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Seed Analysis

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ARTICLE ID: 48

Introduction

Most agricultural operations start with seeds and end with seeds. For seeds to be successful in the field, factors such as their physiology, morphology, genetic purity, biochemistry, and molecular biology are crucial. The seed certification processes also help to the evaluation of varietal identification and purity.DUS characters are essential for the effective implementation of PVP and PBR initiatives in India. These testing methods do, however, have significant drawbacks. For example, the majority of them take a lot of time and effort, and occasionally the outcomes are not repeatable under real-world field conditions. It is important to consider the implications of new techniques for testing seeds, and international attention is being paid to the development of suitable techniques such image analysis of seeds and other plant organs, biochemical markers, and molecular markers. One of these technologies, the machine vision system, provides the possibility that researchers will be able to investigate seed shape, its anatomical activity during germination, and the growth of germinated seedlings in a comfortable working environment. Unlike other systems, IA has extremely little ongoing expense beyond the initial investment in hardware and research. Closer, this will improve accuracy while analyzing various seed-related activities.

The process of removing numerical information from an obtained image is referred to as "image analysis." In essence, a machine vision system is a computerized tool created for image analysis (IA) that works similarly to human observations. The basic idea behind this technology is to collect data (such as shape, size, and color) using a video or still camera and then enter that data into the appropriate computer.

Compared to manual procedures, image analysis demonstrates numerous significant benefits. In contrast to any traditional procedures, it offers quick analysis. Seeds are not treated in any way or harmed in any way. The entire process can be automated once the works have been designed. A more engaging and user-friendly working environment is

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offered through imaging. Unlike other systems, IA has extremely little ongoing expense beyond the initial investment in hardware and research. Image-based measurements can provide data that correlates with the genetic characteristics of germination and seedling growth performance since they are quick and simple to accomplish the intended target.

Advantages of seed image analysis.

a) Imaging software offers a more interactive and user-friendly working environment and it is non-invasive and not exposed to any form of treatment.
b) In comparison to other methods, image analysis is substantially faster and requires much less trained labour, with relatively little additional expenditure.
c) It is essential for seed producers, retailers, and end users to have accurate understanding of the varietal identity of seed and plant parts, as well as seed quality.
d) It can be completed more quickly, and the entire process can be automated.
e) Additionally, it has the capacity to identify certain aberrant in sizable populations, enabling an improvement in seed quality.

Software's Used in Image Analysis

To capture the photos of the seed, an automated image analysis system essentially has a digital camera or a flat-bed scanner. Then, these photos are analyzed by a suitable piece of computer software, yielding numerical data that is then applied to additional statistical analysis.When employed for various reasons, such as germination studies, vigor assessments, grading and sorting, etc., this fundamental methodology differs with a few small alterations. The acquisition of seed coat color is especially crucial when using this technique for varietal identification or characterization research, as some varieties exhibit pronounced and distinctive changes in their seed colors as a result of developmental physiology. There is numerous software which has been used in different image analysis studies as you can see in the table mentioned below:

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Sr.no.	Name of software	Crop	Parameters studied	References
1	LUCIA 3.52 software package	Flax, Lentil	Seed area, perimeter, mean chord, MinFeret	Wiesnerova and Wiesne (2008), Firatligil-Durmuş et al. (2008)
2	KS-400 V.3.0	Vetch, Pea	Seed morphometric and clorimrtric features (Varietal identification)	Grillo et al. (2011), Smykalova et al. (2011)
3	Delta-T© image analysis system having software ‘‘winDIAS’	Mustard, oat	Characterization by measuring variation in seed morphology	Vijaya Geetha et al. (2011), Sumathi and Balamurgan (2013)
4	ImageJ software	Sunflower	X and Y position of the inertia centre and length	Ducournau etal. (2004)
5	Matrox image processing board	Lettuce, Sorghum	Germination studies	Howarth and Stanwoo (1993)
6	ImageTool v.3.0 software	Medicago satuva, Onobrychis vicifolia	RGB intensities of seed images	Behtari et al. (2014)
7	Seed Vigor Imaging System (SVIS®).	Various crops	Analysis of seedling images, providing indexes of growth, uniformity and vigor	Sako et al. (2001)

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www.researchgate.net/publication/324820379_Image_Analysis_A_Modern_Approach_To_Seed_Quality_Testing

www.slideshare.net/SandeepVannam/seed-image-analysis