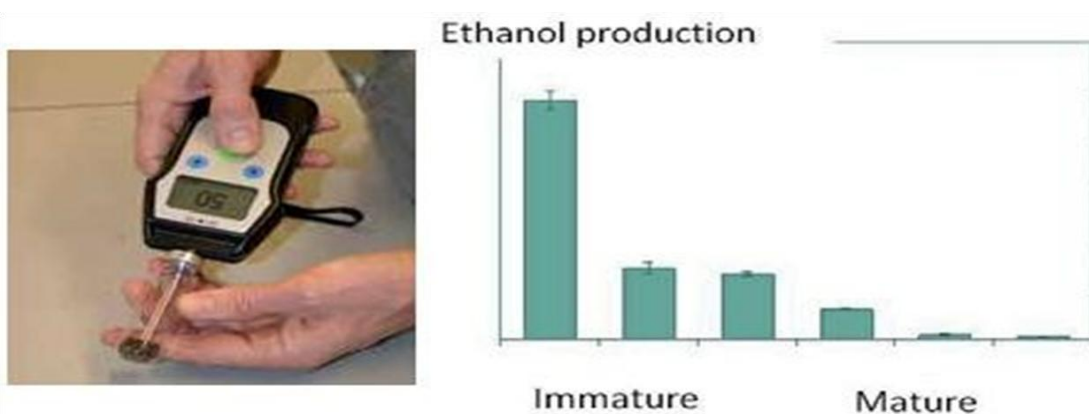
This novel technique was developed to measure seed viability in a quick and non-invasive manner by measuring oxygen flux of intact seeds; it takes ten seconds to screen one seed. It is a highly sensitive and selective technique to measure oxygen concentration and physiological activity of live tissues. In this technique the seeds are soaked in solution (0.1 mM CaCl₂, 0.1 mM KCL, 0.3 mM MES, pH 6.0) for three hours and then transferred to new solution to detect oxygen fluxes and data evaluated by influx software



3. Modified breath analyzer

This based on fact that seeds produce ethanol, when they deteriorate. Immature seeds produce more ethanol than the mature seeds. In this the five hundred milligrams of seeds equilibrated at 32 percent RH are placed in 20 ml glass vial. Initial moisture content is kept at 6 percent. Seeds are incubated at 20°C. Ethanol concentration was measured at different time points using modified breath analyzer. Premature seeds

produce more ethanol upon imbibitions than mature seeds. The increase in ethanol production was observed when cabbage seeds were deteriorated by storage under ambient conditions and reduce the number of normal seedlings.



Conclusion

These techniques can be useful for real time assessment of the seed quality parameters associated with seed structure and morphology. These are non-invasive, reliable and fast tools evaluating the germination and viability potentials of the individual seeds. Micro-optrode techniques provide information about the oxygen consumption and seed germination that is not possible through other techniques. MSI measure the multiple components by reflection from both visual and near-infrared wavelengths at same time for quality assurance. This technique also assesses the physiological parameters and fungal infection on the seed surface. Methods discuss earlier can be a essential for the development of seed Industry in India.

References:

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